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Invigilator's Signature :	

 ${\rm CS/B.Tech(ECE, EEE, IC, BME, PWE, CSE, IT)/SEM-3/EE-301/2009-10} \\ {\bf 2009}$

CIRCUIT THEORY & NETWORKS

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

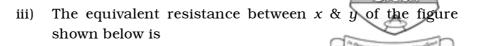
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

 $10 \propto 1 = 10$

- i) Laplace transform analysis gives
 - a) time domain response only
 - b) frequency domain response only
 - c) both (a) & (b)
 - d) real response only.
- ii) If a function is shifted by ${}^{t}T^{t}$, then it is correctly represented as
 - a) f(t-T)u(t)
 - b) f(t-T)u(t-T)
 - c) f(t)u(t-T)
 - d) (t-T)f(t-T).

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Dia.

a) 30Ω

b) 50Ω

c) 60Ω

- d) 10Ω .
- iv) If f(t) is an even function, then its Fourier transform F(jw) is given by

a)
$$2 \int f(t) \cos wt dt$$

b)
$$\int f(t) \cos wt \, dt$$

c)
$$2 \int f(t) \sin wt dt$$

$$\frac{\cdot}{\int} f(t) \sin wt dt.$$

v) The Thevenin's equivalent resistance of the given circuit with respect to the terminals $A \otimes B$ is equal to

Dia.

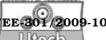
a) 2.66Ω

b) 3.2Ω

c) 8Ω

d) 12Ω .

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The value of the unity impulse function δ (t) at t = 0 is vi)

0 a)

b)

c) 1 d) indeterminate.

The number of links for a graph having 'n' nodes & 'b' branches are

- b n + 1a)
- b) n b + 1
- b + n 1c)
- d) b + n.

viii) The h parameters $h_{\ 11}\ \ \&\ h_{\ 12}\ \ {\rm are\ obtained\ by}$

- a) shorting output terminals
- b) opening input terminals
- shorting input terminals c)
- opening output terminals.

ix) The convolution of f(t) * g(t) is

a)
$$\int_{0}^{t} f(t)g(t-\tau) d\tau$$
b)
$$\int_{0}^{t} f(\tau)g(t-\tau) d\tau$$

b)
$$\int_{0}^{\tau} f(\tau) g(t-\tau) d\tau$$

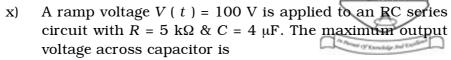
c)
$$\int_{0}^{t} f(t-\tau)g(t) dt$$

d)
$$\int_{0}^{t} f(t)g(t-\tau) dt.$$

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[Turn over



a) 0.2 volt

b) 2.0 volt

c) 10.0 volt

d) 50.0 volt.

xi) The voltage across the dependent source of the circuit shown is

Dia.

a) 8 [] 0°

b) 4 [] 0°

c) 4 [] 90°

d) 8 □ – 90°.

xii) Relative to a given fixed tree of a network

- a) link currents form an independent set
- b) branch currents form an independent set
- c) branch voltages form an independent set
- d) both (a) & (c).

GROUP - B

(Short Answer Type Questions)

Answer any three of the following.

 $3 \propto 5 = 15$

2. In the circuit shown, determine the current i (t) when the switch is changed from position 1 to 2. The switch is moved from position 1 to 2 at time t = 0.

Dia.

3. For the circuit shown is the figure, find the current in the 2Ω resistor by using Thevenin's theorem.

Dia.

4. Draw the graph corresponding to the given incidence matrix :

$$A = \begin{bmatrix} -1 & 0 & 0 & 0 & +1 & 0 & +1 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & -1 & +1 \\ 0 & 0 & -1 & -1 & 0 & -1 & 0 & -1 \\ 0 & 0 & 0 & 0 & -1 & +1 & 0 & 0 \\ -1 & +1 & +1 & +1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

5. Determine the cut off frequency for the high pass filter shown below.

dia.

6. Find the *Z*-parameters of the network given below :

Dia.



(Long Answer Type Questions)

Answer any three of the following.

 $3 \propto 15 = 45$

- 7. a) Explain with example, odd symmetry & even symmetry of periodic waveforms.
 - b) Determine the Fourier series for the saw tooth waveform shown below

Dia.

c) Applying Fourier transforms determine the output voltage across the capacitor if the excitation is a current source of $i(t) = e^{-t} u(t)$.

Dia.

8. a) The hybrid parameters of a two-port network shown in figure are $h_{11}=1~\mathrm{k}\Omega,\,h_{12}=0.003,\,h_{21}=100,$ $h_{22}=50~\mathrm{\mu}\,\mathbf{\Sigma}~.~\mathrm{Find}~V_2~\&~Z~\mathrm{parameters}~of~\mathrm{the}~\mathrm{network}.$

Dia.

b) What are ABCD parameters? Prove that AD - BC = 1.

10 + 5

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9. a) For the circuit shown, determine the load current I_2 using Norton's theorem.

Dia.

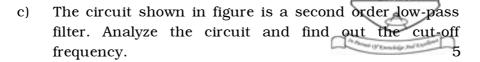
b) Convert the active network shown in figure to a single voltage source in series with impedance.

Dia.

7 + 8

- 10. a) Draw the circuit diagram of a first order high pass filterand find out the expression of the cut-off frequency.
 - b) Draw and explain the characteristics of ideal band-pass& band-stop filter.5

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Dia.

Find the Laplace transform of the periodic waveform shown in figure.

Dia.

- Define convolution theorem. b)
- Find $h^{-\,1}\,\left\{\,F_{\,\,1}^{}\,(\,s\,)\,\,F_{\,\,2}^{}\,(\,s\,)\,\,\right\}$ by using the convolution of c) the following functions:

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$$F_1(s) = \frac{1}{s+1} \& F_2(s) = \frac{1}{s+2}$$
. $8+2+5$