July 2000

GENERAL ENGINEERING SCIENCE II

Attempt ALL questions

Marks for each part question are shown in brackets

1. *(a)* State the difference between *temperature* and *heat energy.* (2)

   (b) Outline the mechanism of heat transfer by EACH of the following:

   (i) conduction; (3)

   (ii) convection. (3)

2. A furnace uses 5.5 m^5 of gas to raise the temperature of a 250 kg mass of steel to 1023K. The calorific value of the gas is 35MJ/m^3 and the specific heat of the steel is 500J/kgK.

   Determine the thermal efficiency of the furnace given that its initial temperature is 25°C. (10)

3. *(a)* Define Boyle's Law. (3)

   (b) A 3.5 m^3 volume of air at a pressure of 20kN/m^2 gauge is compressed at constant temperature to a pressure of 4.25 bar gauge.

   Calculate the final volume of air given that the atmospheric pressure is 100 kN/m^2. (5)

4. *(a)* Explain the process of *combustion.* (3)

   (b) Explain the effect on the combustion process of EACH of the following:

   (i) inadequate air; (3)

   (ii) excess air. (3)

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

   Determine EACH of the following:

   (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)

6. With respect to a refrigeration cycle, state the primary function of EACH of the following components:

   (a) condenser; (2)

   (b) expansion valve; (2)

   (c) evaporator. (2)

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. Distinguish between the terms *electromotive force* and *potential difference.* (6)

9. Determine the resistance of a wire of length 40m, a diameter of 20 mm and a resistivity of 125 μΩmm. (6)

10. *(a)* With reference to electric storage batteries, sketch the basic construction of:

(i) a primary cell; (4)

(ii) a secondary cell. (4)

(b) State the unit of battery capacity. (2)

*11. (*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 1500 rpm and the width of the coil is 40 mm.

Calculate the maximum emf generated. (8)

12. For the circuit shown in Fig. Q.12, calculate EACH of the following:

(a) the value of the resistor R; (4)

(b) the value of the current flowing in EACH resistor. (4)

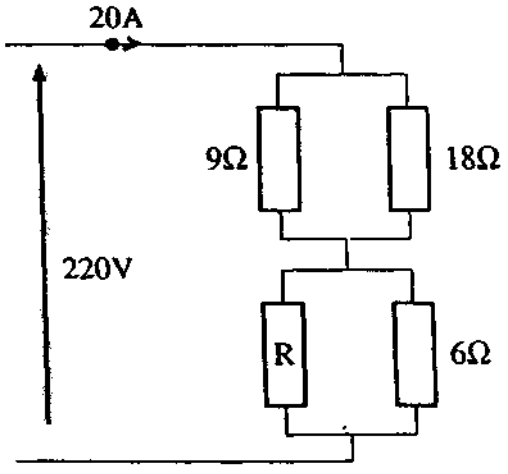

Fig. Q.12