

**GANPAT UNIVERSITY****B. Tech. Sem-IV (Marine Engineering)****Regular Examination/ May - June 2014****Applied Thermodynamics – II (2MR406)****Time: 3 Hours****Total Marks: 70**

- Instruction:**
1. Attempt All The Questions.
  2. Assume Suitable Data if not giving.
  3. Be Precise with your Answer.
  4. Don't write anything on question paper.

**SECTION - I**

- Quest.1 (A) What is fuel give its classifications and also write the advantages of liquid fuel over solid fuels. 6
- (B) What is dissociation, what is the effect of it on IC engine? 6

**OR**

- Quest.1 (A) Define Following terms. 6
- (i) Reynolds Number (ii) Prandtl Number (iii) Nusselt Number  
(iv) Stanton Number (v) Grashoff number (vi) Graetz Number
- (B) Derive the relation for variation of fluid velocity with flow area. 6

- Quest.2 (A) Derive an expression for Fluid pressure with Flow area. 5
- (B) A Reactor's wall, 320 mm thick, is made up of an inner layer of fire brick ( $k=0.84 \text{ W/m}^0\text{C}$ ) covered with a layer of insulation ( $k=0.16 \text{ W/m}^0\text{C}$ ). The reactor operates at a temperature of  $1325^0\text{C}$  and the ambient temperature is  $25^0\text{C}$ . 6
- (i) Determine the thickness of fire brick and insulation which gives minimum heat loss.
- (ii) Calculate the heat loss presuming that insulation material has a maximum temperature of  $1200^0\text{C}$

**OR**

- Quest.2 (A) A steel pipe with 50 mm OD is covered with a 6.4 mm asbestos insulation ( $k=0.166 \text{ W/m-K}$ ) followed by a 25 mm layer of fiber glass insulation ( $k=0.0485 \text{ W/m-K}$ ). The pipe wall temperature is 393K and outside insulation temperature is 311K. Calculate interface temperature between asbestos and fiber glass. 5

- (B) A furnace wall consists of 200 mm layer of refractories bricks, 6 mm layer of steel plate and a 100 mm layer of insulation bricks. The maximum temperature of the wall is  $1150^0\text{C}$  on the furnace side and the minimum temperature is  $40^0\text{C}$  outermost side of the wall. An accurate energy balance over the furnace shows that the heat loss from the wall is  $400 \text{ W/m}^2$ . It is known that there is a thin layer of air between the layer of refractories brick and steel plate. Thermal conductivities for the three layers are 1.52, 45 and  $0.138 \text{ W/m}^0\text{C}$  respectively. Find 6

- (i) To how many mm of insulation brick is the air layer equivalent
- (ii) What is temperature of the outer surface of steel plate

- Quest.3 (A) Determine rate of heat flow through a spherical boiler wall which is 2 m in diameter and 2 cm thick steel ( $k=58 \text{ W/m-K}$ ). The outside surface of boiler wall is covered with asbestos ( $k=0.116 \text{ W/m-K}$ ) 5 mm thick. The temperature of outer surface and that of fluid inside are  $50^0\text{C}$  and  $300^0\text{C}$  respectively. Take inner film resistance as  $0.0023 \text{ K/W}$  6

- (B) How many modes of heat transfer, Describe conduction with Fourier's law of conduction. 6

**SECTION - II**



- Quest.4 (A) Give the description about natural and forced convection. 6  
 (B) Enlist different dimensionless numbers, describe any two. 6  
 OR
- Quest.4 (A) What is fuel, classify and give description 6  
 (B) An exterior wall of a house may be approximated by a 0.1 m layer of common brick ( $k=0.7 \text{ W/m}^\circ\text{C}$ ) followed by a 0.04m layer of gypsum plaster ( $k=0.48 \text{ w/m}^\circ\text{C}$ ). What thickness of loosely packed rock wool insulation ( $k=0.065\text{w/m}^\circ\text{C}$ ) should be added to reduce the heat loss or (gain) through the wall by 80 percent? 6
- Quest.5 (A) Describe the effect of back pressure on the flow rate of gas through converging Diverging nozzle. 5  
 (B) A 150 mm steam pipe has inside diameter of 120 mm and outside diameter of 160 mm. It is insulated at the outside with asbestos. The steam temperature is  $150^\circ\text{C}$  and the air temperature is  $20^\circ\text{C}$ .  $h_{(\text{outside})} = 100 \text{ w/m}^2\text{C}$ ,  $h_{(\text{inside})} = 30 \text{ w/m}^2\text{C}$ ,  $k_{(\text{asbestos})} = 0.8\text{w/m}^\circ\text{C}$  and  $k_{(\text{steel})} = 42 \text{ w/m}^\circ\text{C}$ . How thick should the asbestos be provided in order to limit the heat losses to  $2.1 \text{ kw/m}^2$ . 6  
 OR
- Quest.5 (A) Air enters a diffuser with a velocity of 200 m/s. determine speed of sound and Mach number at the diffuser inlet when air temperature is  $30^\circ\text{C}$  5  
 (B) Describe the effect of back pressure on the flow rate of gas through converging nozzle. 6
- Quest.6 (A) A jet of water having a velocity of 20 m/s strikes a curved vane, which is moving with a velocity of 10 m/s. The jet makes an angle of  $20^\circ$  with the direction of motion of vane at inlet and leaves at an angle of  $130^\circ$  to the direction of motion of vane an outlet. Calculate: (i) Vane angles, so that the water enters and leaves the vane without shock. (ii) Work done per second per unit weight of water striking the vane per second. 6  
 (B) Explain the Equation of combustion 6

ALL THE BEST