

B.E. I EXAMINATION, FEBRUARY' 2023

COMPUTER ENGINEERING 'B'

MER1C3 - ELEMENTS OF MECHANICAL ENGINEERING

Hrs.

Maximum Marks: 60

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

- 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
- d) 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 $C_p = 2.25 \text{ KJ/kg}$ for superheated steam. 06
- e) Explain and describe the Electrical calorimeter and derive the dryness fraction of wet sample of steam by this calorimeter. 06
- f) 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
- g) 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
- h) 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
- i) The bore diameter and stroke of cylinder of an engine working on Otto cycle are 30 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
- Colour Code used in pattern
 - Casting defects due to pouring material
 - External and Internal chills
 - 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).

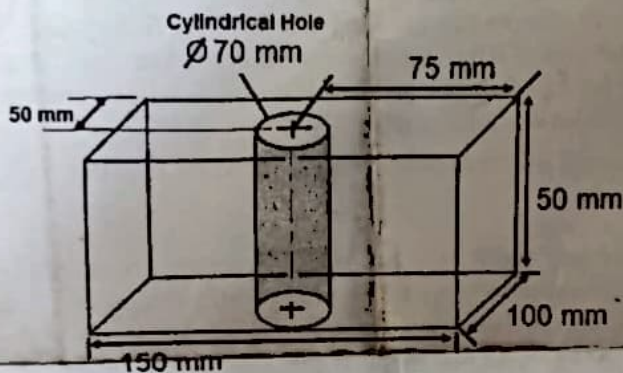


Figure 1: Casting Component

- Q.5. (a) Define the following welding defects with suitable sketch: 06
- Cracks
 - Porosity
 - Undercut
 - Splatter
 - 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
- Submerged Arc Welding Processes
 - Parting and Boring operations performed by Lathe Machine
 - Description and application of 18:4:1 cutting tool material.

B.E. I EXAMINATION, MARCH' 2022
(COMPUTER ENGINEERING - B)
MERIC3
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 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) 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 m^3 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 cm^3 . The fuel is injected at constant pressure for 5% of the stroke. Calculate the air standard efficiency. 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