PART B
General Engineering
(ELECTRICAL)

1. (a) The resistance of copper winding of a motor at room temperature of 25°C is 3·0 Ω. After an extended operation of the motor at full load, the winding resistance increases to 4·0 Ω. Find the temperature rise. Given that the temperature coefficient of copper at 0°C is 0·00426 Ω/°C/Ω. *15*

(b) A toaster rated at 2000 W, 240 V is connected to a 230 V supply. Will the toaster be damaged ? Will its rating be affected ? *15*

(c) Define the following terms : *20*

(i) Drift velocity

(ii) Current density

(iii) Power

(iv) Electromotive force

(d) The domestic power load in a house comprises the following :

(i) 10 lamps of 100 W each

(ii) 5 fans of 80 W each

(iii) 1 refrigerator of 0·5 hp

(iv) 1 heater of 1 kW

Calculate the total current taken from the supply of 230 V. *10*

2. (a) Using Kirchhoff's law, determine the current I_A and I_B in the network shown in Figure 1. *15*

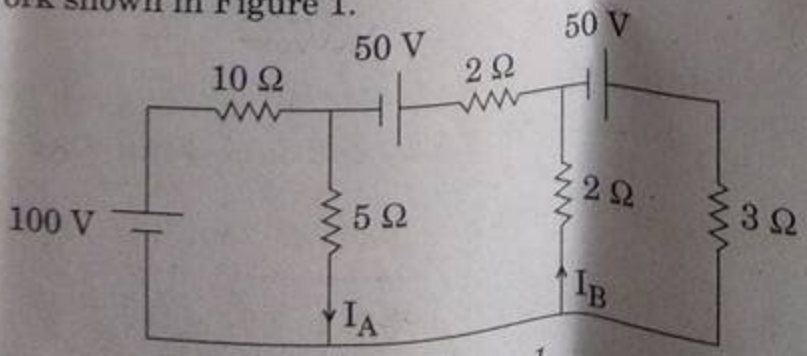

Figure 1

(b) For the circuit shown in Figure 2, find I such that current in the 100 Ω resistor is zero. 15

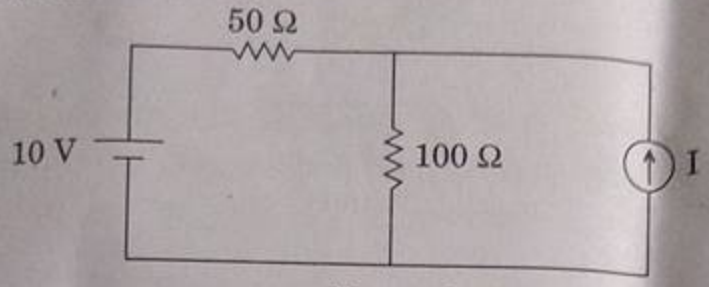

Figure 2

(c) A series combination of two capacitances $C_1 = 5\ \mu F$ and $C_2 = 10\ \mu F$ is connected across a dc supply of 300 V. Determine the

(i) charge

(ii) voltage

(iii) energy stored in each capacitor 15

(d) Define the following terms : 15

(i) Self-inductance

(ii) Flux

(iii) RMS value of alternating waves

3. (a) A circular coil of area 300 cm^2 and 25 turns rotates about its vertical diameter with an angular speed of 40 rad/sec in a uniform horizontal magnetic field of magnitude 0·05 T. Find the maximum voltage induced in the coil. 10

(b) Define the following terms : 15

(i) Reluctance

(ii) Permeance

(iii) Magnetic Field Strength

(c) A coil has 1000 turns enclosing a magnetic circuit of 20 cm^2 in cross-section, with 4 A current in the coil, the flux density is 1·5 Wb/m^2, and with 8 A current, it is 1·9 Wb/m^2. Find the mean value of inductance between these current limits and the induced emf if the current decreases from 8 A to 4 A in 0·05 sec. 15

(d) A coil A of 1200 turns and another coil B of 800 turns lie near each other so that 60 percent of the flux produced in one links with the other. It is found that a current of 5 A in coil A produces a flux of 0·25 mWb, while the same current in coil B produces a flux of 0·15 mWb. Determine the mutual inductance and coefficient of coupling between the coils. 20

4. (a) Determine the average and rms value of the resultant current in a wire carrying simultaneously a dc current of 10 A and sinusoidal current of peak value of 1·414 A. 10

(b) The resistance of a coil is 3 Ω and its time constant is 1·8 sec. At t = 0 sec, a 10 V source is connected to it. Determine the 15

(i) current at t = 1 sec

(ii) time at which the current attains half of its final value

(iii) initial rate of growth of current

(c) Explain in brief the following : 20

(i) Energy meter

(ii) CRO

(iii) 2 wattmeter method

(iv) Multimeter

(d) In a moving coil instrument, the coil has a length of 5 cm, a width of 4 cm and 100 turns. The magnetic flux density in the air gap is 0·2 Wb/m^2. The hair spring provides a controlling torque of $0·5 \times 10^{-7}$ Nm/degree deflection of the coil. What current will be required to give a deflection of 60° ? 15

5. (a) A shunt generator gives full load output of 30 kW at a terminal voltage of 200 V. The armature and shunt field resistances are 0·01 Ω and 100 Ω respectively. The iron and friction losses are 1000 W. Calculate the 15

(i) emf generated

(ii) copper losses

(iii) efficiency

$E_g = V + I_a R_a$

$= 200 + 17$

(b) Explain dynamic braking of 3-phase induction motor. 15

(c) Explain in brief the following : 15

(i) Fractional kilowatt motors

(ii) Auto transformers

(iii) S.C. test of 3-phase transformer

(d) Explain parallel operation of two alternators. 15

6. (a) Explain in brief of the following : 30

(i) Merz-price system of protection

(ii) Short-circuit current for symmetrical faults

(iii) Electric welding

(b) How is the rating of a cable determined ? 10

(c) What are the different configurations of BJT ? Explain each with suitable circuit diagram. 10

(d) Explain electric installation of machines and relevant IE rules in brief. 10