USN										Course Code	2	2	E	E	3	6	1

Third Semester B.E. Degree Examinations, September 2024
ELECTRIC CIRCUIT ANALYSIS

Duration: 3 hrs   **Max. Marks: 100**

Note: 1. Answer any **FIVE** *full questions choosing ONE full Question from each Module.*
2. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*

Module-1

1. **a.** Explain the following network terminology
(i) network element (ii) branch (iii) node (iv) Mesh — **08** — (2 :1 : 1.3.1)

b. Using source transformation and source shifting techniques find the voltage across 2Ω resistance as shown in Fig. Q1(b). — **12** — (3 :1 : 2.1.2)
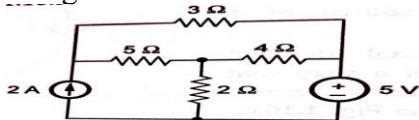

Fig. Q1(b)

(OR)

2. **a.** Derive the delta connected impedance in to its equivalent star connected impedances. — **08** — (3 :1 : 1.3.1)

b. Write the mesh current for the circuit as shown in Fig. Q2(b) below and determine the mesh currents using mesh analysis. — **12** — (3 :1 : 2.1.2)
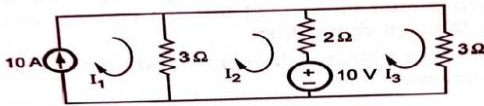

Fig. Q2(b)

Module-2

3. **a.** State and explain the superposition theorem. — **06** — (2 :2 : 1.3.1)

b. Determine the current I in the network shown in the Fig. Q3(b) and verify the reciprocity theorem — **07** — (3 :2 : 2.1.2)
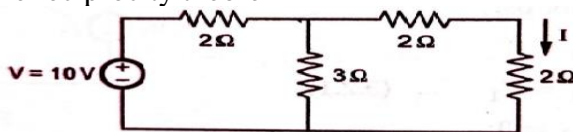

Fig. Q3(b)

c. For the network shown in the Fig Q3(c), determine the current through R_L using Thevenin's theorem — **07** — (3 :2 : 2.1.2)
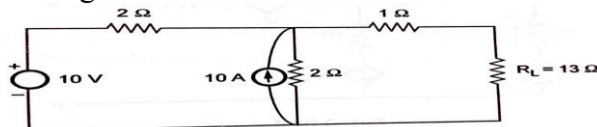
Fig. Q3(c)

(OR)

4. **a.** State and explain Norton's theorem. — **06** — (2 :2 : 1.3.1)

b. Using Millman's theorem find the current through $(2+j3)$ Ω for the circuit as shown in the Fig. Q4(b) below — **07** — (3 :2 : 2.1.2)

Fig. Q4(b)

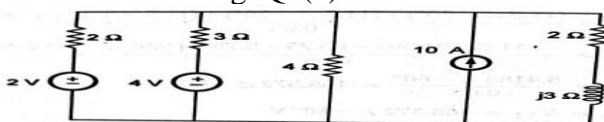**Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)**

c. Find the value of Z_L for which maximum power transfer occurs in the circuit as shown in the Fig. Q4(c) below. Also find the maximum power delivered to load. **07** (3 :2 : 2.1.2)
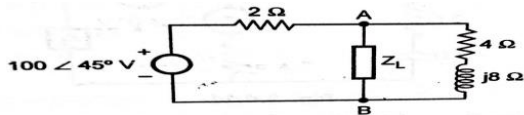

Fig. Q4(c)

Module-3

5. **a.** Explain (i) Oriented graph (ii) Tree (iii) Fundamental cutest (iv) Fundamental tie set **06** (2 :3 : 1.3.1)

b. For the network shown in Fig. Q5(b) draw the dual circuit also write the nodal equation for the dual circuit **07** (3 :3 : 2.1.2)
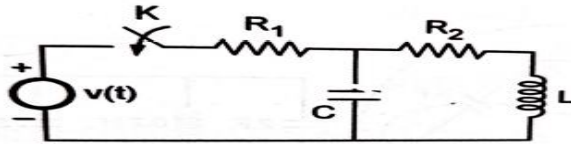

Fig. Q5(b)

c. A series connected RLC circuit has R=4 Ω, L=25 mH. Determine the value of C such that Q=50. Also find resonant frequency, band width and half power frequencies. **07** (2 :3 : 1.3.1)

