CBCS SCHEME

USN | | | | | | | | | | |

15EE32

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 80

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Write diagrams wherever necessary.***

Module-1

1 a. Reduce the circuit shown in Fig.Q1 (a) using source transformation and hence find the power delivered by 50 V source

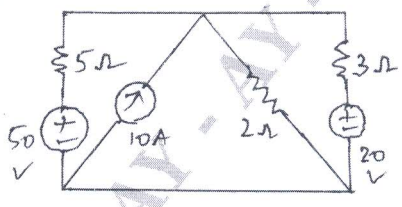

Fig. Q1 (a) **(05 Marks)**

b. Determine the equivalent resistance across terminals A and B using star delta technique for the circuit shown in Fig. Q1 (b).

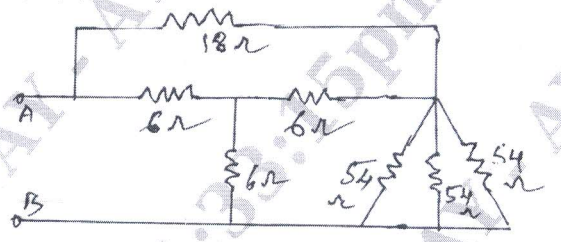

Fig. Q1 (b) **(05 Marks)**

c. Determine the current through capacitor of 6 ohm reactance, using mesh analysis for the network shown in Fig. Q1 (c).

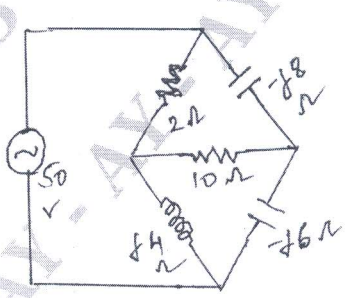

Fig. Q1 (c) **(06 Marks)**

OR

2 a. Explain Duality in Networks. **(04 Marks)**

b. Derive an expression for the relation between Resonant Frequency, Band Width and Quality Factor for a series R-L-C A.C circuit. **(06 Marks)**

c. An impedance coil of 25 ohm resistance and 25 mH inductance is connected in parallel with a variable capacitor. For which value of capacitor will the circuit resonate, if 90 volts, 400 Hz source is applied? What will be the current under resonance? **(06 Marks)**

Module-2

3 a. Find the current through the Galvanometer of the network shown in Fig. Q3 (a) using Thevenins theorem. Take the resistance of Galvanometer as 4 ohms.

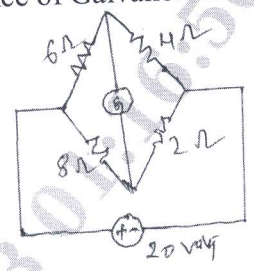

Fig. Q3 (a) **(06 Marks)**

b. Determine Norton's equivalent circuit across terminals 'a' and 'b' for the circuit shown in Fig. Q3 (b).

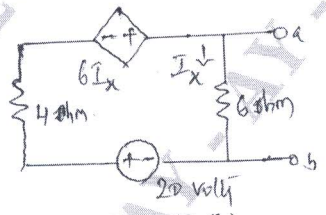

Fig. Q3 (b) **(04 Marks)**

c. Determine voltage V_x and hence verify reciprocity theorem for the circuit shown in Fig. Q3 (c).

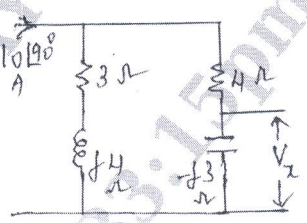

Fig. Q3 (c) **(06 Marks)**

OR

4 a. Using super position theorem obtain current through $R_L = 7.5$ ohms for the circuit shown in Fig. Q4 (a).

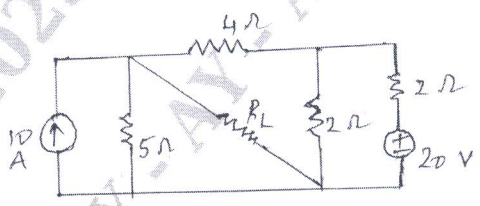

Fig. Q4 (a) **(06 Marks)**

b. State and explain Nillman's theorem. **(04 Marks)**

c. State and prove maximum power transfer theorem for the two cases. **(06 Marks)**

Module-3

5 a. Derive an expression for transient current i(t) in a R-L circuit excited by a d.c source. **(06 Marks)**

b. List the initial conditions for passive elements of a network. **(04 Marks)**

c. In the circuit shown in Fig. Q5 (c) initially switch is kept open for a long time. At t = 0 switch K is closed. Obtain the expression for current in the circuit for t > 0.

