CBCS SCHEME

USN

15EE32

# Third Semester B.E. Degree Examination, Aug./Sept.2020
# Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 80

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

## Module-1

1 a. Reduce the circuit shown in Fig.Q1(a) to a voltage source in series with a resistance between the terminals AB.

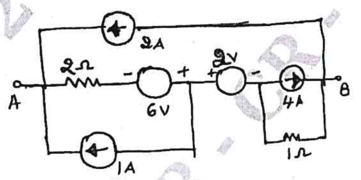


Fig.Q1(a) **(06 Marks)**

b. Find the single delta equivalent circuit of the circuit shown in Fig.Q1(b).

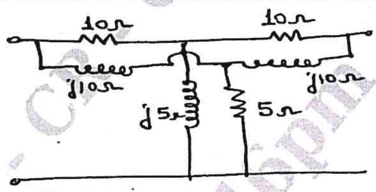


Fig.Q1(b) **(07 Marks)**

c. In Fig.Q1(c), $R = R_L = 1\ \Omega$, L = 1H and C = 0.5F. Find the resonance frequency and the admittance at the resonant frequency.

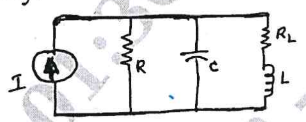


Fig.Q1(c) **(03 Marks)**

**OR**

2 a. In the circuit shown in Fig.Q2(a), find $I_o$ using mesh analysis method.

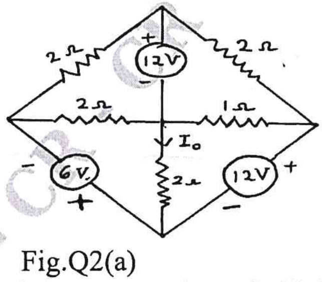


Fig.Q2(a) **(06 Marks)**

b. Using Node-analysis method, find the current through 12 Ω resistor in the circuit shown in Fig.Q2(b).

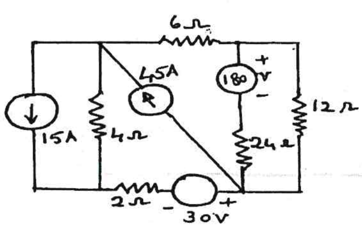


Fig.Q2(b) **(06 Marks)**

c. Construct the dual network for the network shown in Fig.Q2(c).

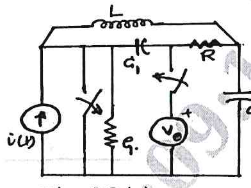


Fig.Q2(c) **(04 Marks)**

## Module-2

3 a. Using superposition theorem find the current I in the circuit shown in Fig.Q3(a).

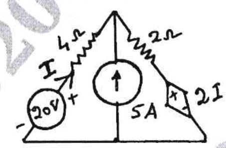


Fig.Q3(a) **(05 Marks)**

b. State and verify the reciprocity theorem for the network shown in Fig.Q3(b).

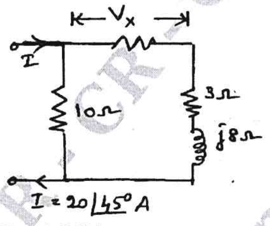


Fig.Q3(b) **(05 Marks)**

c. In the network shown in Fig.Q3(c), find the current I using Thevenin's theorem.

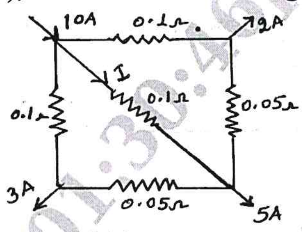


Fig.Q3(c) **(06 Marks)**

**OR**

4 a. Find the Norton's equivalent of the circuit shown in Fig.Q4(a).

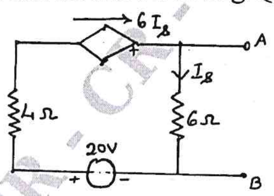


Fig.Q4(a) **(04 Marks)**

b. In the network shown in Fig.Q4(b), find $Z_L$ so that it makes maximum power and determine the maximum power.

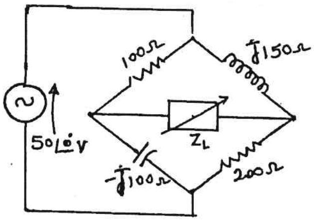


Fig.Q4(b) **(08 Marks)**

c. State and prove Millman's theorem. **(04 Marks)**

## Module-3

5 a. For the network shown in Fig.Q5(a), find the values of nodal voltages, their first and second derivatives at $t = 0_+$. For $t < 0$, all switches are closed. At $t = 0$, they are opened $I_{a(0-)} = 1$ A, $V_{2(0-)} = 0$ V.

