CBCS Scheme

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15EE32

# Third Semester B.E. Degree Examination, June/July 2018
## Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 80

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



### Module-1

1 a. For the circuit shown in Fig.Q.1(a), find $i_A$, $i_B$ and $i_C$ by mesh analysis. **(05 Marks)**

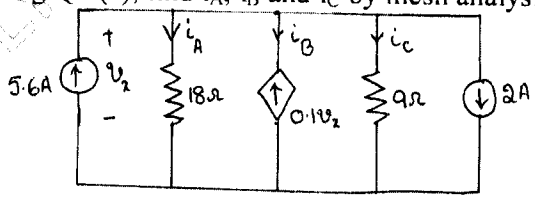


Fig.Q.1(a)

b. Find the equivalent resistance across terminals AB of the network shown in Fig.Q.1(b) using star-delta transformation. Consider all resistance as 10Ω. **(05 Marks)**


Fig.Q.1(b)

c. Compute resonant frequency, half power frequencies, bandwidth and quality factor for a given RLC series circuit with R = 20Ω, L = 50mH and C = 1μF. Also calculate the reactances at resonance. **(06 Marks)**

**OR**

2 a. Two branches of a parallel circuit have elements $R_L$ = 6Ω, L = 1mH and $R_C$ = 4Ω and C = 20 μF. Determine the frequency of resonance when excited with voltage source of variable frequency. **(05 Marks)**

b. Write the equilibrium equations using KVL for the network shown in Fig.Q.2(b). Draw its dual and also write its equilibrium equations. **(05 Marks)**

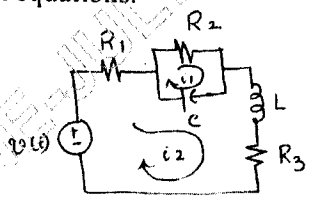


Fig.Q.2(b)

c. In the network shown in Fig.Q.2(c), solve for all the branch currents using nodal analysis and also show that the sum of power absorbed/delivered by all branches is zero. **(06 Marks)**

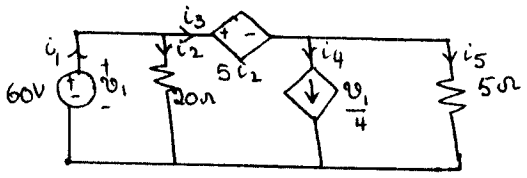


Fig.Q.2(c)

## Module-2

3 a. State and prove superposition theorem with an illustration. **(05 Marks)**

b. Obtain the Thevenin equivalent circuit as seen by the load impedance for the network shown in Fig.Q.3(b). **(05 Marks)**

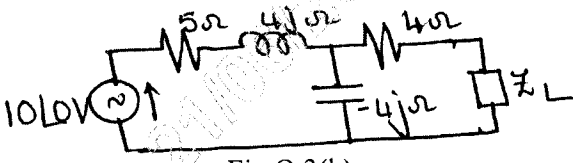


Fig.Q.3(b)

c. State Millman's theorem and apply it to find the current through $R_L$ in the circuit shown in Fig.Q.3(c). **(06 Marks)**

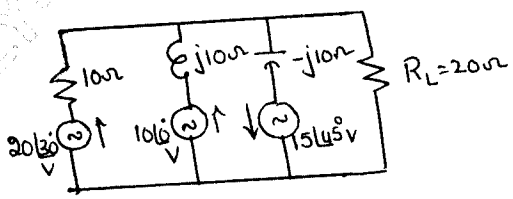


Fig.Q.3(c)

**OR**

4 a. Prove that maximum power is transferred to the load in an ac circuit when $Z_L = Z_i^*$ where $Z_L$ = load impedance = $R_L + jx_L$, $Z_i$ = impedance seen at the source $R_i + jx_i$. **(05 Marks)**

b. Determine the Norton equivalent circuit shown in Fig.Q.4(b) as seen by the terminals 'a' and 'b'. **(05 Marks)**

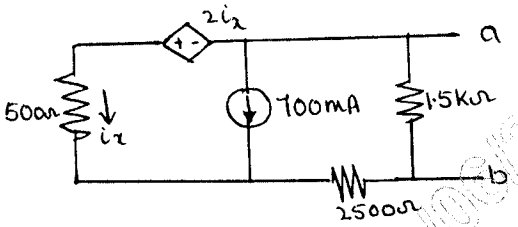


Fig.Q.4(b)

c. In the single source network shown in Fig.Q.4(c), find the current 'I' flowing through the 5Ω branch. Also verify reciprocity theorem for this circuit **(06 Marks)**

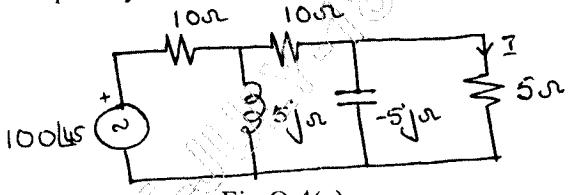


Fig.Q.4(c)

## Module-3

5 a. In the network shown in Fig.Q.5(a), switch is changed from position 'a' to 'b' at t = 0. Solve for i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0+$ if R = 1000Ω, L = 1H, C = 0.1μF and V = 100V. **(05 Marks)**

