53 (EE 201) BEEN

2018

BASIC ELECTRICAL ENGINEERING

Paper : EE 201

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions.*

1. *(a)* Find the equivalent resistance of the network of *Fig. (i)* between terminals *A* and *B*. All resistance values are in ohms. 5

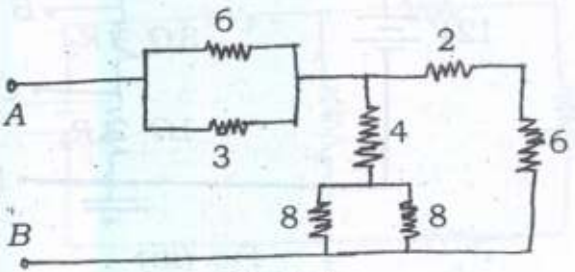

Fig. (i)

(b) In the unbalanced bridge circuit of *Fig. (ii)*, find the current which will flow through the switch when it is closed. All the resistance values are in ohm. 5

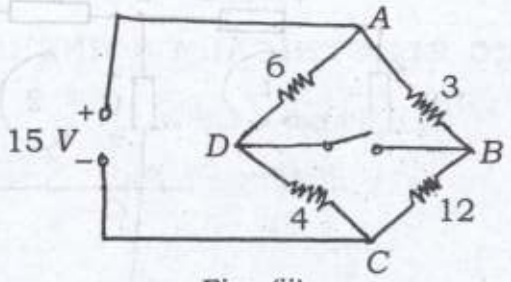

Fig. (ii)

(c) Find the voltage drop across R_1, R_2 and R_3 of *Fig. (iii)* using voltage divider rule. Also find V_A, V_B, V_C. 10

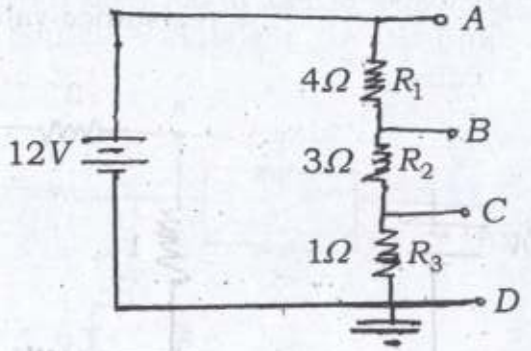

Fig. (iii)

2. (a) Applying Kirchhoff's laws to different loops in *Fig. (iv)*, find the values of V_1 and V_2. 5

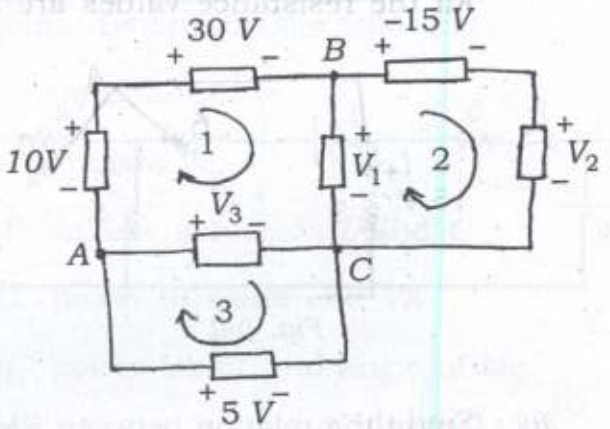

Fig. (iv)

(b) Use Thevenin's theorem to find current in the branch *AB* of the network shown in *Fig. (v)*. All the resistance values are in ohm. 5

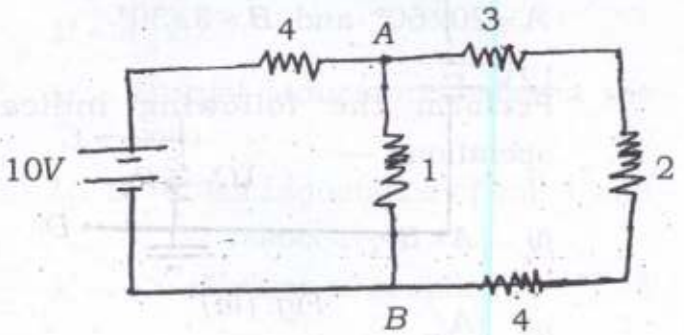

Fig. (v)

(c) Find the branch current in the circuit of *Fig. (vi)* by using nodal analysis. All the resistance values are in ohm. 10

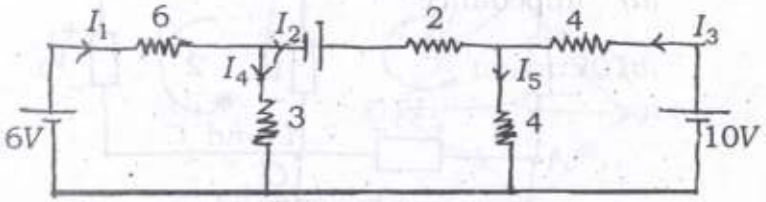

Fig. (vi)

3. (a) Derive the relation between RMS value and maximum value of sinusoidal quantity. 5

(b) Given the following two vectors :

$A = 20\angle 60°$ and $B = 5\angle 30°$

Perform the following indicated operations —

(i) $A \times B$

(ii) A/B 5

(c) A resistance of 20Ω, an inductance of $0.2\ H$ and a capacitance of $100\mu F$ are connected in series across 220 *V*, 50 *Hz* mains. Determine the following :

(a) impedance

(b) current

(c) voltage across *R*, *L* and *C*

(d) power in watts and *VA*

(e) power factor and angle of lag. 10

4. (a) Write the similarities and differences between magnetic and electric circuits. 5

(b) Derive the following relation —

$M = K\sqrt{L_1 L_2}$

$M \rightarrow$ Mutual inductance between the coils

$L_1, L_2 \rightarrow$ Self inductance of coil 1 and 2 respectively

$K \rightarrow$ Co-efficient of coupling. 5

(c) Derive the relation between line currents and phase currents in delta connected 3-phase system with the help of phasor diagram. 10

5. (a) Show that the current lags behind the applied voltage by an angle of 90° in a pure inductive circuit. Also draw the waveform for power. 5

(b) How will you use a PMMC instrument which gives full scale deflection at 50 mV p.d and 10 mA current as an Ammeter of O-10A range? 5

(c) A Δ-connected balanced 3-phase load is supplied from a 3-phase, 400 V supply. The line current is 20 A and the power taken by the load is 10,000 W. Find —

(i) impedance in each branch

(ii) the line current, power factor and power consumed if the same load is connected in star. 10

6. (a) The maximum values of the alternating voltage is 400 V in a circuit connected to a 50 Hz supply. The instantaneous values of voltage is 283 V at time t = 0, increasing positively. Write down the expression for voltage. 5

(b) Two currents i_1 and i_2 are given by the expression $i_1 = 10\sin\left(314t + \pi/4\right)A$ and $i_2 = 8\sin\left(314t - \pi/3\right)A$.

Find $i_1 + i_2$ 5

(c) An inductive coil of resistance 15Ω and inductive reactance 42Ω is connected in parallel with a capacitor of capacitive reactance 47·6Ω.

The combination is energized from a 200 V, 33·5 Hz a.c. supply. Find the total current drawn by the circuit and its power factor. Draw the phasor diagram of the circuit. 10

7. (a) Write briefly on Plate Earthing. 5

(b) What is damping torque in instruments? 5

(c) An iron ring of mean length 100 *cm* with an air gap of 2 *mm* has a winding of 500 turns. The relative permeability of iron is 600. When a current of 3 *A* flows in the winding, determine the flux density. 10
