B. E. First Semester (All) / SoE – 2018-19 Examination

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

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Assume suitable data wherever necessary.
(4) Illustrate your answers wherever necessary with the help of neat sketches.
(5) Use of non – programmable calculator, Drawing instruments is permitted.

1. Solve any **Two** of the following :— (CO 2)

(a) Use mesh analysis to find various branch currents in the passive elements of the network shown in Fig. 1. Also indicate magnitude and direction of branch currents in the network.

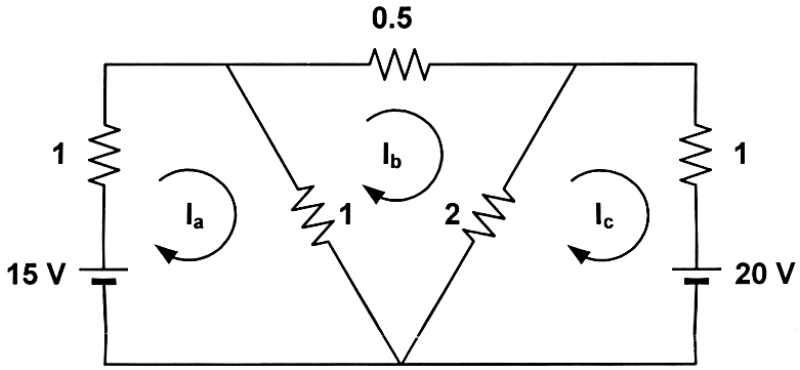

Fig. 1 5

(b) For the circuit of Fig. 2, compute the voltage across each current source. Use nodal analysis.

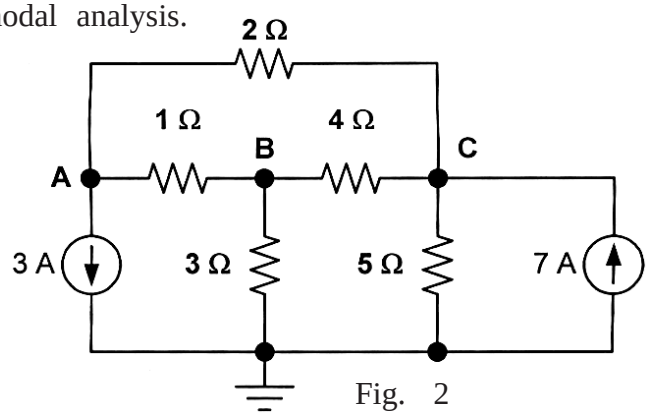

Fig. 2 5

(c) Determine the currents passing through the different branches of the circuit in Fig. 3, by the principle of superposition.

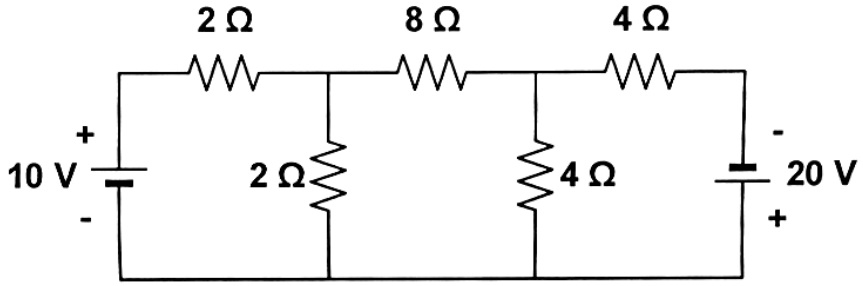

Fig. 3 5

2. Solve any **Two** of the following :— (CO 2)

(a) Calculate the average value, r.m.s. value, form factor and peak factor for the sinusoidal voltage shown in Fig. 4.

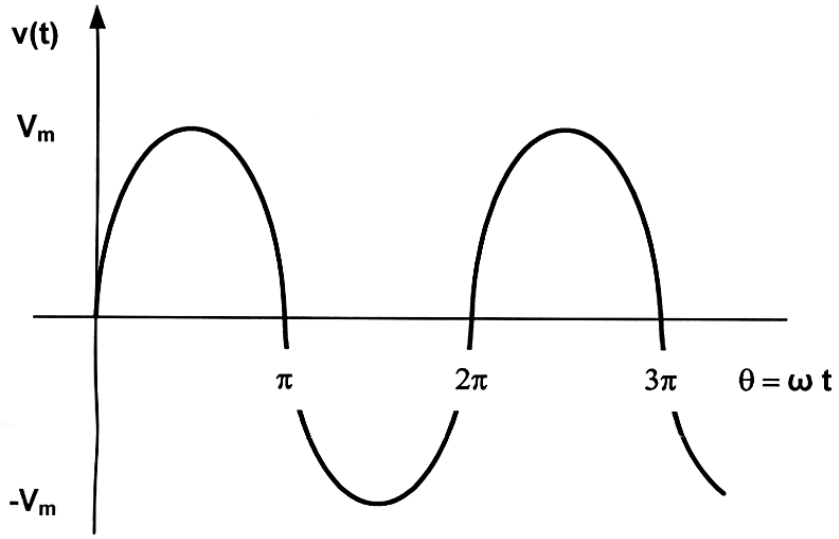

Fig. 4 5

(b) The following currents flow into a junction :

