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.

Q.4. (a) Explain briefly the permanent mould casting processes with advantage and limitation also explain which types of moulding material and pattern is to be used for this processes. 06

(b) Write short notes on: *(Any Three)* 06
(a) Colour Code used in pattern
(b) Casting defects due to pouring material
(c) External and Internal chills
(d) Drop Core.

(c) Design the pattern for the Cuboidal shape of casting component having cylindrical hole of diameter 70 mm which is located at centre of cuboid as shown in Figure 1. The material of the casting component is Aluminium (shrinkage allowances 0.013 mm/mm). Now design the pattern for this casting component. Calculate the dimensions of pattern by including Shrinkage, Draft and Machining Allowances and indicate all the allowances with suitable sketch (Assume suitable allowances).

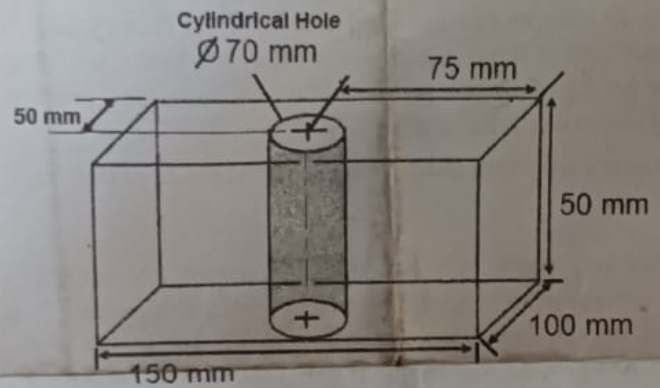

Figure 1: Casting Component

Q.5. (a) Define the following welding defects with suitable sketch: 06
(i) Cracks (ii) Porosity (iii) Undercut (iv) Spatter (v) Slag Inclusions.

(b) Define low pressure oxy -acetylene gas welding with suitable sketch also explain briefly the types of flames used in oxy-acetylene gas welding with their applications. 06

(c) Write short notes on following terms : 06
(i) Submerged Arc Welding Processes
(ii) Parting and Boring operations performed by Lathe Machine
(iii) Description and application of 18:4:1 cutting tool material.

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I B. E. Examination July – 2022
E&I and E&TC -B Engineering
MER1C3 : Elements of Mechanical Engineering

Time: 3 Hrs Max. Marks: 60

Note: Attempt any Two Parts from Each Questions.
Steam tables are permitted in the examination

1. a. Compare Heat and Work Transfer in thermodynamics. How many types of work transfer do you know? Write the respective governing equations. 6

b. A system composed of 2 kg of air expands in a frictionless piston and cylinder machine from an initial state of 1MPa,100°C to a final temperature of 30 °C. 6
(i) Find the net work for the process.(ii) Show that the process is represented by $Pv^{1.4}$ = constant. Assume there is no heat transfer.

c A turbo compressor delivers 3 m³ /s at 0.25 MPa, 45 °C which is heated at this pressure to 450 °C and finally expanded in a turbine which delivers 1850 kW. During the expansion, there is a heat transfer of 0.1 MJ/s to the surroundings. *Calculate the turbine exhaust temperature.* 6

2 a. Establish the relation for the thermal efficiency of Otto cycle 6

b. In an engine working on Diesel cycle, compression ratio is 16, and at the beginning of compression, pressure and temperature of charge are 1bar and 15 °C respectively. The temperature at the end of the isobaric process is 1500 °C. Find : (i) Cut off ratio (ii) Heat supplied per kg of air (iii) cycle efficiency and (iv) Mean Effective Pressure 6

c In an engine working on Otto cycle, compression ratio is 16, and at the beginning of compression, pressure and temperature of charge are 1bar and 20 °C respectively. The heat added during constant volume process is 2200 KJ. Find : (i) cycle efficiency and (ii) Mean Effective Pressure . 6

3 a. Enlist the Measurements of Dryness fraction of steam. And Explain any one. 6

b. Steam expands isentropically in a nozzle from 1 MPa, 250 °C to 10 kPa. The Steam flow rate is 1 Kg/s. Find the velocity of steam at the exit from the nozzle, and the exit area of the nozzle. Neglect the velocity of the steam at the inlet to the nozzle. The exhaust steam from the nozzle flows into a condenser and leaves as saturated water. The cooling water enters the condenser at 25 °C and leaves at 35 °C. *Determine the mass flow rate* of cooling water. 6

c Steam at 0.8 MPa,250 °C and flowing at the rate of 1 kg/s passes into a pipe carrying wet steam at 0.8 MPa,0.95 dry. After adiabatic mixing, the flow rate is 2.3 kg/s. Determine the condition of steam after mixing.. 6

ozzle at a pressure of 7 bar and 20°C (initial ...
... the entrance is 40 m/s and the exit velocity from ...
... nozzle is 1105 KJ/

4. a. What are the different types of patterns used in casting process and the allowances provided there-in? 6

b. Explain Gating System in casting Process. 6

c. Explain different casting defects and its reason.? 6

5. a. In how many ways can Threading Operation be performed on a centre lathe? What other operations can be performed on the Lathe. 6

b. Discuss the various types of flames in Oxy Acetylene Welding? 6

c. Write the important functions of flux used in the Arc-welding process. What are the common welding defects in arc welding process and why these defects occur 6