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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **14ME2015 / 17ME2011** | **Duration** | **3hrs** |
| **Course Title** | **THERMAL ENGINEERING I** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define ‘Boiler Efficiency’. | | CO1 | R | 1 |
| 2. | Write any two factors on which the boiler efficiency depends. | | CO1 | U | 1 |
| 3. | Define ‘Nozzle efficiency’. | | CO2 | R | 1 |
| 4. | Write the reason for high velocity flow in the divergent portion of steam nozzle. | | CO2 | R | 1 |
| 5. | Write the advantages of steam turbines over steam engines. | | CO3 | U | 1 |
| 6. | State the advantages of reheating of steam. | | CO3 | R | 1 |
| 7. | Write the comparison between Rankine cycle and Carnot cycle. | | CO4 | U | 1 |
| 8. | Write any two advantages of regenerative cycle over simple Rankine cycle. | | CO4 | R | 1 |
| 9. | Define ‘isothermal efficiency of air compressor’. | | CO5 | R | 1 |
| 10. | Define ‘Coefficient of performance’. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define and explain ‘Equivalent Evaporation’. | | CO1 | An | 3 |
| 12. | Explain supersaturated expansion of steam in a nozzle. | | CO2 | U | 3 |
| 13. | Write three main differences between impulse and reaction turbine. | | CO3 | U | 3 |
| 14. | Explain basic Rankine cycle with neat diagram. | | CO4 | U | 3 |
| 15. | Write any three application of compressed air in the industry. | | CO5 | An | 3 |
| 16. | Explain simple vapour compression system with neat diagram. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain with the help of neat diagrams i) Cochran Boiler ii) Babcock and Wilcox Boiler. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Derive the expression for discharge through the nozzle and condition for its maximum value. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Write different methods of compounding of steam turbines. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | In a steam turbine, steam at 20 bar, 360 C is expanded to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assume ideal processes, find per kg of steam the network and the cycle efficiency. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | An air compressor takes in air at 1 bar and 20 C and compresses it according to the law pv1.2=constant. It is then delivered to a receiver at a constant pressure of 10 bar. R= 0.287 kJ/kg K. Determine i) Temperature at the end of compression ii) Work done and heat transfer during compression per kg of air. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | A steam generator evaporates 18000 kg/h of steam at 12.5 bar and a quality of 0.97 from feed water at 105 C, when coal is fired at the rate of 2040 kg/h. If the Higher calorific value of the coal is 27400 kJ/kg, find i) The heat rate of boiler in kJ/h ii) The equivalent evaporation iii) The thermal efficiency. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Dry saturated steam enters a frictionless adiabatic nozzle with negligible velocity at a temperature of 300 C. It is expanded to a pressure of 5000 kPa. The mass flow rate is 1 kg/s. Calculate the exit velocity of steam. | CO2 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain Ammonia- water vapour absorption refrigeration system and write the comparison between vapour absorption and compression systems. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Estimate the performance of a steam generator |
| **CO2** | Analyze the flow through steam nozzles |
| **CO3** | Determine the efficiency of the impulse and reaction turbine using velocity triangles |
| **CO4** | Describe vapour power cycles |
| **CO5** | Calculate the efficiency of a reciprocating air compressor |
| **CO6** | Evaluate Coefficient of performance of Refrigeration systems |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 12 | 15 | - | - | 29 |
| **CO2** | 2 | 3 | 12 | 12 | - | - | 29 |
| **CO3** | 1 | 4 | 12 | - | - | - | 17 |
| **CO4** | 1 | 4 | - | 12 | - | - | 17 |
| **CO5** | 1 | - | - | 15 | - | - | 16 |
| **CO6** | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **13ME103 / 14ME1003 / 17ME1001** | **Duration** | **3hrs** |
| **Course Title** | **BASIC MECHANICAL ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | \_\_\_\_\_\_ engine uses a spark plug for ignition. | | CO1 | U | 1 |
| 2. | Identify the turbine that uses nozzles to convert pressure energy into kinetic energy. | | CO1 | U | 1 |
| 3. | \_\_\_\_\_ is the predominantly used fuel in a thermal power plant. | | CO3 | U | 1 |
| 4. | Indicate the process by which nuclear energy is generated in a nuclear power plant. | | CO3 | U | 1 |
| 5. | Identify the term used to describe the ability of a material to resist wear and abrasion. | | CO4 | U | 1 |
| 6. | Indicate the purpose of adding chromium to steel. | | CO4 | U | 1 |
| 7. | Identify the main function of a lathe machine. | | CO6 | U | 1 |
| 8. | Indicate the purpose of pattern in metal casting. | | CO5 | U | 1 |
| 9. | Give an example for commonly used CAD software. | | CO6 | R | 1 |
| 10. | MEMS stands as an acronym for \_\_\_\_\_\_ . | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between two-stroke and four-stroke engines. | | CO1 | U | 3 |
| 12. | Indicate the main challenges in implementing tidal power plants. | | CO3 | U | 3 |
| 13. | Distinguish between thermoplastics and thermo setting plastics. | | CO4 | U | 3 |
| 14. | Differentiate runner and riser in casting. | | CO5 | U | 3 |
| 15. | Distinguish between hot working and cold working. | | CO5 | U | 3 |
| 16. | Identify the benefits of using CAD over traditional drafting methods. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the key differences in construction, working, and efficiency between petrol and diesel engines. | CO1 | A | 6 |
|  | b. | Explain the working principle of a vapor compression refrigeration system with a neat diagram. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the construction and working of a hydroelectric power plant with a neat diagram. List the advantages and limitations of hydro power plants. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Compare nonferrous metals with ferrous metals in terms of composition, properties, and industrial applications. | CO4 | An | 6 |
|  | b. | Illustrate the applications of composites in industries such as aerospace, automotive, and construction. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the extrusion process, its types, and applications in industry. | CO5 | A | 6 |
|  | b. | Explain the working principle of gas welding and its applications. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the working principle and uses of a drilling machine. | CO6 | A | 6 |
|  | b. | Explain its components and functions of Numerical Control systems. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Illustrate the construction and working of the Babcock & Wilcox boiler with a neat diagram. Also discuss the advantages and limitations. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Compare solar power plants with wind power plants in terms of construction and efficiency. | CO3 | An | 6 |
|  | b. | Explain the types of forging processes with industrial applications. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the working of a CIM system with a diagram and describe its integration in a manufacturing plant. | CO6 | A | 6 |
|  | b. | Explain the advantages of MEMS technology over traditional mechanical systems. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Describe the working principle of Engines and Turbines. |
| **CO2** | Classify Boilers and identify different types of Engines |
| **CO3** | Distinguish conventional and non-conventional power plants. |
| **CO4** | Examine various types of Engineering Materials. |
| **CO5** | Select different types of metal forming and joining processes. |
| **CO6** | Analyze metal machining processes. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | - | 5 | 6 | - | - | - | 11 |
| **CO2** | - | - | 18 | - | - | - | 18 |
| **CO3** | - | 5 | 12 | 6 | - | - | 23 |
| **CO4** | - | 5 | 6 | 6 | - | - | 17 |
| **CO5** | - | 7 | 18 | - | - | - | 25 |
| **CO6** | 2 | 4 | 24 | - | - | - | 30 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **14ME2019 / 16ME2011/ 17ME2024 / 18ME2010** | **Duration** | **3hrs** |
| **Course Title** | **HEAT AND MASS TRANSFER** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Thermal Conductivity. | | CO1 | R | 1 |
| 2. | What is critical radius of insulation? | | CO1 | R | 1 |
| 3. | Compare the convection heat transfer coefficients of natural convection and forced convection. | | CO2 | U | 1 |
| 4. | Recall the non-dimensional number which is the ratio between kinematic viscosity to thermal diffusivity. | | CO2 | R | 1 |
| 5. | Distinguish black body and grey body. | | CO3 | R | 1 |
| 6. | Define boundary layer thickness. | | CO3 | R | 1 |
| 7. | What is fouling in heat exchanger? | | CO4 | U | 1 |
| 8. | The size of the bubble on nucleation \_\_\_\_\_\_\_\_\_ as it rises up. | | CO5 | U | 1 |
| 9. | Define equimolar counter diffusion. | | CO6 | R | 1 |
| 10. | State Fick’s law of diffusion. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Heat is lost at a rate of 275 W per m2 area of a 15 cm thick wall with a thermal conductivity of K = 1.1 W/m oC. Calculate the temperature drop across the wall. | | CO1 | An | 3 |
| 12. | State Newton’s law of cooling with expression. | | CO2 | U | 3 |
| 13. | list the applications of fins. | | CO3 | An | 3 |
| 14. | Distinguish laminar and turbulent flow. | | CO4 | U | 3 |
| 15. | Differentiate parallel flow and counter flow heat exchanger. | | CO5 | A | 3 |
| 16. | Hydrogen gas is maintained at pressures of 5 bar and 1 bar on opposite sides of a 2 mm thick membrane. The binary diffusion coefficient of hydrogen in the plastic is 9.5x10-8 m2/s and the solubility of hydrogen in the membrane is 0.0015 kg.mol./m3.bar. Calculate, under uniform conditions and 25o C, the molecular diffusion flux of hydrogen through the membrane. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | A hollow sphere of pure iron contains a liquid chemical mixture releases 30 kW of energy. The ID and OD of the sphere are 15cm and 30cm respectively. If the outer surface temperature of the sphere is 40ºC, determine the temperature at a location 2.5cm from the outer surface. | CO1 | A | 6 |
|  | b. | A steam pipe 200 mm OD is covered with 25 mm thick layer of insulation material with an average thermal conductivity of 0.08 W/m-K. The temperature of the pipe surface is 400ºC and that of the outer surface of insulation is 50ºC. Find the heat loss from a length of 10m of the pipe line. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Water at 10ºC with a free stream velocity of 1.524 m/s flows across a cylinder of 2.54 cm diameter whose surface is kept at 65.6ºC. Compute the average heat transfer coefficient. | CO2 | E | 6 |
|  | b. | A vertical plate 20 cm x 60 cm size is at 110ºC in an atmosphere at 30ºC. Determine the rate of heat transfer by natural convection from the plate when 20 cm side is kept vertical. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. |  | Emissivity’s of two large parallel plates maintained at 800 oC and 300 oC are 0.3 and 0.5 respectively. Find the net radiant heat exchange per square meter of the plates. If a polished aluminum shield (ε = 0.05) is placed between them. Also find the percentage of reduction in heat transfer. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Hot oil having a specific heat of 2.09 kJ/kg-K flows through a counter flow heat exchanger at the rate of 2268 kg/h with an inlet and outlet temperatures of 93 ºC and 65 ºC respectively. Cold oil having a specific heat of 1.67 kJ/kg-K flows in at a rate of 3600 kg/h and leaves at 149 ºC. Using LMTD method estimate the area of the heat exchanger required if the overall heat transfer coefficient is 0.7 kW/m2-K. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain in detail the phenomenon of dropwise and filmwise condensation with necessary sketches. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Draw the boiling curve of water and explain the various boiling regimes in detail. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Calculate the heat exchange by radiation between the surfaces of two long cylinders having radius 120 mm and 60 mm respectively. The axis of the cylinder is parallel to each other. The inner cylinder is maintained at a temperature of 130 °C and emissivity of 0.6. The outer cylinder is maintained at a temperature of 30 °C and emissivity of 0.5. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Estimate the diffusion rate of water from the bottom of a tube of 10 mm diameter and 15 cm long into dry air 25 oC. Take the diffusion coefficient of water through air as 0.235 x 10-4 m2/s. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Formulate and analyze a heat transfer problem involving any of the three modes of heat transfer |
| **CO2** | Obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer |
| **CO3** | Evaluate radiation heat transfer between black, gray surfaces and the surroundings |
| **CO4** | Design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary |
| **CO5** | Apply boiling and condensation correlations to two phase flow processes |
| **CO6** | Apply mass transfer correlations to process–based problems |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | - | 12 | 3 | - | - | 17 |
| **CO2** | 1 | 4 | - | - | 12 | - | 17 |
| **CO3** | 2 | - | 12 | 3 | - | - | 17 |
| **CO4** | - | 4 | - | 12 | 12 | - | 28 |
| **CO5** | - | 25 | 3 | - | - | - | 28 |
| **CO6** | 1 | 1 | - | 3 | 12 | - | 17 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18ME2015** | **Duration** | **3hrs** |
| **Course Title** | **KINEMATICS AND THEORY OF MACHINES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the term ternary joint. | | CO1 | U | 1 |
| 2. | Define a coincident point. | | CO1 | R | 1 |
| 3. | Define the term ‘dedendum’ of a gear. | | CO2 | R | 1 |
| 4. | List any two types of followers in cam. | | CO2 | R | 1 |
| 5. | State D-Alembert’s principle. | | CO3 | R | 1 |
| 6. | Illustrate co-efficient of fluctuation of speed. | | CO3 | U | 1 |
| 7. | State inertia torque. | | CO4 | U | 1 |
| 8. | Define damping factor. | | CO5 | R | 1 |
| 9. | Define the term ‘elastic line of the shaft’. | | CO5 | R | 1 |
| 10. | Discuss stability of a governor. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between lower pair and higher pair. | | CO1 | U | 3 |
| 12. | State the function of a differential gear in an automobile. | | CO2 | R | 3 |
| 13. | State the functions of a flywheel in a prime mover. | | CO3 | R | 3 |
| 14. | Write the procedure of balancing V-engine. | | CO4 | U | 3 |
| 15. | What is meant by ‘torsionally equivalent shaft’? | | CO5 | U | 3 |
| 16. | Describe the gyroscopic effect on four wheeled vehicles. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | A crank and slotted lever mechanism used in a shaper has a centre distance of  300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120 mm. Evaluate the ratio of the time of cutting to the time of return stroke. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform  speed, is required to give a knife edge follower the motion as described below :  1. To move outwards through 40 mm during 100° rotation of the cam;  2. To dwell for next 80°;  3. To return to its starting position during next 90°, and  4. To dwell for the rest period of a revolution i.e. 90°.  Sketch the profile of the cam when the line of stroke of the follower passes through the centre of the cam shaft. The displacement of the follower is to take place with uniform acceleration and uniform retardation. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m ; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm2. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Estimate the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | A four cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Estimate the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Calculate the whirling speed of a shaft 20 mm diameter and 0.6 m long carrying a mass of 1 kg at its mid-point. The density of the shaft material is 40 Mg/m3, and Young’s modulus is 200 GN/m2. Assume the shaft to be freely supported. | CO5 | A | 6 |
|  | b. | The measurements on a mechanical vibrating system show that it has a mass of 8 kg and that the springs can be combined to give an equivalent spring of stiffness 5.4 N/mm. If the vibrating system have a dashpot attached which exerts a force of 40 N when the mass has a velocity of 1 m/s, determine: 1. critical damping coefficient, 2. damping factor, 3. Logarithmic decrement. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | In an engine governor of the Porter type, the upper and lower arms are 200 mm  and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 25 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40°, analyze, taking friction into account, range of speed of the governor. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | The following data relate to a pair of 20° involute gears in mesh:  Module = 6 mm; Number of teeth on pinion = 17; Number of teeth on gear = 49; Addenda on pinion and gear wheel = 1 module. Determine: 1. The number of pairs of teeth in contact, and; 2. The angle turned through by the pinion and when one pair of teeth is in contact. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 r.p.m. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Calculate the gyroscopic effects in the following conditions:  1. The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius.  2. The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Determine mobility, position, velocity and acceleration of links in mechanism. |
| **CO2** | Design cam profiles to meet the motion requirements in mechanisms. |
| **CO3** | Determination of forces on parts of slider-crank mechanism and design of flywheel. |
| **CO4** | Predict balancing mass requirement in rotary and reciprocating unbalanced systems. |
| **CO5** | Determine frequency of translational and longitudinal vibration. |
| **CO6** | Apply the use of governors to control speed and gyroscopes to navigate. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 4 | - | 12 | - | - | 17 |
| **CO2** | 5 | - | 24 | - | - | - | 29 |
| **CO3** | 4 | 1 | - | 12 | - | - | 17 |
| **CO4** | - | 4 | - | 12 | - | - | 16 |
| **CO5** | 2 | 3 | 12 | - | - | - | 17 |
| **CO6** | - | 4 | 12 | 12 | - | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18ME2028** | **Duration** | **3hrs** |
| **Course Title** | **HYDRAULICS AND PNEUMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State Pascal's law. | | CO1 | R | 1 |
| 2. | Specify a key characteristic of hydraulic fluid that affect system efficiency. | | CO1 | U | 1 |
| 3. | Sketch the graphical symbol of the sequence valve. | | CO2 | A | 1 |
| 4. | Identify the component responsible for regulating the flow rate in hydraulic systems. | | CO2 | R | 1 |
| 5. | List the causes of overheating in hydraulic systems. | | CO3 | U | 1 |
| 6. | Distinguish between hydraulics and pneumatics systems used in industrial applications. | | CO3 | An | 1 |
| 7. | Define the term absolute pressure in pneumatic system. | | CO4 | R | 1 |
| 8. | Name the component responsible for maintaining consistent air pressure in a Filter, Regulator, and Lubricator (FRL) unit. | | CO4 | U | 1 |
| 9. | State the importance of air treatment in pneumatic systems. | | CO5 | An | 1 |
| 10. | Identify the main benefit of using Programmable Logic Controller (PLCs) for Electro pneumatics circuit control. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A hydraulic fluid has a specific gravity of 1.9 and kinematic viscosity of 6 stokes. Calculate the dynamics viscosity of fluid. | | CO1 | E | 3 |
| 12. | Discuss the effect of heat generation on hydraulic system efficiency. | | CO2 | U | 3 |
| 13. | Describe the purpose of a deceleration circuit in hydraulic systems. | | CO3 | U | 3 |
| 14. | State the significance of stroke length in cylinder selection for a hydraulic system. | | CO4 | U | 3 |
| 15. | Develop displacement step diagram of pneumatic circuit for drilling operation. | | CO5 | C | 3 |
| 16. | Differentiate between the closed and open loop system used in pneumatic devices. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | A hydraulic press has a small piston with a diameter of 10 cm and a large piston with a diameter of 50 cm. If a force of 200 N is applied to the small piston, determine the force exerted by the large piston and pressure in the hydraulic fluid. | CO1 | E | 6 |
|  | b. | Describe the role of baffles within a hydraulic reservoir, explaining how they influence fluid flow, cooling, and contaminant separation. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Analyze the main elements of a hydraulic system and explain their functions within the system. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain with a neat sketch the working principle of the internal gear pump with its application. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the use of regenerative circuits to increase speed of actuator. | CO4 | A | 6 |
|  | b. | Design a fail-safe circuit for hydraulic system to protect from overload. | CO4 | C | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe in detail the key factors in the selection of pneumatic actuators. | CO5 | U | 6 |
|  | b. | Illustrate the working mechanism of an air pressure regulator and provide a detailed sketch. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Explain the working principle of reciprocating compressor used in pneumatic systems with neat sketch and its industrial applications. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Design an electro-hydraulic circuit to control a packaging press, where the sequence involves Cylinder A extending to position a package, followed by Cylinder B extending to press the package, then Cylinder B retracting, and finally Cylinder A retracting to reset the system (A+B+B-A-). Apply knowledge of cylinder control and sequencing in the design. | CO5 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design a pneumatic system using a double-acting cylinder to perform continuous reciprocating motion. Configure the system so that push button PB1 initiates forward movement of the cylinder, with continuous to-and-fro motion until push button PB2 (stop) is pressed. Incorporate limit switches for end-position sensing, and develop the pneumatic circuit, PLC wiring diagram, and ladder logic diagram to implement this task. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the salient features and constructional details of both hydraulic and Pneumatic systems |
| **CO2** | Understand the various types of actuation modes and control system design procedures for design of circuits and to control them. |
| **CO3** | Understand the concepts of servo and proportional valves. |
| **CO4** | Analyze various application circuits |
| **CO5** | Apply the above outcomes to design pneumatic and hydraulic circuits. |
| **CO6** | Build a PLC programme for a particular application. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 12 | 4 |  |  |  | 17 |
| **CO2** | 2 | 3 | 3 | 12 |  |  | 20 |
| **CO3** |  | 13 | 1 |  |  | 12 | 26 |
| **CO4** | 1 | 1 |  |  | 3 | 12 | 17 |
| **CO5** | 1 |  | 20 | 7 |  |  | 28 |
| **CO6** | 1 |  |  |  |  | 15 | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18ME2034** | **Duration** | **3hrs** |
| **Course Title** | **OPERATIONS RESEARCH** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the term ‘Optimization’. | | CO1 | R | 1 |
| 2. | Compare ‘surplus variable’ with ‘slack variable’. | | CO1 | A | 1 |
| 3. | Cite the method to balance a transportation problem. | | CO2 | R | 1 |
| 4. | Balance the following assignment table (Sales Managers I,II and III and sales areas A and B:   |  |  |  | | --- | --- | --- | |  | A | B | | I | 0 | 1 | | II | 5 | 0 | | III | 7 | 8 | | | CO2 | R | 1 |
| 5. | Draw network for the following activities and find the critical path :   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Activities | 1-2 | 1-3 | 2-4 | 3-4 | 1-4 | | Duration  (Weeks) | 4 | 6 | 5 | 2 | 10 | | | CO3 | U | 1 |
| 6. | Identify the use of skip numbering. | | CO3 | A | 1 |
| 7. | Infer the application of reorder point in inventory control. | | CO4 | A | 1 |
| 8. | Interpret the concept of Economic Ordering Quantity (EOQ). | | CO4 | R | 1 |
| 9. | Differentiate ‘infinite queue size’ and ‘finite queue size’. | | CO5 | An | 1 |
| 10. | Name one example for finite population queue. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List any two advantages and limitations of LPP. | | CO1 | R | 3 |
| 12. | There are 6 jobs each of which must go through the two machines A and B in the order A-B. Processing time in hours are given in the table. Determine the optimal sequence of jobs and idle time of each machine   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Jobs | 1 | 2 | 3 | 4 | 5 | 6 | | Processing Time of  Machine A (Hours) | 3 | 6 | 4 | 7 | 5 | 8 | | Processing Time of  Machine B(Hours) | 2 | 5 | 6 | 3 | 2 | 8 | | | CO2 | A | 3 |
| 13. | Compare ‘assignment model’ with ‘transportation model’. | | CO3 | An | 3 |
| 14. | Normal duration and normal cost crash cost and crash duration of the activities 1-2 and 1-3 are given below. Interpret the cost slope (Delta cost) and Delta time (Time available for crashing) of these activities:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Activities | Normal Cost  (Rupees) | Normal  Duration(Weeks) | Crash  Cost (Rupees) | Crash  Duration(Weeks) | | 1-2 | 7,000 | 6 | 14,500 | 3 | | 1-3 | 4,000 | 8 | 8,500 | 5 | | | CO4 | A | 3 |
| 15. | In a mechanical workshop, it takes 10 days to get the stock of coolant oil after placing an order. The daily requirement of coolant oil in the workshop is 50 litres. Based on the past experience it is determined that the safety is 5 days stock. Infer the re-order point. | | CO5 | An | 3 |