$$i_1(t) = 10 \sin(\omega t) \qquad i_2(t) = 15 \sin\left(\omega t - \frac{\pi}{6}\right)$$

$$i_3(t) = 5 \sin\left(\omega t + \frac{2\pi}{3}\right) \qquad i_4(t) = 7{\cdot}5 \sin\left(\omega t - \frac{2\pi}{3}\right)$$

Find the expression for the current which leaves the junction. 5

(c) When a d.c. supply at 240 V is applied across a coil, the current in the coil is 20 A. If an a.c. supply at 240 V, 50 Hz is applied to the coil, the current in the coil is 12.15 A. Calculate the resistance, impedance, reactance and inductance of the coil. 5

3. Solve any **Two** of the following :— (CO 2)

(a) How is a current of 10 A shared by three circuits in parallel, the impedances of which are $2 - j5\ \Omega$, $6 + j3\ \Omega$ and $3 + j4\ \Omega$? 5

(b) The load taken from ac supply consists of (i) A heating load of 25 kVA ; (ii) A motor load of 50 kVA at 0·6 power factor lagging, and (iii) A load of 30 kW at 0·8 power factor lagging. Calculate the total load from the supply in kW and its power factor. What should be the kVAr rating of a capacitor being used to bring the power factor to unity and how should the capacitor be connected ? 5

(c) A small single phase, 240 V induction motor is tested in parallel with a 160 Ω resistor. The motor takes 2 A and the total current is 3 A. Find the power and power factor of (a) The whole circuit, (b) The motor. 5

4. Solve any **Two** of the following :— (CO 2)

(a) A three – phase, star – connected alternator supplies a delta – connected load with a 415 V, 50 Hz supply. Each phase of the load has a resistance of 15 Ω and a reactance of 25 Ω. Calculate : (i) The current in each phase of the load ; (ii) The alternator phase voltage and current ; (iii) The power factor of the load ; (iv) The total power taken by the load. Sketch the circuit diagram and show on it the phase and line voltages and currents. 5

(b) Three coils are connected in delta to a three – phase, three – wire, 400 V, 50 – Hz supply and take a line current of 10 A, 0·85 power factor lagging. Calculate : (i) The resistance and the inductance of the coils, (ii) The line current and the total power if the coils are star – connected to the same supply. 5

(c) A balanced 3 phase star connected load of 120 kW takes a leading current of 100 A when connected across a 3 phase, 3·3 kV, 50 Hz supply. Determine the impedance, resistance, capacitance and power factor of the load. 5

5. Solve any **Two** of the following :— (CO 3)

(a) Open circuit and short circuit tests on a 5 kVA, 220 / 400 V, 50 Hz, single phase transformer gave the following results :

O. C. test : 220 V, 2 A, 100 W (I. v. side)

S. C. test : 40 V, 11·4 A, 200 W (h. v. side)

Determine the efficiency and approximate regulation of the transformer at full load 0·9 power factor lagging. 5

(b) A transformer is rated at 100 kVA. At full load its copper loss is 1200 W and its iron loss is 960 W. Calculate : (i) The efficiency at full load, unity power factor ; (ii) The efficiency at half load, 0·8 power factor ; (iii) The efficiency at 75% full load, 0·7 power factor ; (iv) The load kVA at which maximum efficiency will occur ; (v) The maximum efficiency at 0·85 power factor. 5

(c) A 100 kVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0·3 Ω and 0·01 Ω respectively and the corresponding leakage reactances are 1·1 Ω and 0·035 Ω respectively. The supply voltage is 2200 V. Calculate : (i) Equivalent impedance referred to primary ; (ii) The voltage regulation and the secondary terminal voltage for full load having a power factor of 0·8 leading. 5

6. Solve any **Two** of the following :— (CO 4)

(a) Explain the construction of squirrel cage rotor of a three phase induction motor. 5

(b) Explain the working principle of three phase induction motor. 5

(c) Two three – phase induction motors when connected across a 400 V, 50 Hz supply and running at 1440 and 940 r.p.m. respectively. Determine which of the two motors is running at higher slip. 5