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 :

(a) Find the equivalent resistance of the circuit shown in Fig. 1 between the points A and B. Each resistor has a resistance 'r'.

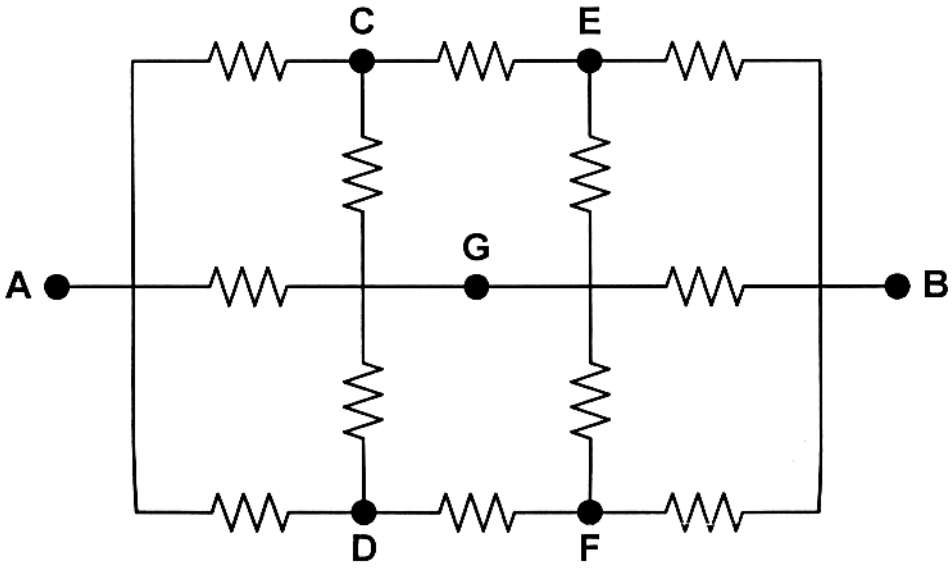

Fig. 1

5CO2)

(b) In the network shown in Fig. 2, determine :

(i) The current I;

(ii) Voltage across 5 Ω resistor;

(iii) Power loss in 18 Ω resistor.
Use Ohm's law and current division rule.

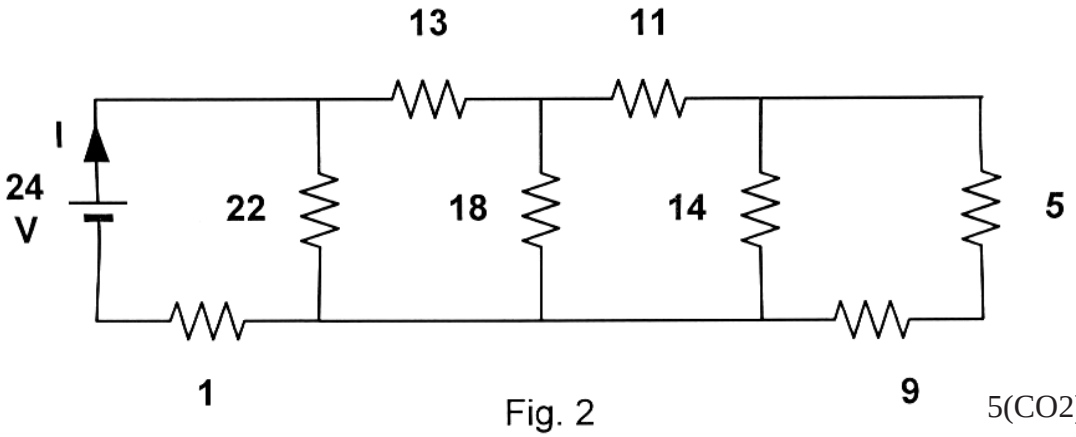

Fig. 2

5(CO2)

(c) Find the current through 20 Ω resistor in the network shown in Fig. 3. Use mesh analysis.