| 16. | Compare FCFS with LCFS in queuing model. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Solve the following LPP by using **Graphical Method :**  Maximize Z = 3X1+2X2  Subjected to  X1-X2 ≥ 1  X1+X2 ≥ 3  With non-negative restrictions X1, X2 ≥ 0 | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | A machine shop has one shearing, one punching and one de-burring machine. Time in minutes for shearing, punching and de-burring operations is given for each job. Determine the optimal order (**sequence)** in which the jobs are to be processed to minimize the total time. Find the **total time to process** all the jobs and **idle time** of each machine:   |  |  |  |  | | --- | --- | --- | --- | | Job | Shearing  Time  (Minutes) | Punching  Time  (Minutes) | De-burring  Time  (Minutes) | | 1 | 40 | 50 | 80 | | 2 | 20 | 60 | 100 | | 3 | 80 | 20 | 60 | | 4 | 50 | 30 | 70 | | 5 | 60 | 40 | 110 | | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | A food manufacturing company has 2 processing plants P1 and P2; three fruit cultivators are willing to supply fruits in the following quantities. Cultivator C1 is willing to supply 190 quintal at the rate of Rs 100 per quintal, Cultivator C2 is willing to supply 290 quintal at the at the rate of Rs 90 per quintal, Cultivator C3 is willing to supply 390 quintal at the rate of Rs 80 per quintal. Cost of transportation from cultivator to plants is given below:   |  |  |  | | --- | --- | --- | |  | P1 | P2 | | C1 | 20 | 26 | | C2 | 9 | 16 | | C3 | 49 | 31 |   Plant requirements and labor costs are as follows:   |  |  |  | | --- | --- | --- | | Details | Plant P1 | Plant P2 | | Requirement in quintal | 440 | 360 | | Labor cost  Rupees/Quintal | 30 | 22 |   Processed fruits are sold at the rate of Rs. 480 per quintal .objective of this problem to maximize profit, Infer the initial solution by North-west corner method. | CO 1 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | In a small machine shop, there are 4 operators available to assign jobs for the day. There are 5 jobs and profit in rupees for each operator on each job is represented in the table:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | JI | J2 | J3 | J4 | J5 | | O 1 | 6.30 | 5.90 | 6.80 | 10.20 | 7.40 | | O 2 | 8.00 | 10.10 | 9.00 | 8.50 | 7.30 | | O 3 | 8.70 | 8.80 | 9.10 | 7.60 | 6.50 | | O 4 | 7.30 | 8.30 | 6.40 | 7.70 | 8.00 |   Determine the optimal assignment and find out which job is to be rejected. | CO 4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | The activities of a project with their respective time estimates (in weeks) are given in the following table:   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Activities | 1-2 | 1-6 | 2-3 | 2-4 | 3-5 | 4-5 | 6-7 | 5-8 | 7-8 | | Optimistic  time | 3 | 2 | 6 | 2 | 5 | 3 | 3 | 1 | 4 | | Most  Probable  Time | 6 | 5 | 12 | 5 | 11 | 6 | 9 | 4 | 9 | | Pessimistic  time | 15 | 14 | 30 | 8 | 17 | 15 | 27 | 7 | 28 |   i)Draw the network of this project and compute duration, variance and standard deviation of the project (6)  ii) what is the probability of completing the project within 42 weeks and also for completing the project within 44 weeks(4)  iii) what is the probability of NOT completing the project within 40 weeks (2) | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Draw network for activities (total 10 activities) of a project which is shown in the following table and perform forward and backward scheduling.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Activities | 1-2 | 2-3 | 2-4 | 3-5 | 3-6 | | Duration  (Days) | 2 | 3 | 5 | 4 | 1 |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Activities | 4-6 | 4-7 | 5-8 | 6-8 | 7-8 | | Duration  (Days) | 6 | 2 | 8 | 7 | 4 |   Compute the critical path of the project and also find out the **total float/total slack** available for each activity. | CO 3 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Draw Annual consumption cost Versus Annual consumption graph and conduct ABC analysis for the following 10 items in an inventory:     |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Items | 1 | 2 | 3 | 4 | 5 | | Annual  Usage(units) | 200 | 3000 | 25 | 1100 | 60 | | Unit Cost(Rs) | 11 | 14 | 9 | 6 | 5 |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Items | 6 | 7 | 8 | 9 | 10 | | Annual  Usage(units) | 250 | 140 | 850 | 550 | 80 | | Unit Cost(Rs) | 90 | 6 | 6 | 15 | 9 | | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Arrivals at a public telephone booth with an average of 8 minutes between one arrival and the next. The length of the telephone calls is assumed with a mean value of 2 minutes, find,   * Utilization factor * Average queue length * Average waiting time of customer | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Correlate this subject knowledge with the engineering problems. |
| **CO2** | Construct flexible appropriate mathematical model to represent physical problem. |
| **CO3** | Schedule their engineering projects by using network analysis. |
| **CO4** | Analyze the transportation problem and optimize the resources and output. |
| **CO5** | Apply knowledge in solving their engineering queuing problems. |
| **CO6** | Develop their skills in decision making analysis by allocation of resources. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 4 |  | 13 | 12 |  |  | 29 |
| **CO2** | 2 |  | 3 | 12 |  |  | 17 |
| **CO3** |  | 1 | 1 | 3 | 12 |  | 17 |
| **CO4** | 1 |  | 4 | 12 |  |  | 17 |
| **CO5** |  |  | 12 | 4 |  |  | 16 |
| **CO6** | 1 |  | 12 | 15 |  |  | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18ME2040** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTATIONAL FLUID DYNAMICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define ‘curl’. | | CO1 | U | 1 |
| 2. | Classify the forces that exert influence on a fluid particle. | | CO1 | U | 1 |
| 3. | Write the importance of hybrid grids. | | CO2 | A | 1 |
| 4. | Define ‘Adaptive mesh’. | | CO2 | R | 1 |
| 5. | Write the condition for implicit discretization of the unsteady conductive heat transfer. | | CO3 | A | 1 |
| 6. | Write the differential form of 2D steady diffusion. | | CO3 | A | 1 |
| 7. | The flow in which property which is not varying with time is called----- | | CO4 | R | 1 |
| 8. | Write the essential requirement for boundedness. | | CO4 | A | 1 |
| 9. | Write one problem associated with the solution of governing equations of laminar 2D flow. | | CO5 | U | 1 |
| 10. | Define Reynold’s number. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the differential form of the general transport equation. | | CO1 | A | 3 |
| 12. | Differentiate between uniform and non-uniform grids. | | CO2 | U | 3 |
| 13. | Determine the expression for central difference first derivative using the Taylor series. | | CO3 | A | 3 |
| 14. | Write the advantage of QUICK differencing scheme. | | CO4 | A | 3 |
| 15. | SIMPLER stands for—---------------- | | CO5 | A | 3 |
| 16. | Sketch the boundary layer for the flow on a flat plate. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Derive the three-dimensional mass conservation equation for a compressible fluid. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the basic steps involved in creating mesh for CFD simulation. Categorize the mesh in terms of application and accuracy. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Derive the discretized form of equation for 1D steady diffusion problem. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A property φ is transported by means of convection and diffusion through a one-dimensional domain. Consider the case to be steady one-dimensional convection diffusion, with boundary conditions as φ0 = 1at x = 0 and φL = 0 at x = L. Using five equally spaced cells and the central difference scheme for convection and diffusion, calculate the distribution of φ as a function of x. Apply the following data: u=0.1 m/s, L= 1 m, Γ= 0.1 kg/m/s, ρ= 1 kg/m3 | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain SIMPLE algorithm and derive the equation for pressure correction. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain staggered grid in detail explaining the concept of correct prediction of pressure field. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Derive the y-momentum equation from the fundamentals of thermodynamics. | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | What is the criterion for a turbulence model to be useful in a CFD code? Explain a two equation turbulence model. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Formulate the required governing equations for flow and heat transfer problems |
| CO2 | Discretize the governing equations of flow and heat transfer problems |
| CO3 | Solve the diffusion equations |
| CO4 | Solve the diffusion-convection equations |
| CO5 | Use appropriate algorithms to solve the discretized equations. |
| CO6 | Apply turbulence models to accurately predict the variables based on the flow characteristics. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 2 | 15 | 12 |  |  | 29 |
| CO2 | 1 | 3 | 1 | 12 |  |  | 17 |
| CO3 |  |  | 17 |  |  |  | 17 |
| CO4 | 1 |  | 4 | 12 |  |  | 17 |
| CO5 |  | 1 | 3 | 24 |  |  | 28 |
| CO6 | 1 |  |  | 15 |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18ME2044** | **Duration** | **3hrs** |
| **Course Title** | **REFRIGERATION AND AIR CONDITIONING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Mention the Bell-Coleman cycle's alternate name. | | CO1 | R | 1 |
| 2. | Name the cooling system suitable for low flight speed. | | CO1 | R | 1 |
| 3. | Define compression efficiency. | | CO2 | U | 1 |
| 4. | In a refrigeration system, what is the component that connects the compressor and condenser? | | CO2 | U | 1 |
| 5. | How many vapour-compression cycles with different refrigerants are used in a cascade refrigeration system? | | CO3 | R | 1 |
| 6. | Multiple refrigerants can be used in the cascade refrigeration system. True or false? | | CO3 | U | 1 |
| 7. | The investigation of the air-water mixture is known as \_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | Adiabatic cooling lines which are the same (for water vapour only) as the wet bulb or psychrometric line. True or False? | | CO4 | U | 1 |
| 9. | Rapid heating and cooling of milk is called as …………… | | CO5 | U | 1 |
| 10. | Name a refrigerant is used in Ice plant. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define air refrigeration. | | CO1 | U | 3 |
| 12. | What are absorbers in vapour absorption refrigeration systems? | | CO2 | R | 3 |
| 13. | Describe the advantages of a cascade refrigeration system. | | CO3 | An | 3 |
| 14. | State bypass factor. | | CO4 | U | 3 |
| 15. | Write short notes on infiltration. | | CO5 | U | 3 |
| 16. | Draw the layout of the Ice plant. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Discuss in detail Bell-Coleman refrigeration cycle with T-S and P-V diagrams. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | With a neat sketch explain the Cascade refrigeration system and also represent the processes on the T-S diagram. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the types of condensers installed in refrigeration systems with a neat sketch. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain water – ammonia vapour absorption refrigeration system and discuss its advantages over the vapour compression system. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | The atmospheric air at 30 °C dry bulb temperature and 75 % RH enters a cooling coil at the rate of 200 m3/min. The coil dew point temperature is 14 °C and the bypass factor of the coil is 0.1. Determine i) the temperature of the air leaving the cooling coil. ii) the capacity of cooling coil in tons of refrigeration and in kW. iii) the amount of water vapour removed per minute, and iv) the sensible heat factor for the process. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | In air conditioning system the inside and outside conditions are: dry bulb temperature 25°C, RH 50 % and dry bulb temperature 40°C, wet bulb temperature 27°C respectively. The room sensible heat factor is 0.8. 50 % of room air is rejected to atmosphere and then equal quantity of fresh air added before air enters the air conditioning apparatus. If the fresh air is added is 100 m3/min., determine: i) Room sensible and latent heat load ii) sensible and latent heat load due to fresh air iii) apparatus dew point temperature iv) humidity ratio and dry bulb temperature of air entering air conditioning apparatus. Assume bypass factor zero, density of air is 1.2 kg/m3 at a total pressure of 1.01325 bar. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the summer air conditioning system for hot and dry conditions and also mark the processes on a Psychrometric chart. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain i) refrigeration system for food storage plants ii) Train air conditioning system | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand various refrigeration systems |
| **CO2** | Demonstrate the working of refrigeration equipment. |
| **CO3** | Understand various psychrometric processes |
| **CO4** | Estimate the space cooling load |
| **CO5** | Design the air-conditioning equipments |
| **CO6** | Select suitable refrigeration and air-conditioning systems for various applications |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 3 | 12 | - | - | - | 17 |
| **CO2** | 3 | 2 | - | - | 12 | - | 17 |
| **CO3** | 1 | 1 | - | 3 | 12 | - | 17 |
| **CO4** | - | 5 | 12 | - | 12 | - | 29 |
| **CO5** | - | 4 | 12 | - | 12 | - | 28 |
| **CO6** | 1 | 12 | 3 | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **18ME2055** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTER AIDED DESIGN** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State an important difference between CAD and CAM. | | CO1 | R | 1 |
| 2. | Write the key function of the graphics standards used in CAD. | | CO1 | R | 1 |
| 3. | State the use of Random scan graphics. | | CO2 | R | 1 |
| 4. | List two types of line drawing algorithms that are widely used in graphics. | | CO2 | R | 1 |
| 5. | State the use of analytics curves in surface modelling. | | CO3 | R | 1 |
| 6. | Changing the position of the control points can change the shape of the curve with greater\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Mention the function of graphics cards in CAD. | | CO4 | R | 1 |
| 8. | State the significance of the prototype in the manufacturing industry. | | CO4 | R | 1 |
| 9. | List two important softwares used to perform finite element analysis. | | CO5 | R | 1 |
| 10. | Can a CAD model be 3D printed without the generation of an STL file? | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Articulate four key reasons for implementing CAD systems in product design. | | CO1 | U | 3 |
| 12. | Write short notes on the homogenous matrix calculations. | | CO2 | U | 3 |
| 13. | Compare the pros and cons of active and passive graphics displays. | | CO3 | U | 3 |
| 14. | Write Iterative Clippingsteps involved inSutherland-Hodgman Polygon Algorithmic | | CO4 | U | 3 |
| 15. | Sketch neatly the expanded product life cycle and mention all the stages. | | CO5 | U | 3 |
| 16. | List a few resins and polymer materials used in additive manufacturing. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Summarize the advantages of implementing CAD tools. Write their merits and demerits. | CO1 | A | 6 |
|  | b. | Sketch a detailed architecture of the CAD system and provide examples of the same in design and analysis. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Distinguish between the z-buffer and the painter’s algorithm for removing hidden lines. | CO2 | A | 6 |
|  | b. | Elaborate the midpoint subdivision line clipping algorithm with relevant sketches. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the application of solid modelling. How is it different from wireframe modelling? | CO3 | A | 6 |
|  | b. | Sketch and enumerate the significant applications of constructive solid geometry in product design. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Summarize the steps involved in utilizing a B-spline curve with suitable sketches and examples. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | With neat sketches explain the following graphics displays in detail. (a) CRT (b) DVST. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Elucidate the procedural steps involved in solving FEM problems in Ansys. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Derive the shape function for the global coordinate system. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Distinguish between SLA and SLS types of 3d printing technologies with neat sketches. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the basic structure and components of CAD. |
| **CO2** | Outline the process of representing graphical entities in a CAD environment. |
| **CO3** | Construct the geometric model using different techniques to represent a product. |
| **CO4** | Illustrate various techniques and devices involved in CAD hardware. |
| **CO5** | Analyze the models for design solutions using FEM. |
| **CO6** | Discuss the various computer-aided tools implemented in various industrial applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 3 | 12 |  |  |  | 17 |
| **CO2** | 2 | 3 | 12 |  |  |  | 17 |
| **CO3** | 2 | 3 | 12 |  |  |  | 17 |
| **CO4** | 2 | 3 | 24 |  |  |  | 29 |
| **CO5** | 1 | 3 | 24 |  |  |  | 28 |
| **CO6** | 1 | 3 | 12 |  |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18ME2058** | **Duration** | **3hrs** |
| **Course Title** | **MECHATRONICS SYSTEM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the term hard automation. | | CO1 | R | 1 |
| 2. | Demonstrate the principle of transducer. | | CO2 | U | 1 |
| 3. | Expand SMA and PLA. | | CO1 | R | 1 |
| 4. | Define Mechatronics as per NEMA. | | CO3 | R | 1 |
| 5. | Outline the schematic diagram of DC motor. | | CO2 | U | 1 |
| 6. | Recall the function of a relay. | | CO4 | R | 1 |
| 7. | List few types of electromechanical devices. | | CO4 | R | 1 |
| 8. | Label different industrial applications of PLC units. | | CO6 | R | 1 |
| 9. | Illustrate the the pin diagram of microprocessor. | | CO5 | U | 1 |
| 10. | Summarize the principle of hall effect sensor. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the various elements that might be present in a control system involving a thermostatically controlled electric heater. | | CO1 | A | 3 |
| 12. | Appraise the working principle of Inductive Proximity sensor. | | CO2 | E | 3 |
| 13. | Illustrate the components of a basic pneumatic system. | | CO3 | U | 3 |
| 14. | Construct Piezoelectric Sensor. | | CO4 | A | 3 |
| 15. | Examine the working of a magneto strictive transducers. | | CO5 | A | 3 |
| 16. | Analyse the basic logics with LD programming. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Interpret that the mechatronics is an interdisciplinary field of study. | CO1 | E | 6 |
| b. | Show different levels of integration in Mechatronics systems. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Infer the various elements that might be present in a control system involving a thermostatically controlled electric heater. | CO2 | An | 8 |
| b. | Examine one application of mechatronics systems like washing machine. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the principle, application and the uses of LVDT. | CO3 | U | 8 |
| b. | Discuss the working of optical encoder with a neat diagram. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Assess PM type stepper motor with neat diagram. | CO6 | E | 6 |
| b. | Appraise the principle of operation for variable reluctance stepper motor. | CO6 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe the working principle of Inductive Proximity Sensor with neat drawing. | CO5 | U | 6 |
| b. | Discuss the working of a photo electric sensor. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the working of Electro-hydraulic power steering system in automobile with neat diagram. | CO4 | A | 6 |
| b. | Compare and conclude few PLC I/O devices. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the principle of Anti-lock Braking System used in automobiles with neat diagram. | CO5 | E | 6 |
| b. | Summarize the SMA sensor with an example. | CO5 | E | 6 |
|  |  | **COMPULSORY** | | | |
| 24. | a. | Construct the architecture of PLC and describe the function of various components. | CO6 | A | 6 |
| b. | Write about the LD programming methods. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
|  | After completing the course, the student will be able to |
| CO1 | Summarize and recall the overview of mechatronics applications. |
| CO2 | Demonstrate knowledge of electrical circuits and logic design. |
| CO3 | Develop and formulate engineering solutions and techniques to solve design problems. |
| CO4 | Design mechatronic components and systems. |
| CO5 | Classify and select various micro-sensors and microprocessors for a specific problem. |
| CO6 | Develop PLC programs for a given task. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / BL | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | - | 3 | - | - | - | 5 |
| CO2 | 0 | 2 | 10 | 8 | 9 | - | 29 |
| CO3 | 1 | 15 | - | - | - | - | 16 |
| CO4 | 2 | - | 15 | - | - | - | 17 |
| CO5 | - | 14 | 3 | - | 12 | - | 29 |
| CO6 | 1 | - | 12 | 3 | 12 | - | 28 |
| Total | 6 | 31 | 43 | 11 | 33 | - | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **18ME2060** | **Duration** | **3hrs** |
| **Course Title** | **INDUSTRIAL SAFETY ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Quote the expansion of the term ‘OSHA’. | | CO1 | R | 1 |
| 2. | Indicate the direct costs involved, while ensuring workplace safety. | | CO1 | R | 1 |
| 3. | Identify the role of lock out / tag out in industrial safety. | | CO2 | U | 1 |
| 4. | List the types of machine guards in ensuring safety in industries. | | CO2 | U | 1 |
| 5. | Indicate one health risk that results from exposure to UV rays. | | CO3 | U | 1 |
| 6. | Give few examples of non-ionizing radiation. | | CO3 | R | 1 |
| 7. | Define: Threshold Limit Value in toxicology. | | CO4 | R | 1 |
| 8. | Identify a mode of entry of toxic substances into the human body. | | CO4 | U | 1 |
| 9. | Indicate the symptoms of good layout. | | CO5 | A | 1 |
| 10. | Express two artificial sources of light. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the advantages of product layouts in industries. | | CO1 | A | 3 |
| 12. | Identify the basic areas to be safeguarded in an industry. | | CO2 | U | 3 |
| 13. | Discuss the negative effects of industrial atmospheric contaminants. | | CO3 | R | 3 |
| 14. | Express few health problems faced by workers due to high temperature. | | CO4 | U | 3 |
| 15. | Write the benefits of following safety procedures in industries. | | CO5 | A | 3 |
| 16. | Identify the benefits of good housekeeping in industries. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the different types of work-related injuries and diseases. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Justify: ‘Machine guards are used to protect workers from amputation injury’. | CO2 | E | 6 |
|  | b. | Classify nip point protective devices used in industries. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | ‘Personal Protective Equipment minimize exposure to a variety of hazards’. Justify with suitable examples. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the different long term and short term effects of various types of toxins. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Analyze the role of safety training in reducing industrial accidents. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the role of a good industrial layout in minimizing the possibility of industrial accidents. | CO1 | An | 6 |
|  | b. | Analyze the role of safety rules in reducing industrial accidents. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Justify: “ZMS provides maximum protection against unexpected mechanical movement”. Explain with the steps involved in achieving ZMS. | CO2 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate the important strategies to improve industrial lighting performance. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understanding the importance of safety in process industries |
| **CO2** | Understanding the ethical issues that may arise from industrial processes |
| **CO3** | Communicate the difference between Hazard and Risk |
| **CO4** | Be able to express Safety in terms of Risk and to recognize unacceptable/inappropriate levels of Risk. |
| **CO5** | Be able to Assess & identify the potential hazards in process industries |
| **CO6** | Appreciation and applying safety procedures in a process industries. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | - | 3 | 24 | - | - | 29 |
| **CO2** | - | 11 | - | - | 18 | - | 29 |
| **CO3** | 4 | 1 | - | - | 12 | - | 17 |
| **CO4** | 1 | 4 | - | 12 | - | - | 17 |
| **CO5** | - | - | 4 | 12 | - | - | 16 |
| **CO6** | - | 4 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18ME2063** | **Duration** | **3hrs** |
| **Course Title** | **RAPID MANUFACTURING TECHNOLOGIES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name two advantages of rapid prototyping processes. | | CO1 | R | 1 |
| 2. | Interpret the term: SLA. | | CO1 | U | 1 |
| 3. | Select any two reverse engineered products in aerospace industry. | | CO2 | R | 1 |
| 4. | Name the software used for CAD model slicing. | | CO2 | R | 1 |
| 5. | Define the process: SGC. | | CO3 | R | 1 |
| 6. | Identify the working of SLA process. | | CO3 | R | 1 |
| 7. | List the parameters of FDM process. | | CO4 | U | 1 |
| 8. | Discover any one advantage of LOM. | | CO4 | U | 1 |
| 9. | Define: 3DP. | | CO5 | R | 1 |
| 10. | List the applications of LENS. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the process parameters of 3DP. | | CO1 | An | 3 |
| 12. | State the use of modern tools in digitization of CAD models. | | CO2 | U | 3 |
| 13. | Appraise the use of STEP files for SLA process. | | CO3 | An | 3 |
| 14. | Illustrate the working of a LOM system. | | CO4 | U | 3 |
| 15. | Explain the salient features of SLS system. | | CO5 | An | 3 |
| 16. | State the applications of Controlled Metal Build-up (CMB) process. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Express the various types of RP processes used for automotive applications. | CO1 | C | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain about support structures, slicing and part orientation in SLA process. | CO2 | An | 6 |
|  | b. | Survey the advantages, limitations and applications of SGC. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Criticize the types of photo polymer resins used in SLA process. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Evaluate the different types of FDM systems, with neat sketch. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Estimate the advantages, limitations and uses of liquid-based 3DP systems. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Construct the process involved in CAD-assisted tool path generation. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Assess the advantages, applications and materials used in LOM. | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Sketch and explain the indirect tooling methods. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Differentiate between conventional and rapid manufacturing approach |
| **CO2** | Demonstrate the knowledge of Rapid Manufacturing technologies |
| **CO3** | Understand the need and place for RP in an integrated manufacturing environment |
| **CO4** | Get exposed to commercial Rapid Prototyping systems |
| **CO5** | Possess knowledge on Rapid Prototyping software |
| **CO6** | Model and manufacture RP components |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 |  | 3 |  | 12 | 17 |
| **CO2** | 2 | 3 | 12 | 6 |  |  | 23 |
| **CO3** | 2 |  |  | 21 |  |  | 23 |
| **CO4** | 2 | 3 |  |  | 24 |  | 29 |
| **CO5** | 1 |  |  | 3 | 12 |  | 16 |
| **CO6** | 1 | 3 | 12 |  |  |  | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18ME2067** | **Duration** | **3 Hrs** |
| **Course Title** | **AUTOMOBILE ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Distinguish between S.I. engine and C.I. engine. | | CO1 | U | 1 |
| 2. | Define hybrid vehicles. | | CO1 | R | 1 |
| 3. | State the function of flywheel in an automobile. | | CO2 | R | 1 |
| 4. | Identify the function of a torque converter. | | CO2 | U | 1 |
| 5. | State the condition for perfect steering. | | CO3 | R | 1 |
| 6. | Distinguish between dampers and springs in a vibrating system. | | CO3 | U | 1 |
| 7. | Identify any two methods to control tyre wear. | | CO4 | U | 1 |
| 8. | State the main function of a secondary brake. | | CO4 | U | 1 |
| 9. | Identify the function of turbocharger in diesel engine. | | CO5 | U | 1 |
| 10. | Indicate any two examples for zero emission vehicles. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare four-wheel drive with two wheel drive. | | CO1 | U | 3 |
| 12. | Distinguish between manual transmission and automatic transmission. | | CO2 | U | 3 |
| 13. | Distinguish between ‘bouncing’ and ‘rolling’ of an automobile. | | CO3 | U | 3 |
| 14. | Identify the role of Traction Control System (TCS) in automobiles. | | CO4 | U | 3 |
| 15. | Indicate the benefits of Electronic injection system over mechanical injection system. | | CO5 | U | 3 |
