B. E. First Semester (ALL) / SOE – 18-19 – Rev – FY-201 Examination

Course Code : EL 2101 **Course Name : Electrical Engineering**

Time : 2 Hours] [Max. Marks : 40

Instructions to Candidates :—

(1) Attempt any **Four** questions out of **Six**.
(2) All questions carry **Ten** marks.
(3) Assume suitable data wherever necessary.
(4) Diagrams should be given wherever necessary.
(5) Illustrate your answers wherever necessary with the help of neat sketches.
(6) Use of non programmable calculator is permitted.

1. Solve **Q. 1 (A)** or **Q. 1 (B)** :—

(A) (A1) Determine the current through 1 Ω resistor in the network shown in Fig. 1, use mesh analysis.

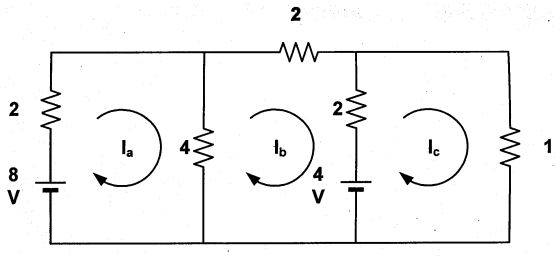

Fig. 1

6(CO2)

(A2) Calculate R_{ab} for the circuit shown in Fig. 2.

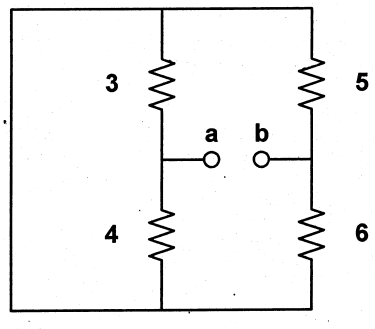

Fig. 2

4(CO2)

(B) (B1) For the circuit of Fig. 3, compute the voltage across each current source.

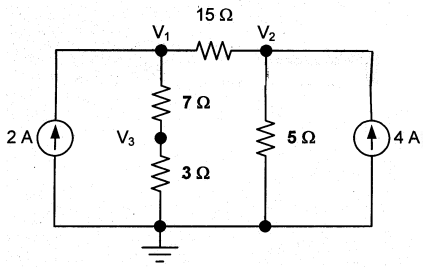

Fig. 3

6(CO2)

(B2) Find V_{AB} in Fig. 4 by using superposition theorem.

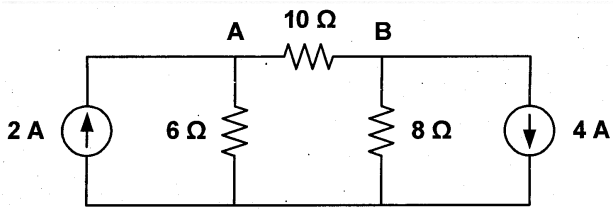

Fig. 4

4(CO2)

2. Solve **Q. 2 (A)** or **Q. 2 (B)** :—

(A) (A1) A series R – L circuit, having R = 4Ω and L = 0.2 H is connected across $230 \angle 30^0$ V , 50 Hz supply. Calculate :

(i) The current drawn by the circuit, and

(ii) The power factor of the circuit. 4(CO2)

(A2) Calculate the average and r.m.s. value of the voltage waveform shown in Fig.5. Also show that form factor and peak factor are equal to one.

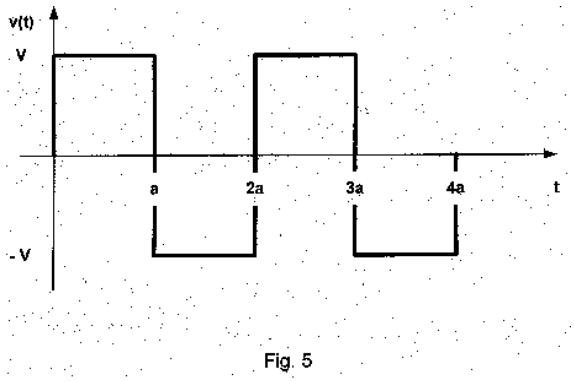

Fig. 5

6(CO2)

(B) (B1) A coil has an inductance of 0.05 H and a resistance of 10Ω. It is connected to a sinusoidal 200 V, 50 Hz supply. Calculate the impedance, current, power consumed and power factor. 4(CO2)

(B2) The instantaneous voltages across each of the three coils connected in series is given by

$v_1(t) = 200 \sin(\omega t)$
$v_2(t) = 200 \sin(\omega t - 120^0)$
$v_3(t) = 200 \sin(\omega t + 120^0)$

Determine an expression for the resultant voltage v (t). 6(CO2)