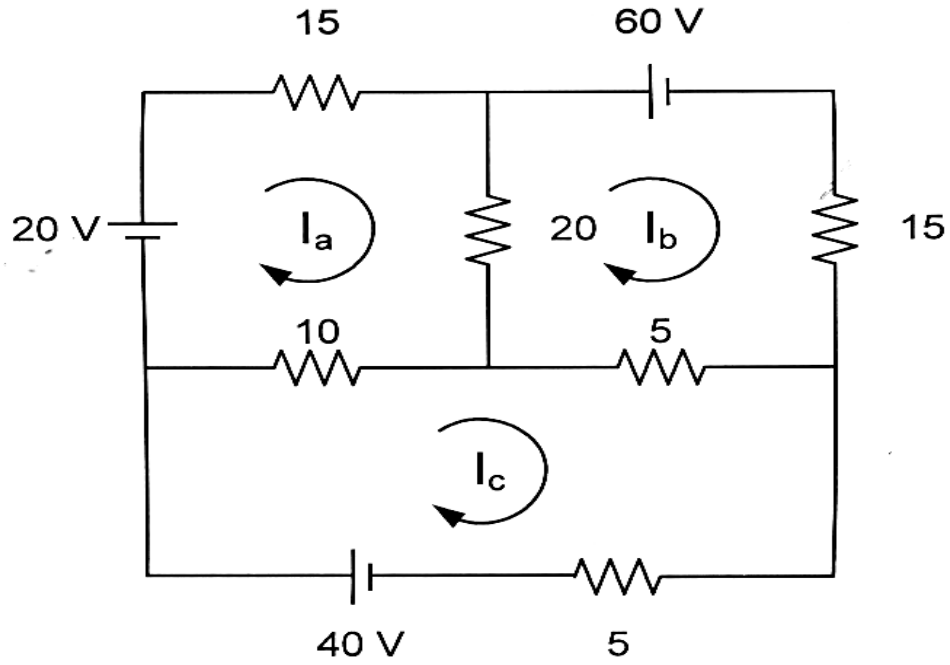

Fig. 3

5(CO2)

2. Solve any **Two** of the following :

(a) Calculate the average value and r.m.s. value of the function shown in Fig.4.

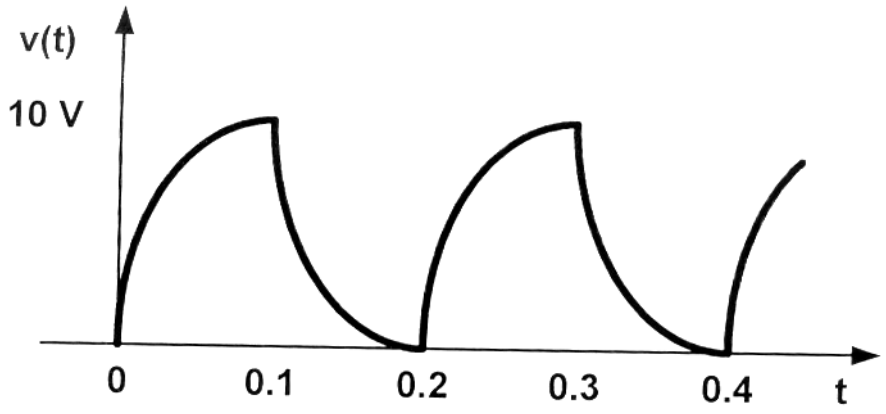

Fig. 4

It is given that

$$y(t) = \begin{cases} 10\left(1-e^{-100t}\right) & 0 < t < 0.1 \\ 10e^{-50(t-0.1)} & 0.1 < t < 0.2 \end{cases}$$ 5(CO2)

(b) In the circuit of Fig 5, $v_s(t) = 120\cos(377t+90^0)$, $v_1(t) = 40\sqrt{2}\cos(377t+45^0)$, and $v_3(t)=60\cos(377t-53.13^0)$. Find an expression for the voltage $v_2(t)$.

