



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech(ECE,EE,EEE,IC,BME,PWE,CSE,IT)/SEM-3/EE-301/2009-10

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

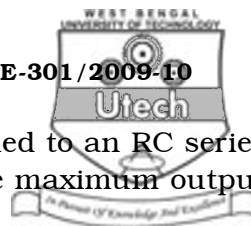
(Multiple Choice Type Questions)

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', 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) $(t - T)f(t - T)$.

- vii) The number of links for a graph having ' n ' nodes & ' b ' branches are
 a) $b - n + 1$
 b) $n - b + 1$
 c) $b + n - 1$
 d) $b + n.$
- viii) The h parameters h_{11} & h_{12} are obtained by
 a) shorting output terminals
 b) opening input terminals
 c) shorting input terminals
 d) opening output terminals.
- ix) The convolution of $f(t) * g(t)$ is
 a) $\int_0^t f(\tau)g(t-\tau)d\tau$
 b) $\int_0^t f(\tau)g(t+\tau)d\tau$
 c) $\int_0^t f(t-\tau)g(\tau)d\tau$
 d) $\int_0^t f(t)\cdot g(t-\tau)dt.$



- x) A ramp voltage $V(t) = 100\text{ V}$ is applied to an RC series circuit with $R = 5\text{ k}\Omega$ & $C = 4\text{ }\mu\text{F}$. The maximum output voltage across capacitor is
- 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) $8\angle 0^\circ$ b) $4\angle 0^\circ$
- c) $4\angle 90^\circ$ d) $8\angle -90^\circ$.
- 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).

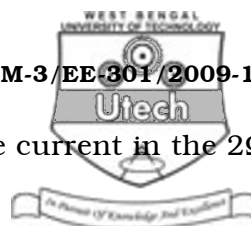
GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

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 in 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 :

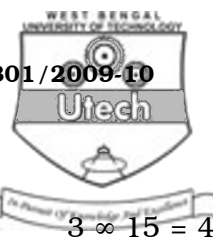
$$A = \begin{bmatrix} -1 & 0 & 0 & 0 & +1 & 0 & +1 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & -1 & +1 \\ 0 & 0 & -1 & -1 & 0 & -1 & 0 & -1 \\ 0 & 0 & 0 & 0 & -1 & +1 & 0 & 0 \\ -1 & +1 & +1 & +1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

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.



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.

3 × 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 $i(t) = e^{-t} u(t)$.

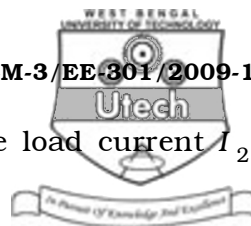
Dia.

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

Dia.

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

10 + 5



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

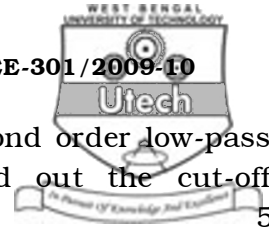
Dia.

- 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 filter and find out the expression of the cut-off frequency. 5
- b) Draw and explain the characteristics of ideal band-pass & band-stop filter. 5



- c) The circuit shown in figure is a second order low-pass filter. Analyze the circuit and find out the cut-off frequency.

Dia.

11. a) Find the Laplace transform of the periodic waveform shown in figure.

Dia.

- b) Define convolution theorem.
- c) Find $h^{-1} \{ F_1(s) F_2(s) \}$ by using the convolution of the following functions :

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

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