Roll No: | | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2021-22
NETWORK ANALYSIS AND SYNTHESIS

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. Illustrate the admittance parameter of a two-port network.

b. Describe the band stop filter with suitable example.

c. Demonstrate time scaling property of Laplace transform.

d. Describe the singularity function with suitable example.

e. Demonstrate time convolution property of Fourier transform.

f. Illustrate the drawback of Fourier Transform and how this drawback can be removed by using Laplace transform.

g. Describe and state Thevenin's theorem with suitable example.

h. Describe the following terms for a network: Graph, Tree, Co-Tree, and Twig.

i. Use source transformation to solve v_o in the circuit shown in figure 1.

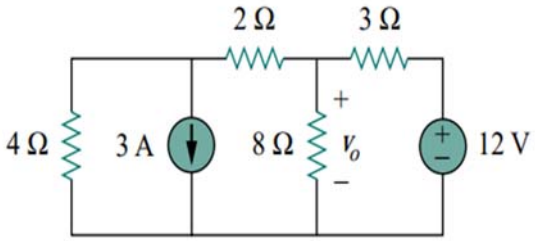

Figure 1

j. When the voltage across a resistor is 120 V, the current through it is 2.5 mA. Calculate its conductance.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Identify the node voltages in the circuit shown in figure 2.

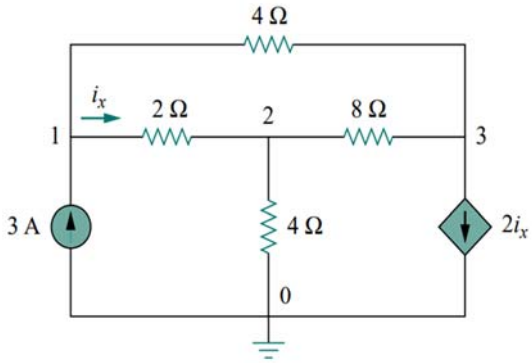

Figure 2

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b. Find i_o in the circuit shown in the figure 3 using superposition.

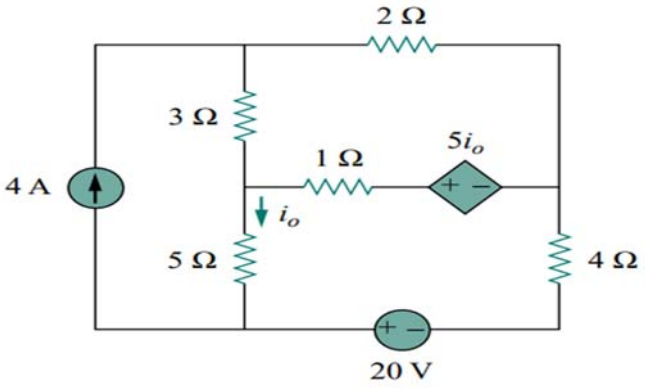

Figure 3

c. Calculate the Fourier Transform for the signal

$$x(t) = t^2 e^{-at} u(t)$$

d. Find the Laplace transform for the given signal.

$$x(t) = \left(\frac{1 - e^{-t}}{t}\right) u(t)$$

e. Illustrate the low pass filter. Derive the expression for transfer function of a low pass filter and plot the curve.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Describe the following terms with example.

i. Junction Point
ii. Node
iii. Branch
iv. Active and Passive Network
v. Linear and Non-Linear Network

(b) Calculate the mesh currents i_1 and i_2 in the circuit shown in figure 4.

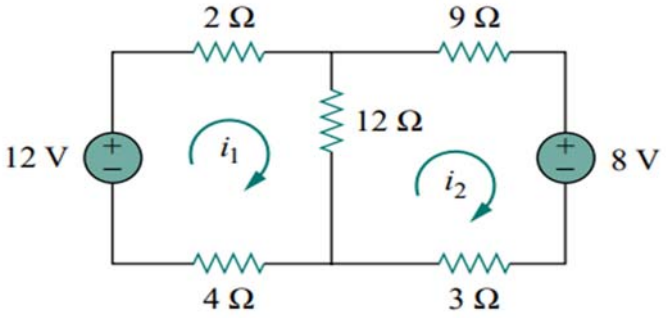

Figure 4

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4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Using Norton's theorem, find R_N and I_N of the circuit shown in the figure 5.

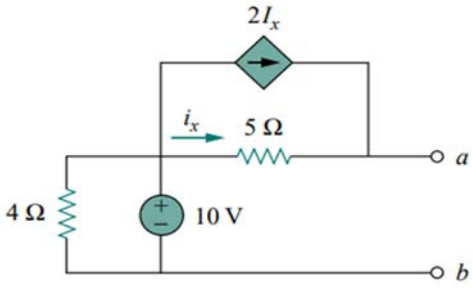

Figure 5

(b) Find the value of R_L for the maximum power transfer in the circuit shown in the figure 6. Find the maximum power.

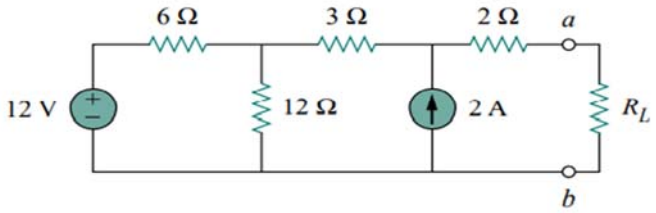

Figure 6

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Demonstrate and prove the frequency convolution and time differentiation property of Fourier transform.

(b) Find out the Fourier Transform of $x(t) = e^{-at}u(t)$. Also draw the magnitude and phase spectrum of the output.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Derive the expression for source free RLC circuit and discuss all three cases: Overdamped response, Underdamped response and critical damped response.

(b) Find the Laplace transform for the given signal and calculate the ROC.

$$x(t) = t\, e^{-2|t|}$$

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Obtain the y parameters for the circuit shown in the figure 7.

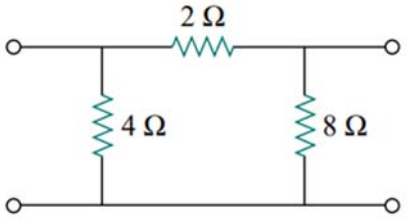

Figure 7

(b) Illustrate the high pass filter. Derive the expression for transfer function of a high pass filter and plot the curve.