3. Solve **Q. 3 (A)** or **Q. 3 (B)** :

(A) (A1) A 60 Ω resistor is connected in parallel with an inductive reactance of 80 Ω to a 240 V, 50 Hz supply. Calculate :

(i) The current through the resistor and inductive reactance ;

(ii) The supply current ;

(iii) The circuit phase angle ;

(iv) Power factor ;

(v) P, Q, and S. 6(CO2)

(A2) Three impedances $(6 + j5)\,\Omega$, $(8 - j6)\,\Omega$ and $(8 - j10)\,\Omega$ are connected in parallel. Calculate the current in each branch when the total current is 20 A. 4(CO2)

(B) (B1) The following single – phase loads are connected to a 230 V supply :
160 kVA at 0.7 power factor lagging
50 kVA at 0.65 power factor leading
50 kW at unity power factor
Calculate :

(i) The total load in kVA ;

(ii) The line current ;

(iii) The combined power factor. 6(CO2)

(B2) A 10 Ω resistor, a 15.9 mH inductor and a 159 μF capacitor are connected in parallel to a 200 V, 50 Hz supply. Calculate the supply current and power factor. 4(CO2)

4. Solve **Q. 4 (A)** or **Q. 4 (B)** :

(A) (A1) A balanced star – connected load of $(4 + j\,3)\,\Omega$ per phase is connected to a 3 – phase, 415 – V, 50 – Hz supply.
Find :

(i) The line current,

(ii) The power factor,

(iii) The power,

(iv) The reactive volt – amperes, and

(v) The total volt amperes. 6(CO2)

(A2) Three identical resistors each of value $40\,\Omega$ are connected first in star and then in delta across a 200 V, three – phase, 50 Hz supply. Calculate the power taken from the supply in each case. 4(CO2)

(B) (B1) Each phase of a delta connected load has a resistance of $25\,\Omega$, an inductance of 0.15 H, and a capacitance of $120\,\mu$F. The load is connected across a 400 V, 50 Hz three – phase supply. Determine the line current, volt – amperes, active power and reactive volt – amperes. 6(CO2)

(B2) Three identical resistors of $20\,\Omega$ are connected in star to a 415 V, three phase, 50 Hz supply.

(i) Calculate the total power taken by the load.

(ii) Also calculate the power consumed in the resistors if they are connected in delta to the same supply. 4(CO2)

5. Solve **Q. 5 (A)** or **Q. 5 (B)** :

(A) (A1) A 200 kVA, single phase transformer with a voltage ratio 6350/660 V has the following winding resistances and reactances :

$$R_1 = 1.56\,\Omega \quad R_2 = 0.016\,\Omega$$

$$X_1 = 4.67\,\Omega \quad X_2 = 0.048\,\Omega$$

Calculate the resistance and reactance of the transformer referred to the high – voltage and low – voltage winding. 5(CO4)

(A2) A 2 kVA, 400/200 V, 50 Hz, single phase transformer has the following parameters as referred to primary side :

$R_{el} = 3\ \Omega$; $X_{el} = 4\ \Omega$

Determine the regulation of transformer, when operating at :

(i) Full load with 0.8 p. f. lagging ;

(ii) Full load with 0.8 p. f. leading ;

(iii) Half load at 0.8 p. f. lagging. 5(CO4)

(B) (B1) In a transformer, the core loss is found to be 52 W at 40 Hz ; and 90 W at 60 Hz : measured at same peak flux density. Compute the hysteresis and eddy current losses at 50 Hz. 5(CO4)

(B2) A 20 kVA , 1100/110 – V transformer has primary and secondary winding resistances of 4.0 Ω and 0.04 Ω, respectively. If the core loss is 2.5 kW, determine the efficiency of the transformer when it is delivering :

(i) Full load and

(ii) Half load at 0.8 power factor. Calculate the load at which the transformer has maximum efficiency. What is the maximum efficiency of the transformer ? 5(CO4)

6. Solve **Q. 6 (A)** or **Q. 6 (B)** :

(A) (A1) Derive torque equation of a three phase induction motor. 5(CO3)

(A2) A 4 pole induction motor is fed from 50 Hz supply, and has a rotor speed of 1425 r.p.m. Find :

(i) Slip speed ;

(ii) Per unit slip ;

(iii) Percent slip. 5(CO4)

(B) (B1) Give comparison between squirrel cage induction motor and slip ring induction motor. (write any three points of comparison). 5(CO3)

(B2) A 4 pole, 3 phase induction motor operates from a supply whose frequency is 50 Hz. Calculate :

(i) The speed at which the magnetic field of the stator is rotating ;

(ii) The speed of the rotor when the slip is 0.04 ;

(iii) The frequency of the rotor current when the slip is 0.03. 5(CO4)