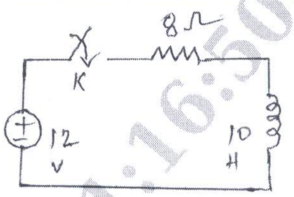

Fig. Q5 (c) **(06 Marks)**

OR

6 a. For the circuit shown in Fig. Q6 (a) the switch is moved from position 1 to position 2 at $t = 0$. The steady state has been reached before switching. Calculate i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$.

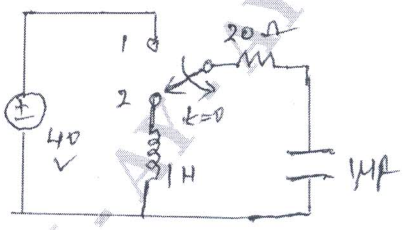

Fig. Q6 (a) **(08 Marks)**

b. In the network shown in Fig. Q6 (b) 'K' is changed from 1 to 2 at t = 0. Steady state having been attained in position 1. Find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$.

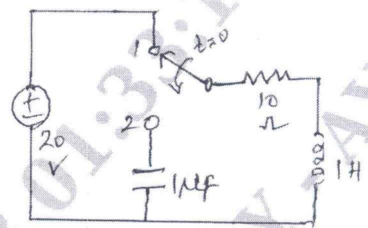

Fig. Q6 (b) **(08 Marks)**

Module-4

7 a. Mention any four important properties of Laplace transformation as applicable to network analysis. **(04 Marks)**

b. For the circuit shown in Fig. Q7 (b), find i(0) and $i(\infty)$ using initial value and final value theorems.

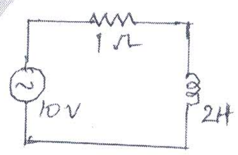

Fig. Q7 (b) **(06 Marks)**

c. Obtain the Laplace inverse of $\frac{1}{s(s+1)}$ using convolution integral. **(06 Marks)**

OR

8 a. Find the Laplace transform of the square waveform shown in Fig. Q8 (a).

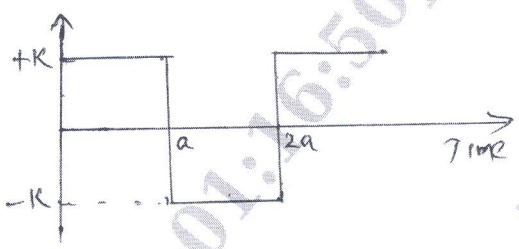

Fig. Q8 (a) **(06 Marks)**

b. Find the Laplace transformation of the waveform shown in Fig. Q8 (b).

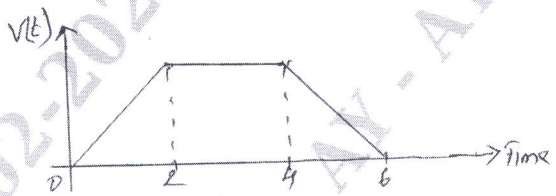

Fig. Q8 (b) **(04 Marks)**

c. Write the transform network of the circuit shown in Fig. Q8 (c) and determine voltage across capacitor using Laplace transformation. Take $i_L(0^-) = 0.25$ A and $V_C(0^-) = 4$ Volts.

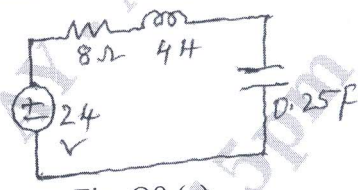

Fig. Q8 (c) **(06 Marks)**

Module-5

9 a. A 3 phase 400 V, 4 wire system has a star connected load with $Z_A = 10\angle 0$ ohms ; $Z_B = 15 + j10$ ohms and $Z_C = 5\angle 90^\circ$ ohms. Find the line currents and current through neutral. Draw the phasor diagram. **(08 Marks)**

b. Three equal inductors connected in star take 5 kW at 0.7 pf lag when connected to a 400 V, 50 Hz 3 ph supply. Calculate the line currents (i) if one of the inductor is disconnected (ii) if one of the inductor is short circuited. **(08 Marks)**

OR

10 a. Explain the significance of poles and zeros. **(04 Marks)**

b. Derive the relation between Z and T pavements. **(06 Marks)**

c. The following equations gives the relation, between voltage and current of a Two-port network :

$$I_1 = 0.25V_1 - 0.2V_2$$
$$I_2 = -0.2V_1 + 0.1V_2$$

Obtain T-parameters. **(06 Marks)**

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