Sub Code: MET-001/TME101 **ROLL NO……..……..**

Ist SEMESTER EXAMINATION, 2022 – 23

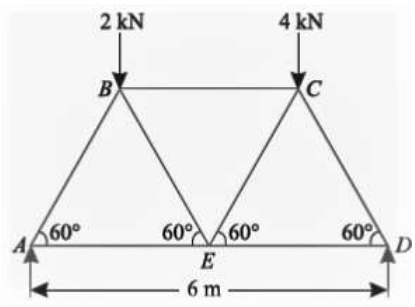
First Year , Ist Year B.Tech.

Basic Mechanical Engineering

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any four parts of the following. a) A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force, which can move the body, while acting at an angle of 25° with the horizontal. b) Briefly define hardness, toughness and malleability. c) State and derive Pascal's law. d) A steam turbine operates under steady flow conditions. It receives 7500 kg/h of steam from the boiler. The steam enters the turbine at 2800 kJ/kg enthalpy, 70 m/s velocity, and an elevation of 4 m. The steam leaves the turbine at 2000 kJ/kg enthalpy, 140 m/s velocity, and an elevation of 1.5 m. Heat losses from the turbine to surroundings amount to 0.213 kJ/kg. Calculate the output of the turbine in kW. e) Briefly define Bore, Stroke, Top dead centre, Bottom dead centre and swept volume by drawing a neat sketch of piston cylinder arrangement of an IC engine. f) Define (i) elastic limit, (ii) yield strength, (iii) ultimate strength and show them on a stress strain diagram for a ductile material.	5x4=20
Q 2.	Answer any four parts of the following. a) Describe various types of errors in measurement. b) What is Cast Iron? Also describe its general properties. c) The density and kinematic viscosity of a liquid is 850 kg/m^3 and 1.75 cm^2/s respectively. Calculate its (a) specific weight, (b) specific gravity, (c) specific volume and (d) dynamic viscosity in Ns/m^2. d) Explain the working principle of centrifugal pump with a neat sketch. e) Briefly describe any one instrument for the measurement of (i) Temperature, and (ii) Pressure. f) An ideal gas expands in the piston cylinder arrangement. Derive the formulae of work done by the ideal gas if the expansion process is (i) isothermal, and (ii) Isobaric.	5x4=20
Q 3.	Answer any two parts of the following. a) State and derive Bernoulli's Equation b) A cylinder contains 0.2 m^3 of a gas at 1 bar and 100^{0}C. This is compressed polytropically to volume 0.05 m^3 so that the pressure becomes 6 bar. Calculate (a) the mass of gas, (b) change in internal energy of the gas during process, and (c) Heat transfer during compression. Assume γ = 1.4 and Characteristic gas constant for gas (R) = 0.3 kJ/kg. K. c) Explain the working principle of two-stroke CI engine with the help of a suitable diagram.	10x2= 20

Q 4.	Answer any two parts of the following. a) Figure 1 shows a simple truss consisting of seven members, each of 3 m length, freely supported at its end points. It is loaded at B and C as shown. Find the forces in all the members of the truss, also indicate whether the force is compressive or tensile.  *Figure 1* b) Write short notes on: (i) Carbon steels and their application, (ii) Hook's Law, (iii) Newton's law of viscosity, (iv) Zeroth Law of Thermodynamics. c) In an air standard diesel cycle, the compression ratio is 18. The pressure and temperature at the beginning of compression are 0.1 MPa and 300 K, respectively. Heat is added at constant pressure until the temperature is increased to 1700 K. Calculate: (i) cutoff ratio, (ii) heat supplied per kg of air, (iii) cycle efficiency, and (iv) mean effective pressure C_p = 1.005 kJ/kg, γ_{air} = 1.4.	10x2= 20
Q 5.	Answer any two parts of the following. a) The water is flowing through a tapering pipe having diameters 300 mm and 150 mm at sections **1** and **2** respectively. The discharge through the pipe is 40 litres/sec. The section **1** is 10 m above datum and section **2** is 6 m above datum. Find the intensity of pressure at section **2** if that at section **1** is 400 kN/m^2. b) Draw Otto cycle in p-V and T-s diagram and obtain the expression of its efficiency. c) Draw a neat representative sketch of a heat engine and heat pump. Also write the expression of their efficiency/COP (whichever required). A refrigerator operates on reversed Carnot cycle. Determine the power required to drive refrigerator between temperatures of 42ºC and 4ºC, if heat at the rate of 2 kJ/s is extracted from the low temperature reservoir.	10x2= 20

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