Printed pages: 04

Subject Code: KEC-303 Roll No.:

B.Tech.

(SEM III) ODD SEMESTER EXAMINATION 2022-23

NETWORK ANALYSIS AND SYNTHESIS

[TIME: 3 hrs.] [Max. Marks: 100]

Note: *Attempt All Questions. All Questions carry equal marks.*

Q1. Answer ALL parts.	Marks
(a) Explain the concept of supernode and supermesh with an example.	5
(b) Explain duality in electrical engineering. State the steps followed in finding the dual of a network.	5
(c) Define V-shift and I-shift in the source transformation.	5

OR

"All circuits are networks, but all networks are not circuits." Justify this statement.

(d) Determine the voltage V in the network shown in Fig. 1 using nodal analysis. 5

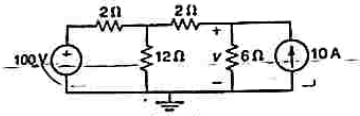

Fig. 1

OR

Draw the dual of the network shown in Fig. 2.

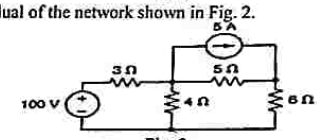

Fig. 2

Q2. Answer ALL parts.

(a) Replace the circuit shown in Fig. 3 with its Thevenin's equivalent circuit across terminals AB. 10

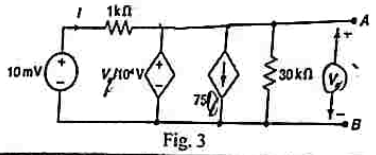

Fig. 3

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(b) Find the Norton equivalent circuit of the circuit shown in Fig. 4. 10

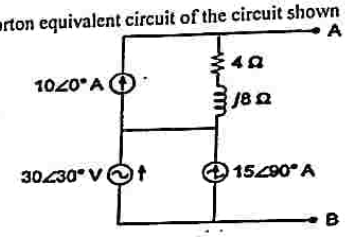

Fig. 4

OR

A network has two output terminals. The open-circuit voltage at these terminals is 260 V. The current flowing through the terminals is 20 A when the terminals are short circuited. Also, the current is 13 A when a coil of 11-ohm reactance and negligible resistance is connected across the terminals. Find the impedance components of the equivalent circuit feeding the terminals. What value of load impedance will give maximum power transfer and what is the value of this power?

Q3. Answer ALL parts.

(a) Find the Fourier series for the train of pulses shown in Fig. 5, draw its amplitude, and phase spectra. 10

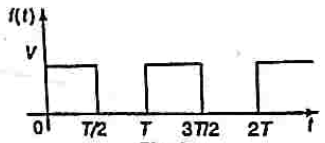

Fig. 5

OR

Determine the Fourier Transform of the signal shown in Fig. 6.

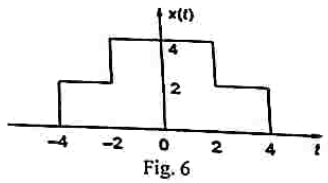

Fig. 6

(b) Two wattmeters are connected to measure power in a three-phase circuit. The reading of one of the meter is 7 KW when the load power factor is unity. If the power factor of load is changed to 0.8 lagging without changing the total input power, calculate the readings of the two wattmeters. 10

Q4. Answer ALL parts.

(a) Find the Laplace transform of the square wave shown in Fig. 7 using periodicity property. 10

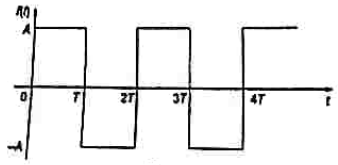

Fig. 7

(b) Find the current $i(t)$ and voltage $V_L(t)$ in the circuit shown in Fig. 8. Assume the circuit was initially relaxed. 10

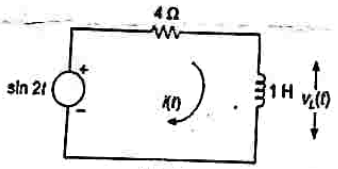

Fig. 8

OR

Determine the current $i(t)$ in a series RLC circuit shown in Fig. 9 consisting of $R = 6\,\Omega, L = 1\,H, C = 1/8F$, when a ramp voltage $6r(t-1)$ is applied. Assume that the circuit was initially relaxed.