| 16. | Discuss the concept of using air as a fuel for automobiles. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compare front-engine vehicle layout with rear-engine vehicle layout highlighting their advantages and benefits. | CO1 | An | 6 |
|  | b. | Explain the concept of Variable Valve Timing (VVT) in engines. Explain how VVT improves engine efficiency and performance. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the function and importance of a transmission system in vehicles. | CO2 | A | 6 |
|  | b. | Illustrate the functions of a differential in a vehicle's rear axle assembly. Explain how it enables smooth turning and distributes torque between the wheels. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the working of a power steering system. Explain its advantages over manual steering in terms of driver comfort and control. | CO3 | A | 6 |
|  | b. | Explain how independent suspension differs from dependent suspension. Discuss the benefits of independent suspension for ride comfort and handling. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the working principle of an Antilock Braking System (ABS) and its benefits. | CO4 | A | 6 |
|  | b. | Explain the role of electronic brake force distribution (EBD) in optimizing braking performance. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the common rail direct injection (CRDI) system highlighting its advantages over traditional injection systems in terms of fuel efficiency, emissions, and engine performance. | CO5 | An | 6 |
|  | b. | Explain how a turbocharger enhances engine power output and fuel efficiency. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the major components of an internal combustion engine and describe their functions. | CO1 | A | 6 |
|  | b. | Compare coil spring with leaf spring suspension systems in terms of design, application, and advantages. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the concept of traction control in vehicles. Explain how it improves vehicle stability and safety under different driving conditions. | CO4 | A | 6 |
|  | b. | Illustrate the role of catalytic converter system in emission control. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Even though Hydrogen fuel cell vehicles produce no pollution, it is not flourishing worldwide. Justify. | CO6 | E | 6 |
|  | b. | Analyze the problems and challenges associated with electric vehicles. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Understand different types of internal combustion engines. |
| **CO2** | Demonstrate the functions of clutch and gear box systems. |
| **CO3** | Describe the types of steering and suspension systems |
| **CO4** | Summarize the construction and operating principles of brakes and tyres |
| **CO5** | Express the functions and components of fuel injection and ignition systems. |
| **CO6** | Analyze the performance & emissions of alternate fuels. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 4 | 12 | 6 | - | - | 23 |
| **CO2** | 1 | 4 | 12 | - | - | - | 17 |
| **CO3** | 1 | 4 | 6 | 12 | - | - | 23 |
| **CO4** | - | 5 | 18 | - | - | - | 23 |
| **CO5** | - | 4 | 6 | 12 | - | - | 22 |
| **CO6** | - | 4 | - | 6 | 6 | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18ME2073** | **Duration** | **3 Hrs** |
| **Course Name** | **MODERN MANUFACTURING TECHNIQUES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | \_\_\_\_\_\_\_\_ is the manufacturing process which involves reshaping without adding or removing material. | | CO1 | U | 1 |
| 2. | \_\_\_\_\_\_ is the primary ingredient in ceramics. | | CO1 | U | 1 |
| 3. | The main metal cutting mechanism in Ultrasonic Machining is \_\_\_\_\_\_\_ . | | CO2 | U | 1 |
| 4. | In AJM, \_\_\_\_ is used as a medium to carry abrasive particles to the work surface. | | CO2 | U | 1 |
| 5. | \_\_\_\_\_\_\_ working improves the ductility of metals. | | CO3 | U | 1 |
| 6. | Identify the main advantage of explosive forming. | | CO3 | U | 1 |
| 7. | Indicate the purpose of the gating system in casting. | | CO4 | U | 1 |
| 8. | \_\_\_\_\_\_\_ casting combines casting and forging by applying high pressure during solidification. | | CO4 | U | 1 |
| 9. | Electron beam welding typically conducted inside \_\_\_\_\_\_\_ chamber. | | CO5 | U | 1 |
| 10. | \_\_\_\_\_\_ is the major factor that influences arc stability. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List any three differences between ferrous and non-ferrous materials. | | CO1 | U | 3 |
| 12. | Distinguish between orthogonal and oblique metal cutting. | | CO2 | U | 3 |
| 13. | Differentiate between hot working and cold working. | | CO3 | U | 3 |
| 14. | Compare sand casting with die casting. | | CO4 | U | 3 |
| 15. | Write the measures that can be taken to minimize arc blow in welding and its effects. | | CO5 | A | 3 |
| 16. | Indicate the role of adaptive control in manufacturing, | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Classify manufacturing processes based on their principles, materials and applications. | CO1 | An | 6 |
|  | b. | Illustrate the main differences between thermoplastics and thermosetting plastics, and give examples of their applications in manufacturing. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the working principle and key components in EDM setup. | CO2 | A | 6 |
|  | b. | Illustrate the effect of process parameters on material removal rate and surface finish in Abrasive Machining Process. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the working principle, types and applications of Explosive forming. | CO3 | A | 6 |
|  | b. | Explain the working principle and key components of electromagnetic forming. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the main components of a gating system and their respective functions in the metal casting process. | CO4 | A | 6 |
|  | b. | Illustrate shell casting with suitable sketches and its applications. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the process of Electron Beam Welding (EBW), highlighting its advantages, disadvantages, and common applications. | CO5 | A | 6 |
|  | b. | Explain the ultrasonic welding process and discuss its advantages, limitations, and typical applications. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the continuous casting process highlighting its advantages, and applications in the manufacturing industry. | CO4 | A | 6 |
|  | b. | Illustrate the squeeze casting process and highlight its advantages in producing high-quality metal parts. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the effect of forces that influence metal transfer in welding. | CO5 | An | 6 |
|  | b. | Explain Laser Beam Welding (LBW) process and discuss its benefits. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the principal components of Numerical Control (NC) and compare it with Computer Numerical Control (CNC). | CO6 | A | 6 |
|  | b. | Analyze the significance of sensors in manufacturing automation highlighting their capabilities and applications. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand different manufacturing processes and the economic considerations |
| **CO2** | Understand the theory of metal cutting and the sciences of advanced machining processes |
| **CO3** | Learn the theories of advanced metal forming. |
| **CO4** | Know about the process of metal casting in detail |
| **CO5** | Understand the physics of arc welding and theory of advanced welding techniques |
| **CO6** | Demonstrate an understanding of competitive manufacturing environment |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | - | 5 | - | 12 | - | - | 17 |
| **CO2** | - | 5 | 6 | 6 | - | - | 17 |
| **CO3** | - | 5 | 12 | - | - | - | 17 |
| **CO4** | - | 5 | 18 | 6 | - | - | 29 |
| **CO5** | - | 2 | 21 | 6 | - | - | 29 |
| **CO6** | - | 3 | 6 | 6 | - | - | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18ME3013** | **Duration** | **3hrs** |
| **Course Title** | **ENGINEERING MATERIALS AND APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Analyze the atomic model of elastic behaviour, emphasizing the principles of rubber-like elasticity and its relation to real-world applications. Discuss the factors influencing elastic and plastic deformation in crystalline materials. | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Critically evaluate the shear strength of perfect and real crystals, focusing on the role of dislocation movement in plastic deformation. Illustrate how these concepts are applied in improving material properties. | CO1 | E | 20 |
|  |  |  |  |  |  |
| 3. |  | Critically analyze the mechanisms of ductile and brittle fracture in materials, focusing on the energy and stress intensity approaches. Evaluate the concept of fracture toughness and its role in predicting material behaviour under different conditions. | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Examine the phenomena of fatigue and creep in materials, highlighting their significance in long-term structural performance. Discuss the ductile-to-brittle transition and its implications for material selection in engineering applications. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Evaluate the criteria for material selection in engineering applications, with reference to ASTM standards. Tabulate the properties and applications of patented steel wires, maraging steels, and precipitation-hardened aluminium alloys. | CO3 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Examine the characteristics and applications of advanced steel grades, including HSLA steels, dual-phase steels, duplex stainless steels, and TRIP steels. Discuss their relevance in modern engineering and industrial processes. | CO3 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | Critically analyze the properties and applications of shape memory alloys and smart ceramics. Discuss the structure and characteristics of silicate ceramics, carbon-based materials such as diamond and graphite, and the role of imperfections and impurities in enhancing their performance. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Analyze the structure and types of smart materials, with an emphasis on piezoelectric and magneto-rheological materials. Evaluate their applications in industrial and biomedical fields, highlighting their unique advantages and limitations. | CO5 | An | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Elaborate on the processes used in the fabrication of Polymer Matrix Composites (PMC), including hand layup, spray up, compression moulding, resin transfer moulding, pultrusion, and filament winding. Evaluate their suitability for various industrial applications. | CO6 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Apply the concepts of materials science for material selections towards new product development. |
| CO2 | Analyze the elastic and plastic behaviour of materials. |
| CO3 | Suggest modern metallic materials for engineering applications. |
| CO4 | Evaluate fracture behaviour of materials in engineering applications. |
| CO5 | Appraise the utility of new-age material for specific applications. |
| CO6 | Synthesize and develop unique customized composites for special needs. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  |  | 20 | 20 |  | 40 |
| CO2 |  |  |  | 40 |  |  | 40 |
| CO3 |  |  |  | 20 | 20 |  | 40 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 |  |  |  | 20 |  |  | 20 |
| CO6 |  |  |  |  | 20 |  | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **18ME3062** | **Duration** | **3hrs** |
| **Course Title** | **COMPOSITE MATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Outline the general characteristics and applications of composite materials. Evaluate the roles of various fibres, including glass, carbon, ceramic, and aramid, in combination with polymer, graphite, ceramic, and metal matrices, highlighting their compatibility and performance. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Critically assess the types and characteristics of smart materials. Discuss their integration with fibre-matrix systems and their contribution to enhancing the functionality and applications of advanced composites. | CO1 | E | 20 |
|  |  |  |  |  |  |
| 3. |  | Examine the characteristics of fibre-reinforced lamina and laminates, focusing on interlaminar stresses. Evaluate their static mechanical properties, fatigue, and impact behaviour under varying environmental conditions. | CO2 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Analyze the environmental effects on fiber-reinforced composites. Discuss the degradation mechanisms induced by exposure to moisture, temperature, and chemicals. Devise strategies to enhance the environmental durability of composites. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Evaluate the reliability of composite materials in engineering applications. Discuss factors affecting the reliability of composites and methods for improving reliability. | CO3 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Illustrate the characterization techniques used in the evaluation of composite products. Enumerate the application of finite element analysis (FEA) in predicting the behaviour of composite materials under different loading conditions. | CO3 | A | 20 |
|  |  |  |  |  |  |
| 7. |  | Analyze the characteristics of metal matrix composites (MMC) in comparison to traditional alloys. Evaluate the advantages and limitations of MMCs, focusing on the effects of different types of reinforcements such as particles and fibres on their mechanical properties and volume fraction using the rule of mixtures. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Evaluate the stress analysis methods for laminated composite beams, plates, and shells. Discuss their vibration and stability behaviour, highlighting their impact on the reliability of composite structures under various loading conditions. | CO5 | E | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Analyze the role of non-destructive testing techniques in the assessment of composite products. Elaborate on the failure mode predictions in composite materials, providing insights into their application in advanced design and manufacturing processes. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Predict elastic properties of composites. |
| CO2 | Predict mechanical properties of fiber-reinforced composite materials. |
| CO3 | Design a composite laminate for a given load condition. |
| CO4 | Describe fundamental fabrication processes for polymer matrix composites. |
| CO5 | Analyze the stresses using laminated plate theories. |
| CO6 | Compare and contrast different processes of manufacture of polymer composites. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 20 |  | 20 |  | 40 |
| CO2 |  |  |  | 20 | 20 |  | 40 |
| CO3 |  |  | 20 |  | 20 |  | 40 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 |  |  |  |  | 20 |  | 20 |
| CO6 |  |  |  | 20 |  |  | 20 |
|  | | | | | | | **180** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19ME1003** | **Duration** | **3hrs** |
| **Course Title** | **ENGINEERING MECHANICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Discuss triangle law of forces. | | CO1 | U | 1 |
| 2. | Describe the principle of transmissibility of forces. | | CO1 | R | 1 |
| 3. | Discuss about Varignon’s theorem. | | CO2 | U | 1 |
| 4. | Identify the types of supports in a beam. | | CO2 | U | 1 |
| 5. | The moment of inertia (Ixx) of a triangle of width (b) and height (h) is given by \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | Explain centre of gravity and centroid. | | CO3 | R | 1 |
| 7. | Describe the term ‘Range’ of a projectile. | | CO4 | U | 1 |
| 8. | Discuss on Newton’s second law of motion. | | CO4 | U | 1 |
| 9. | Enumerate on Impulse and momentum method. | | CO5 | R | 1 |
| 10. | Illustrate about angle of repose. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Distinguish between collinear and coplanar force system. | | CO1 | U | 3 |
| 12. | State Lami’s Theorem. | | CO2 | R | 3 |
| 13. | Discuss on the perpendicular axis theorem. | | CO3 | U | 3 |
| 14. | A scooter starts from rest and moves with a constant acceleration of 1.2 m/s2. Determine its velocity, after it has travelled for 60 meters. | | CO4 | A | 3 |
| 15. | Derive the Work Energy equation. | | CO5 | U | 3 |
| 16. | Describe about the laws of friction. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order. Find the magnitude and direction of the  resultant force. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Two rollers, each weighing 50 N and of radius 10 cm rest in a horizontal channel of width 36 cm, as shown in the figure. Find the reaction at the point of contacts A, B and C.  1B | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Find the moment of inertia of a T-section with flange as 150 mm × 50 mm and web as 150 mm × 50 mm about X-X and Y-Y axes through the centre of gravity of the section. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | The equation of motion of a particle moving in a straight line is given by : s = 18t + 3t2 – 2t3; where (s) is in metres and (t) in seconds.  Find (1) velocity and acceleration at start, (2) time, when the particle reaches its maximum velocity, and (3) maximum velocity of the particle. | CO4 | A | 6 |
|  | b. | In a factory, an elevator is required to carry a body of mass 100 kg. What will be the force exerted by the body on the floor of the lift, when (a) the lift is moving upwards with retardation of 0.8 m/s2 ; (b) moving downwards with a retardation of 0.8 m/s2. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | A ball of mass 1 kg moving with a velocity of 2 m/s impinges directly on a ball of mass 2 kg at rest. The first ball, after impinging, comes to rest. Find the velocity of the second ball after the impact and the coefficient of restitution. | CO5 | A | 6 |
|  | b. | Find the acceleration of a solid body A of mass 10 kg, when it is being pulled by another body B of mass 5 kg along a smooth horizontal plane as shown in figure.  Also find the tension in the string, assuming the string to be inextensible. Take g = 9.8 m/s2. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Calculate the reactions at the supports of the overhanging beam shown in figure. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Two blocks A and B of weight 80 N and 60 N are connected by a string, passing through a smooth pulley, as shown in the fig. Find the acceleration of the body and the tension in the string. Use work-energy method.  4b | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A uniform ladder of length 3.25 m and weighing 250 N is placed against a smooth vertical wall with its lower end 1.25 m from the wall. The coefficient of friction between the ladder and floor is 0.3.  What is the frictional force acting on the ladder at the point of contact between the ladder and the floor? | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Determine the resultant force and moment for a given system of forces |
| CO2 | Understand basics of equilibrium of rigid bodies |
| CO3 | Determine the centroid and second moment of area of simple solids |
| CO4 | Apply fundamental concepts of kinematics and kinetics to the analysis of simple / practical problems |
| CO5 | Understand basic kinematics concepts – displacement, velocity and acceleration |
| CO6 | Determine friction and its effects as per the laws of friction |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | 3 | 2 | - | 24 | - | - | 29 |
| CO3 | 2 | 3 | - | 12 | - | - | 17 |
| CO4 | - | 2 | 15 | - | - | - | 17 |
| CO5 | 1 | 3 | 6 | 18 | - | - | 28 |
| CO6 | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19ME2020** | **Duration** | **3hrs** |
| **Course Title** | **DRONE TECHNOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Unmanned aircraft are often used in \_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_ roles due to their ability to operate in environments that are hazardous for humans. | | CO1 | R | 1 |
| 2. | In the \_\_\_\_\_\_\_\_\_\_ phase of design, the overall requirements and system goals of the UAV are determined. | | CO1 | R | 1 |
| 3. | The \_\_\_\_\_\_\_\_\_\_ theorem states that the moment of a force about a point is equal to the sum of the moments of the components of the force about the same point. | | CO2 | R | 1 |
| 4. | The two main types of aerodynamic drag experienced by UAVs are \_\_\_\_\_\_\_\_\_\_ drag and \_\_\_\_\_\_\_\_\_\_ drag. | | CO2 | R | 1 |
| 5. | \_\_\_\_\_\_\_\_\_\_ density is a critical factor in determining the feasibility and performance of UAV structures and mechanics. | | CO3 | R | 1 |
| 6. | The \_\_\_\_\_\_\_\_\_\_ signature of a UAV is critical for reducing visual detection, especially during covert operations. | | CO3 | R | 1 |
| 7. | \_\_\_\_\_\_\_\_\_\_ payloads are expendable during missions, while \_\_\_\_\_\_\_\_\_\_ payloads are not. | | CO4 | R | 1 |
| 8. | \_\_\_\_\_\_\_\_\_\_ communication is commonly used in UAVs to ensure real-time transmission of data and control signals. | | CO4 | R | 1 |
| 9. | UAVs are launched and recovered using various systems, including \_\_\_\_\_\_\_\_\_\_ stations and \_\_\_\_\_\_\_\_\_\_ stations. | | CO5 | R | 1 |
| 10. | The \_\_\_\_\_\_\_\_\_\_ is the primary branch of the military that uses UAVs for surveillance and strike missions in naval operations. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write three significant applications of unmanned aircraft systems to environmentally critical roles. | | CO1 | U | 3 |
| 12. | Tabulate the differences between the conceptual, preliminary, and detailed phases of UAV design. | | CO2 | U | 3 |
| 13. | Summarize the scale effects that influence the aerodynamic performance of UAVs. | | CO3 | U | 3 |
| 14. | Compare the methods used to minimize thermal signatures and radio/radar signatures in UAV systems. | | CO4 | U | 3 |
| 15. | Sketch the schematic of a mini-UAV laptop ground control station. | | CO5 | U | 3 |
| 16. | List the advantages and potential limitations of unmanned aircraft systems in paramilitary operations. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Outline the evolution of unmanned aircraft systems (UAS) from their historical origins to modern-day applications and highlight the technological advancements and changes in the current scenario. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Tabulate various roles of UAVs: Dull, Dirty, Dangerous, Covert, Research, Environmentally Critical, and Economic. Provide examples of specific missions or scenarios for each role. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Sketch the equilibrium of rigid bodies, including the application of free-body diagrams and explain Varignon’s theorem, utilized in understanding the stability and support reactions of a UAV. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Examine the factors influencing the aerodynamic performance of UAVs, including lift-induced drag, parasitic drag, and scale effects. Discuss how these factors affect design decisions such as airframe configuration and power plant selection. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the challenges and considerations in designing UAV airframes for rotary-wing versus fixed-wing configurations. How do the packaging density and structural mechanics influence these designs? | CO3 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Enumerate the importance of stealth in UAV operations and examine how different types of signatures (acoustic, visual, thermal, radio/radar) are minimized during the design phase. Write any two technologies used to achieve stealth. | CO4 | AN | 12 |
|  |  |  |  |  |  |
| 23. |  | Examine the design and functionality of control stations for UAV systems, including mini-UAV laptop ground control stations. How do these systems ensure seamless communication, collision avoidance, and effective launch and recovery in diverse operational scenarios? | CO5 | AN | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Depict the following functionalities through a sketch: (a) seamless communication and (b) collision avoidance of UAVs across various operational scenarios. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the design parameters of UAV systems |
| **CO2** | Understand the aerodynamics and selection of power plants of UAV systems |
| **CO3** | Identify stealth and payload types of UAV systems |
| **CO4** | Analyze the principles of communication and control station systems used in UAV’s |
| **CO5** | Design launch and recovery systems of UAV’s |
| **CO6** | Apply the application of UAS for various applications |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 3 | 24 |  |  |  | 29 |
| **CO2** | 2 | 3 | 12 |  |  |  | 17 |
| **CO3** | 2 | 3 |  | 12 | 12 |  | 29 |
| **CO4** | 2 | 3 |  | 12 |  |  | 17 |
| **CO5** | 2 | 3 |  | 12 |  |  | 17 |
| **CO6** |  | 3 | 12 |  |  |  | 15 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **19ME2025** | **Duration** | **3hrs** |
| **Course Title** | **THERMODYNAMICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define ‘Intensive property’. | | CO1 | R | 1 |
| 2. | Write the difference between work transfer and heat transfer. | | CO1 | U | 1 |
| 3. | State the first law for a closed system undergoing a change of state. | | CO2 | R | 1 |
| 4. | Define the COP of a refrigerator. | | CO2 | R | 1 |
| 5. | Write the difference between homogeneous and heterogeneous substance. | | CO3 | U | 1 |
| 6. | Define ‘saturation state’. | | CO3 | R | 1 |
| 7. | Write down the Van der Waals equation of state. | | CO4 | R | 1 |
| 8. | State Avagadro’s law. | | CO4 | R | 1 |
| 9. | Define specific humidity. | | CO5 | R | 1 |
| 10. | Write the three basic components of a gas turbine plant. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Define the quasi-static process and write the characteristic feature. | | CO1 | U | 3 |
| 12. | Show that enthalpy of a fluid before throttling is equal to that after throttling. | | CO2 | U | 3 |
| 13. | Explain the terms critical pressure, critical temperature, and critical volume of water. | | CO3 | U | 3 |
| 14. | Write the assumptions used to consider gas as an ideal gas. | | CO4 | U | 3 |
| 15. | Define (i) dry bulb temperature, (ii) wet bulb temperature, and (iii) dew point temperature. | | CO5 | R | 3 |
| 16. | State the processes of a dual cycle and represent them on p-v plot. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | It is required to melt 5 tonnes/h of iron from a charge at 15°C to molten metal at 1650°C. The melting point is 1535°C, and the latent heat is 270 kJ/kg. The specific heat in solid state is 0.502 and in liquid state (29.93/atomic weight) kJ/kg K. If an electric furnace has 70% efficiency, find the kW rating needed. If the density in molten state is 6900 kg/m3 and the bath volume is 3 times the hourly melting rate, find the dimension of the cylindrical furnace if the length to diameter ratio is 2. The atomic weight of iron is 56. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | In a gas turbine gas enters at the rate of 5 kg/s with a velocity of 50 m/s and enthalpy of 900 kJ/kg and leaves the turbine with a velocity of 150 m/s and enthalpy of 400 kJ/kg. The loss of heat from the gases to the surroundings is 25 kJ/kg. Assume for gas R = 0.285 kJ/kg K and Cp = 1.004 kJ/kg K and the inlet conditions to be at 100 kPa and 27°C. Determine the power output of the turbine and the diameter of the inlet pipe. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the phase equilibrium diagram for a pure substance on a p-v plot with relevant constant property lines. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Show that for an ideal gas Cp - Cv = R. | CO4 | A | 6 |
