Scheme of Valuation/Answer Key

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2019

Course Code: EC201

Course Name: NETWORK THEORY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

1 a) Mesh equations (6) Current through 10Ω (1) Voltage across 10Ω (1) (8)

$$(7+j3)I_1 - j5I_2 - 5I_3 = 10$$

$$-j5I_1 + (12+j3)5I_2 - (2-j2)I_3 = -(4.33+j2.5)$$

$$-5I_1 - (2-j2)I_2 + (17-j2)I_3 = 0$$

Current through 10Ω, $I_3 = 0.435\angle -194.15°$ A

Voltage across 10Ω $= 10I_3 = 4.35\angle -194.15°$ A

b) Each property – 3.5 (statement-1, proof -2.5) (7)

2 a) Node equations (4) node voltages calculation (3) Current I (1) (8)

$V_1 = 24.763\angle -287.74°$ V $\quad V_2 = 34.3406\angle -307.184°$ V

I = -3.434 ∠15.95° A

b) Necessary equations and calculations (3+3) Voltage V_2 (1) (7)

$V_a = 12\angle 53.14°$ V $\quad V_b = 0.707V_2\angle -45°$ V

$V_a = V_b \quad V_2 = 16.9731\angle 98.14°$ V

3 a) Current/voltage through 10Ω with each source acting alone (2.5+2.5+2.5) (9)

Calculation of votage across 10Ω (1.5)

10 V source alone I' = 0.44 A (→)

2A source alone I'' = 1.11 A (→)

10V source alone I''' = 0.55 A (←)

Current through 10Ω = 1A (→) Voltage across 10Ω = 10V

b) Thevenin's voltage (3) Thevenin's resistance (2) Power dissipated (1) (6)

V_{Th} = 93.5V R_{Th}= 22.75 Ω I = 2A Power = 96W

PART B

Answer any two full questions, each carries 15 marks.

4 a) Circuit (1) Necessary Equations (5) (6)

b) Formulation of equation in terms of 's' (3) Partial Fraction Expansion (4) (9)

Solution (2)

$v(t) = \frac{1}{4}\,(1 + 2e^{-2t} + e^{-4t})u(t)$

5 a) Pole – zero plot (2) Obtaining time domain response from plot (6) (8)

$V(s) = \frac{3}{s+2} + \frac{2}{s+7}$ $v(t) = 3e^{-2t} + 2e^{-7t}$

b) Initial current (2) Calculation of current (5) (7)

$i(0^-) = 3.33$ A $i(t) = 5 - 1.667e^{-200t}$ A

6 a) Necessary conditions (6) (6)

b) Calculations of each parameter (2+2+2) Values (1+1+1) (9)

$$\frac{I_2(s)}{I_1(s)} = \frac{1}{4s^2 + 4s + 1}$$

$$\frac{V_2(s)}{V_1(s)} = \frac{1}{4s^3 + 4s^2 + 2s + 1}$$

$$\frac{V_1(s)}{I_1(s)} = \frac{8s^3 + 8s^2 + 4s + 2}{4s^2 + 4s + 1}$$

PART C

Answer any two full questions, each carries20 marks.

7 a) Circuit diagram (2) Derivation (4) (6)

b) Equations and calculations (5) Each parameter (1+1+1+1) (9)

$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} s^4 + 3s^2 + 1 & \dfrac{(s^4 + 3s^2 + 1)^2 - 1}{s(s^2 + 2)} \\ s(s^2 + 2) & s^4 + 3s^2 + 1 \end{bmatrix}$$

c) Definitions (2.5+2.5) (5)

8 a) Equations and calculations (4) Values of R, L and C (1+1+1) Maximum current (10)

(1) Half power frequencies (2)

R=33.33Ω L=7.08mH C=1.56mF

b) (8)

Equations (6) Each parameter (1+1+1+1) $[Z] = \begin{bmatrix} \frac{7}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{7}{2} \end{bmatrix}$

9 a) Circuit diagram (2) Steps involved (6) maximum output voltage (2) maximum amplification factor (2) (12)

b) Equations and calculations (6) Drop across the capacitor (2) (8)

$I_1 = 0.06324 \angle -42.83°\text{A}$ $\quad \text{I}_2 = 0.5059 \angle -42.82°\text{A}$

Drop across the capacitor = $3.0354 \angle -132.82°$ V

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