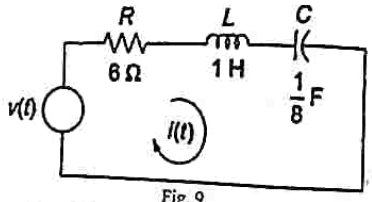

Fig. 9

Q5. Answer ALL parts.

(a) A series RLC circuit has the values $R = 10\,\Omega, L = 0.01\,H, C = 100\mu F$. Calculate resonant frequency, quality factor, bandwidth, and the half-power frequencies. 10

(b) Determine the current transfer ratio α_{21}, and driving point impedance Z_{21} for the circuit shown in Fig. 10. 10

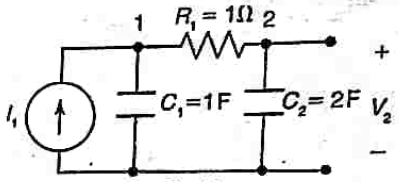

Fig. 10

OR

Write notes on (i) Convolution theorem, and (ii) Filters.

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Subject Code: IEC-402 Roll

B.Tech.

(SEM IV) EVEN SEMESTER EXAMINATION 2023-24

NETWORK ANALYSIS AND SYNTHESIS

[TIME: 3 hrs.] [Max. Marks: 70]

Note: *Attempt All Questions. All Question carry equal marks.*

Q1. Answer ALL parts. Marks

(a) Explain 'duality' in electrical engineering. State the steps followed in finding the dual of a network. 3.5

(b) Using source transformation and simplification, determine the voltage between the points P and Q as shown in Fig. 1. 3.5

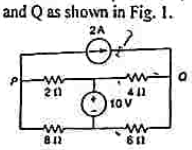

Fig. 1

(c) Find the current through the 5-ohm resistor in Fig. 2 using mesh analysis. 3.5

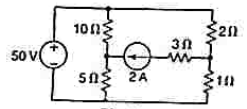

Fig. 2

OR

Using nodal analysis, find I in the circuit shown in Fig. 3.

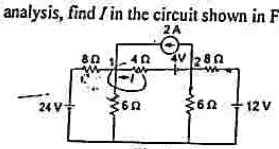

Fig. 3

(d) Determine the current in $5\,\Omega$ resistor for the circuit shown in Fig. 4 by using supernode analysis. 3.5

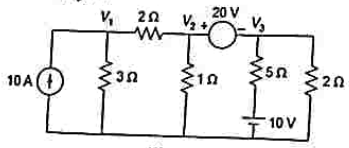

Fig. 4

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OR

Criticize supermesh and supernode analysis with the help of suitable circuit diagram.

Q2. Answer ALL parts.

(a) Determine the current I through the impedance $Z_1 = (4 + j6)\Omega$ in the network shown in Fig. 5 using superposition theorem. 7

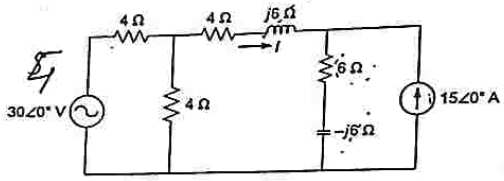

Fig. 5

(b) Determine the voltage V using Norton's theorem for the circuit shown in Figure 6. 7

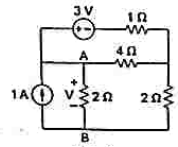

Fig. 6

OR

Determine the current through the load resistance $R_L = 8\Omega$ across terminals A-B of the circuit shown in Fig. 7 using Thevenin's theorem. Find also the maximum power transfer to the resistance R_L.