|  | b. | Derive the equations used for computing the entropy change of an ideal gas. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Explain the psychrometric process. (i) Sensible heating. (ii) Cooling and dehumidification. (iii) Adiabatic mixing of two streams. (iv) Adiabatic Evaporative cooling. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Establish the equivalence of Kelvin-Planck and Clausius statements. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Steam initially at 1.5 MPa, 300°C expands reversibly and adiabatically in a steam turbine to 40°C. Determine the ideal output of the turbine per kg of steam. | CO3 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain air standard cycle of CI engine and derive the expression for thermal efficiency and network output. | CO6 | A | 12 |

**CO** – COURSE +OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts in thermodynamics and energy balance to systems and control volumes, in situations involving heat and work interactions. |
| CO2 | Differentiate between high grade and low-grade energies. |
| CO3 | Evaluate changes in thermodynamic properties of pure substances. |
| CO4 | Apply gas laws to solve problems related to gas mixtures. |
| CO5 | Create psychrometric chart to perform moist air process calculations |
| CO6 | Recognize the significance of I law for reacting systems and heating value of fuels. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | - | 12 | - | - | 17 |
| CO2 | 2 | 3 | 12 | 12 | - | - | 29 |
| CO3 | 1 | 4 | 12 | 12 | - | - | 29 |
| CO4 | 2 | 3 | 12 | - | - | - | 17 |
| CO5 | 4 | - | 12 | - | - | - | 16 |
| CO6 | - | 4 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19ME2026** | **Duration** | **3hrs** |
| **Course Title** | **APPLIED THERMODYNAMICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State ‘Equivalent of evaporation’. | | CO1 | U | 1 |
| 2. | Define ‘Factor of evaporation’? | | CO1 | U | 1 |
| 3. | Express the net work done equation of a Rankine Cycle. | | CO2 | A | 1 |
| 4. | Describe the processes in vapour power cycle. | | CO2 | A | 1 |
| 5. | The of kinetic energy steam is converted into heat energy in a nozzle. (True / False) | | CO3 | U | 1 |
| 6. | Dryness fraction of dry saturated steam is \_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | U | 1 |
| 7. | Write the main components of impulse turbine. | | CO4 | U | 1 |
| 8. | Write the purpose of fixed and moving blades in reaction turbine.. | | CO4 | A | 1 |
| 9. | Why intercooling is done in multi-stage air compressors. | | CO5 | A | 1 |
| 10. | One metric ton of refrigeration is equal to­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe evaporative capacity and calorific value of the fuel. | | CO1 | U | 3 |
| 12. | Derive the efficiency relation for vapour power cycle. | | CO2 | A | 3 |
| 13. | Derive the relation to find the outlet velocity of the steam nozzle. | | CO3 | A | 3 |
| 14. | Difference between impulse turbine and reaction turbine. | | CO4 | A | 3 |
| 15. | Derive the expression to find the volumetric efficiency of the reciprocating air compressor. | | CO5 | A | 3 |
| 16. | List any three differences between vapour compression and vapour absorption refrigeration systems. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | In a boiler trial, the following observations were made in which the pressure of the steam is 10 bar, steam condensed is 540 kg/h and fuel used was 65 kg/h. The Moisture present in the fuel is 2% by mass and mass of dry flue gases is 9 kg/kg of fuel. The calorific value of fuel is 32000 kJ/kg and temperature of the flue gases is given by 325OC .The boiler house temperature is 28OC and feed water temperature is given by 50OC. The specific heat of flue gases is 1 kJ/kg K and dryness fraction of steam is given by 0.95. The specific heat of super-heated steam is given as 2.1 kJ/kg K. Draw the heat balance sheet for the boiler | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Discuss with the help of schematic layout and T-S diagram about the working of reheat Rankine cycle and derive the relation for thermal efficiency | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Derive the expression to find the mass of steam discharged through the nozzle and evaluate the condition for maximum discharge through the nozzle. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | In a D Laval turbine steam is supplied from the nozzle with the velocity of 1200 m/s. The nozzle angle is 20o and the mean blade velocity is 400 m/s. The inlet and outlet angles of the blades are equal and the mass of the steam leaving the turbine is 1000 kg/hr. Calculate (i) Blade angles, (ii) relative velocities, (iii) Tangential force on blades, (iv) power developed, (v) Blade efficiency. Take the blade velocity coefficient as 0.8 | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Derive the relation to find the work done on a single stage, single acting reciprocating air compressor i) with clearance volume ii) without the clearance volume. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain working of water tube and fire tube boilers and discuss the relative advantages and disadvantages. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain i) Reheat Rankine cycle ii) Regenerative Rankine cycle with the help of neat sketch. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the working principle of a vapour compression refrigeration system with a neat sketch. Derive the equation to find the following. (i) work of compression; (ii) heat rejected in condenser; (iii) heat added to evaporator and the Coefficient of performance | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Estimate the performance of a steam generator |
| CO2 | Carry out analysis of vapour power cycles. |
| CO3 | Conduct analysis of steam nozzles and turbines. |
| CO4 | Evaluate performance of reciprocating compressors |
| CO5 | Apply principles of refrigeration and air conditioning for analysis and performance evaluation. |
| CO6 | Design turbine and nozzles and compressors. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 5 | 12 | 12 |  |  | 29 |
| CO2 |  |  | 29 |  |  |  | 29 |
| CO3 |  | 2 | 15 |  |  |  | 17 |
| CO4 |  | 1 | 4 | 12 |  |  | 17 |
| CO5 |  |  | 16 |  |  |  | 16 |
| CO6 |  | 4 |  | 12 |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME1006** | **Duration** | **3hrs** |
| **Course Title** | **PROFESSIONAL ETHICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define engineering ethics. | | CO1 | R | 1 |
| 2. | List few values of ethics. | | CO1 | U | 1 |
| 3. | List benefits of Integrity. | | CO2 | R | 1 |
| 4. | What is meant by trade secrets? | | CO2 | R | 1 |
| 5. | Summarize a few conflicts of interest in business practices. | | CO3 | U | 1 |
| 6. | What are social skills? | | CO3 | R | 1 |
| 7. | Define occupational crime. | | CO4 | U | 1 |
| 8. | Define collective bargaining. | | CO4 | R | 1 |
| 9. | State the purpose of the employee misconduct form. | | CO5 | U | 1 |
| 10. | Define code of ethics. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write a short note on professionalism. | | CO1 | R | 3 |
| 12. | List the various forms of intellectual property rights. | | CO2 | An | 3 |
| 13. | State academic freedom. | | CO3 | An | 3 |
| 14. | How are falsified data detected in research practice? | | CO4 | U | 3 |
| 15. | Describe risk-benefit analysis. | | CO5 | R | 3 |
| 16. | List a few unethical practices in education. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the different professional ideals & virtues. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Suggest the qualities required for a peaceful life. | CO2 | U | 8 |
|  | b. | State the characteristics of respect. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. |  | Interpret the different professional roles that engineers should adopt. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Examine the importance of accountability in a professional's life. | CO4 | An | 6 |
|  | b. | Explain the role of code of ethics in a professional engineer's service life. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the various steps in managing conflicts in an organization. | CO5 | E | 6 |
|  | b. | Examine the common forms of occupational crime. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the importance of engineers as moral leaders. | CO6 | E | 6 |
|  | b. | Explain the various roles of an engineer as a professional. | CO6 | E | 6 |
|  |  |  |  |  |  |
| 23. |  | Explain the core elements of a strong work ethic. | CO3 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Identify the factors behind unethical behaviors in government offices. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the ethical framework in professional life. |
| **CO2** | Know the psychology and philosophy of ethics. |
| **CO3** | Recognize the ethics in scientific and engineering society. |
| **CO4** | Diagnose the code of ethics and ethical standards. |
| **CO5** | Understand the integrity in research. |
| **CO6** | Realize the Enforcement of Code of Ethics. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 4 | 1 | - | - | 12 | - | 17 |
| **CO2** | 6 | 8 | - | 3 | - | - | 17 |
| **CO3** | 1 | 1 | - | 3 | 24 | - | 29 |
| **CO4** | 1 | 4 | - | 6 | 6 | - | 17 |
| **CO5** | 3 | 1 | - | 6 | 6 | - | 16 |
| **CO6** | 1 | - | 12 | 3 | 12 | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME1007** | **Duration** | **3hrs** |
| **Course Title** | **3D PRINTING TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The process of converting the STL file model into layers is called\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | List the correct sequence to generate parts by 3D printing. | | CO1 | R | 1 |
| 3. | SLS stands as an acronym for \_\_\_\_\_\_\_\_\_ . | | CO2 | U | 1 |
| 4. | Identify a file format that cannot be converted into STL file format. | | CO2 | U | 1 |
| 5. | Indicate the percentage of photopolymer in the monomers. | | CO3 | U | 1 |
| 6. | List the materials used in 3D printers for consumers. | | CO3 | R | 1 |
| 7. | List the key functions of the LOM process. | | CO4 | R | 1 |
| 8. | Express the importance of the post-curing process. | | CO5 | U | 1 |
| 9. | Indicate the preheat temperature of electron beam melting. | | CO6 | U | 1 |
| 10. | Indicate the key functions of the shape deposition manufacturing. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the common challenges in 3D printing and how they can be addressed. | | CO1 | An | 3 |
| 12. | Distinguish between conventional machining and 3D printing. | | CO2 | U | 3 |
| 13. | Write short notes on SLA resin. | | CO3 | A | 3 |
| 14. | Discuss the sheet lamination process. | | CO4 | U | 3 |
| 15. | Write short notes on laser engineered net shaping. | | CO5 | A | 3 |
| 16. | List the merits and limitations of the electron beam melting. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Write the detailed procedure of the new product development cycle. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Classify geometric modeling techniques and explain them in detail. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the stereo lithography process. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the Fused Deposition Modeling process. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Write the working of the selective laser sintering process. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the Rapid Prototyping data Processing procedure and its applications. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Illustrate the steps involved in Solid Ground Curing and its applications. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the wire arc additive manufacturing process. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Conceptualize the product development cycle and identify the role of 3D Printing in industries. |
| CO2 | Illustrate appropriate 3D Printing techniques for developing products. |
| CO3 | Articulate the working principles of various 3D Printing Technologies. |
| CO4 | Identify suitable applications for every classification of 3D Printing Technology |
| CO5 | Correlate the process variables with the quality of products built using 3D Printing Processes |
| CO6 | Design materials for 3D Printing Process to solve real time industrial problems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | 12 | 3 | - | - | 17 |
| **CO2** | - | 5 | 12 | 12 | - | - | 29 |
| **CO3** | 1 | 1 | 27 | - | - | - | 29 |
| **CO4** | 1 | 3 | 12 | - | - | - | 16 |
| **CO5** | - | 1 | 15 | - | - | - | 16 |
| **CO6** | 3 | 2 | 12 | - | - | - | 17 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME2002** | **Duration** | **3hrs** |
| **Course Title** | **CNC PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | Indicate the function of the hydraulic hammer. | CO1 | U | 1 |
| 2. | State the applications of an induction motor in a CNC machine. | CO1 | R | 1 |
| 3. | Describe the function of the stepper motor in CNC machines. | CO2 | U | 1 |
| 4. | Indicate the steps per revolution range of the stepper motor. | CO2 | U | 1 |
| 5. | Define interpolation. | CO3 | R | 1 |
| 6. | Indicate the function of the Tustin method. | CO3 | U | 1 |
| 7. | Indicate the function of G-codes. | CO4 | U | 1 |
| 8. | List the two types of coordinate systems. | CO5 | R | 1 |
| 9. | Define position error. | CO5 | R | 1 |
| 10. | Identify the function of G-28 code. | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Differentiate between NC system and CNC system. | CO1 | U | 3 |
| 12. | Compare encoder with resolver. | CO2 | U | 3 |
| 13. | Differentiate between reference pulse and sample data interpolation methods. | CO3 | U | 3 |
| 14. | Sketch the acceleration/deceleration profiles used in CNC. | CO4 | A | 3 |
| 15. | Write short notes on the servo controller positioning system used in CNC. | CO5 | A | 3 |
| 16. | Compare fixed cycle with canned cycle. | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | |
| 17. | Explain the CNC Control Loop and its components. | CO1 | A | 12 |
|  |  |  |  |  |
| 18. | Sketch and explain the servo and stepping motor drives used in CNC machine tools. | CO2 | A | 12 |
|  |  |  |  |  |
| 19. | Explain hardware interpolation digital differential analyzer algorithm. | CO3 | A | 12 |
|  |  |  |  |  |
| 20. | Describe the linear and circular interpolation functions used in CNC machining. | CO4 | A | 12 |
|  |  |  |  |  |
| 21. | Illustrate the importance and working of the PID controller used in CNC for position response analysis. | CO5 | A | 12 |
|  |  |  |  |  |
| 22. | Appraise the functions of Programmable logic control and its architecture. | CO1 | A | 12 |
|  |  |  |  |  |
| 23. | Develop a CNC program for the given specimen. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | |
| 24. | Develop a CNC program for machining the diameter 30 mm rod as shown in figure; also mention the importance of G code and M code. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the control systems for CNC machine tool and select the components of CNC architecture |
| CO2 | Articulate the principles of motors, Feedback devices and hydraulic system |
| CO3 | Compare the interpolation methods in CNC control system |
| CO4 | Propose the PLC programming Languages. |
| CO5 | Recommend PID controllers, servo controller, Numerical control Kernel types |
| CO6 | Design and evaluate CNC programming techniques for various industrial applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 4 | 24 | - | - | - | 29 |
| **CO2** | - | 5 | 12 | - | - | - | 17 |
| **CO3** | 1 | 4 | 12 | - | - | - | 17 |
| **CO4** | - | 4 | 12 | - | - | - | 16 |
| **CO5** | 2 | - | 15 | - | - | - | 17 |
| **CO6** | - | 4 | 24 | - | - | - | 28 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20ME2004** | **Duration** | **3 hrs.** |
| **Course Name** | **DESIGN OF MEDICAL DEVICES AND IMPLANTS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Illustrate a comprehensive model of life cycle stages of medical devices. | | CO1 | A | 1 |
| 2. | Compare and contrast between the design process and the design control. | | CO1 | A | 1 |
| 3. | List the material requirements for implants used in orthopedic applications. | | CO2 | R | 1 |
| 4. | Explain the concept of bio-adhesion function within biological systems. | | CO2 | A | 1 |
| 5. | Indicate two polymer biomaterials used in medical industries. | | CO2 | U | 1 |
| 6. | List two types of ventilator support in noninvasive ventilation. | | CO3 | R | 1 |
| 7. | List the important tribological properties of biomaterials for implants. | | CO3 | U | 1 |
| 8. | Write the primary function of a bone screw. | | CO4 | R | 1 |
| 9. | Illustrate the Hydrolysis process. | | CO5 | U | 1 |
| 10. | State the term degradation of materials. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain FDA based medical device categorization. | | CO1 | An | 3 |
| 12. | Justify the selection of properties that an ideal material for invasive medical devices should possess. | | CO2 | E | 3 |
| 13. | Sketch the schematic diagram of a typical oxygen concentrator. | | CO3 | C | 3 |
| 14. | Interpret the safety and essential performance characteristics for medical devices. | | CO4 | A | 3 |
| 15. | Examine the mechanisms of fatigue wear in materials and illustrate them through detailed sketches | | CO5 | A | 3 |
| 16. | Construct the gate symbols used in fault tree analysis. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Evaluate the strengths and limitations of the Waterfall design process in comparison to Pahl and Beitz’s design approach. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the properties of zirconia implant material. | CO2 | An | 8 |
|  | b. | Assess the properties of various polymers used as biomaterials for their potential use in medical and healthcare sectors. | CO2 | E | 4 |
|  |  |  |  |  |  |
| 19. | a. | Compose the principles and mechanisms of noninvasive ventilation (NIV) for clinical applications. | CO3 | C | 8 |
|  | b. | Analyze the operational mechanism of Pressure Swing Adsorption (PSA) in air separation methods. | CO3 | An | 4 |
|  |  |  |  |  |  |
| 20. | a. | Examine the different types of bone defects based on their characteristics and implications for treatment. | CO4 | A | 6 |
|  | b. | Infer the biocompatibility and its need with the classification of biological tests to be conducted for a device used for implantation. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Determine various physical and mechanical properties that can be measured using Universal Testing Machine. | CO4 | A | 6 |
|  | b. | Critically analyze and compare various paradigms for implant design. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Compare and contrast four major degradation mechanisms for polymers. | CO5 | An | 6 |
|  | b. | Distinguish the natural polymers from synthetic polymers with their merits, demerits and applications in medical field. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Summarize various steps involved in writing own Failure Mode Effects Analysis (FMEA). | CO6 | E | 8 |
|  | b. | Illustrate briefly various types of FMEA. | CO6 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate the critical role of risk assessment in the manufacturing of medical devices in terms of safeguarding patient safety and achieving regulatory compliance. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
| **COURSE OUTCOMES** | |
| The student will be able to | |
| CO1 | Understand the class of medical devices and design cycle. |
| CO2 | Apply the design process and different design models. |
| CO3 | Evaluate the design procedures. |
| CO4 | Have in-depth knowledge about blood interfacing implants. |
| CO5 | Evaluate the design quality and realization. |
| CO6 | Test the design and evaluate the risk management involved in the design of new medical device. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | - | 1 | 3 | 12 | - | 17 |
| CO2 | - | 1 | 2 | 8 | 7 | - | 18 |
| CO3 | 1 | 1 | - | 4 | - | 11 | 17 |
| CO4 | 1 | - | 15 | 12 | - |  | 28 |
| CO5 | - | 1 | 3 | 6 | 6 | - | 16 |
| CO6 | 1 | - | 3 | 4 | 20 | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20ME2007** | **Duration** | **3hrs** |
| **Course Name** | **AUTOMATION OF PRODUCT LIFE CYCLE MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Which of the following is a basic element of an automated system?  A) Control unit B) Human operator C) Raw materials D) Market demand | | CO1 | U | 1 |
| 2. | In transfer lines, what is primarily analyzed to improve efficiency?  A) Market demand B) Transfer mechanisms C) Employee satisfaction  D) Supply chain logistics | | CO1 | R | 1 |
| 3. | What type of logic device uses Boolean algebra for decision-making?  A) Hydraulic actuator B) Pneumatic sensor C) Logic gate D) Encoder | | CO2 | R | 1 |
| 4. | Passive orientation devices do not require an external power source to function. (True/False) | | CO2 | R | 1 |
| 5. | Give any one mathematical model used in manufacturing. | | CO3 | U | 1 |
| 6. | Name any two important applications of robots in manufacturing automation. | | CO3 | R | 1 |
| 7. | Identify one component of Product Life Cycle Management (PLM). | | CO4 | R | 1 |
| 8. | Name one key benefit of implementing a PLM strategy in an organization. | | CO4 | U | 1 |
| 9. | What does FMEA stands for? | | CO5 | U | 1 |
| 10. | Name one function of Product Data Management (PDM) systems. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | What is cellular manufacturing, and how does it differ from traditional manufacturing methods? | | CO1 | An | 3 |
| 12. | Write the basic components of pneumatic circuits and their significance in automation. | | CO2 | U | 3 |
| 13. | Explain how artificial neural networks contribute to manufacturing automation. | | CO3 | An | 3 |
| 14. | List the stages of Product Life Cycle (PLC). | | CO4 | U | 3 |
| 15. | Write the significances of Taguchi Method for design of experiments in optimizing product performance characteristics. | | CO5 | An | 3 |
| 16. | Why the material master data in product structures is crucial for manufacturing? | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the levels of automation and provide an example for each level. | CO1 | U | 6 |
|  | b. | What are Flexible Manufacturing Systems (FMS)? Discuss shortly how FMS is implemented in industries. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | How do orientation devices improve the efficiency of automated assembly systems? | CO2 | An | 6 |
|  | b. | Explain the concept of Schmitt triggering devices and their application in automation. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the fundamentals of system modeling and its significance in optimizing manufacturing operations with suitable examples. | CO3 | U | 6 |
|  | b. | Explain the applications of AI and fuzzy logic in control systems of manufacturing industries. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 20. |  | Discuss the steps involved in preparing for and developing a PLM strategy. How the companies can select the most suitable PLM strategies for their needs? | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the application of case studies on new product design using brainstorming techniques. What are the key takeaways from these case studies regarding creativity and innovation in design? | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Write the advantages and disadvantages of hydraulic systems and pneumatic systems. | CO2 | U | 6 |
|  | b. | Discuss the role of product design in automatic assembly. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the elements of PLM and how they interact to improve product data management and workflow efficiency. | CO4 | A | 6 |
|  | b. | Discuss the strategies for reducing manufacturing costs in product design without comprising the quality. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the benefits of using 3D CAD systems in the design and development of components and machines. | CO6 | U | 6 |
|  | b. | Write a short note on the functions and architectures of PDM. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Explain various strategies and technologies adapted in industrial automation. |
| **CO2** | Select appropriate evaluation methods used in the automation. |
| **CO3** | Apply modern tools like AI, ANN and Fuzzy logics in the building of automation systems. |
| **CO4** | Apply the concept of New Product Development and its structuring. |
| **CO5** | Analyse the virtual product development. |
| **CO6** | Develop new product development, product structure and supporting systems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 7 | 7 | 6 | 3 | - | - | 23 |
| **CO2** | 2 | 9 | - | 12 | - | - | 23 |
| **CO3** | 7 | 7 | - | 3 | - | - | 17 |
| **CO4** | 1 | 4 | 6 | 12 | - | - | 23 |
| **CO5** | - | 7 | - | 15 | - | - | 22 |
| **CO6** | - | 16 | - | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME2010** | **Duration** | **3hrs** |
| **Course Title** | **KINEMATICS AND DYNAMICS OF MACHINERY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Discuss about higher pair. | | CO1 | U | 1 |
| 2. | List the types of joints in a mechanism | | CO1 | R | 1 |
| 3. | Define instantaneous centre of rotation. | | CO2 | R | 1 |
| 4. | Cite an expression maximum power transmitted by belt drive. | | CO3 | U | 1 |
| 5. | State the phenomena of ‘creep’ in a belt drive. | | CO3 | R | 1 |
| 6. | Define addendum in a gear. | | CO4 | R | 1 |
| 7. | Discuss about a ‘compound gear train’. | | CO4 | U | 1 |
| 8. | Define the term ‘sensitiveness’ relating to a governor. | | CO5 | R | 1 |
| 9. | Define a gyroscopic couple. | | CO5 | U | 1 |
| 10. | Generalize as to why balancing of rotating parts is necessary for high speed engines. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Discuss the types of constrained motion. | | CO1 | U | 3 |
| 12. | Illustrate how velocity of a slider is obtained in a slider crank mechanism. | | CO2 | A | 3 |
| 13. | Discuss relative merits and demerits of belt and rope drives for transmission of power. | | CO3 | U | 3 |
| 14. | Compare the cycloidal and involute tooth forms. | | CO4 | R | 3 |
| 15. | Discuss on the classification of cams. | | CO5 | U | 3 |
| 16. | Discuss the basic elements of a vibratory system. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Sketch and explain the various inversions of slider crank chain. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Angular velocity of crank OA is 300 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD. The dimensions of various links are: OA = 30 mm; AB = 45 mm ; BC 50 mm ; and BD = 46 mm, as shown in Fig (a). The distance between the centres of rotation O and C is 60 mm. The path of travel of the slider is 10 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical.  Fig (a) | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter running at 250 rpm. The angle embraced is 165º and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1000 kg/m3 and thickness of the belt is 10 mm, estimate the width of the belt, taking centrifugal tension into account. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20 degree pressure angle, 12 mm module and 10 mm addendum. Evaluate the length of path of contact, arc of contact and the contact ratio. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | A Proell governor has all four arms of length 250 mm. The upper and lower ends of the arms are pivoted on the axis of rotation of the governor. The extension arms of the lower links are each 100 mm long and parallel to the axis when the radius of the ball path is 150 mm. The mass of each ball is 4.5 kg and the mass of the central load is 36 kg. Determine the equilibrium speed of the governor. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | A, B, C and D are four masses carried by a rotating shaft at radii 100,  125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively. Evaluate the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 r.p.m. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Calculate the gyroscopic effects in the following conditions:  1. The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius.  2. The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | The following data are given for a vibratory system with viscous damping:  Mass = 2.5 kg ; spring constant = 3 N/mm and the amplitude decreases to 0.25 of the initial value after five consecutive cycles. Determine the damping coefficient of the damper in the system. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the basic concepts of Mechanisms, Machines and their relative motions, then apply it to appropriate environments. |
