APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

Third Semester B.Tech Degree (R) Examination December 2020 (2019 scheme)

Course Code: ECT205

Course Name: NETWORK THEORY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1 Example – 1.0 marks (3)

Explanation - 2.0 marks

2 Figure ----1.5 marks (3)

Explanation ----1.5 marks

3 Statement 3 marks (3)

4 For LTI n/w 1.0 marks (3)

Explanation 2.0 marks

5 Initial value theorem 1.5 marks (3)

Final value theorem 1.5 marks

6 Circuit and derivation----1.5 marks (3)

$i(t) = \frac{1}{R}[\partial(t) - \frac{1}{RC} e^{\frac{-t}{RC}}]$ ----1.5 marks

7 No 1.0 marks (3)

Degree of N(s) greater than degree of D(s) 2.0 marks

8 Explanation of Natural frequency 2.5 marks (3)

Distinction between OCNF & SCNF 0.5 marks

9 Definition equations 2 marks (3)

Equations 1 marks

10 $\begin{bmatrix} \frac{4}{15} & \frac{-3}{15} \\ \frac{-3}{15} & \frac{6}{15} \end{bmatrix}$ (3)

Intermediate calculations- 2 marks

Final answer- 1 mark (1/4 each for the four values)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11 (7)

a) $\frac{V1}{2}+\frac{V1-V2}{2}=6$ 2 mark

$\frac{V2}{8}+\frac{V2-V1}{2}+4=7$ 2 mark

Solving $V1=14V\ and\ V2=16V$ 2 mark

$I=\frac{V1-V2}{2}=-1.0\ A$ 1 mark

b) $I1=4\angle 45°=2.828+j2.828$ 1 mark

$-(6+j4)I1+(6+j4-j2)I2=-10\angle 30°$ 2 mark

$solving\ I2=3.714\angle 78.91°=0.714+j3.645A$ 2 mark

$V_{6\Omega}=6(I1-I2)=12.684-j4.89V$ 2 mark

12 a) $1.08V1-0.75V2=-6.25$ 2 mark (7)

$Vx=V1+5-V2$ 1 mark

$-4.75V1+5.75V2=21.25$ 2 mark

Solving $V1=-7.55V\ and\ V2=-2.54V$ 1 mark

So $Vx=-0.01\ V$ 1 mark

b) $I1-I2=3$ 2 mark (7)

$50-5I1-5I2-10(I2-I3)-1(I1-I3)=0$ 2 mark

$I3=10$ 1 mark

Solving $I2=6.76A$ 1 mark

Current in $10\Omega=I3-I2=3.24A$ 1 mark

Module 2

13 (7)

a) $V_{th}=24V$ 2 mark

$I_N=10A$ 2 mark

$R_{th}=2.4\Omega$ 1 mark

$I_L=6A$ 2 mark

b) $50\angle 0$ alone

$I1 = 7.46\angle -26.56$ 2.5 marks (7)

$20\angle 90$ alone

$I2 = 11.94\ \angle 63.44$ 2.5 marks

$I = I1 + I2 = 14.08\angle 31.46 = 12.01 + j\ 7.35\ A$ 2 mark

14 (7)

a) Node equations

$V_{th} = 13.09\ V$ 2 mark

$R_{th} = 1.09\Omega$ 2 mark

$R_L = Rth$ 1 mark

$P_{max} = 39.3\ W$ 2 mark

b) 8V alone

$I1 = -0.133A$ 2.5 marks (7)

4A alone

$I2 = 3.732A$ 2.5 marks

$I_{4\Omega} = I1 + I2 = 3.6A$ 2 mark

Module 3

15 a)Each equivalent circuit - 2mark (8)

b) $i(0^-) = 2\ A$ 2 mark

I(s)= $\frac{2s+12}{s(s+2)}$ 2mark (6)

$i(t) = [6 - 4e^{-2t}]u(t)$ 2 mark

16 (6)

a) $I(s) = \frac{A[1-e^{-sT}]}{s[R+sL]}$ 3 marks

$$i(t) = \frac{A}{R}\left[u(t) - U(t-T) - e^{-Rt/L} + e^{-Rt/L}u(t-T)\right]$$ 3 marks

b) $\frac{10}{s} - I1(s) - (1+s)[I1(s) - I2(s)] = 0$ 2 mark

$-(s+1)[I2(s) - I1(s)] - I2(s) - \frac{I2(s)}{s} - \frac{4}{s} = 0$ 2 mark

$I1(s) = \frac{5}{s} - \frac{2}{s+1}$ 1 mark

$I2(s) = \frac{3}{s+1} - \frac{2}{(s+1)^2}$ 1 mark

$i1(t) = 5 - 2e^{-t}$ 1 mark

$i2(t) = 3e^{-t} - 2te^{-t}$ 1 mark

In the figure instead of capacitor (equal length parallel lines), symbol is that of a cell (unequal length parallel lines). But from the values (1F, 4V) it can be interpreted as capacitor. It is just a drawing error. In the question it is clearly said initial voltage on capacitor is 4V

Module 4

17 a) Pole zero plot 2 mark (8)

V(s) = $1 + \frac{2(s+3.5)}{(s+1)(s+5)}$ -------- 2mark

V(s) = $1 + \frac{\frac{5}{4}}{s+1} + \frac{\frac{3}{4}}{s+5}$ ----------2 mark

$v(t) = \delta(t) + \frac{5}{4}e^{-t} + \frac{3}{4}e^{-5t}$ ----------2mark

b) Explanation 6 marks (6)

18 a) Any six conditions 6 marks (6)

b) Steps 2 marks

$Z_{11}(s) = \frac{7s^2 + 7s + 5}{s^2 + s + 1}$ 2 mark

$Z_{21}(s) = \frac{2s}{s^2 + s + 1}$ 2 mark (8)

$G_{21}(s) = \frac{2s}{7s^2 + 7s + 5}$ 2 mark

Module 5

19 a) 4 marks for each derivation (8)

b) $\begin{bmatrix} \frac{h22}{\Delta h} & \frac{-h12}{\Delta h} \\ \frac{-h21}{\Delta h} & \frac{h1}{\Delta h} \end{bmatrix}$ 3 marks (6)

$\begin{bmatrix} \frac{C}{A} & \frac{-\Delta T}{A} \\ \frac{1}{A} & \frac{B}{A} \end{bmatrix}$ 3 marks

Since g parameters are not mentioned in the syllabus explicitly, if student attempts this question, 3 marks can be given.

20 a)Proof ---------- 6 marks (6)

b) $\begin{bmatrix} \frac{1}{3} & \frac{-1}{6} \\ \frac{-1}{6} & \frac{1}{3} \end{bmatrix} + \begin{bmatrix} \frac{1}{3} & \frac{-1}{3} \\ \frac{-1}{3} & \frac{1}{3} \end{bmatrix} = \begin{bmatrix} \frac{2}{3} & \frac{-1}{2} \\ \frac{-1}{2} & \frac{2}{3} \end{bmatrix}$ (8)

3 marks + 3 marks + 2 marks