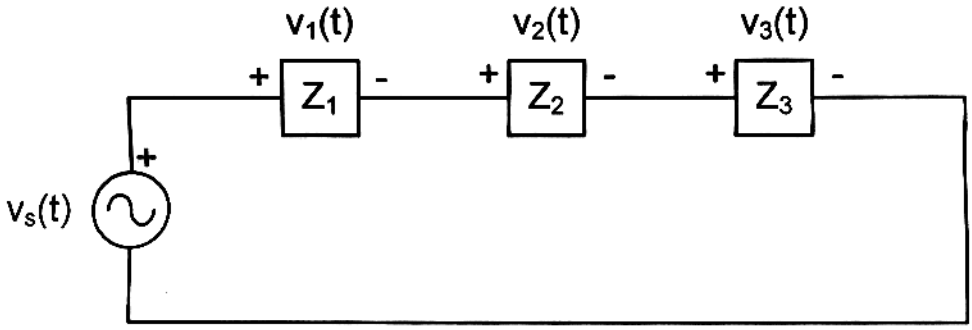

Fig. 5

5(CO2)

(c) A series R–C circuit, having R = 4 Ω and C = 120 μF, is connected across 230 V, 50 Hz supply.
Calculate :

(i) The reactance,

(ii) The impedance,

(iii) The current drawn by the circuit, and,

(iv) The power factor of the circuit. 5(CO2)

3. Solve any **Two** of the following :

(a) Two circuits, the impedances of which are given by $\bar{Z}_1 = 10 + j15\ \Omega$ and $\bar{Z}_2 = 6 - j8\ \Omega$ are connected in parallel. If the total current supplied is 15 A, what is the power taken by each branch ? 5(CO2)

(b) Four loads are connected across a 230 V, 50 Hz line :

Lights 10 kVA at unity power factor.

A motor 4 kW at power factor 0.8 lagging.

A rectifier 3.6 kW at power factor 0.6 leading.

A capacitor of 8 kVA.
Determine :

(i) The total kW;

(ii) The total kVAr;

(iii) The total kVA;

(iv) The overall power factor;

(v) The total line current. 5(CO2)

(c) Two inductive coils A and B are in parallel across a 100 V, 50 Hz supply. Coil A takes 12 A at 0.9 power factor and the total current for both the coils is 20 A at 0.8 power factor.
Determine :

(i) The equivalent resistance and equivalent reactance;

(ii) The individual resistance and reactance of both coils;

(iii) The power factor of coil B. 5(CO2)

4. Solve any **Two** of the following :

(a) A balanced star–connected load of $(4 + j3)\Omega$ 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. 5(CO2)

(b) A delta connected load draws a current of 15 A at a lagging power factor of 0.85 from a 400 V, 3–phase, 50 Hz supply. Find the resistance and inductance of each phase. 5(CO2)

(c) A three–phase delta–connected load, each phase of which has an inductive reactance of 40 Ω and a resistance of 25 Ω, is fed from the secondary of a three–phase star–connected transformer, which has a phase voltage of 240 V. Draw the circuit diagram of the system and calculate :

(i) The current in each phase of the load;

(ii) The p.d. across each phase of the load;

(iii) The current in the transformer secondary windings;

(iv) The total power taken from the supply and its power factor. 5(CO2)

5. Solve any **Two** of the following :

(a) The following results were obtained on a 50 kVA, 2400/120 V transformer:

Open circuit test, instruments on L. V. side : 396 W, 9.65 A, 120 V

Short circuit test, instruments on H. V. side : 810 W, 20.8 A, 92 V

Determine :

(i) The circuit constants :

(ii) The efficiency at full load, 0.8 power factor lagging;

(iii) The approximate voltage regulation. 5(CO3)

(b) 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(CO3)

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

$$R_{e1} = 3\ \Omega; \quad X_{e1} = 4\ \Omega$$

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(CO3)

6. Solve any **Two** of the following :

(a) Write advantages, disadvantages and application of three phase induction motor. 5(CO3)

(b) Give comparison between squirrel cage induction motor and slip ring induction motor. 5(CO3)

(c) A three phase, 400 V, 50 Hz induction motor has a speed of 950 r.p.m. on full load. The motor has 6 poles.
Calculate :

(i) How many complete alternations will the rotor voltage make per second ?

(ii) Speed of rotor field with respect to rotor core. 5(CO3)