| **CO2** | Carry out kinematic analysis (Displacement, Velocity and Acceleration) of simple mechanisms (Single slider Crank Mechanism and four bar Mechanisms) by graphical and analytical method. |
| **CO3** | Construct & Design different CAM profiles for given conditions using graphical & Theoretical methods. |
| **CO4** | Apply the concept of balancing and use it for reducing the unbalanced forces in rotating masses and reciprocating engines under operating conditions exposure to IS standards. |
| **CO5** | Acquire knowledge on types of vibrations in different systems and damping methods to minimize vibrations. |
| **CO6** | Understand, apply and analyze the control mechanisms in Governors and Gyroscopes. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 16 | - | - | - | - | 17 |
| **CO2** | 1 | - | 3 | 12 | - | - | 16 |
| **CO3** | 1 | 4 | 12 | - | - | - | 17 |
| **CO4** | 4 | 1 | - | 12 | - | - | 17 |
| **CO5** | 1 | 4 | 24 | - | - | - | 29 |
| **CO6** | - | 4 | 12 | 12 | - | - | 28 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20ME2011** | **Duration** | **3hrs** |
| **Course Title** | **FINITE ELEMENT METHODS IN ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Write the application of finite element analysis in Thermal Engineering. | | CO5 | A | 1 |
| 2. | List any two finite element based analysis software. | | CO6 | R | 1 |
| 3. | Define Finite Element Analysis. | | CO1 | R | 1 |
| 4. | Write the degrees of freedom in Co continuity. | | CO3 | A | 1 |
| 5. | List the functions of node. | | CO3 | R | 1 |
| 6. | Classify the types of boundary conditions in FEA. | | CO3 | U | 1 |
| 7. | Define Discretization. | | CO1 | R | 1 |
| 8. | Write the purpose of Pascal’s triangle. | | CO2 | A | 1 |
| 9. | Define serendipity element. | | CO2 | R | 1 |
| 10. | State the different modes of heat transfer. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define weighted residual method and write its advantages. | | CO2 | R | 3 |
| 12. | Differentiate between r, p, and h versions of the finite element method. | | CO6 | An | 3 |
| 13. | Write the functions of shape function. | | CO2 | A | 3 |
| 14. | Justify the reason for preferring polynomial function instead of trigonometric function. | | CO5 | E | 3 |
| 15. | Differentiate between local, global and natural coordinate systems. | | CO3 | An | 3 |
| 16. | Define Higher order element and write its limitations. | | CO2 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine the nodal displacements and stresses induced in the axially loaded stepped bar shown in Figure 1. The bar has cross sectional areas A1 and A2 over the lengths L1 and L2 respectively. Assume the following datas: A1= 2cm2 and A2= 1cm2, L1=L2=10cm, E1=E2=2x107N/cm2, P=100N.  2  10 cm  10 cm  1  3  P  Figure1 | CO5 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Consider the differential equation for the problem as ; 0 ≤x ≤ 1 ; with the boundary conditions y (0) = 0 and y(1) = 0. Use one coefficient trial function as y=a1x(1-x3).  Evaluate the value of parameter a**1** using Galerkin’s method, point collocation method, sub domain method and least square method. Also compare the solutions obtained using weighted residual method with exact solution | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the factors to be considered in finite element analysis during the process of discretization. | CO1 | U | 8 |
|  | b. | Formulate the element stiffness matrix for 1D link element | CO2 | C | 4 |
|  |  |  |  |  |  |
| 20. |  | Develop the shape functions for 1D quadratic element (use local coordinate system) | CO2 | C | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the element shape functions and calculate the value of temperature at point ‘P’ as shown in Figure 2.  The nodal values of temperature are Ti = 80oC; Tj = 100 oC ; Tk= 150 oC. Point ‘P’ is located at (2, 5). (All dimensions are in cm)  •  P  X  Y  i (1,1)  j(3,4)  k(2,7)  Figure 2 | CO4 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain lagrangian element and establish the shape functions for any one lagrangian family of element. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | For the smooth pipe of variable cross section shown in Figure 3, determine the potential at the junctions, velocities in each section of the pipe and the volumetric flow rate. The potential at the left end is p1=10m and that at the right end is p4=2m. Permeability coefficient k=1m/s.    1 m  1 m  1 m  A1=3m2  A2=2m2  A3=1m2  1  2  3  4  Figure3 | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Determine the temperature distribution in a one dimensional fin with the physical properties shown in Figure4. The fin is rectangular in shape and is 8cm long, 4cm wide and 1cm thick. Assume that convection heat loss occurs from the right end of the fin. (use 2 element idealization)  ;  L=8 cm  80°C  4cm  1cm  Figure4 | CO5 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Acquire the fundamental theory of finite element analysis and develop characteristic equation. |
| **CO2** | Derive element matrix equation by applying basic laws in mechanics and integration by parts |
| **CO3** | Apply suitable boundary conditions to a global equation for field problems |
| **CO4** | Analyse scalar and vector variable problems |
| **CO5** | Understand the application and use FE method for solving heat transfer, fluid mechanics and  structural problems |
| **CO6** | Use professional level finite element software to solve engineering problems |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 8 | - | - | - | - | 10 |
| **CO2** | 7 | - | 4 | 12 | - | 16 | 39 |
| **CO3** | 1 | 1 | 13 | 3 | - | - | 18 |
| **CO4** | - | - | - | - | 12 | - | 12 |
| **CO5** | 1 | - | 37 | - | 3 | - | 41 |
| **CO6** | 1 | - | - | 3 | - | - | 04 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20ME2012** | **Duration** | **3hrs** |
| **Course Title** | **INTERNET OF THINGS FOR MECHANICAL SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Outline the applications of IOT in Manufacturing Process. | | CO1 | | R | 1 |
| 2. | Smart products can analyze big data and perform computations through software. (True/False). | | CO1 | | A | 1 |
| 3. | Name one area of research where High Performance Computing is used. | | CO2 | | R | 1 |
| 4. | The V of Big Data, which defines different formats of data from various sources, is termed as \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | | R | 1 |
| 5. | The ability of an organization to reduce waste in time, effort and materials as much as possible, while still producing a high-quality service or product is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | | R | 1 |
| 6. | Tip of the extruder where hot material comes out in a 3D printer is termed as print bed. (True/False). | | CO3 | | U | 1 |
| 7. | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is designed to intelligently analyze data to automate key supply chain processes and supporting capabilities. | | CO4 | | R | 1 |
| 8. | Mention any one application of head mounted displays. | | CO4 | | A | 1 |
| 9. | …………. recently unveiled a Level 4 self-driving taxi service in Arizona, where they had been testing driverless cars―without a safety driver in the seat―for more than a year and over 10 million miles. | | CO5 | | R | 1 |
| 10. | BIM model cannot contain information on design, construction, logistics, operation, maintenance, budgets and schedules. (True/False) | | CO6 | | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | List two functions of the gateway in IoT. | | CO1 | R | | 3 |
| 12. | Compare structured and unstructured data. | | CO2 | An | | 3 |
| 13. | Mention any 2 examples of industries who have adapted predictive maintenance and explain the predictive maintenance used by them. | | CO3 | R | | 3 |
| 14. | Sketch the enablers for synchronized planning. | | CO4 | R | | 3 |
| 15. | Contrast AI and Autonomy. | | CO5 | An | | 3 |
| 16. | Classify the types of electrical vehicle charging. | | CO6 | An | | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | | |
| 17. |  | Summarize the working and classification of IoT with respect to networking, communication and connectivity protocols with suitable examples used in the market today. | CO1 | E | | 12 |
|  |  |  |  |  | |  |
| 18. |  | Determine the laws of robotics and examine the application of robots in any five domains with their benefits. | CO2 | An | | 12 |
|  |  |  |  |  | |  |
| 19. | a. | With the help of a neat diagram, explain the components of supply chain management. | CO3 | An | | 6 |
|  | b. | Elaborate on the implantation of the intelligent supply chain management. | CO3 | An | | 6 |
|  |  |  |  |  | |  |
| 20. |  | Appraise Cyber physical systems and any five applications of cyber physical systems with IoT. | CO4 | E | | 12 |
|  |  |  |  |  | |  |
| 21. |  | Classify the resource constraints and explain any six-resource constraints with appropriate examples. | CO5 | An | | 12 |
|  |  |  |  |  | |  |
| 22. | a. | Interpret Big data in IOT. | CO2 | A | | 6 |
|  | b. | Outline the steps to be followed to deploy a Big Data solution. | CO2 | A | | 6 |
|  |  |  |  |  | |  |
| 23. | a. | Differentiate Augmented Reality and Virtual Reality. | CO4 | An | | 4 |
|  | b. | Examine in detail two main applications of virtual reality in manufacturing. | CO4 | A | | 8 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Justify the reason for the condition monitoring for industrial drives. | CO6 | E | | 4 |
|  | b. | Explain any four technologies used for the condition monitoring for industrial drives. | CO6 | An | | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Interpret the Essentials of IoT for Modern Engineers. |
| **CO2** | Examine the importance of Smart and Digital Factories. |
| **CO3** | Make use of IoT in Manufacturing Process and Applications. |
| **CO4** | Model IoT for Cyber-Physical Systems, Virtual Reality and Data Analytics. |
| **CO5** | Interpret the IoT Challenges in Mechanical Systems. |
| **CO6** | Apply IoT concepts in various applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 4 |  | 1 |  | 12 |  | 17 |
| **CO2** | 2 |  | 12 | 15 |  |  | 29 |
| **CO3** | 4 | 1 |  | 13 |  |  | 18 |
| **CO4** | 3 |  | 9 | 4 | 12 |  | 29 |
| **CO5** | 1 |  |  | 15 |  |  | 17 |
| **CO6** |  | 1 | 8 | 3 | 4 |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME2013** | **Duration** | **3hrs** |
| **Course Title** | **SENSOR TECHNOLOGY FOR MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Distinguish between the transducer and sensor. | | CO1 | An | 1 |
| 2. | Write the significance of the term ‘Hysteresis’ in the sensor measurement system. | | CO1 | A | 1 |
| 3. | The output voltage of a Hall sensor is directly proportional \_\_\_\_\_\_\_\_\_\_field. | | CO2 | U | 1 |
| 4. | Write the effect of Reflection and Transmission in the ultrasonic sensor. | | CO3 | A | 1 |
| 5. | Indicate the frequency range that a human can observe. | | CO3 | U | 1 |
| 6. | Define windowing in the machine vision system. | | CO4 | R | 1 |
| 7. | Indicate the two applications of Thermistor sensors. | | CO5 | U | 1 |
| 8. | Indicate the materials used for the fabrication of Diaphragm used in pressure sensors. | | CO5 | U | 1 |
| 9. | Write the advantages of implementing SCADA in the food industry. | | CO6 | A | 1 |
| 10. | Identify the mobile phone sensor that recognizes when a user is holding the phone close to his face during a call. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Infer the ‘Accuracy and ‘Resolution' with an example. | | CO1 | An | 3 |
| 12. | Articulate the principle of Faraday’s first law of induction with an example. | | CO2 | A | 3 |
| 13. | State the working principle of the sensors used in gas and liquid chromatography. | | CO3 | R | 3 |
| 14. | Articulate the term ‘Template Matching' in machine vision systems. | | CO4 | A | 3 |
| 15. | Explain the significance of Debye temperature in selecting sensor materials in high-temperature applications. | | CO5 | A | 3 |
| 16. | Sketch the food processing control using the PLC system. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the static and dynamic characteristics of sensors used in mechanical systems. | CO1 | A | 8 |
|  | b. | Articulate the significance of Microelectronic systems (MEMs) and their applications. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the principle of ‘Microwave Motion Detection Sensor’ with a neat sketch. | CO2 | U | 6 |
|  | b. | Explain the working principle of vibration sensors with a neat sketch. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the working procedure of a sensor used to detect the breathing rate of a sleeping child with a neat line sketch. | CO3 | An | 8 |
|  | b. | Describe the principle of the Electrochemical sensor with a simple sketch. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. |  | Describe the operational function of the Eddy Current Proximity sensor with a neat sketch and its potential application in industries. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the working principle of Resistance Thermometerwith a neat sketch and its applications. | CO5 | U | 8 |
|  | b. | Illustrate the principle of the Piezoelectric sensor used for temperature measurement. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | Describe the working principle of the Reed switch and LED based proximity sensor with a clear sketch and its applications. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Illustrate the working principle of Optoelectronic Pressure Sensors with a neat sketch and its industrial applications. | CO5 | A | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Articulate the various process control systems used in modern food processing industries. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL**M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Recognize the concept of sensors and its characteristics. |
| **CO2** | Summarize the practical approach in design of technology based on different sensors |
| **CO3** | Categorize various sensor materials and technology used in designing sensors |
| **CO4** | Describe the working principle of resistive, inductive and capacitive sensors and their applications. |
| **CO5** | Determine the thermocouples, piezoelectric and pyro-electric sensors and their applications. |
| **CO6** | Apply the digital and proximity sensors in Industries. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | - | - | 13 | 4 | - | - | 17 |
| **CO2** | - | 19 | 9 | - | - | - | 28 |
| **CO3** | 4 | 4 | 1 | 8 | - | - | 17 |
| **CO4** | 1 | 12 | 3 | - | - | - | 16 |
| **CO5** | - | 10 | 19 | - | - | - | 29 |
| **CO6** | - | 1 | 16 | - | - | - | 17 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME2014** | **Duration** | **3hrs** |
| **Course Title** | **INDUSTRIAL SAFETY AND QUALITY STANDARDS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the types of machine guards. | | CO1 | U | 1 |
| 2. | State the following sentence as **True or False**  ‘Personnel protective equipment’s (PPE) are substitute for Engineering controls’. | | CO1 | R | 1 |
| 3. | Articulate any one objective of OSHA. | | CO2 | R | 1 |
| 4. | Assess any two benefits of safety audit. | | CO2 | R | 1 |
| 5. | Name the hearing protection devices. | | CO3 | U | 1 |
| 6. | As per the definition of Crossby, conformance to the ----------------- is known as quality. | | CO3 | R | 1 |
| 7. | Define the term ‘Accuracy’ in quality control. | | CO4 | U | 1 |
| 8. | Name any two quality control methods. | | CO4 | R | 1 |
| 9. | List few examples of Prevention Expenses. | | CO5 | U | 1 |
| 10. | State Quality Function Deployment. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the hierarchy of safety control. | | CO1 | An | 3 |
| 12. | Articulate the fundamental goal of national policy for safety. | | CO2 | U | 3 |
| 13. | Determine the Stages in Risk Management. | | CO3 | An | 3 |
| 14. | List any three Safety practices adopted in paint shops. | | CO4 | U | 3 |
| 15. | Distinguish quality management and assurance. | | CO5 | An | 3 |
| 16. | State the formula to compute ‘Process Capability Ratio’. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Describe the goals of safety management and the various responsibilities of the members of an organization. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the various safety measure to be adopted during welding. | CO2 | An | 6 |
|  | b. | Survey the safety rules to be followed during material handling, | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Examine the many guarding methods used in the machining industry and enumerate their benefits and drawbacks. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Elaborate on some safety precautions adopted in chemical industries. | CO3 | An | 6 |
|  | b. | Categorize the costs for poor quality with examples. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Outline the various barriers towards TQM implementation in an organization. | CO5 | A | 4 |
|  | b. | Compute the various variable and attribute control charts and their unique applications in quality assurance. | CO5 | A | 8 |
|  |  |  |  |  |  |
| 22. |  | Illustrate FMEA in an Automotive industry. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Construct different types of control charts and make inference for each graph. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Appraise the ‘Business Process Reengineering ( BPR)’ with suitable example. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Apply safety principles, protocols and Personnel protective equipments (PPE) to engineering processes |
| **CO2** | Assess risk in manufacturing processes in term of Risk Priority Number (RPN) ,manage and mitigate them |
| **CO3** | Apply quality principles and control charts to maintain quality of the processes and products |
| **CO4** | Appraise quality costs in products and minimize failure and reworks |
| **CO5** | Experimenting failure analysis thereby improve the production process and develop fool proof Manufacturing processes |
| **CO6** | Adapting Total Quality Management tools such as Quality function deployment, Benchmarking and Business process reengineering to realize quality standards |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 1 | 5 | 16 |  |  | 24 |
| **CO2** | 2 | 2 | 17 |  |  |  | 21 |
| **CO3** | 1 | 2 | 8 | 13 |  |  | 24 |
| **CO4** | 1 | 4 | 6 |  |  |  | 11 |
| **CO5** | 1 | 2 | 14 | 12 |  |  | 29 |
| **CO6** | 1 | 2 | 12 |  |  |  |  |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME2016** | **Duration** | **3hrs** |
| **Course Title** | **FLUID MECHANICS AND FLUID MACHINES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Write the expression of bulk modulus. | | CO1 | R | 1 |
| 2. | 1 atmospheric pressure = \_\_\_\_\_\_\_\_\_\_\_\_\_Torr. | | CO1 | R | 1 |
| 3. | \_\_\_\_\_\_\_\_\_\_\_\_fluids are irrotational. | | CO2 | R | 1 |
| 4. | Write Bernoulli’s eqn with respect to unit volume. | | CO2 | R | 1 |
| 5. | Euler number is the ratio of\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | R | 1 |
| 6. | The dimensionless number express with respect to velocity of sound. | | CO3 | R | 1 |
| 7. | Write the expression for peizometric head. | | CO4 | R | 1 |
| 8. | Write Darcy -Welsbach equation. | | CO4 | R | 1 |
| 9. | The overall efficiency of the pump is the product of \_\_\_\_\_\_\_\_\_\_\_\_ | | CO5 | R | 1 |
| 10. | Multistage of pumps in parallel increases\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the characteristics of inverted U tube manometer. | | CO1 | U | 3 |
| 12. | List any four applications of Bernoulli’s equation. | | CO2 | R | 3 |
| 13. | Explain shape factor of boundary layer (H). | | CO3 | U | 3 |
| 14. | Compare Chezy’s formula with Darcy Weisbach equation. | | CO4 | U | 3 |
| 15. | Write the different types of rotary pumps. | | CO5 | R | 3 |
| 16. | Explain surge tank and its applications. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. |  | Distinguish between capillary rise and fall with neat sketches and examples | CO1 | R | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain with a neat diagram the working of a venturi meter. | CO2 | R | 8 |
|  | b. | Derive the expression for discharge in venturi meter. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. |  | Discuss in detail about the shear stress and velocity distribution for boundary layer theory. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the minor losses in pipes with neat sketch. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 21. | a. | Expressions for total velocity and total acceleration of fluid particles. | CO4 | R | 8 |
|  | b. | Explain flow condition with respect to convective and local acceleration | CO4 | R | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the construction and working of centrifugal pump with neat diagram | CO5 | R | 9 |
|  | b. | Discuss about the multistage of pumps in series and parallel with equations | CO5 | R | 3 |
|  |  |  |  |  |  |
| 23. |  | Explain the working principle of Pelton wheel turbine with neat sketches. | CO6 | R | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Determine the rate of ﬂow of water through a pipe of diameter 20cm and length 50m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4m above the center of the pipe. Consider all minor losses and take ƒ = 0.009 in the formula . Also draw Hydraulic Gradient Line (H.G.L) and Total Energy Line (T.E.L) for this case | CO4 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the important fluid properties and determine forces acting on immersed bodies. |
| CO2 | Solve fluid flow problems using Conservation principles. |
| CO3 | Analyze the characteristics of boundary layer and relationship between different physical quantities of fluid flow. |
| CO4 | Determine rate of flow and calculate flow losses through pipes. |
| CO5 | Evaluate the performance of pumps. |
| CO6 | Evaluate the performance of turbines. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 14 | 3 | - | - | - | - | 17 |
| CO2 | 13 | 4 | - | - | - | - | 17 |
| CO3 | 14 | 15 | - | - | - | - | 29 |
| CO4 | 26 | 3 | - | - | - | - | 17 |
| CO5 | 16 | - | - | - | - | - | 29 |
| CO6 | 15 | 1 | - | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME2017** | **Duration** | **3hrs** |
| **Course Title** | **AUTOMOTIVE MATERIALS AND ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name one application where materials selection is critical in aerospace engineering. | | CO1 | A | 1 |
| 2. | What role do materials selection charts play in the engineering design process? | | CO1 | An | 1 |
| 3. | What are material indices used for in engineering? | | CO2 | U | 1 |
| 4. | Name one design requirement that influences materials selection. | | CO2 | R | 1 |
| 5. | What material is commonly used for cylinder liners in internal combustion engines? | | CO3 | R | 1 |
| 6. | What materials are commonly used for gear box in internal combustion engines? | | CO3 | R | 1 |
| 7. | Draw the basic starting circuit in an automotive electrical system. | | CO4 | A | 1 |
| 8. | Enumerate the role of electrical wiring terminals and switching in automotive components. | | CO4 | U | 1 |
| 9. | Define driver instrumentation systems. | | CO5 | R | 1 |
| 10. | Briefly explain the concept of automatic transmission. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Provide examples of environmentally friendly materials and their suitability for each application area, considering factors such as recyclability, energy efficiency, and emissions reduction. | | CO1 | A | 3 |
| 12. | Define systematic process selection and explain its importance in optimizing manufacturing processes for cost, efficiency, and quality. | | CO2 | U | 3 |
| 13. | Discuss the importance of material selection for connecting rods in internal combustion engines, considering factors such as fatigue strength. | | CO3 | E | 3 |
| 14. | Compare and contrast electronic control of carburetion with fuel injection systems. | | CO4 | E | 3 |
| 15. | Identify the components involved in electronic control systems for traction and braking, highlighting their roles. | | CO5 | A | 3 |
| 16. | Outline the operation of vehicle lighting circuits, including the types of lights typically included and their functions. | | CO6 | C | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Identify and discuss three forces driving change in materials selection and design. | CO1 | A | 6 |
|  | b. | Analyze how each force influences materials selection criteria, design methodologies, and engineering practices. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the factors driving the development of new materials. | CO1 | C | 6 |
|  | b. | Explain the purpose and utility of materials selection charts, such as Ashby charts, in displaying material properties. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain how computer-aided selection software assists engineers in analyzing, comparing, and optimizing material and process choices. | CO2 | E | 6 |
|  | b. | Discuss the benefits and limitations of computer-aided selection tools in engineering design. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Discuss the materials commonly used for manufacturing gears and clutches, including alloy steels, carbon composites, and friction materials, and explain their respective advantages and limitations. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Outline the principles of charging systems in automobiles, including the role of alternators, voltage regulators, and battery management systems. | CO4 | A | 6 |
|  | b. | Discuss the requirements and challenges of modern starting systems, considering factors such as cold starting, cranking speed, and reliability. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the fundamental concept of instrumentation systems and their role in monitoring and controlling various parameters in vehicles. | CO5 | E | 6 |
|  | b. | Discuss the principles of operation and specific applications of at least three types of sensors. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Analyze the application of artificial intelligence in engine management systems, such as predictive maintenance, adaptive engine tuning, and fault diagnosis. Discuss how AI algorithms improve engine performance and efficiency. | CO6 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | State the functionalities of miscellaneous safety or comfort systems found in modern vehicles, such as adaptive cruise control, lane departure warning, automatic parking assistance, and adaptive suspension systems. Explain how these systems improve vehicle safety, comfort, and driving experience. | CO6 | A | 12 |
|  |  |  |  |  |  |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Familiar with different materials used for automotive component manufacturing. |
| **CO2** | Select proper material for Automobile applications. |
| **CO3** | Choose a suitable material for selected part of the engine components. |
| **CO4** | Know the working of electronic starting and ignition systems. |
| **CO5** | Use the instrumentations and electronic controls. |
