Sub Code: MET-001 **ROLL NO……..……..**

II[nd] SEMESTER EXAMINATION, 2022 – 23

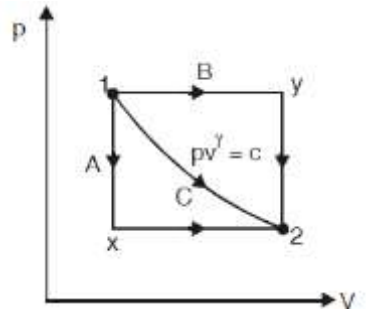
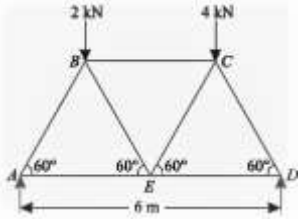
First Year , I[st] Year B.Tech.

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 steal bar 1.5 m long, 50 mm wide and 20 mm thick is subjected to an axial tensile load of 120 kN. If the extension in the length of the bar is 0.9 mm, find the stress, strain and modulus of elasticity of the bar material. b) Define (i) Newton's law of viscosity, (ii) flow and non flow work. c) State and derive Pascal's law. d) A closed system having a mass of 50 kg has an initial velocity of 10 m/s. During a process its velocity increases to 30 m/s and its elevation also rises by 40 m. During the same process, the system receives 30000 J of heat and work done by the system is 2700 J. Find the change in the internal energy of the system during the process. e) Draw representative sketches of a heat engine and refrigerator. Also write the expression of their efficiency. f) Draw stress strain diagram for a ductile material and describe its salient features.	5x4=20
Q 2.	Answer any four parts of the following. a) Derive relation between E (modulus of elasticity), K (bulk modulus) and μ (Poisson's ratio). b) Prove that violation of Clausius statement leads to violation of Kelvin-Plank statement. c) Define alloy steels. Why alloying elements are added to steel. d) A reversible heat engine delivers 0.6 kW power and rejects heat energy to a reservoir at 300 K at the rate of 24 kJ/min. Make calculations for the engine efficiency and the temperature of the thermal reservoir supplying heat to the engine. e) Explain any two devices for force measurement with the help of suitable diagram. f) What are various types of error in measurement.	5x4=20
Q 3.	Answer any two parts of the following. a) Define: (i) Direct and indirect measurement, (ii) specific weight, (iii) specific volume, (iv) Zeroth Law of Thermodynamics. b) Explain the working principle of four-stroke CI engine with the help of a suitable diagram.	10x2= 20

	c) A perfect gas changes from equilibrium state 1 to state 2 by three quasi-static processes *A, B, C* as shown in Figure 1. The internal energy at 1 is 800 J. The work transfer during paths *A, B,* and *C* are 120 J, 180J and 150 J respectively. Calculate the internal energy at state 2 and heat energy transferred during these processes.  *Figure 1*	
Q 4.	Answer any two parts of the following. a) In an Otto cycle, air at 15°C and 1 bar is compressed adiabatically until the pressure is 15 bar. Heat is added at constant volume until the pressure rises to 40 bar. Calculate (a) the compression ratio (b) the air-standard efficiency, and (*c*) the mean effective pressure for the cycle. Assume c_v = 0.718 kJ/kg.K, γ = 1.4 and R = 8.314 kJ/kmol.K. b) State and derive Bernoulli's Equation c) Figure 2 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 2*	10x2= 20
Q 5.	Answer any two parts of the following. a) Explain the working principal of reciprocating and centrifugal pump with the help of neat sketches. b) Draw Otto cycle in p-V and T-s diagram and obtain the expression of its efficiency. c) A nozzle is a device for increasing the velocity of a steadily flowing stream. At inlet to a certain nozzle, the fluid parameters are: Enthalpy = 2850 kJ/kg; velocity = 50 m/s; area = 0.1 m² and specific volume = 0.18 m³/kg. At the discharge end the enthalpy is 2650 kJ/kg and the specific volume is 0.49 m³/kg. Make calculations for the velocity of fluid at exit from the nozzle, mass flow rate of fluid, and the exit area of the nozzle. The nozzle is horizontal and there is negligible heat loss from it.	10x2= 20

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