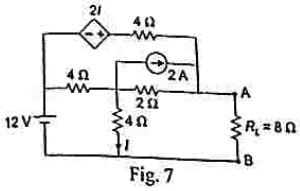

Fig. 7

Q3. Answer ALL parts.

(a) Find the Fourier series expansion of the waveform shown in Fig. 8. 7

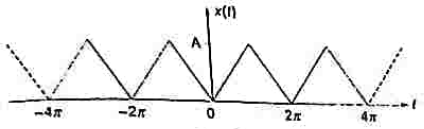

Fig. 8

OR

Find the Fourier transform of the exponentially damped sinusoidal waveform shown in Fig. 9.

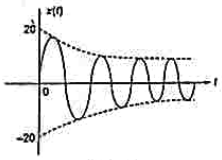

Fig. 9

(b) Find the Fourier transform of the periodic pulse train shown in Fig. 10. 7

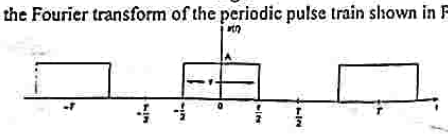

Fig. 10

Q4. Answer ALL parts.

(a) Find the Laplace transform of the full-wave rectifier shown in Fig. 11 using periodicity property. 7

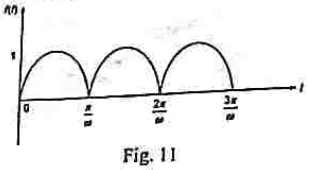

Fig. 11

(b) For the network shown in Fig. 12, find $v_0(t)$ for $t \geq 0$, using mesh equations. 7

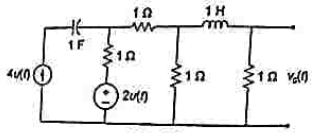

Fig. 12

OR

The impulse train of second derivative of a function $f(t)$ is shown in Fig. 13. Determine the function $f(t)$.

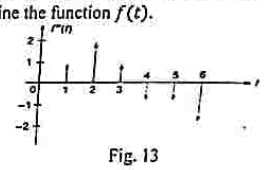

Fig. 13

Q5. Answer ALL parts.

(a) For the network shown in Fig. 14, obtain the transfer functions $G_{21}(s)$ and $Z_{21}(s)$ and the driving point impedance $Z_{11}(s)$ 7

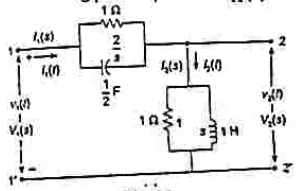

Fig. 14

(b) Two networks shown in Fig 15 (a) and Fig. 15 (b) are connected in parallel. Obtain the y-parameters of the combination. 7

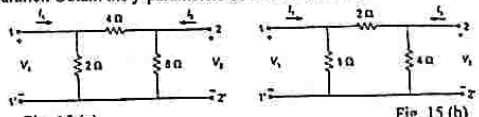

Fig. 15 (a) Fig. 15 (b)

OR

Write short notes on low pass filter, high pass filter, band-pass filter, and band-reject filter.

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Subject Code: IEC-402 Roll No.:

B.Tech.

(SEM IV) EVEN SEMESTER EXAMINATION 2024-25

NETWORK ANALYSIS AND SYNTHESIS

[TIME: 3 hrs.] [Max. Marks: 70]

Note: *Attempt All Questions. All Question carry equal marks.*

Q1. Answer **ALL** parts. Marks

(a) Using source transformation and circuit simplification techniques, determine the voltage V in the circuit shown in Figure 1. 3.5

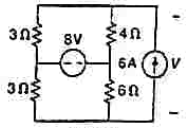

Figure 1

(b) Convert the current source into the equivalent voltage source given in Figure 2 and hence find the voltage V_0. 3.5

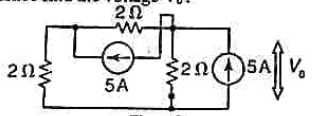

Figure 2

(c) Calculate the effective resistance between the points A and B in the circuit shown in Figure 3 3.5

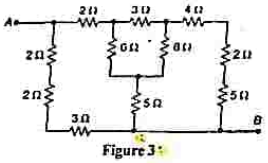

Figure 3

OR

Find the equivalent π network for the circuit shown in Figure. 4

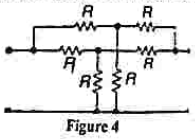

Figure 4

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3.5

(d) Determine the voltage V in the network in Figure 5 using nodal analysis.