| **CO6** | Understand the engine managements system, lighting and security systems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** |  |  | 10 | 7 | 6 | 6 | 29 |
| **CO2** | 1 | 4 | 6 |  | 6 |  | 11 |
| **CO3** | 2 |  | 12 |  | 3 |  | 17 |
| **CO4** |  | 1 | 7 | 6 | 3 |  | 23 |
| **CO5** | 1 |  | 9 |  | 6 |  | 16 |
| **CO6** |  | 1 | 12 |  |  | 15 | 28 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME3001** | **Duration** | **3hrs** |
| **Course Title** | **ADDITIVE MANUFACTURING TECHNOLOGIES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Outline the principles of Additive Manufacturing (AM) and discuss the steps to follow in the current industrial scenario for product and prototype development. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Differentiate the types of light sources used in liquid-based AM processes. With a neat sketch distinguish the light sources used in the Stereolithography Apparatus (SLA) process and Solid Ground Curing (SGC) process. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | Evaluate with a use case analysis, the merits, and demerits of Z Corp’s 3D printer (3DP) over the Selective Laser Sintering (SLS) technique. | CO3 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Analyze the classification of rapid tooling methods, focusing on indirect rapid tooling techniques. Distinguish between the principles, processes, and applications of methods of spray metal deposition, investment casting, and sand casting. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Classify the digitization techniques available for reverse engineering a product, and represent it with a schematic diagram. List the application of reverse engineering in the medical and automotive sectors. | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Enumerate the critical factors that influence the performance and functions of Electron Beam Melting. Justify the answer with an example. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | Analyze the principles and processes of direct rapid tooling methods, including Direct AIM, and LOM tools. Discuss their advantages and limitations in comparison to indirect rapid tooling methods and their applications. | CO5 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Compare and contrast conventional tooling with rapid tooling (RT). Evaluate the need for RT in modern manufacturing, and classify its methods, emphasizing the principles and applications of indirect techniques such as arc spray metal deposition, investment casting, and the 3D Keltool process. | CO5 | AN | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Explain in detail the role of Rapid Prototyping in Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), and other engineering simulations for design validation and optimization. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Describe the significance and importance of Additive manufacturing (AM) for product development and innovation. |
| CO2 | Demonstrate comprehensive knowledge of the broad range of AM processes, devices, capabilities, and materials. |
| CO3 | Articulate the various trade-offs in selecting advanced/additive manufacturing processes, devices, and materials to suit particular product requirements. |
| CO4 | Design a product and employ a suitable AM process for value addition and reproduction of complex parts. |
| CO5 | Select an RP tool for multi-component objects using advanced/additive manufacturing devices and processes. |
| CO6 | Apply the principles of Rapid tooling and develop a tool for various applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 20 |  |  |  | 20 |
| CO2 |  |  |  | 20 |  |  | 20 |
| CO3 |  |  |  |  | 20 |  | 20 |
| CO4 |  |  | 20 | 20 |  |  | 40 |
| CO5 |  |  | 20 | 20 |  |  | 40 |
| CO6 |  |  | 20 | 20 |  |  | 40 |
|  | | | | | | | **180** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20ME3008** | **Duration** | **3hrs** |
| **Course Title** | **NON-DESTRUCTIVE TESTING AND INSPECTION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Illustrate the suitable methods to find out the cracks in engineering components; explain with suitable sketches. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Outline the working principles of ultrasonic testing with appropriate examples; also discuss the types of waves used in ultrasonic testing. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. |  | Sketch and elucidate the working procedure of Radiography testing and enumerate the types of Radiography testing methods. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Analyze the principles and applications of Visual Testing (VT) and Liquid Penetrant Testing (LPT). highlighting their adherence to codes, standards, and best practices. | CO2 | AN | 20 |
|  |  |  |  |  |  |
| 5. |  | Compare the role of **optical methods** in ultrasonic testing with a focus on **Laser Ultrasonic** and **Laser Stereography.** | CO3 | AN | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Critically examine the characteristic curves and processing defects in film radiography. Discuss the interpretation of radiographs, highlighting the advantages, and limitations in industrial applications. | CO3 | E | 20 |
|  |  |  |  |  |  |
| 7. |  | Examine the theory and principles of Time-of-Flight Diffraction (TOFD). Discuss its equipment requirements, advantages, and limitations, and evaluate its adherence to codes and standards in interpretation and application scenarios. | CO4 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Analyze the principles, advantages, and limitations of ultrasonic guided waves and optical methods in ultrasonics, including laser ultrasonics and laser stereography. Evaluate their applications in advanced structural health monitoring systems. | CO5 | AN | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Summarize the methodologies of leak testing, including the measurement of leakage, types of leaks, and flow characteristics. Compare these techniques with thermographic NDE, digital radiography, and computed tomography (CT), highlighting their roles in strain measurement and structural analysis. | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Apply non-destructive testing techniques and formulate standard solutions for conducting defect analysis. |
| CO2 | Develop test procedures aligned with safety protocols, codes, standards, and specifications for advanced material evaluation and defect detection. |
| CO3 | Assess radiographic defects, interpret radiographs, and apply radiation safety protocols for assessing image quality. |
| CO4 | Differentiate various defect types and select the appropriate NDT method for inspecting the component. |
| CO5 | Evaluate advanced structural health monitoring and condition monitoring techniques for real-world thermography diagnostics. |
| CO6 | Analyze the types of leaks, flow characteristics, and strain measurement methods to develop comprehensive diagnostic solutions. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 40 |  |  |  | 40 |
| CO2 |  |  | 20 | 20 |  |  | 40 |
| CO3 |  |  |  | 20 | 20 |  | 40 |
| CO4 |  |  |  |  | 20 |  | 20 |
| CO5 |  |  |  | 20 |  |  | 20 |
| CO6 |  |  | 20 |  |  |  | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **20ME3009** | **Duration** | **3hrs** |
| **Course Title** | **NEW-AGE MATERIALS** | **Max. Marks** | **100** |
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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Compare the key properties of advanced and new-age materials and how do these properties contribute to their applications in modern engineering? | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Illustrate the principles of the direct and indirect piezoelectric effects, and demonstrate how piezoelectric materials are applied in sensors, actuators, biomorphs, and energy-harvesting technologies. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Compare and contrast the structural and electronic properties of carbon nanotubes (CNTs) and graphene. Highlight their unique characteristics and justify their potential applications. | CO2 | An | 10 |
|  | b. | Outline the principles of the magnetorheological (MR) effect and explain the rheological properties of these materials that can be regulated using magnetic fields. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Enumerate the principles behind thermochromism, photochromism, electrochromism, halochromism and solvatochromism | CO3 | A | 10 |
|  | b. | Differentiate the principles and mechanisms underlying the Shape Memory Effect and Super elastic Effect in Shape Memory Alloys. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Analyze the structure of perovskite ceramics (ABO₃) and assess their significance in piezoelectric applications. | CO4 | AN | 10 |
|  | b. | Evaluate the use of smart polymers in drug delivery systems. Discuss how smart polymers can respond to external stimuli to release drugs in a controlled manner. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Analyze and compare the principles, mechanisms, and applications of shape memory and superelastic effects in shape memory alloys (SMAs). Evaluate the differences between the one-way and two-way shape memory effects with suitable examples. | CO5 | AN | 20 |
|  |  |  |  |  |  |
| 7. |  | Critically assess the industrial and medical applications of Ni-Ti shape memory alloys. Discuss the preparation techniques, properties, and applications of advanced shape memory materials such as ceramics, polymers, and alloy foams, providing examples to illustrate their functionalities. | CO5 | AN | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Summarize the concepts of self-healing materials and the mechanisms involved in their self-repairing capabilities. | CO6 | A | 10 |
|  | b. | Compare various approaches to molecular imprinting and assess their significance in biotechnology and biomedical applications. | CO6 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Elucidate the principles behind smart corrosion protection coatings. Articulate the mechanisms employed by these coatings to detect and prevent corrosion. | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply advanced manufacturing techniques such as AM, VIM, VAR, and SPS, to design and develop innovative smart systems. |
| CO2 | Analyze the structure of piezoelectric materials in sensors, actuators, and biomorphs to develop energy-harvesting technologies. |
| CO3 | Evaluate the techniques, properties, and applications of shape memory ceramics, polymers, and alloy foams for smart medical applications. |
| CO4 | Develop advanced materials such as CNTs, graphene, metallic glasses, high entropy alloys, and magnetorheological materials for special-purpose industrial applications. |
| CO5 | Synthesize the properties of thermally-responsive and electroactive polymer microgels, to develop biocompatible materials in biomedical applications. |
| CO6 | Develop self-healing materials, sensors, actuators, transducers, and MEMS for space applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 40 |  |  |  | 40 |
| CO2 |  |  | 10 | 10 |  |  | 20 |
| CO3 |  |  | 20 |  |  |  | 20 |
| CO4 |  |  |  | 10 | 10 |  | 20 |
| CO5 |  |  |  | 40 |  |  | 40 |
| CO6 |  |  | 40 |  |  |  | 40 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **21ME2002** | **Duration** | **3hrs** |
| **Course Title** | **STRENGTH OF MATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | | **M** | |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | State clearly the Hooke’s law. | | CO1 | R | | 1 | |
| 2. | If a force acts on a body, it sets up some resistance to the deformation. This resistance is known as ------ | | CO1 | U | | 1 | |
| 3. | List out the different types of beam and applied load. | | CO2 | R | | 1 | |
| 4. | If a cantilever beam is subjected to a point load at its free end, then the shear force under the point load is **--------** | | CO2 | R | | 1 | |
| 5. | In the theory of simply bending, the bending stress in the beam section varies **------** | | CO3 | U | | 1 | |
| 6. | Describe the moment of resistance. | | CO3 | R | | 1 | |
| 7. | Define the term ‘torque’. | | CO4 | U | | 1 | |
| 8. | Define resilience in the context of strain energy. | | CO4 | R | | 1 | |
| 9. | A simply supported beam carriers a point load at its centre. The slope at its supports is ---- | | CO5 | U | | 1 | |
| 10. | Obtain a relation for the Rankine’s crippling load for columns. | | CO6 | R | | 1 | |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | A brass rod 2 m long is fixed at both its ends. If the thermal stress is not to exceed 76.5 MPa, calculate the temperature through which the rod should be heated. Take the values of α and E as 17 × 10–6/K and 90 GPa respectively. | | CO1 | An | | 3 | |
| 12. | Discuss the utility of shear force and bending moment diagrams. | | CO2 | U | | 3 | |
| 13. | State the assumptions made in the theory of simple bending. | | CO3 | U | | 3 | |
| 14. | A circular shaft of 50 mm diameter is required to transmit torque from one shaft to another. Find the safe torque, which the shaft can transmit, if the shear stress is not to exceed 40 MPa. | | CO4 | An | | 3 | |
| 15. | Explain the concept of the double integration method for calculating the deflection of beams. How is it applied in a simply supported beam under a central point load? | | CO5 | A | | 3 | |
| 16. | Explain the failure of long columns and short columns. | | CO6 | U | | 3 | |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | | | |
| 17. |  | A steel bar ABCD 4 m long is subjected to forces as shown in Figure 1.    Figure 1  Find the elongation of the bar. Take E for the steel as 200 GPa. | CO1 | E | 12 | |
|  |  |  |  |  |  | |
| 18. |  | A cantilever beam AB, 2 m long carries a uniformly distributed load of 1.5 kN/m over a length of 1.6 m from the free end. Draw shear force and bending moment diagrams for the beam. | CO2 | An | 12 | |
|  |  |  |  |  |  | |
| 19. |  | A rectangular beam 300 mm deep is simply supported over a span of 4 m. What uniformly distributed load the beam may carry, if the bending stress is not to exceed 120 MPa. Take I = 225 × 106 mm4. | CO3 | An | 12 | |
|  |  |  |  |  |  | |
| 20. |  | A hollow shaft is to transmit 200 kW at 80 r.p.m. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 of the external diameter, find the diameters of the shaft. | CO4 | E | 12 | |
|  |  |  |  |  |  | |
| 21. |  | A simply supported beam AB of span 5 m is carrying a point load of 30 kN at a distance 3.75 m from the left end A. Calculate the slopes at A and B and deflection under the load. Take EI = 26 × 1012 N-mm2. | CO5 | E | 12 | |
|  |  |  |  |  |  | |
| 22. |  | A simply supported beam 5 m long is loaded with a uniformly distributed load of 10 kN/m over a length of 2 m as shown in Figure 2. Draw shear force and bending moment diagrams for the beam indicating the value of maximum bending moment.    Figure 2 | CO2 | E | 12 | |
|  |  |  |  |  |  | |
| 23. | a. | A circular shaft of 60 mm diameter is running at 150 r.p.m. If the shear stress is not to exceed 50 MPa, find the power which can be transmitted by the shaft. | CO4 | An | 8 | |
|  | b. | Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion. | CO4 | U | 4 | |
| **COMPULSORY QUESTION** | | | | |
| 24. |  | An I-section joist 400 mm × 200 mm × 20 mm and 6 m long is used as a strut with both ends fixed. What is Euler’s crippling load for the column? Take Young’s modulus for the joist as 200 GPa. | CO6 | E | 12 | |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **COURSE OUTCOMES** | | | | | | | | | |
| **CO1** | Demonstrate fundamental knowledge about various types of loading and stresses induced. | | | | | | | | | |
| **CO2** | Draw the SFD and BMD for different types of loads and support conditions. | | | | | | | | | |
| **CO3** | Analyze the stresses induced in basic mechanical components. | | | | | | | | | |
| **CO4** | Estimate the strain energy in mechanical elements. | | | | | | | | | |
| **CO5** | Analyze the deflection in beams. | | | | | | | | | |
| **CO6** | Evaluate buckling and bending phenomenon in columns, struts and beams. | | | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 1 | - | 3 | 12 | - | 17 |
| **CO2** | 2 | 3 | - | 12 | 12 | - | 29 |
| **CO3** | 1 | 4 | - | 12 | - | - | 17 |
| **CO4** | 1 | 5 | - | 11 | 12 | - | 29 |
| **CO5** |  | 1 | 3 | - | 12 | - | 16 |
| **CO6** | 1 | 3 | - | - | 12 | - | 16 |
|  | | | | | | | **124** |



**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21ME2003** | **Duration** | **3hrs** |
| **Course Title** | **DESIGN OF MACHINE ELEMENTS** | **Max. Marks** | **100** |

Use of PSG Data book and approved data books/materials are permitted.

Any missing data may be suitably assumed

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Classify the types of machine design. | | CO1 | U | 1 |
| 2. | Name the theory of failure suitable for the design of brittle materials. | | CO2 | R | 1 |
| 3. | Define eccentric load. | | CO1 | R | 1 |
| 4. | List the type of stresses induced in shafts. | | CO2 | R | 1 |
| 5. | Write the different type of loads that can act on machine components. | | CO2 | A | 1 |
| 6. | Define factor of safety. | | CO1 | R | 1 |
| 7. | Justify the reason for using flange coupling. | | CO3 | E | 1 |
| 8. | Define Soderberg line. | | CO4 | R | 1 |
| 9. | Write the difference between coupling and a clutch. | | CO3 | A | 1 |
| 10. | Name the possible modes of failure in riveted joint. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the factors affecting endurance strength. | | CO2 | R | 3 |
| 12. | Distinguish between brittle fracture and ductile fracture. | | CO2 | U | 3 |
| 13. | Distinguish between axle and shaft with examples. | | CO3 | An | 3 |
| 14. | List the methods used to reduce stress concentration. | | CO4 | R | 3 |
| 15. | Write the factors to be considered in the selection of materials for a machine element. | | CO1 | A | 3 |
| 16. | Write the function of rebound clips in a leaf spring. | | CO5 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Figure1  A mild steel bracket as shown in Figure1 is subjected to a pull of 6000N acting at 45˚ to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Estimate the cross-sectional dimensions of the bracket, if the permissible stress in the materials of the bracket is limited to 60 MPa. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | A mild steel shaft is subjected to 3500 N-m of bending moment at its critical point and transmits a torque of 2500 N-m. The shaft is made of steel having yield strength of 231 MPa. Estimate the size of the shaft based on various theories of failure and specify the final size. Take factor of safety as 2 and Poisson's ratio as 0.3. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | A bar of circular cross-section is subjected to alternating tensileforces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A hollow shaft of 0.5m outside diameter and 0.3m inside diameter is used to drive a propeller of a marine vessel. The shaft is mounted on bearings 6m apart and it transmits 5600kW at 150rpm. The maximum axial propeller thrust is 500kN and the shaft weighs 70kN. Evaluate   1. The maximum shear stress developed in the shaft. 2. Angular twist between the bearings. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Design a helical compression spring to sustain an axial load of 3KN. The deflection is 60mm. Spring index is 6. The shear stress is not to exceed 300 MPa. Modulus of rigidity for spring material is 81 GPa. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 22. |  | Design a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 23. |  | A semi-elliptical spring has an overall length of 1.1m and sustains a load of 70kN at its centre. The spring has 3 extra full length leaves and 13 graduated leaves with a central band of 100mm wide. All the leaves are to be stressed equally without exceeding 420 N/mm2 when fully loaded. The total depth of the spring is twice the width. If the young’s modulus is 2.1x105 N/mm2 , determine the following   1. The thickness and width of leaves 2. The nip to be provided for pre-stressing 3. The load exerted on the clipping bolts after the spring is assembled. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design a knuckle joint for transmitting an axial load of 30kN. The allowable stresses are 80N/mm2 in tension, 120N/mm2 in crushing and 60N/mm2 in shear. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the standard design procedure for design of machine elements |
| **CO2** | Analyze stresses acting on components and determine the size based on theories of failure |
| **CO3** | Design machine components for a given load condition using design data hand book |
| **CO4** | Decide specifications as per standards given in design data and select standard components to improve interchangeability. |
| **CO5** | Design and develop non- standard machine components |
| **CO6** | Prepare a detail design layout, drawing and computer coding of machine elements |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 3 | 13 | 3 | - | - | - | 19 |
| **CO2** | 5 | 3 | 1 | 12 | - | - | 21 |
| **CO3** | - | - | 13 | 3 | 1 | - | 17 |
| **CO4** | 4 | - | - | - | 12 | 12 | 28 |
| **CO5** | - | - | 15 | - | - | 12 | 27 |
| **CO6** | - | - | - | - | - | 12 | 12 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21ME2006** | **Duration** | **3hrs** |
| **Course Title** | **HEAT AND MASS TRANSFER** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Conduction resistance due to a plane wall of thickness L of material with thermal conductivity K and area A is \_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | Critical insulation thickness on a cylindrical pipe is calculated by the expression \_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | According to lumped system analysis, solid possesses thermal conductivity that is infinitely \_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 4. | Grashoff number has significant role in heat transfer by \_\_\_\_\_\_\_\_ convection. | | CO2 | U | 1 |
| 5. | Radiation shield should have \_\_\_\_\_\_\_ reflectivity. | | CO3 | U | 1 |
| 6. | If the temperature of a solid surface changes from 27°C to 627°C, then its emissive power changes in the ratio of \_\_\_\_\_\_\_. | | CO3 | A | 1 |
| 7. | Compare to parallel flow heat exchanger, LMTD in case of counter flow heat exchanger is \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | Ratio of actual heat transfer to maximum possible heat transfer is termed as \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | The ratio of a mass concentration of species A to the total mass of the mixture is known as \_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | Give one example of diffusion mass transfer. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State Fourier’s law of heat conduction. | | CO1 | R | 3 |
| 12. | Distinguish between natural and forced convection heat transfer. | | CO2 | U | 3 |
| 13. | A black surface is positioned in a vacuum container so that it absorbs incident solar radiant energy at the rate of 950 W/m2. If the surface conducts no heat to its surroundings, determine its equilibrium temperature. | | CO3 | A | 3 |
| 14. | Define fouling. Describe its effects on heat exchanger performance. | | CO4 | R | 3 |
| 15. | Define film wise and drop wise condensation. | | CO5 | U | 3 |
| 16. | Hydrogen gas is maintained at 5 bar and 1 bar on opposite sides of a plastic membrane, which is 0.3 mm thick. The temperature is 250C, and the binary diffusion coefficient of hydrogen in the plastic is 8.7 x 10-8m2/s. The solubility of hydrogen in the membrane is 1.5x10-3 kgmol / m3bar. Calculate the mass flux of hydrogen by diffusion through the membrane. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | A wall of 0.5m thickness is to be constructed from a material which has an average thermal conductivity of 1.4 W/mK. The wall is to be insulated with a material having an average thermal conductivity of 0.35W/mK so that the heat loss per square metre will not exceed 1450 W. Assuming that the inner and outer surface temperature are 12000C and 150C respectively. Calculate the thickness of insulated material. | CO1 | A | 6 |
|  | b. | A hollow cylinder 5 cm I.D and 10 cm O.D. has an inner surface temperature of 2000C and an outer surface temperature of 1000C. Determine the temperature of the point halfway between the inner and the outer surfaces. If the thermal conductivity of the cylinder material of 70 W/mK, determine the heat flow through the cylinder per metre. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | An air stream at 100C is flowing along a heated plate at 900C at a speed of 75 m/s. The plate is 45cm long and 60 cm wide. Assuming the transition of boundary layer takes place at Recr=5 x 105, calculate the average value of friction coefficient and heat transfer coefficient for full length of the plate. Also calculate the heat dissipation from the plate. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Two large parallel plates at temperature 1000 K and 600 K have emissivity of 0.5 and 0.8 respectively. A radiation shield having emissivity 0.1 on one side and 0.05 on the other side is placed between the plates. Calculate the heat transfer rate by radiation per square metre with and without radiation shield. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | 45.5 kg/h of water is to be heated from 100C to 770C with flue gases having an initial temperature of 1660C. The mass flow rate of the flue gases is 182 kg/h and their specific heat is 1.05 kJ/kgK. The overall heat transfer coefficient may be taken as 114 W/m2K.Estimate the size of the heating surface for parallel and counter flow. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | It is desired to generate 100 kg/h of saturated steam at 1000C using a heating element of copper of surface area 5m2. Calculate the convective heat transfer coefficient, the temperature of the heating surface and the critical heat flux. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | An aluminium sphere weighing 5.5 kg and initially at a temperature of 2900C is suddenly immersed in a fluid at 150C. The convective heat transfer coefficient is 58 W/m2K. Estimate the time required to cool the aluminium to 950C, using the lumped capacity method of analysis. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | State Buckingham’s π theorem. Explain the various parameters used in forced convection. Using dimensional analysis show that Nu=φ(Re,Pr). | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Air at 1atm and 250C, containing small quantities of iodine, flows with a velocity of 6.2m/s inside a 35 mm diameter tube. Calculate mass transfer coefficient for iodine. The thermo-physical properties of air are υ=15.5 x 10-6 m2/s, D=0.8 x 10-5 m2/s. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Formulate and analyze a heat transfer problem involving conduction heat transfer. |
| **CO2** | Estimate the heat transfer rates due to convection phenomena in external and internal flows |
| **CO3** | Evaluate radiation heat transfer between black, gray surfaces and the surroundings |
| **CO4** | Design heat exchangers and also estimate the pressure drop and pumping power. |
| **CO5** | Apply boiling and condensation correlations to two phase flow processes. |
| **CO6** | Estimate the mass transfer by applying suitable correlations. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 5 | - | 12 | 12 | - | - | 29 |
| **CO2** | - | 5 | 24 | - | - | - | 29 |
| **CO3** | - | 1 | 16 | - | - | - | 17 |
| **CO4** | 4 | 1 | 12 | - | - | - | 17 |
| **CO5** | 1 | 3 | 12 | - | - | - | 16 |
