Total number of printed pages: 4

UG/3rd Semester/UECE304

2023

NETWORK THEORY

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. a) What is the difference between loop and mesh? Find the voltage across 3Ω resistor in the circuit shown in Figure-1(a) using Superposition theorem. 2+5=7

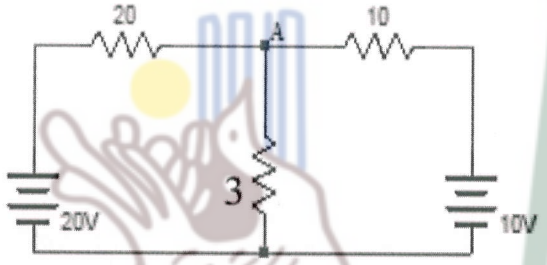

Figure-1(a)

b) State and prove maximum power transfer theorem. In the following circuit Figure-1(b), when R = 0 Ω, the current I_R equals to 10 A. The maximum power will be? 5+2=7

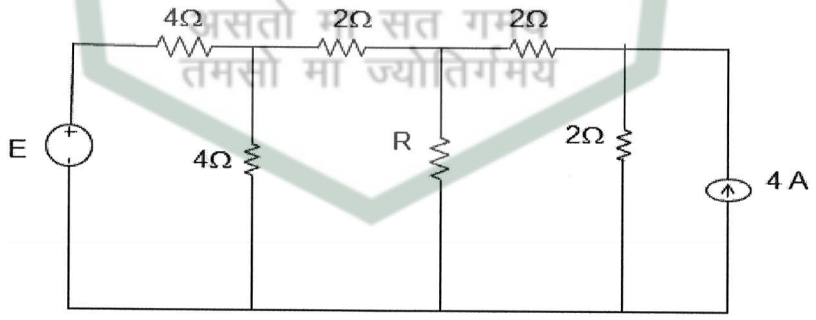

Figure-1(b)

c) Find the voltage across the 2Ω resistor as shown in Figure-1(c). 6

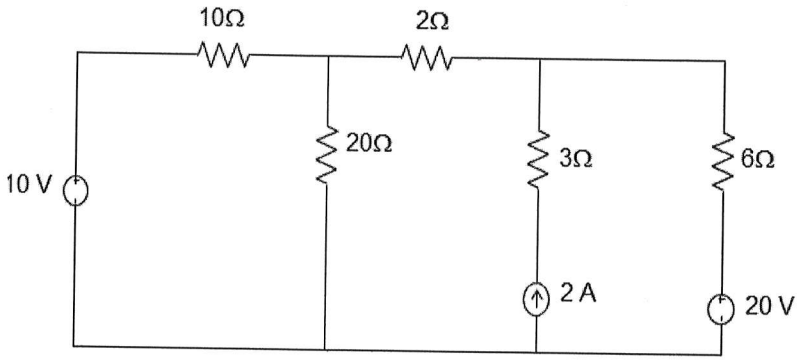

Figure-1(c)

2. a) Calculate the Fourier transforms of the following: 4+7=11

(i) $e^{-2(t-1)}U(t-1)$ (ii) $e^{-3|t-1|}$

Find the trigonometric Fourier series for the triangular periodic signal f(t) as shown in Figure-2.

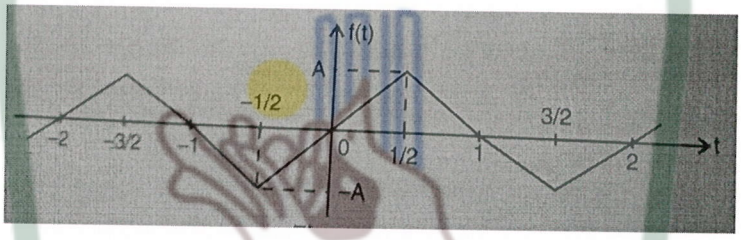

Figure-2

b) Define the Laplace transforms and inverse Laplace transform. Find the Laplace transform of the following functions 3+3+3=9

(i) f(t)=$e^{-3t}(cos2t+\frac{5}{2}sin2t)$

(ii) f(t)= e^{at} .cos(αt).u(t)

3. a) Find the inverse Laplace transform of the following functions 5+4=9

(i) $\mathbf{I(s)=\frac{s^2+5s+9}{s^3+5s^2+12s+8}}$ (ii) $H(s)=\frac{s^2+3s+5}{(s+1)(s+2)(s+3)}$

b) In R-L series circuit R=5Ω, L=2.5 mH and i(0 $^-$)=2A. If a source of 50V is applied at t=0. Find i(t) for t ⟩ 0. 6

c) Find the transient responses a series R-C circuits having DC excitation. 5

4. a) Find the open circuit driving point impedance at terminals 1-1' of the ladder network shown in Figure-3. 5