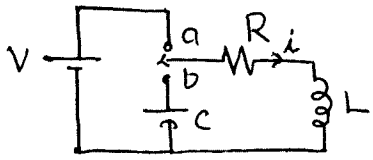


Fig.Q.5(a)

b. In the circuit shown in Fig.Q.5(b), switch is opened at time t = 0. Find the values of V, $\frac{dv}{dt}$, $\frac{d^2v}{dt^2}$ at t = 0+ and v(∞). **(05 Marks)**

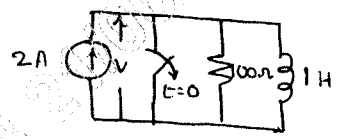


Fig.Q.5(b)

c. Consider a circuit consisting of 1Ω resistance in series with 1F capacitor excited with 5V DC source. Derive an expression for the current flowing in the circuit and draw the current waveform and also calculate the current at 0.1 sec. **(06 Marks)**

**OR**

6 a. Discuss the behaviour of R, L, C elements at,
i) the time of switching (t = 0+) ii) under steady state (t = ∞). **(06 Marks)**

b. In the circuit shown in Fig.Q.6(b), the switch was in position 'a' and circuit was under steady state. At t = 0, the switch is moved to position b. Find $v_c(t)$ at t equal to i) 0- ii) 0+ iii) ∞ iv) 0.08S. **(10 Marks)**

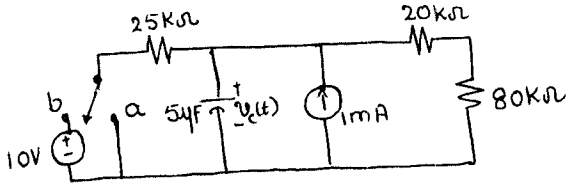


Fig.Q.6(b)

## Module-4

7 a. Synthesize the waveform shown in Fig.Q.7(a) and also write the Laplace transform of the synthesized equation. **(05 Marks)**

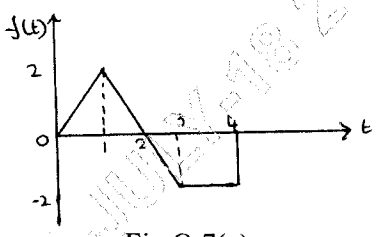


Fig.Q.7(a)

b. State and prove final value theorem as applied in Laplace transform and hence find x(∞) of $x(s) = \frac{5}{s(s+1)(s+2)}$. **(05 Marks)**

c. Determine the voltage $v_c(t)$ for t ≥ 0 for the circuit shown in Fig.Q.7(c) using Laplace transform method. In the circuit, switch is opened at t = 0. **(06 Marks)**

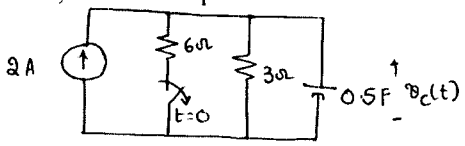


Fig.Q.7(c)

**OR**

8 a. In the circuit shown in Fig.Q.8(a), the switch is initially in closed position. The switch opened at t = 0. Determine the expression for current through the resistor using Laplac transform method for $t \geq 0$. **(05 Mark**

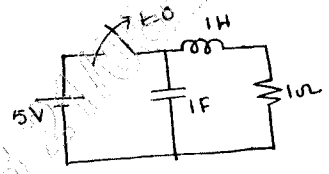


Fig.Q.8(a)

b. Find the Laplace transform of the periodic signal shown in Fig.Q.8(b). **(05 Mark**

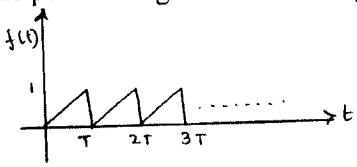


Fig.Q.8(b)

c. Derive an expression for the current flowing through a series RL circuit excited with a D source of V volts using Laplace transform method. **(06 Mark**

## Module-5

9 a. Derive an expression for 'Displacement voltage of neutral' in a star connected unbalanc load supplied with 3ϕ balanced supply voltages. **(05 Mark**

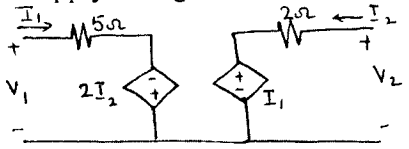


Fig.Q.9(b)

b. Find the Y parameters for the network shown in Fig.Q.9(b). **(05 Mark**

c. Obtain the driving point impedance function for the network shown in Fig.Q.9(c). Also pl the poles and zeros in the s plane. **(06 Mark**

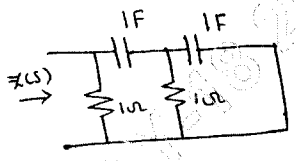


Fig.Q.9(c)

**OR**

10 a. An unbalanced 3ϕ load is supplied by a symmetrical, 3ϕ, 440V, 3 wire system. The st connected load branch impedances are $Z_R = 5\angle 30^\circ\,\Omega$, $Z_Y = 10\angle 45^\circ\,\Omega$ and $Z_B = 10\angle 60^\circ\,\Omega$. Find the line currents. **(09 Mark**

b. Obtain T parameters for the network shown in Fig.Q.10(b). Using these parameters, fi Z parameters. **(07 Mark**

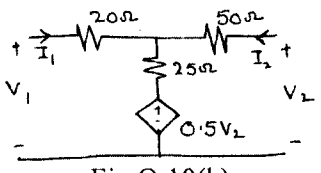


Fig.Q.10(b)

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