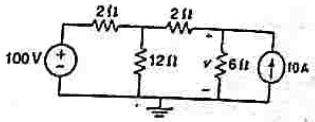

Figure 5

OR

Draw the dual of the circuit shown in Figure 6.

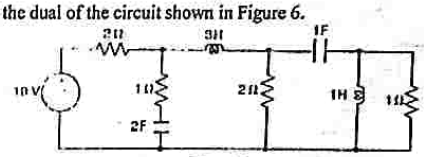

Figure 6

Q2. Answer **ALL** parts.

(a) Find current through 2 ohm resistor, in the given Figure 7, using Thevenin's theorem. 7

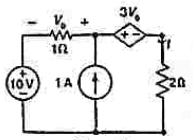

Figure 7

(b) Find current *I* in the Figure 8 using the superposition theorem. 7

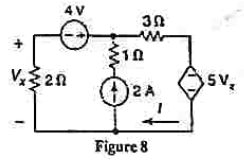

Figure 8

OR

Determine the value of resistance R in the circuit shown in Figure 9 to achieve maximum power transfer. Also, calculate the amount of power transferred under this condition.

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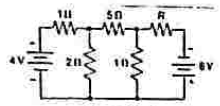

Figure 9

Q3. Answer ALL parts.

(a) Determine the Fourier series for the square waveform shown in Figure 10 and plot the magnitude and the phase spectra. 7

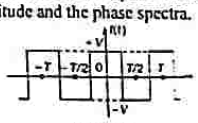

Figure 10

OR

Determine the Fourier series of voltage response obtained at the output of a half-wave rectifier shown in Figure 11. Plot the discrete spectrum of the waveform.

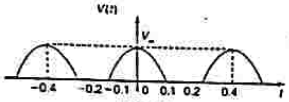

Figure 11

(b) Determine the Fourier transform of one cycle of sine wave $f(t) = A\sin\omega_0 t$ shown in Figure 12. 7

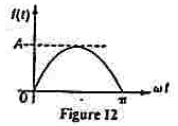

Figure 12

Q4. Answer ALL parts.

(a) (i) Determine the Laplace transform of damped hyperbolic Sine function. 7

(ii) Determine the Laplace transform of damped hyperbolic Cosine function.

(b) The circuit given in Figure 13 is initially at steady state with the switch 'K' open. If the switch is closed at time t = 0, find the voltage $V_c(t)$ across the capacitor. 7

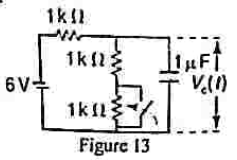

Figure 13

OR

In the network shown in Figure 14 the switch S is closed and a steady state is attained. At t=0, the switch is opened. Determine the current through the inductor for t>0.

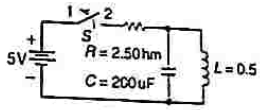

Figure 14

Q5. Answer ALL parts.

(a) Find the z-parameters for the network shown in Figure 15 and state whether the network is reciprocal and symmetrical. 7

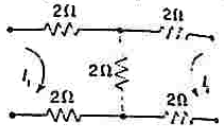

Figure 15

(b) Determine driving point impedance Z_{11}, transfer impedance Z_{21} and voltage transfer function G_{21}, for the network shown in Figure 16. 7

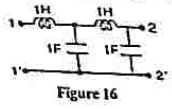

Figure 16

OR

A band-pass filter has the component values $R = 21.12\,k\Omega$, $R_f = 42.42\,k\Omega$, $R_r = 3.03k\Omega$ and $C_1 = C_2 = 0.015\,\mu F$. Find the resonant frequency and the bandwidth.