| **CO6** | 1 | - | 15 | - | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **21ME2007** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTATIONAL FLUID DYNAMICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define ‘divergence’. | | CO1 | U | 1 |
| 2. | Classify the forces that exert influence on a fluid particle. | | CO1 | U | 1 |
| 3. | Write the importance of adaptive grids. | | CO2 | A | 1 |
| 4. | Define ‘Hybrid mesh’. | | CO2 | R | 1 |
| 5. | Write the condition for explicit discretization of the unsteady conductive heat transfer. | | CO3 | A | 1 |
| 6. | Write the differential form of 1D steady diffusion. | | CO3 | A | 1 |
| 7. | The flow in which property which is not varying with time is called----- | | CO4 | R | 1 |
| 8. | Write the essential requirement for transportiveness. | | CO4 | A | 1 |
| 9. | Define ‘no-slip condition’. | | CO5 | U | 1 |
| 10. | SIMPLE algorithm stands for-------------------- | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the differential form of general transport equation. | | CO1 | A | 3 |
| 12. | Differentiate between uniform and non-uniform grids. | | CO2 | U | 3 |
| 13. | Determine the expression for central difference second derivative using the Taylor series. | | CO3 | A | 3 |
| 14. | Write the advantage of hybrid differencing scheme. | | CO4 | A | 3 |
| 15. | Sketch u & v velocity cell at the outlet boundary. | | CO5 | A | 3 |
| 16. | Write the two main problems associated with the solution of momentum and continuity equation. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Derive the three-dimensional mass conservation equation for a compressible fluid. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the basic steps involved in creating mesh for CFD simulation. Categorize the mesh in terms of application and accuracy. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Derive the discretized form of equation for 1D steady diffusion problem. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A property φ is transported by means of convection and diffusion through a one-dimensional domain. Consider the case to be steady one-dimensional convection diffusion, with boundary conditions as φ0 = 1at x = 0 and φL = 0 at x = L. Using five equally spaced cells and the central difference scheme for convection and diffusion, calculate the distribution of φ as a function of x. Apply the following data: u=0.1 m/s, L= 1 m, Γ= 0.1 kg/m/s, ρ= 1 kg/m3 | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain how the following boundary conditions are implemented.   1. Inlet boundary condition 2. Periodic or cyclic boundary condition 3. Pressure boundary conditions | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Consider the problem of source free heat conduction in an insulated rod whose ends are maintained at constant temperatures of 100 ◦C and 500◦C respectively. Calculate the steady state temperature distribution in the rod if the length of the rod is 0.5 m, thermal conductivity equals to 1000 W/mK, and cross-sectional area is 10-2 m2. Divide the rod into five equal control volumes and solve the problem. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Derive the y-momentum equation from the fundamentals of thermodynamics. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain SIMPLER algorithm and derive the Discretized equation for pressure. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Formulate the required governing equations for flow and heat transfer problems. |
| CO2 | Identify suitable grids for computing |
| CO3 | Discretize the governing equations of flow and heat transfer problems |
| CO4 | Solve the diffusion equations |
| CO5 | Develop a suitable finite volume method for the convection diffusion problems |
| CO6 | Use appropriate algorithms to solve the discretized equations. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 2 | 3 | 12 |  |  | 17 |
| CO2 | 1 | 3 | 1 | 12 |  |  | 17 |
| CO3 |  |  | 17 | 12 |  |  | 29 |
| CO4 | 1 |  | 16 | 12 |  |  | 29 |
| CO5 |  | 1 | 3 | 12 |  |  | 16 |
| CO6 | 1 |  | 3 | 12 |  |  | 16 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **21ME2009** | **Duration** | **3hrs** |
| **Course Title** | **APPLICATION OF MACHINE LEARNING FOR MECHANICAL ENGINEERING SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the term Machine Learning. | | CO1 | R | 1 |
| 2. | List the common problems addressed by Artificial Intelligence. | | CO1 | R | 1 |
| 3. | Define simple linear regression. | | CO2 | R | 1 |
| 4. | Differentiate between dependent and independent variables. | | CO2 | U | 1 |
| 5. | List the primary functions of decision trees. | | CO3 | R | 1 |
| 6. | Define overfitting in Machine Learning. | | CO3 | R | 1 |
| 7. | State the full form of the DBSCAN algorithm. | | CO4 | R | 1 |
| 8. | Define clustering in Machine Learning. | | CO4 | R | 1 |
| 9. | List the application areas of Recurrent Neural Networks (RNNs). | | CO5 | R | 1 |
| 10. | What is rotary machines? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between supervised learning and unsupervised learning with their key differences. | | CO1 | An | 3 |
| 12. | Define ridge regression and explain its purpose in addressing multicollinearity in regression models. | | CO2 | U | 3 |
| 13. | Analyze the methods used to handle missing data in Machine Learning. | | CO3 | An | 3 |
| 14. | State the main objective of clustering algorithms in data analysis. | | CO4 | U | 3 |
| 15. | Identify the purpose of using multiple filters in a convolutional layer of a Convolutional Neural Network (CNN). | | CO5 | U | 3 |
| 16. | Classify the different types of prognostics used in machine condition monitoring. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Describe the various search techniques used in Artificial Intelligence and explain each algorithm with examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the process of fitting a simple linear regression model by detailing the mathematical formulation and the steps involved in parameter estimation with an example. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the various techniques for handling missing data in Machine Learning. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the applications of clustering algorithms across various domains and provide a detailed example of their use in one specific domain. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the architecture of a Deep Neural Network (DNN) and describe the role of each component in the learning process. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Elucidate the architecture of Long Short-Term Memory (LSTM) networks and discuss their advantages in handling sequential data. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the working principles of condition monitoring in rotary machines and discuss the challenges associated with its implementation. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Define prognostics and explain its significance in the maintenance of both rotary and reciprocating machines. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Obtain the basics terminologies of artificial intelligence and machine learning. |
| **CO2** | Formulate and evaluate the prediction models using supervised learning algorithms. |
| **CO3** | Design and analyses the models using unsupervised learning algorithms. |
| **CO4** | Understand the basics of clustering and develop prediction model. |
| **CO5** | Understand the basics of deep learning. |
| **CO6** | Applying the concept of machine learning and deep learning in mechanical engineering related problems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 12 | - | 3 | - | - | 17 |
| **CO2** | 1 | 4 | 12 | - | - | - | 17 |
| **CO3** | 2 | - | - | 15 | - | - | 17 |
| **CO4** | 2 | 3 | 12 | - | - | - | 17 |
| **CO5** | 1 | 27 | - | - | - | - | 28 |
| **CO6** | - | 16 | - | 12 | - | - | 28 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **21ME2015** | **Duration** | **3hrs** |
| **Course Title** | **DESIGN OF ELECTRIC VEHICLES AND BATTERY MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the law of motion that explains how forces affect a vehicle's acceleration. | | CO1 | R | 1 |
| 2. | Name the component in electric vehicles that provides torque to the wheels. | | CO1 | R | 1 |
| 3. | State the primary motor requirements for Electric Vehicles (EVs) and Hybrid Electric Vehicles (HEVs). | | CO2 | R | 1 |
| 4. | List the main components of a DC machine. | | CO2 | R | 1 |
| 5. | Define Permanent Magnet Machine (PM). | | CO3 | R | 1 |
| 6. | Indicate the role of an AC drive in an electrical system. | | CO3 | U | 1 |
| 7. | Discuss the purpose of the transmission configuration in an electric vehicle (EV). | | CO4 | U | 1 |
| 8. | Name the two primary components of an electric vehicle drive train. | | CO4 | R | 1 |
| 9. | State the typical voltage range of a lead-acid battery cell. | | CO5 | U | 1 |
| 10. | Interpret the function and importance of a Battery Management System (BMS). | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the key components of an electric vehicle (EV) propulsion system and their functions. | | CO1 | U | 3 |
| 12. | Define the concept of regenerative braking in electric vehicles. | | CO2 | U | 3 |
| 13. | Describe the concept of Pulse Width Modulation (PWM). | | CO3 | U | 3 |
| 14. | Discuss the function and importance of a clutch in an electric vehicle. | | CO4 | U | 3 |
| 15. | Illustrate the key advantages of lithium-ion batteries over lead-acid batteries. | | CO5 | An | 3 |
| 16. | List some key battery standards that ensure safe and reliable battery operation. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the working principle and key components of electric vehicles (EVs) and compare them with conventional internal combustion engine vehicles. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Describe the construction and working principle of DC machines with a neat sketch. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Discuss the construction and working principle of PM Synchronous Motor with a neat sketch. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the role and function of a gearbox and automobile differential in an electric vehicle. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the construction and working principle of a Lead-Acid Battery with a neat sketch. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Discuss the construction and working principle of Nickel-Metal-Hydride (NiMH) batteries with a neat sketch and compare the advantages over other types of batteries. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Compare Lithium-Ion and Lithium-Polymer batteries in terms of their construction and applications. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Compare and contrast rule-based control and optimization-based control in Battery Management Systems (BMS) with their principles, advantages, and limitations. | CO6 | An | 12 |

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|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the EV kinetics and dynamics |
| **CO2** | Identify appropriate motor and converter for EV applications. |
| **CO3** | Select suitable standards for the motor drive. |
| **CO4** | Estimate transmission drive configuration and characteristics of EV. |
| **CO5** | Analyze the different battery parameters and characteristics for specific applications. |
| **CO6** | Design efficient battery management system (BMS) for EV. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 3 | - | 12 | - | - | 17 |
| **CO2** | 2 | 15 | - | - | - | - | 17 |
| **CO3** | 1 | 16 | - | - | - | - | 17 |
| **CO4** | 1 | 16 | - | - | - | - | 17 |
| **CO5** | 1 | 12 | - | 27 | - | - | 40 |
| **CO6** | 4 | - | - | 12 | - | - | 16 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **22ME2001** | **Duration** | **3hrs** |
| **Course Title** | **INDUSTRIAL APPLICATIONS OF AI TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | ……………….recognized the beginning of the Industry 4.0 revolution. | | | CO1 | U | 1 |
| 2. | Classify the various phases of ‘Industrial Revolution History’ | | | CO1 | A | 1 |
| 3. | “Classification” is a………………machine learning technique. | | | CO2 | U | 1 |
| 4. | Identify any 2 applications of Object Detection | | | CO2 | U | 1 |
| 5. | Define Thresholding. | | | CO3 | U | 1 |
| 6. | Define region growing. | | | CO3 | R | 1 |
| 7. | List two applications of Vectoriser. | | | CO4 | U | 1 |
| 8. | Interpret Markov Model machine learning technique. | | | CO4 | R | 1 |
| 9. | Cite the application of AI in spam mail filtering techniques. | | | CO5 | U | 1 |
| 10. | Distinguish between weak and strong AI. | | | CO6 | U | 1 |
| PART – B (6 X 3 = 18 MARKS) | | | | | | |
| 11. | Indicate any three Limitations of smart factories. | | | CO1 | U | 3 |
| 12. | Contrast AI and Autonomy. | | | CO2 | U | 3 |
| 13. | Describe open class words and closed class words with examples | | | CO3 | An | 3 |
| 14. | Interpret Histogram of Oriented Gradients (HOG). | | | CO4 | U | 3 |
| 15. | Mention any two challenges in natural language processing | | | CO5 | A | 3 |
| 16. | Illustrate anomaly detection using AVI system. | | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | | |
| 17. |  | Articulate the concept of "smartization" with reference to the principles of Industry 4.0. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | Differentiate between supervised and unsupervised learning with suitable environment for its application in Industry 4.0. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 19. |  | Explain POS tagging with example. | CO3 | | A | 6 |
|  |  | Determine the phases of image processing. | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 20. |  | Lighting is one key factor for successful machine vision results. Justify. | CO4 | | E | 12 |
|  |  |  |  | |  |  |
| 21. |  | Summarize the interaction between the agent, environment, and reward system which shapes the learning process in reinforcement learning. | CO5 | | E | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Establish the 7 techniques in NLP for processing speech recognition. | CO3 | | A | 6 |
|  | b. | Analyze any two Object Detection and Recognition Technique for processing data. | CO4 | | An | 6 |
|  |  |  |  | |  |  |
| 23. |  | Appraise the different phases of analysis in Natural Language Processing for Mechanical system applications. | CO 4 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Explain any 2 Anomaly Detection techniques employed in industries. | | CO6 | A | 6 |
|  | b. | Differentiate Augmented Reality and Virtual Reality. | | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand AI Techniques in Mechanical Systems. |
| **CO2** | Classify Machine Learning Techniques. |
| **CO3** | Apply various computer Vision Techniques. |
| **CO4** | Compare Natural Language Processing Techniques. |
| **CO5** | Analyze the Reinforcement Learning Techniques. |
| **CO6** | Assess case studies on AI solutions in the production level. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** |  | 4 | 13 |  |  |  | 17 |
| **CO2** |  | 5 | 12 |  |  |  | 17 |
| **CO3** | 1 | 1 | 18 | 3 |  |  | 23 |
| **CO4** | 1 | 4 |  | 6 | 24 |  | 35 |
| **CO5** |  | 1 | 3 |  | 12 |  | 16 |
| **CO6** |  | 4 | 6 | 6 |  |  | 16 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23ME1001** | **Duration** | **3hrs** |
| **Course Title** | **ENGINEERING MATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | How does microstructure influence the properties of a material? | | CO1 | C | 1 |
| 2. | Differentiate between materials scientist and a materials engineer. | | CO1 | U | 1 |
| 3. | What is the difference between vacancy defects and interstitial defects in a crystal structure? | | CO2 | An | 1 |
| 4. | Illustrate a line dislocation and clearly indicate the Burger’s vector. | | CO2 | R | 1 |
| 5. | State Gibbs' phase rule and write the associated equation. | | CO3 | R | 1 |
| 6. | In ferrous alloys, the martensitic structures are \_\_\_\_\_\_ and \_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Differentiate between an anelastic material and a viscoelastic material. | | CO4 | U | 1 |
| 8. | Compare paramagnetic material with diamagnetic material. | | CO4 | U | 1 |
| 9. | Nanomaterials are classified based on their size. Specify the size range for these materials. | | CO5 | U | 1 |
| 10. | List any two metals that are highly resistive to a corrosive environment. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Derive the atomic packing factor and coordination number for an FCC structure. | | CO1 | A | 3 |
| 12. | Explain the importance of Miller Indices. | | CO2 | E | 3 |
| 13. | List the three phases in Fe-C diagram and the associated temperature for each phase. | | CO3 | R | 3 |
| 14. | Differentiate between Creep Failure and Fatigue Failure. | | CO4 | U | 3 |
| 15. | List and explain the most significant properties of a magnetostrictive material. | | CO5 | R | 3 |
| 16. | Categorize at least three materials based on their application in the Nuclear energy sector and space sector. | | CO6 | C | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Distinguish between amorphous and polycrystalline materials. | CO1 | U | 6 |
|  | b. | List all the desired physical and chemical properties of an engineering material. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Draw the construction of a Scanning Electron Microscope and explain its working principle. | CO2 | A | 6 |
|  | b. | Explain the theory of Edge dislocation and screw dislocation, with neat sketches. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | List the conditions required for creating an alloy combination. | CO3 | An | ~~126~~ |
|  | b. | Draw the Fe-C diagram and explain its functionality. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | List the stages in creep. | CO4 | An | 6 |
|  | b. | Discuss the plastic deformation in metallic materials by twinning. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the various heat treatment processes carried out on ferrous alloys and list the benefits of each process. | CO5 | U | 6 |
|  | b. | ~~Classify the smart materials under various categories and name the materials associated with this classification.~~  Describe the true stress, true strain relationship. | ~~CO5~~  CO4 | ~~An~~  U | 6 |
|  |  |  |  |  |  |
| 22. | a. | What is the role of the eutectoid point in the iron-iron carbide phase diagram? | CO3 | U | 6 |
|  | b. | Describe the stages in ductile fracture with neat sketches. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Elaborate on body-centered cubic (BCC) and hexagonal close-packed (HCP) crystal structures, including suitable sketches. | CO1 | U | 6 |
|  | b. | Classify the smart materials under various categories and name the materials associated with this classification. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the procedure that is followed to select a material for different applications given below: 1) Space Technologies, 2) Marine Technologies. | CO6 | E | 6 |
|  | b. | Classify the materials with a flow diagram and list the engineering applications associated with each category. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Identify materials structures to ascertain properties of the materials |
| **CO2** | Test the mechanical properties of metals and analyze the metal failure |
| **CO3** | Predict the behavior of materials through phase diagrams |
| **CO4** | Choose appropriate fabrication techniques by following engineering standards |
| **CO5** | Select suitable polymers and composites for advanced applications |
| **CO6** | Develop products through smart materials |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 6 | 13 | 3 | - | - | 1 | 23 |
| **CO2** | 1 | - | 6 | 1 | 9 | - | 17 |
| **CO3** | 5 | 12 | - | 6 | 6 | - | 29 |
| **CO4** | - | 11 | - | 6 | - | - | 17 |
| **CO5** | 3 | 7 | - | 12 | - | - | 22 |
| **CO6** | 1 | 6 | - | - | 6 | 3 | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23ME1003** | **Duration** | **3hrs** |
| **Course Title** | **INNOVATION AND CREATIVITY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define creativity. | | CO1 | R | 1 |
| 2. | Describe the first step in the innovation process. | | CO1 | R | 1 |
| 3. | Outline any two techniques stimulating innovation and creativity. | | CO2 | R | 1 |
| 4. | Describe incubation in entrepreneurship. | | CO2 | R | 1 |
| 5. | Give an example of traditional design. | | CO3 | U | 1 |
| 6. | Define open innovation. | | CO3 | R | 1 |
| 7. | Label an employee who innovates in an entrepreneurial venture. | | CO4 | R | 1 |
| 8. | An entrepreneur interested in starting a business for the greater social good and not for the pursuit of profit is called …………… | | CO4 | R | 1 |
| 9. | State the key factor of entrepreneurship. | | CO5 | U | 1 |
| 10. | Distinguish entrepreneur and manager. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | How can individuals enhance their creativity? | | CO1 | R | 3 |
| 12. | Describe the importance of innovation in entrepreneurship. | | CO2 | U | 3 |
| 13. | Indicate the barriers to innovation and creativity. | | CO3 | R | 3 |
| 14. | Expand the technique SCAMMPERR. | | CO4 | U | 3 |
| 15. | Write short notes on entrepreneurial society. | | CO5 | R | 3 |
| 16. | Describe business plan. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the various steps in the problem-solving process. | CO1 | U | 8 |
|  | b. | List the barriers to innovation and creativity. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. |  | Compare the major differences between the traditional and design thinking process. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain in detail the various steps in the design thinking process. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Define empathy. | CO4 | R | 2 |
|  | b. | Illustrate the different ways of improving empathy. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 21. |  | Discuss the role of entrepreneurship in the economic development of India. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Outline the fundamental elements of entrepreneurial ventures. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Interpret the importance of open innovation and list its benefits. | CO5 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate the prospects of the entrepreneurship journey in India. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Design innovative systems with enhanced performance. |
| **CO2** | Devise innovative techniques for optimizing the system's performance. |
| **CO3** | Develop new products for industrial applications. |
| **CO4** | Collaborate with external partners and stakeholders to develop new products. |
| **CO5** | Design new processes and methodologies to improve system performance. |
| **CO6** | Evolve creative technology for innovative entrepreneurial ventures |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 5 | - | - | - | 12 | - | 17 |
| **CO2** | 2 | 3 | - | - | 12 | - | 17 |
| **CO3** | 4 | 1 | 12 | - | - | - | 17 |
| **CO4** | 4 | 3 | - | 10 | - | - | 17 |
| **CO5** | 3 | 13 | - | - | 12 | - | 28 |
| **CO6** | - | 4 | - | 12 | 12 |  | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23ME1004** | **Duration** | **3hrs** |
| **Course Title** | **INDUSTRIAL ROBOTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the Laws of Robotics. | | CO1 | R | 1 |
| 2. | List any four components of a Robot. | | CO1 | R | 1 |
| 3. | In robotics, RR represents\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | DH notation represents\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | Identify the different generations of robot programming. | | CO3 | R | 1 |
| 6. | Name three key positions in space used for robot programming. | | CO3 | R | 1 |
| 7. | Define robot perception. | | CO4 | R | 1 |
| 8. | The basic purpose of a robot vision system is to identify\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 9. | Name four key sensors used in robots for manufacturing applications. | | CO5 | R | 1 |
| 10. | Distinguish between a robot and a cobot. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the different types of industrial robots with examples. | | CO1 | R | 3 |
| 12. | Describe homogeneous transformations and their representation using matrices. | | CO2 | R | 3 |
| 13. | Define Joint Space and Cartesian Space. | | CO3 | R | 3 |
| 14. | Write the steps to recognize the 2D to 3D in robotics perception. | | CO4 | A | 3 |
| 15. | Explain the importance of sound sensors in robot applications. | | CO5 | A | 3 |
| 16. | Write about Human Robot Interaction (HRI). | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the different types of automation and their applications. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate in detail the sketches of the 2 DOF and Reverse 2 DOF. | CO2 | A | 4 |
|  | b. | Explain in detail with the sketches of the 3 DOF and 4 DOF. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 19. | a. | Write the sequence of commands for fetching and placing the object using branching commands. | CO3 | A | 6 |
|  | b. | The robot must pick up the parts from an incoming chute and deposit them onto a pallet. The plane of the pallet is assumed to be parallel to the xy plane. The rows of the pallet are parallel to the x axis and the columns of the pallet are parallel to the y axis. Figure shows the arrangement of the pallet . The objects to be picked up are about 25 mm tall (approximately 1.0 in). Use the variables as ROW,COLUMN, X,Y for solving the program. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. |  | Explain the working principle of a robot vision system, and its components, and provide a clear sketch along with its applications. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the working principle of different types of robot control systems, their components, and applications with a clear sketch. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain in detail the different types of robot configurations with neat sketches. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Articulate the WAIT, SIGNAL, and DELAY commands in detail with examples. | CO3 | A | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain in detail the working principles of different types of mobile robots and unmanned aerial vehicles (UAVs). | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Design industrial robots specific to applications. |
| **CO2** | Implement robot dynamics and control algorithms. |
| **CO3** | Develop robot programming for various applications. |
| **CO4** | Design robot vision system for image processing and object tracking. |
| **CO5** | Use different control algorithms for optimizing the performance of robots. |
| **CO6** | Create collaborative robots for industrial applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 5 | 12 | 12 | - | - | - | 29 |
| **CO2** | 5 | - | 12 | - | - | - | 17 |
| **CO3** | 5 | - | 18 | 6 | - | - | 29 |
| **CO4** | 1 | 1 | 3 | 12 | - | - | 17 |
| **CO5** | 1 | - | 3 | 12 | - | - | 16 |
| **CO6** | - | - | 3 | 13 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23ME1005** | **Duration** | **3hrs** |
| **Course Title** | **INTRODUCTION TO MECHANICAL SYSTEMS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define an isolated system. | | CO1 | R | 1 |
| 2. | Identify anyone conditions for the body in static equilibrium. | | CO1 | R | 1 |
| 3. | **State** Boyle’s law in terms of pressure and volume. | | CO2 | R | 1 |
| 4. | Specify one key difference between a heat pump and a refrigerator. | | CO2 | U | 1 |
| 5. | Indicate the property that measures resistance to scratching in materials. | | CO3 | R | 1 |
| 6. | State the purpose of fatigue testing in materials science. | | CO3 | U | 1 |
| 7. | Identify the law that governs the rate of heat transfer by conduction. | | CO4 | U | 1 |