(OR)

6. **a.** Derive the expression for resonant frequency for the parallel circuit where R_L- resistance in the inductor branch and Rc = resistance in the capacitor branch. **06** (2 :3 : 1.3.1)

b. Two coils: One of R_1= 0.51 Ω, L1= 32 mH and other coil of R_2=1.3 Ω, L_2= 15 mH, are in series and are in series with a capacitor of 25×10^{-6} Farad and 25×10^{-6} Farad and a series resistor of resistance 0.24 Ω. Determine (i) Resonant frequency (ii) Q- factor of the circuit (iii) Bandwidth (iv) Power dissipated in the circuit at resonant frequency **06** (3 :3 : 2.1.2)

c. Find the value of R_1 such that the circuit given in the Fig. Q6 (c) resonant **07** (3 :3 : 2.1.2)
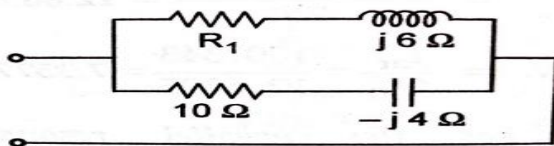

Fig. Q6 (c)

Module-4

7. **a.** Why do we need to study the initial condition and write the equivalent form of the elements in terms of the initial condition of the element? **06** (2 :4 : 1.3.1)

b. Show that the voltage across the capacitor and current across the inductor cannot change instantaneously. **06** (2 :4 : 1.3.1)

c. In the circuit shown in Fig. Q7 (c) switch K is changed from position 1 to 2 at t=0 steady state condition having reached before swathing find i, di/dt and d^2i/dt^2 at t $=0^+$ **08** (3 :4 : 2.1.2)
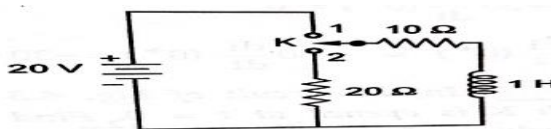

Fig. Q7 (c)

(OR)

8. **a.** State and prove (i) Initial value theorem (ii) Final value theorem as applied to Laplace transform **06** (2 :4 : 1.3.1)

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)

b. Use initial and final value theorems where they apply to find $f(0)$ **06**   (3 :4 : 2.1.2)
and $f(\infty)$.

$$F(S) = S^3 + 7S^2 + 5 / S\left(S^3 + 3S^2 + 4S + 2\right)$$

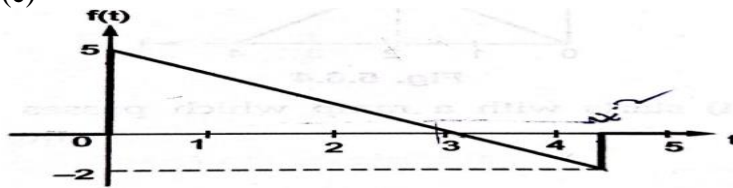**c.** Obtain the Laplace transform of f(t) for the waveform shown in Fig. Q 8   **08**   (3 :4 : 2.1.2)
(c)

Fig. Q8 (c)

Module-5

9.   **a.** Obtain Z-parameters in terms of y-parameters and transmission   **10**   (2 :5 : 1.3.1)
parameters.

     b. For the network shown in the Fig. Q9 (b), find Z- parameters.   **10**   (3 :5 : 2.1.2)
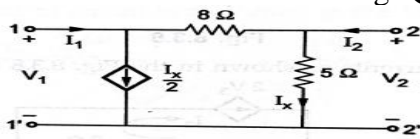

Fig. Q9 (b)

(OR)

10   **a.** Derive transmission line parameters of two port network.   **10**   (2 :5 : 1.3.1)

     b. Determine the ABCD parameters for the network shown in Fig. Q10 (b)   **10**   (3 :5 : 2.1.2)
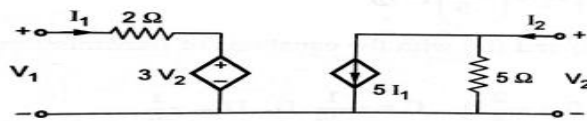

Fig. Q10 (b)

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