GENERAL ENGINEERING SCIENCE II

Attempt ALL questions

Marks for each part question are shown in brackets

1 Explain why thermal insulation is necessary and beneficial for some marine plant. (6)

2. *(a)* Define *latent heat of evaporation.* (2)

   (b) Describe how a mercury in glass thermometer is calibrated. (8)

3. *(a)* Define Charles' Law. (2)

   (b) A gas, originally at 1 bar, is heated from 20°C to 323 K in a 0.08 m^3 bottle.

   Determine the final pressure of the gas. (4)

4. A fuel, with a chemical composition of C_2H_8 is completely burned in 50kg of air at stoichiometric conditions. Determine the mass of the fuel. (10)

   Air contains 23% oxygen by mass.
   Relative atomic masses: hydrogen 1, carbon 12, oxygen 16.

5. *(a)* List FOUR desirable properties of a refrigerant (4)

   (b) State why EACH of the properties in Q.5(a) is desirable. (4)

6. An IC engine develops 600 kW at the shaft. It has an indicated specific fuel consumption of 170g/kWhr and consumes fuel at a rate of 115kg/hr.

   Determine:

   (a) the mechanical efficiency of the engine; (5)

   (b) the brake thermal efficiency given that the calorific value of the fuel is 40.8MJ/kg. (5)

7. *(a)* State the THREE main effects of an electric current (3)

   (b) Give TWO practical applications of EACH effect in Q.7(a). (6)

8. An electric circuit uses resistors of 4 Ω and 6 Ω in parallel across a 24 V supply.

   (a) Draw the circuit diagram using standard symbols. (2)

   (b) Calculate:

   (i) the current in each resistor; (4)

   (ii) the power rating of the circuit. (2)

9. A copper wire conductor 60 m long produces a pd of 24 V when carrying a current of 30 A. The conductor has a resistivity of 17 μΩmm. Calculate the diameter of the wire. (8)

10. *(a)* State Lenz's Law. (2)

    (b) A coil of axial length 100 mm and 80 turns rotates between the poles of a 4-pole generator within a uniform flux density of 150mT. The speed of rotation is 1500rpm and the width of the coil is 40 mm. Calculate the maximum emf generated. (7)

11. A test meter has an internal resistance of 5 Ω and gives a full-scale deflection at 15 mA. Sketch the circuit arrangements and determine the values of the resistors and other components required to enable the instrument to give a full scale deflection of:

    (a) 10 A; (5)

    (b) 24 V. (5)

12. Sketch a labelled diagram showing the construction of a moving coil meter. (6)