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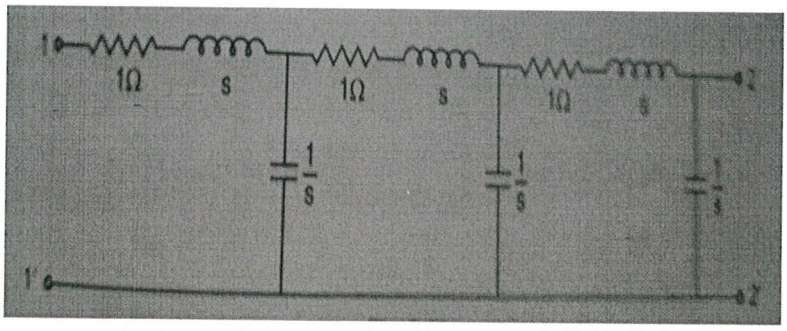

Figure-3

b) Show that the driving-point impedance function of the network in Figure-4, by continued fraction, becomes $\frac{s^4+3s^2+1}{s^2+2s}$ 5

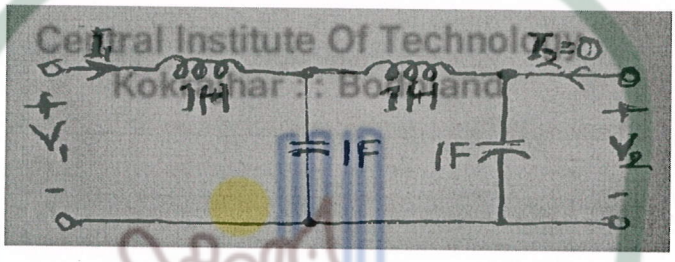

Figure-4

c) The denominator polynomial of transfer function for a network is as below: 5
$Q(s) = s^4+s^3+2s^2+2s+12$. Form the Routh array and verify for stability of the network.

d) Find the transfer functions $G_{21}(s)$, $Z_{21}(s)$ and driving point admittance $Y_{11}(s)$ of the two-port network shown in Figure-5. 5

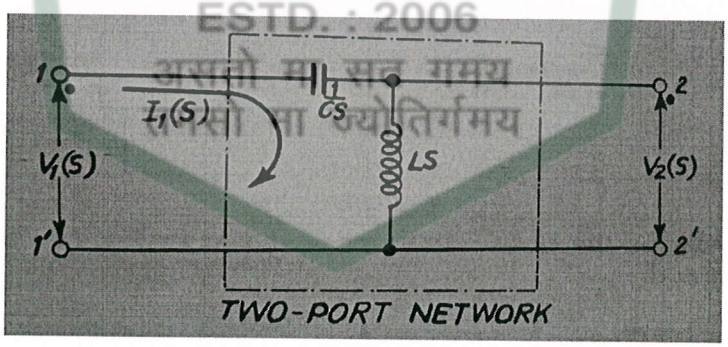

Figure-5

5 a) What is poles and zeros in network functions? Write the criterion for stability of active network in terms of root locus plot. Plot the poles and zeros in the s-plane for the following network. 3+4+3+3= 13

(i) $\mathbf{F(s)} = \frac{s^2+4s+3}{s^2+2s}$ (ii) $\mathbf{F(s)} = \frac{(s+2)(s^2+9)}{(s^2+4)(s^2+4s+5)}$

b) Express ABCD parameters in terms of Z-parameters and h-parameters 7

6 a) Two two-port networks shown in Figure-6(a) and 6(b) are connected in series. Obtain the Z-parameters of the resulting network. Also verify the result by direct calculation. 6

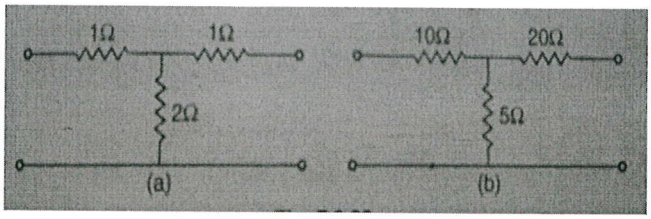

Figure-6

b) The bandwidth of a series resonant circuit is 500 Hz. If the resonant frequency is 6000 Hz, what is the Q-factor? If R = 10 Ω, what is the value of the inductive reactance at resonance? Calculate the inductance and capacitance of the circuit. 5

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c) Write a short note on passive filter network. Derive the condition for reciprocity and symmetry in case of T-parameters. 5+4=9

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