

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN

Course Code

2 2 E E 3 6 1

Third Semester B.E. Degree Examinations, January 2025

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

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
Module-1			
1.	a. Explain source transformation with a suitable example.	06	(2 : 1 : 1.3.1)
	b. Find the equivalent resistance between A and B of the circuit shown in Fig. Q1(b).	07	(3 : 1 : 2.1.2)

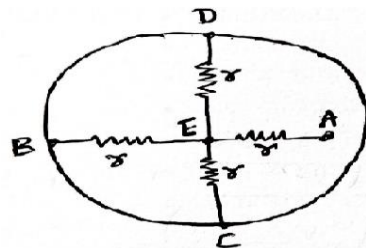


Fig.Q1(b)

- c. Using star delta transformation determine the resistance between M and N of the network shown in Fig.Q1(c). 07 (3 : 1 : 2.1.2)

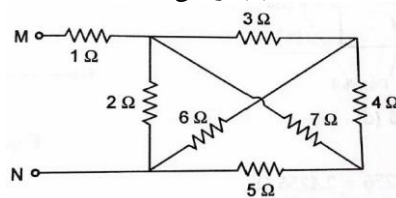


Fig.Q1(c)

(OR)

2. a. Discuss the concepts of super node and super mesh with suitable examples. 06 (2 : 1 : 1.3.1)
- b. Using mesh analysis find the current through 10 Ω resistor in the network shown in Fig.Q2(b) 07 (3 : 1 : 2.1.2)

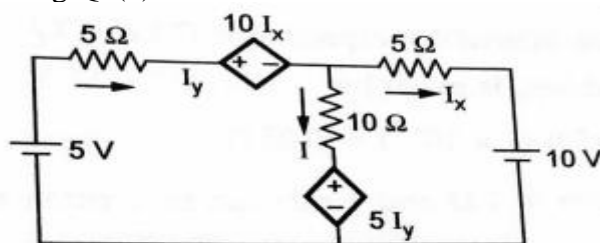


Fig.Q2(b)

- c. Find V_x of the circuit shown in Fig.Q2(c) using nodal analysis is such that the current flowing through $(2+j3)$ is zero. 07 (3 : 1 : 2.1.2)

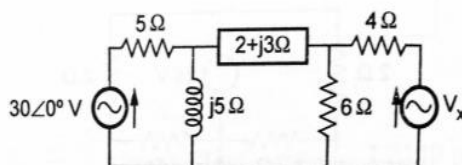


Fig.Q2(c)

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

Module-2

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| 3. | a. State and explain the superposition theorem. | 06 | (2 : 2 : 1.3.1) |
| | b. Find the current I for the circuit shown in Fig.Q3 (b) using the superposition theorem. | 07 | (3 : 2 : 2.1.2) |

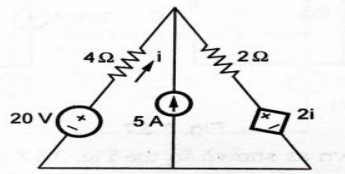


Fig.Q3(b)

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|----|--|----|-----------------|
| c. | Find the value of Z_L for which maximum power transfer occurs in the circuit given in Fig.Q3(c). | 07 | (3 : 2 : 2.1.2) |
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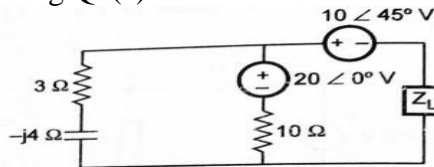


Fig.Q3(c)

(OR)

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| 4. | a. State and explain the Reciprocity theorem. | 06 | (2 : 2 : 1.3.1) |
| | b. Find the current through 16-ohm resistor for the circuit shown in Fig.Q4 (b) using Norton's theorem. | 07 | (3 : 2 : 2.1.2) |

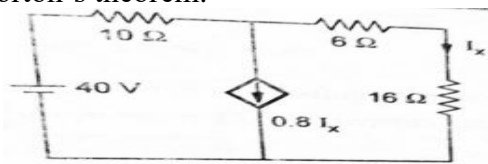


Fig.Q4 (b)

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| c. | Find current through Z_1 for the circuit shown in Fig.Q4 (c) using Millman's theorem. | 07 | (3 : 2 : 2.1.2) |
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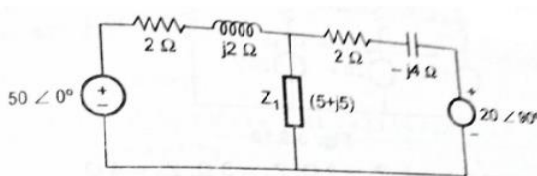


Fig.Q4 (c)