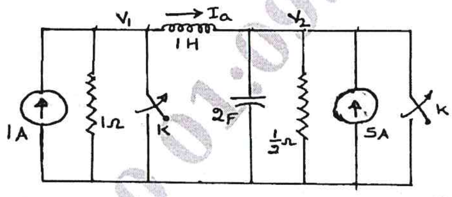


Fig.Q5(a) **(10 Marks)**

b. In the network shown in Fig.Q5(b), switch k is closed at $t = 0$ with zero current in the inductor. Find i(t), $\frac{d}{dt}i(t)$ at $t = 0_+$ and obtain an expression for i(t) at $t \geq 0$ by classical method.

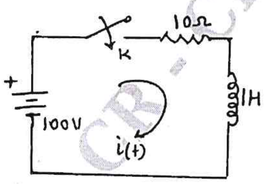


Fig.Q5(b) **(06 Marks)**

**OR**

6 a. The switch k in the network of the Fig.Q6(a) is closed at $t = 0$, connecting the battery to an unenergized network. Determine i, $V_1$, $\frac{d}{dt}i$, $\frac{d^2}{dt^2}i_1$ and $\frac{d}{dt}V_1$ at $t = 0_+$.

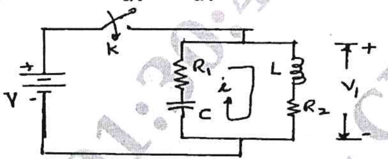


Fig.Q6(a) **(10 Marks)**

b. In the network shown in Fig.Q6(b), the switch k is closed at $t = 0$ a steady-state having previously been attained. Solve for the current in the circuit as a function of time.

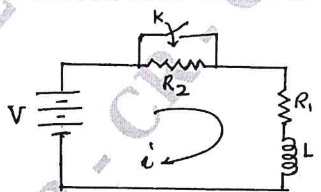




Fig.Q6(b) **(06 Marks)**

## Module-4

7 a. State and prove Initial and Final value theorem. **(05 Marks)**

b. At $t = 0$ the switch is closed. Using Laplace transform determine $i_1(t)$ and $i_2(t)$ shown in Fig.Q7(b). The initial currents through the inductors are $i_{1(0)} = 1$A and $i_{2(0)} = 2$A.

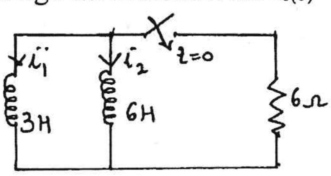


Fig.Q7(b) **(08 Marks)**

c. State and prove Shifting theorem. **(03 Marks)**

**OR**

8 a. Find the Transform of voltage V(t) of waveform shown in Fig.Q8(a).

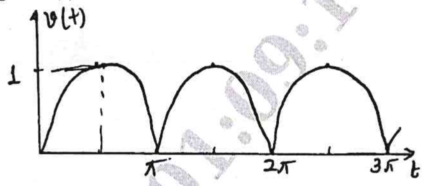


Fig.Q8(a) **(10 Marks)**

b. Find the initial and final values of i(t) using initial and final value theorems:

(i) $I(s) = \dfrac{(s^2+5)}{(s^3+2s^2+4s)}$ (ii) $I(s) = \dfrac{8(s^2+2s+1)}{(s+2)(s^2+4)}$ **(06 Marks)**

## Module-5

9 a. A star-connected unbalanced system of impedance of 20Ω, (16+j12)Ω and (16 – j12)Ω in the phases R, Y and B is being supplied by a 400V balanced, 3ϕ generator with phase sequence RYB. Determine the line currents, current in the neutral line and the power supplied to the load, when the neutrals are connected. **(06 Marks)**

b. Define Transmission parameters. **(04 Marks)**

c. Determine the expression for current i(t) in the circuit shown in Fig.Q9(c), when the applied voltage is given by $e(t) = 10 + 100\sin(100t + 30°) + 50\sin(300t + 60°) + 20\cos(500t + 30°)$V

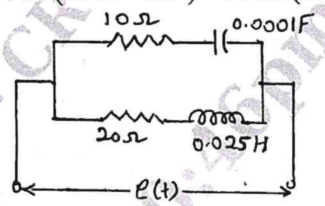


Fig.Q9(c) **(06 Marks)**

**OR**

10 a. Find the transmission parameters for the circuit shown in Fig.Q10(a).

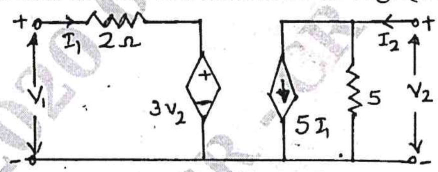


Fig.Q10(a) **(08 Marks)**

b. Determine $G_{21}(s)$ and $Y_{12}(s)$ for the network shown in Fig.Q10(b).

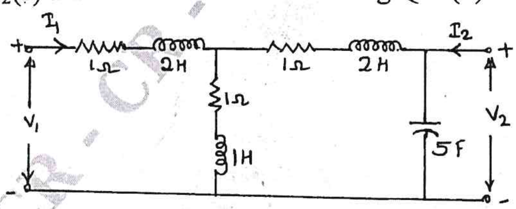


Fig.Q10(b) **(08 Marks)**

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