Solved Paper 2014

Electrical Engineering

(Paper II)

1. (*a*) A copper wire has a resistance of 0.85 Ω at 20°C. What will be its resistance at 40°C? Temperature coefficient of resistance of copper at 0°C is 0.004°C. (10)

(*b*) In the circuit shown in Figure, what is the value of V? (10)

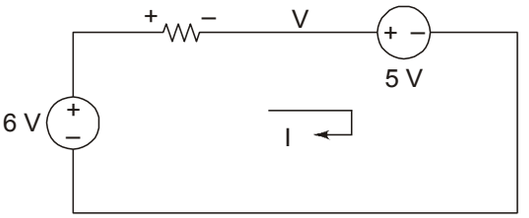

Figure 1

(*c*) What is the value of Thevenin voltage E_{Th} in the given circuit of Figure? (10)

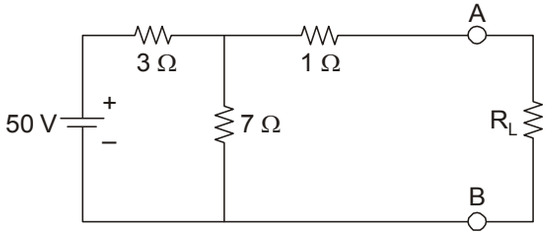

Figure 2

(*d*) In Figure, find the value of resistance R. (30)

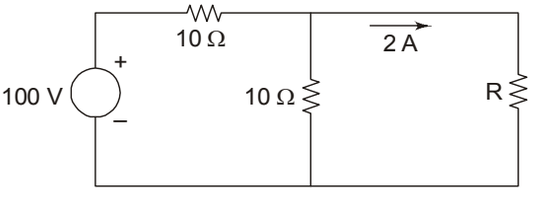

Figure 3

2. (*a*) Define the following terms: (20)

(*i*) Magnetic field intensity

(*ii*) Magnetic flux density

(*iii*) Magnetomotive force

(*iv*) Reluctance

(*b*) In a pair of coupled coils, coil 1 has a continuous current of 2A and the corresponding fluxes φ_{11} and φ_{21} are 0.3 and 0.6 mWb respectively. If the turns are $N_1 = 500$ and $N_2 = 500$, find L_1, L_2, M and K. (10)

(*c*) An AC voltage of 50 Hz has a maximum value of 50V. What will be its voltage after 1/600 second? (10)

(*d*) A circuit with a resistor, inductor, and capacitor in series is resonant of f_0 Hz. If all the component values are now doubled. Find the new resonant frequency. (20)

3. (*a*) A 100 μA ammeter has internal resistance of 100Ω. For extending its range to measure 500μA, calculate the value of shunt resistance (in Ω). (10)

(*b*) A wattmeter is connected as shown in Figure. What will be the wattmeter reading of power consumed either by Z_1 or Z_2? (10)

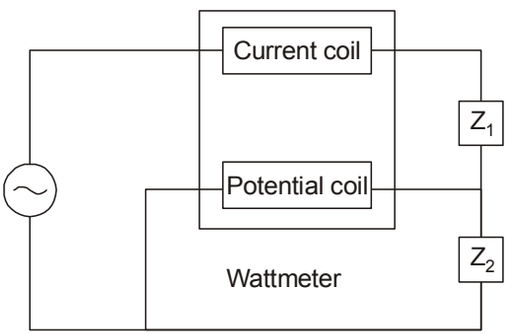

Figure 4

(*c*) A CRO screen has ten divisions on the horizontal scale. If a voltage signal 5 sin (314 t + 45°) is examined with a line base setting of 5 msec/div, find the number of cycles of signal displayed on the screen.(20)

(*d*) Prove that the power in AC circuit is equal to VI cos φ. (20)

4. (*a*) Explain the various losses in DC machines. (20)

(*b*) A DC machine induces an EMF of 240 V at 1500 rpm. Find the developed torque for an armature current of 25 A. (10)

(*c*) A 3300/300 V single phase transformer gives 0.6 A and 60 W as ammeter and wattmeter reading when supply is given to the low voltage winding and high voltage winding is kept open. What is the power factor of no load current? (15)

(*d*) A 3 hp, 3-phase 4-pole, 400V 50Hz induction motor runs at 1440 rpm. What will be the frequency of the rotor-induced EMF? (15)

5. (*a*) Explain the need for connecting a capacitor in the auxiliary winding of a single phase induction motor. (15)

(*b*) Why are two alternators connected in parallel to supply a common load? What are the necessary conditions for parallel connection? (15)

(*c*) What are the advantages and disadvantages of AC over DC? (15)

(*d*) Overhead power transmission lines are preferred over underground power cables. Discuss. (8)

(*e*) What are the main advantages of SF6 circuit breakers? (7)

6. (*a*) A residential flat has the following average electrical consumptions per day:

(*i*) 4 tube lights of 40 watts working for 5 hours per day;

(*ii*) 2 filaments of 60 watts working for 8 hours per day;

(*iii*) 1 water heater rated 2 kW working for 1 hour per day;

(*iv*) 1 water pump of 0.5 kW rating working for 3 hours per day.

Calculate the cost of energy per month if 1 kWh of energy (i.e., 1 unit of energy) costs ₹3.50. (20)

(*b*) Cite the advantages and disadvantages of electric drives. (20)

(*c*) A silicon diode is connected across a 3V supply with a series resistance of 20Ω as shown in Figure. Neglecting diode resistance, find the diode current. (20)