Module-3

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| 5. | a. Define tree. Write the properties of a tree. | 06 | (2 : 3 : 1.3.1) |
| | b. Define (i) Resonance (ii) Selectivity (iii) Bandwidth | 06 | (2 : 3 : 1.3.1) |
| | c. For the network shown in Fig.Q5 (c) draw the dual network. Also write the nodal equation for the dual network | 08 | (3 : 3 : 2.1.2) |

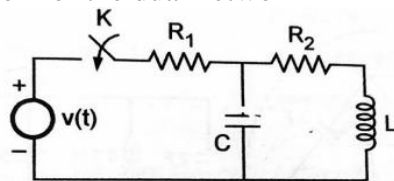


Fig.Q5 (c)

(OR)

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| 6. | a. Show that resonant frequency for series resonance circuit is equal to the geometric mean of two half-power frequencies. | 06 | (2 : 3 : 1.3.1) |
| | b. Derive the expression for the resonance frequency of a resonant circuit consisting of R_L and L in parallel with C . Draw the frequency response curve of the above circuit | 06 | (2 : 3 : 1.3.1) |

- c. Two coils; one of $R_1 = 0.51 \, \Omega$, $L_1 = 32 \, \text{mH}$ and the other coil of $R_2 = 1.3 \, \Omega$, $L_2 = 15 \, \text{mH}$ are in series and are in series with a capacitor of $25 \, \mu\text{F}$ and $62 \, \mu\text{F}$ and a series resistance $0.24 \, \Omega$. Determine (i) Resonant frequency (ii) Q-factor of the circuit (iii) Bandwidth (iv) Power dissipated in the circuit at the resonant frequency. **08** (3 : 3 : 2.1.2)

Module-4

7. a. Show that (i) voltage across cannot change instantaneously (ii) the current in an inductor cannot change instantaneously. **06** (2 : 4 : 1.3.1)
- b. In the circuit shown in Fig.Q7 (b) switch K is changed from position 1 to 2 at $t=0$, steady state condition having reached before switching. Find i , di/dt **07** (3 : 4 : 2.1.2)

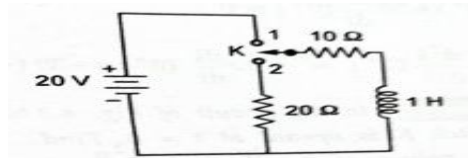


Fig.Q7 (b)

- c. The switch K is opened at $t = 0$ for the circuit shown Fig.Q7 (c). Find the value of v , dv/dt , d^2v/dt^2 at $t = 0^+$. **07** (3 : 4 : 2.1.2)

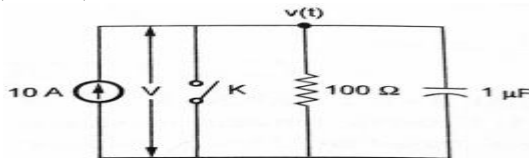


Fig.Q7 (c)

(OR)

8. a. Define the Laplace transform of a function. Find the Laplace transform of $f(t) = K$ for t greater than equal to zero. **06** (3 : 4 : 2.1.2)
- b. State and prove (i) Initial value theorem (ii) Final value theorem as applied to Laplace transform **07** (2 : 4 : 1.3.1)
- c. Obtain Laplace transform of $f(t)$ for the waveform shown in Fig.Q8 (c). **07** (3 : 4 : 2.1.2)

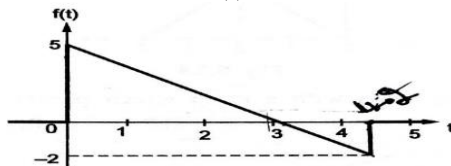


Fig.Q8 (c)

Module-5

9. a. Define y parameters and z parameters. Derive relationships such that y-parameters are expressed in terms of z-parameters, and z-parameters are expressed in terms of y-parameters. **10** (2 : 5 : 1.3.1)
- b. Following short circuit currents and voltages are obtained experimentally for a two-port network **10** (3 : 5 : 2.1.2)
- (i) With output short-circuited: $I_1 = 5 \, \text{mA}$, $I_2 = -0.3 \, \text{mA}$, $V_1 = 25 \, \text{V}$
- (ii) With input short-circuited: $I_1 = -5 \, \text{mA}$, $I_2 = 10 \, \text{mA}$, $V_1 = 30 \, \text{V}$.
- Determine y-parameters

(OR)

- 10 a. Transmission parameters. Show that $AD - BC = 1$ **10** (2 : 5 : 1.3.1)
- b. Find the transmission parameters for the circuit shown in Fig.Q10 (b). **10** (3 : 5 : 2.1.2)

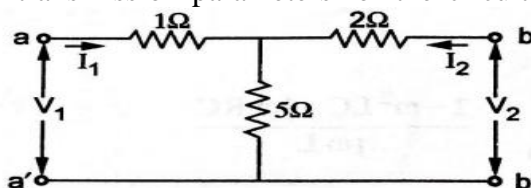


Fig.Q10 (b)

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