B.E. I EXAMINATION, FEBRUARY' 2023

COMPUTER ENGINEERING 'B'

MER1C3 - ELEMENTS OF MECHANICAL ENGINEERING

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All Questions are compulsory. Attempt any two parts within each Question. Assume suitable data wherever if necessary. Use of Steam tables is permitted in the examination hall.

Q.1 (a) A partition wall divides a rigid vessel containing air into two compartments, the volume of each being 0.2 m^3. The pressure of air in one of the compartment is maintained at 2 bar and in other compartment is 4 bar. Initial temperature of air of both the compartment is the same. The vessel is heated and 125 kJ of heat is supplied resulting puncture of the partition wall. Calculate the final pressure of air when the equilibrium is attained, **06**

(b) A reciprocating air compressor installed in a fertilizer factory takes in air at 1 bar and 20°C and delivers at 6 bar. Calculate work done, heat transfer and change in internal energy per kg of air compressed, if the compression process follows (a) isothermal, (b) reversible adiabatic. **06**

(c) Explain the concept of temperature and differentiate between heat, temperature and internal energy **06**

Q.2. (a) Steam at 10 bar and 200°C is cooled till it becomes dry saturated and is then throttled to 1 bar pressure .Determine change in enthalpy and heat transferred during each process. Also calculate quality of steam at the end of throttling process. Take $C_p = 2.25$ KJ/kg for superheated steam. **06**

(b) Explain and describe the Electrical calorimeter and derive the dryness fraction of wet sample of steam by this calorimeter. **06**

(c) Wet steam at 20 bar pressure and 0.9 dryness fraction is heated reversibly at constant pressure to a temperature of 300°C. Calculate work done, heat supplied and changes in internal energy and entropy. Represent the process on T-S diagram and indicate area which represents heat interaction. **06**

Q.3. (a) Derive the variation in efficiency of air standard diesel cycle due to variable specific heat and draw effect of variable specific heat on PV and TS diagram. **06**

(b) A diesel engine operates on air standard diesel cycle. The engine has 6 cylinder of 11 cm bore diameter and 13 cm stroke. The engine runs at 2000 rpm .At beginning of compression the air is at 1 bar and 26°C. If clearance volume is 12.5 percent of stroke volume. Calculate (a) compression ratio (b) pressure and temperature of air after compression, (c) thermal efficiency, if air is heated to 1370°C. **06**

(c) The bore diameter and stroke of cylinder of an engine working on Otto cycle are 18 cm and 32 cm. The clearance volume is 0.002 m^3. Calculate the (a) air standard efficiency (b) compression ratio. Assume γ for air =1.4. **06**

P.T.O.

B.E. I EXAMINATION, MARCH' 2022
(COMPUTER ENGINEERING – B)
MER1C3
ELEMENTS OF MECHANICAL ENGINEERING

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All Questions are compulsory. Attempt any two parts of each Question. Assume suitable data wherever if necessary. Steam tables are permitted in the examination hall.

Q.1 (a) A partition wall divides a rigid vessel containing air into compartments, the volume of each being 0.2 m³. The pressure of air in one of the compartment is maintained at 2 bar and in other compartment is 4 bar. Initial temperature of air of both the compartment is the same. The vessel is heated and 125 kJ of heat is supplied resulting puncture of the partition wall. Calculate the final pressure of air when the equilibrium is attained. **06**

(b) An axial flow compressor of a gas turbine plant receives air from atmosphere at a pressure of 1 bar, temperature 27°C and velocity 60 m/s. At the discharge of compressor the pressure is 5 bar and the velocity is 100 m/s. The mass flow rate through the compressor is 20 kg/s. Assuming isentropic compression. Calculate the power required to drive the compressor. Also Calculate the inlet and outlet pipe diameters. **06**

(c) Explain the concept of temperature and differentiate between heat, temperature and internal energy. **06**

Q.2. (a) In a steam turbine dry and saturated steam expands from 22 bar to 2 bar isothermally, Calculate (a) change in enthalpy, (b) change in internal energy, (c) change in entropy, (d) heat transferred, (e) work done **06**

(b) Explain and describe the combined separating and throttling calorimeter and derive the dryness fraction of wet sample of steam by this method. **06**

(c) A rigid tank of 1 m³ volume contains dry saturated steam at 2 bar. Due to poor insulation, there is heat transfer to the surroundings and the pressure drops to 1 bar after some time. Calculate for the final condition of steam and the amount of heat transferred. **06**

Q.3. (a) Derive the variation in efficiency of air standard diesel cycle due to variable specific heat and draw effect of variable specific heat on PV and TS diagram. **06**

(b) A diesel engine operating on air standard diesel cycle has 15 cm bore and 25 cm stroke. The clearance volume is 400 cm³. The fuel is injected at constant pressure for 5% of the stroke. Efficiency. Calculate the air standard If the cut off is delayed from 5 to 8%. What will be the percentage loss in efficiency? In both cases, the compression ratio is same. **06**

(c) In a constant volume cycle the temperature at the beginning and end of the compression are 43°C and 323°C. Calculate the (a) air standard efficiency (b) compression ratio. Assume γ for air =1.4. **06**

 P.T.O.

Q.4. (a) Write the Short notes on following terms related to foundry practice: (Any Three) **06**

(i) Function of Sprue Hole.
(ii) Differentiate between Match Plate Pattern and Cope and Drag Pattern
(iii) Fettling Processes.
(iv) Draft Allowances on pattern.

(b) Explain the Precision Investment Casting and Hot Chamber Pressure Die Casting Processes with suitable diagram. **06**

(c) Explain the term Chills & Chaplets used in foundry practice with their types. **06**

Q.5. (a) Write short notes on following terms related to Welding & Machining Processes: (Any Three) **06**

(i) MIG Welding Processes.
(ii) Types of operation performed on lathe machine
(iii) Types of electrode
(iv) Differentiate between Spot & Seam Welding Processes.

(b) Explain the method for producing Acetylene Gas for Low Pressure Oxy-Acetylene gas welding. Also explain the various types of flames used in Oxy-Acetylene gas welding. **06**

(c) Sketch the following parameters 2°-7°-6.5°-6°-12°-10°-0.5 *mm* for ASA - Nomenclature of single point cutting tool in all the views with their name also explain any three methods to perform taper turning operation in lathe machine. **06**