| 8. | Define Stefan-Boltzmann Law. | | CO4 | R | 1 |
| 9. | Name the dimensionless numbers used to characterize flow regimes in convection. | | CO5 | R | 1 |
| 10. | Indicate the type of energy converted into electrical energy in a hydel power plant. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain how the principles of statics and dynamics are relevant in real-world engineering and physics applications. | | CO1 | U | 3 |
| 12. | State the importance of the law of conservation of energy in fluid mechanics principles. | | CO2 | U | 3 |
| 13. | Interpret the significance of yield strength in material performance. | | CO3 | U | 3 |
| 14. | Differentiate between forced and natural convection. | | CO4 | An | 3 |
| 15. | Analyze the role of thermal conductivity in influencing heat transfer efficiency. | | CO5 | An | 3 |
| 16. | Describe the fundamental working principle of a solar power plant. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Analyze the role of free-body diagrams in representing forces on an object, illustrating with a real-world application example and a sketch. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | On turning a corner, a motorist rushing at 20 m/s, finds a child on the road 50 m ahead. He instantly stops the engine and applies brakes, so as to stop the car within 10 m of the child.  Calculate:   1. retardation, and 2. time required to stop the car. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Classify different types of fluids based on physical properties, assessing the significance of each type in engineering applications. | CO3 | U | 8 |
|  | b. | State the first law of thermodynamics and its application, with an example to illustrate the concept. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 20. |  | Describe the thermodynamic cycle of a heat pump, detailing the roles of the compressor, evaporator, condenser, and expansion valve. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Sketch the stress-strain curve for ductile materials, discussing each stage, and analyze how material selection impacts long-term applications. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Describe the procedure for conducting a creep test, including specimen preparation, loading conditions, and strain measurement. Also, explain its importance in evaluating material behavior under stress. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Illustrate the working principles of heat exchangers, providing a neat sketch, and explain their applications in industry. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe the working principle of thermal power plant with neat sketch. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Draw free body diagram and analyze the systems under equilibrium |
| **CO2** | Design heat engine and refrigeration systems. |
| **CO3** | Apply fluid mechanics principles in designing hydraulic pumps |
| **CO4** | Select appropriate materials required for mechanical systems |
| **CO5** | Design heat exchangers specific to heat transfer applications. |
| **CO6** | Analyze the performance of renewable energy production systems |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 3 | 12 |  | 8 |  | 25 |
| **CO2** | 1 | 17 |  | 3 |  |  | 21 |
| **CO3** | 4 | 19 |  |  |  |  | 23 |
| **CO4** | 3 | 6 | 4 | 8 |  |  | 21 |
| **CO5** | 4 | 10 |  | 3 |  |  | 17 |
| **CO6** |  | 16 |  |  |  |  | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23ME2006** | **Duration** | **3 hrs** |
| **Course Title** | **ENGINEERING MECHANICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State Principle of Transmissibility. | | CO1 | R | 1 |
| 2. | Explain Lami’s theorem. | | CO1 | U | 1 |
| 3. | Define couple in mechanics and its effect. | | CO2 | U | 1 |
| 4. | What type of reaction is provided by a fixed support in a beam? | | CO2 | R | 1 |
| 5. | What is the formula for moment of inertia of a hollow rectangle about its center? | | CO3 | R | 1 |
| 6. | Define relative velocity. | | CO4 | R | 1 |
| 7. | Write the equation for velocity in motion under gravity. | | CO4 | U | 1 |
| 8. | Explain the impulse-momentum equation. | | CO5 | U | 1 |
| 9. | Discuss coefficient of restitution. | | CO5 | U | 1 |
| 10. | Define angle of friction. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between coplanar forces and concurrent forces. | | CO1 | U | 3 |
| 12. | Resolve a force F=20 kN acting at a point B into a force and a couple at point A, given the distance between the point A and point B is 3 m. | | CO2 | A | 3 |
| 13. | Compute the centroid of a composite figure consisting of a square and a semicircle, where the square has side length a=4 m and the semicircle has radius r=2 m, with the semicircle placed above the square. Assume both parts to be homogeneous. | | CO3 | A | 3 |
| 14. | A particle is projected with an initial velocity of 60 m/s, at an angle of 75º with the horizontal. Calculate the maximum height attained by the particle. | | CO4 | A | 3 |
| 15. | Explain D'Alembert’s principle. | | CO5 | U | 3 |
| 16. | Discuss Coulomb’s law of dry friction. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Given three coplanar forces acting at a point, as shown in the figure. Determine the magnitude and direction of the resultant force.  C:\Users\Lenovo\Desktop\B1.jpg | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Given a simply supported beam AB with a 6-meter span, loaded as shown in the figure. Evaluate the reactions at supports A and B. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | With reference to the angle section shown in the figure, calculate the moment of inertia about the centroidal X-X axis. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | **A stone is dropped from the top of a tower and reaches the ground in 8 seconds.**  **(i) Calculate the height of the tower using the kinematic equations of motion. (ii) Determine the velocity of the stone when it reaches the ground.** | CO4 | A | 04 |
|  | b. | The equation of motion of a particle is given, with acceleration (a) in terms of time (t) as:  a = 3t2 + 2t + 4, in which acceleration is in m/s2 and time ‘t’ is in seconds. It is known that the velocity of the particle is 12 m/s after 4 seconds; and the displacement is 8 m after 4 seconds. Examine: (i) Velocity of the particle after 8 seconds, and; (ii) Displacement of the particle after 2 seconds. | CO4 | A | 08 |
|  |  |  |  |  |  |
| 21. |  | Two weights 80 N and 120 N are connected by a rope and move along a rough horizontal plane under the action of a 40 N force, as shown in the figure. The coefficient of friction is 0.3. Evaluate the velocity of the system after 2 sec. Also calculate the tension on the rope using impulse momentum equation. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Three forces are acting on a square ABCD of side 3 m, as shown in the figure.  Determine the resultant force in terms of both magnitude and direction. Examine the location of its point of application relative to sides AB and AD using the principle of moments.  .C:\Users\Lenovo\Desktop\2B.jpg | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | The motion of a body moving on a curved path is given by the equations:  x = 4 sin(3t) and y = 4 cos(3t). Examine the velocity and acceleration of the body after 2 seconds. | CO4 | A | 06 |
|  | b. | Two bodies, one of mass 30 kg, moving with a velocity of 9 m/s, and another body of mass 15 kg, moving in the opposite direction with a velocity of 9 m/s, collide centrally. Given that the coefficient of restitution is 0.8, calculate the velocity of each body after the impact. | CO5 | A | 06 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Consider a ladder of weight 390 N and length 6 m, leaning against a vertical wall at an angle of 30º. The coefficient of friction between the ladder and the wall is 0.25, and between the ladder and the floor is 0.38. A man of weight 1170 N starts to ascend the ladder. Estimate the height to which the man can ascend before the ladder begins to slip. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Solve equilibrium problems in a variety of engineering and physical scenarios. |
| **CO2** | Analyze the equilibrium of rigid bodies through the application of statics principles and vector  mechanics. |
| **CO3** | Determine centroid and moment of inertia for simple plane figures. |
| **CO4** | Solve dynamic equilibrium problems on particles by applying the concept of kinematics of  particles with rectilinear, curvilinear motions. |
| **CO5** | Apply the fundamental principles of concepts of kinetics – displacement, velocity and  acceleration in real life scenario. |
| **CO6** | Solve problems related to dry friction and analyze components that function based on the theory of friction. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 4 | 12 | - | - | - | 17 |
| **CO2** | 1 | 1 | 15 | 12 | - | - | 29 |
| **CO3** | 1 | - | 3 | 12 | - | - | 16 |
| **CO4** | 1 | 1 | 21 | - | - | - | 23 |
| **CO5** | - | 5 | 6 | 12 | - | - | 23 |
| **CO6** | 1 | 3 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23ME2007** | **Duration** | **3hrs** |
| **Course Title** | **THERMODYNAMICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State first law of thermodynamics. | | CO1 | A | 1 |
| 2. | Give an example for intensive and extensive property. | | CO1 | U | 1 |
| 3. | Work done for a constant volume process is always zero. (True / False) | | CO2 | A | 1 |
| 4. | Write the work done relation for a constant pressure process. | | CO2 | A | 1 |
| 5. | Write the property introduced by the second law of thermodynamics. | | CO3 | A | 1 |
| 6. | COP of heat pump is equal to COP of refrigerator plus one. (True/False) | | CO3 | A | 1 |
| 7. | Define dryness fraction of steam. | | CO4 | A | 1 |
| 8. | Define Amagat’s law of partial volume. | | CO5 | R | 1 |
| 9. | How much is the relative humidity at the dew point temperature ? | | CO6 | A | 1 |
| 10. | Dry bulb and wet bulb temperatures are equal at the dew point temperature. (True/False) | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Derive the pdv work for a constant pressure process. | | CO1 | An | 3 |
| 12. | Prove that Cp – Cv = R. | | CO2 | A | 3 |
| 13. | Define Clausius statement of second law of thermodynamics with source and sink diagram. | | CO3 | U | 3 |
| 14. | Find the saturation temperature, the changes in specific volume and entropy during the evaporation of steam at 1MPa. | | CO4 | An | 3 |
| 15. | Prove that the mole fraction, pressure fraction and the volume fraction of a gas mixture are equal. | | CO5 | A | 3 |
| 16. | Write three differences between Dry Bulb Temperature (DBT) and Wet Bulb temperature (WBT). | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Derive the expression for pdV work under conditions of constant pressure, constant temperature, and for polytropic processes. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Air flows steadily at the at the rate of 0.5 kg/s through an air compressor, entering at 7 m/s velocity, 100 kPa pressure and 0.95 m3/kg volume and leaving at 5 m/s, 700 kPa and 0.19 m3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in the compressor jackets absorbs heat from the air at the rate of 58 kW. Compute the rate of shaft work in put to the air in kW. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the functioning of a cyclic heat engine and derive the expression to determine its thermal efficiency. Additionally, derive the expression for calculating the Coefficient of Performance of both the refrigerator and the heat pump with source and sink diagram | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A vessel of volume 0.04m3 contains a mixture of saturated water and saturated steam at a temperature of 250oC. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and the internal energy. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Air at 200kPa and 300oC has a volume of 0.8m3. In a frictionless process at constant volume the pressure changes to 100 kPa. Find the final temperature, work done, heat transferred and the change in internal energy. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Express the Dalton’s law of partial pressure and prove that the sum of the mole fractions and the mass fractions of a gas mixture will always be one. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | A stationary mass of gas is compressed without friction from an initial state of 0.3m3 and 0.105MPa to a final state of 0.15m3. The pressure remains constant during the process. There is a transfer of 37.6 kJ of heat from the gas during the process. How much does the internal energy of the gas change? | CO2 | E | 6 |
|  | b. | A domestic food freezer maintains a temperature of -15oC, ambient air temperature is 30oC. If the heat leaks into the freezer at a constant rate of 1.75kJ/s, what is the least power necessary to pump this heat out continuously? Also calculate the COP of the freezer. | CO3 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | An air conditioning system is designed under the following conditions: Outdoor conditions: 40o C DBT and 50% RH  Indoor conditions: 20o C DBT and 70% RH  Amount of free air circulated is 3.33 m3/s  The required condition is achieved by cooling and dehumidification. Estimate the (i) Capacity of the cooling coil. (ii) Amount of moisture removed in kg/s. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Apply the concepts of equilibrium, processes, and cycles to various thermodynamic systems. |
| **CO2** | Analyse the first and second laws of thermodynamics for closed and open systems. |
| **CO3** | Design heat engines, heat pumps, and refrigerators. |
| **CO4** | Apply thermodynamic properties to pure substances and interpret phase diagrams. |
| **CO5** | Analyse ideal gas mixtures, including properties, equations of state, and laws |
| **CO6** | Design air-conditioning systems for domestic and industrial applications |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | -- | 01 | 13 | 03 | 06 | -- | 23 |
| **CO2** | -- | -- | 05 | -- | 18 | -- | 23 |
| **CO3** | -- | 03 | 14 | -- | -- | -- | 17 |
| **CO4** | -- | -- | 01 | 03 | 12 | -- | 16 |
| **CO5** | 01 | -- | 15 | -- | 12 | -- | 28 |
| **CO6** | -- | 03 | 02 | -- | 12 | -- | 17 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23ME2008** | **Duration** | **3hrs** |
| **Course Title** | **FLUID MECHANICS AND FLUID MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define specific volume. | | CO1 | R | 1 |
| 2. | State Newton’s law of viscosity. | | CO1 | R | 1 |
| 3. | Apply the continuity equation in two sections of the same pipe and write the flow equation. | | CO2 | A | 1 |
| 4. | List two examples of a rotational flow. | | CO2 | R | 1 |
| 5. | Define laminar boundary layer. | | CO3 | R | 1 |
| 6. | The application of the Orifice meter is to measure ………………. | | CO3 | U | 1 |
| 7. | Give an example of basic dimension. | | CO4 | U | 1 |
| 8. | List the factors influencing the frictional loss in pipe flow. | | CO4 | R | 1 |
| 9. | Identify the reason for installing draft tube in an impulse turbine. | | CO5 | R | 1 |
| 10. | State the reason for fitting a foot valve with a strainer. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | The capillary rise in glass tube is not to exceed 0.2 mm of water. Determine its minimum size given that surface tension for water in contact with air is 0.0725 N/m | | CO1 | A | 3 |
| 12. | Write any three applications of stream function. | | CO2 | U | 3 |
| 13. | Calculate the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 litres/sec. | | CO3 | An | 3 |
| 14. | List the assumptions in Euler's equations. | | CO4 | R | 3 |
| 15. | Classify the energy losses in a fluid system. | | CO5 | An | 3 |
| 16. | Differentiate pump and turbine. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the film is 1.5 mm. | CO1 | A | 6 |
|  | b. | **Water rises 3.2 cm in a glass capillary tube. Compute the height to which the same water rises in another capillary tube with half the area of the cross-section.** | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the relationship between Euler's equation and Bernoulli's equation, and derive the latter by applying appropriate assumptions. | CO2 | An | 6 |
|  | b. | A Venturi meter of 15 cm inlet diameter and 10 cm throat is laid horizontally in a pipe to measure the flow of oil of 0.9 specific gravity. The reading of a mercury manometer is 20 cm. Calculate the discharge in lit/min. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. |  | The attacking force R of a bullet from an Arjun tank during flight can be considered as dependent upon the barrel length (Ɩ), velocity (v), air viscosity (μ), air density (ρ) and the bulk modulus of air (K). Deduce the functional relationship between these variables and the attacking force using the Raleigh method of analysis. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of the water level in the tank is 8 m above the center of the pipe. Considering all losses of head which occur, estimate the rate of flow, and also draw the hydraulic gradient line and total energy line of the same. Take f=0.01 for both sections of the pipe. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | A nozzle of 150 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Evaluate:  (1) the force on the plate, (2) the work done, (3) the efficiency of jet. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Deduce the expression for force acting on the symmetrically curved plate when the jet strikes at one end tangentially. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Compare the operational differences between single-stage and multi-stage centrifugal pumps, and analyze how each design impacts efficiency and performance in various applications. | CO6 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Appraise the construction and working of a radial flow reaction turbine with the help of a neat diagram. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recognize the important fluid properties and determine forces acting on immersed bodies. |
| **CO2** | Solve fluid flow problems using Conservation principles. |
| **CO3** | Analyze the characteristics of boundary layer and the relationship between different physical quantities of fluid flow. |
| **CO4** | Determine rate of flow and calculate flow losses through pipes. |
| **CO5** | Evaluate the performance of pumps |
| **CO6** | Evaluate the performance of turbines |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | - | 15 | - | - | - | 17 |
| **CO2** | 1 | 3 | 1 | 6 | 6 | - | 17 |
| **CO3** | 1 | 1 | - | 15 | - | - | 17 |
| **CO4** | 4 | 1 | - | - | 12 | - | 17 |
| **CO5** | 1 | - | 12 | 3 | 12 | - | 28 |
| **CO6** | 1 | 3 | - | - | 24 | - | 28 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23ME2009** | **Duration** | **3hrs** |
| **Course Title** | **FLUID POWER CONTROL ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Draw the symbol for a hydraulic pump. | | CO1 | R | 1 |
| 2. | Differentiate between oil hydraulics and pneumatics. | | CO1 | U | 1 |
| 3. | Sketch the graphical symbol of flow control valve. | | CO2 | R | 1 |
| 4. | List the three common construction types of positive displacement hydraulic pumps. | | CO2 | U | 1 |
| 5. | Illustrate the concept of a hydraulic intensifier and provide a few of its applications. | | CO3 | U | 1 |
| 6. | Describe the concept of cylinder motion synchronization in a hydraulic circuit. | | CO3 | U | 1 |
| 7. | Explain the purpose of shuttle valve in pneumatic systems. | | CO4 | U | 1 |
| 8. | Classify the pneumatic cylinders based on operating principle. | | CO4 | U | 1 |
| 9. | Explain the function and role of Moving Part Logic (MPL) in the operation of a pneumatic system. | | CO5 | U | 1 |
| 10. | Draw the symbol of OR element. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe three essential properties of hydraulic fluids and explain their importance in a fluid power system. | | CO1 | U | 3 |
| 12. | Explain the differences between linear and rotary hydraulic actuators, with examples of applications for each. | | CO2 | An | 3 |
| 13. | Construct the diagram of a piston-type accumulator and explain its working in detail. | | CO3 | A | 3 |
| 14. | Describe the function of an FRL unit in a pneumatic system and draw its symbol. | | CO4 | U | 3 |
| 15. | Design a pneumatic circuit that enhances cylinder speed using a quick exhaust valve. | | CO5 | C | 3 |
| 16. | Draw the symbol and truth table of AND gate. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Construct a hydraulic reservoir and explain its working principle and functions. | CO1 | U | 6 |
|  | b. | Compare different fluid power systems to mechanical systems, highlighting the advantages and disadvantages of each approach. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the working principle of a balanced vane pump with a neat sketch, and discuss its advantages, disadvantages, and typical applications. | CO2 | A | 10 |
|  | b. | Identify two types of direction control valves and illustrate their graphical symbols. | CO2 | U | 2 |
|  |  |  |  |  |  |
| 19. |  | Create a hydraulic fail-safe circuit to prevent inadvertent cylinder extension and explain its operation. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 20. | a. | Demonstrate the working mechanism of a vane compressor with a neat sketch. | CO4 | A | 8 |
|  | b. | Explain the purpose of time delay valve with neat sketch. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. |  | Consider an automatic pneumatic drilling machine. The complete cycle is as follows: Cylinder A extends to clamp the workpiece, then cylinder B extends to drill a hole and then retracts. Cylinder A retracts to unclamp the workpiece. Design a control circuit applying the step-counter method. The circuit is provided with a start valve to avoid continuous cycling. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 22. | a. | A gear pump with the following specification runs at 1400 rpm. Module = 3mm/tooth, Gear width = 15mm, Number of teeth = 12 and Pressure angle = 20o  (a) Calculate the theoretical discharge and (b) Calculate the hydraulic power produced by the pump when working against a pressure of 100 bar. | CO2 | E | 10 |
|  | b. | Explain the working principle of double acting hydraulic cylinder. | CO2 | U | 2 |
|  |  |  |  |  |  |
| 23. | a. | Create a hydraulic circuit for a shaping machine using a flow control valve and explain its function. | CO3 | C | 8 |
|  | b. | Develop the hydraulic circuit for synchronizing the mechanical motions of the actuators with matching pumps. | CO3 | E | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss the ladder diagram configuration and necessary connections for implementing a regenerative circuit that increases the extending speed of a double-acting hydraulic cylinder. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze the constructional details of both hydraulic and pneumatic systems. |
| **CO2** | Design fluid power circuits for hydraulic and pneumatic fluid conditioning. |
| **CO3** | Evaluate different types of actuation modes and employ control system design procedures for circuit design and regulation. |
| **CO4** | Design pneumatic and hydraulic circuits based on given specifications. |
| **CO5** | Apply mechanical skills to perform maintenance, testing, and repair of hydraulic and pneumatic components and systems. |
| **CO6** | Select suitable Programmable Logic Controllers (PLCs) and demonstrate comprehension of basic logic operations. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 1 | 10 | - | 6 |  | - | 17 |
| **CO2** | 1 | 5 | 10 | 3 | 10 | - | 29 |
| **CO3** | - | 2 | 3 | - | 4 | 20 | 29 |
| **CO4** | - | 9 | 8 | - | - | - | 17 |
| **CO5** | - | 1 | - | - | - | 15 | 16 |
| **CO6** | - | 1 | 3 | - | 12 | - | 16 |
|  | | | | | | | **124** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **23ME2010** | **Duration** | **3hrs** |
| **Course Title** | **ELECTRIC VEHICLE DESIGN** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Mention two key electrical components used in electric vehicles. | | CO1 | R | 1 |
| 2. | List the main function of a DC motor drive in electric vehicles. | | CO1 | R | 1 |
| 3. | State the role of a fuel cell in electric vehicles. | | CO2 | U | 1 |
| 4. | Differentiate between battery-based and fuel cell-based energy storage systems. | | CO2 | An | 1 |
| 5. | Discuss one challenge in implementing energy management strategies in electric vehicles. | | CO3 | U | 1 |
| 6. | State the importance of energy management strategy in electric vehicles | | CO3 | R | 1 |
| 7. | Compare the Brushless DC (BLDC) motor with a traditional DC motor. | | CO4 | An | 1 |
| 8. | Mention one key power electronic component used in motor drives. | | CO4 | R | 1 |
| 9. | List the role of the Electronic Control Unit (ECU) in motor drives. | | CO5 | R | 1 |
| 10. | State the need for a transmission system in electric vehicles (EVs). | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define Electric Vehicle Dynamics and explain its significance in the context of EV performance. | | CO1 | U | 3 |
| 12. | Discuss the limitations of battery-based energy storage system in electric vehicles. | | CO2 | An | 3 |
| 13. | State the rule-based energy management strategy and its key features. | | CO3 | U | 3 |
| 14. | List the different control modes used in motor drives. | | CO4 | R | 3 |
| 15. | List the main types of traction motors used in electric vehicles. | | CO5 | R | 3 |
| 16. | State the primary types of transmission systems used in electric vehicles. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the configuration and performance characteristics of Permanent Magnet Synchronous Motors (PMSMs) with a neat sketch. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the role of Li-ion batteries in enhancing the performance of electric vehicles with a neat sketch. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Illustrate the different energy management strategies implemented in hybrid and electric vehicles | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Discuss the significance of thermal management in battery systems and focusing on its impact on battery performance and safety features. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Describe the control strategies implemented in Brushless DC (BLDC) motors with a neat sketch and explain how these strategies contribute to improved performance. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Discuss the construction and operation of DC motor drives with a neat sketch. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the role and functions of supercapacitors in electric vehicles with neat sketch. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss the powertrain components for series, parallel, and series-parallel hybrid electric vehicles with neat sketch. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze and select appropriate electric components and motors to optimize drive system efficiency. |
| **CO2** | Evaluate and prioritize different energy storage devices, incorporating hybridization methods. |
| **CO3** | Apply energy management system strategies to resolve complex problems. |
| **CO4** | Design the power train and transmission systems in electric vehicles |
| **CO5** | Evaluate the performance of motor drives and power electronic components. |
| **CO6** | Develop thermal management systems for batteries |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | 2 | 39 | - | - | - | - | 41 |
| **CO2** | - | 13 | - | 4 | - | - | 17 |
| **CO3** | 1 | 16 | - | - | - | - | 17 |
| **CO4** | 4 | - | - | 13 | - | - | 17 |
| **CO5** | 4 | - | - | 12 | - | - | 16 |
| **CO6** | 3 | 13 | - | - | - | - | 16 |
|  | | | | | | | **124** |