Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech(EIE)/SEM-3/EE-301(EI)/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)   If the voltage across a given capacitor is increased, the amount of stored charge

   a) increases   b) decreases

   c) remains constant   d) is exactly doubled.

   ii) A practical voltage source consists of

   a) an ideal voltage source in series with an internal resistance

   b) an ideal voltage source in parallel with an internal resistance

   c) both (a) & (b) are correct

   d) none of these.

33306   [Turn over

iii) Determine the current *I* in the circuit shown is figure :

Dia.

a) 2·5 A   b) 1A

c) 3·5 A   d) 4·5 A.

iv) A 1 kHz sinusoidal volatage is applied to an RL circuit. What is the frequency of the resulting current ?

a) 1 kHz   b) 0·1 kHz

c) 100 kHz   d) 2 kHz.

v) A series circuit consisting of two elements has the following current & applied voltage :

$$i = 4 \cos (2000\, t + 11{\cdot}32°)\ \text{A}$$

$$v = 200 \sin (2000\, t + 50°)\ \text{V}$$

The circuit elements are

a) resistance & capacitance

b) capacitance & inductance

c) inductance & resistance

d) both resistances.

vi) In a certain RL circuit, $V_R = 2$ V & $V_L = 3$V.

What is the magnitude of the total voltage ?

a) 2 V   b) 3 V

c) 5 V   d) 3·61 V.

vii) Maximum power transfer occurs at

a) 100% efficiency   b) 50% efficiency

c) 25% efficiency   d) 75% efficiency.

viii) A source has an emf of 10V and impedance of $500 + j100\Omega$. The amount of maximum power transferred to the load will be

    a)   0·5 mW   b)   0·05 mW

    c)   0·05 W   d)   0·5 W.

ix) Transient current in an RLC circuit is oscillatory when

    a) $R = 2\sqrt{L/C}$ b) $R = 0$

    c) $R > 2\sqrt{L/C}$ d) $R < 2\sqrt{L/C}$.

x) When a series RL circuit is connected to a voltage V at $t = 0$, the current passing through the inductor L at $t = 0^+$ is

    a) $\dfrac{V}{R}$ b)   infinite

    c)   zero   d) $\dfrac{V}{L}$.

xi) The current in the neutral wire of a balanced three-phase, four-wire star-connected load is given by

    a)   zero

    b) $\sqrt{3}$ times the current in each phase

    c)   3 times the current in each phase

    d)   the current in each phase.

xii) A two port network is simply a network inside a black box & the network has only

    a)   two terminals

    b)   two pairs of accessible terminals

    c)   two pairs of ports

    d)   4 pairs of ports.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 ∞ 5 = 15

2. Determine the voltage V which causes the current I_1 to be zero in the circuit shown Use mesh analysis.

Dia.

3. A series cricuit consisting of two pure elements has the following current & voltage :

$$v = 100 \sin (2000\, t + 50°)\, V$$

$$i = 20 \cos (2000\, t + 20°)\, A$$

Find the element in the circuit.

4. A three phase balanced delta-connected load with line voltage of 200 V, has line currents as $I_1 = 10 \angle 90°$, $I_2 = 10 \angle -150°$ & $I_3 = 10 \angle -30°$.

a) What is the phase sequence ?

b) What are the impedances ?

5. For the circuit shown in figure, find the complete expression for the current when the switch is closed at $t = 0$:

    dia.

6. Find the Norton's equivalent circuit across terminal *AB* for the circuit shown.

    Dia.

GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following. $3 \infty 15 = 45$

7. a) The circuit shown in figure consists of series $R - L$ elements. The sine wave is applied to the circuit when the switch S is closed at $t = 0$. Determine the current $i \, (\, t \,)$

    Dia.

b) Find the Laplace transform of the waveform shown :

Dia.

10 + 5

8. a) For the parallel circuit shown in figure. Find the magnitude of current in each. Branch & the total current. What is the phase angle between the applied voltage & current ?
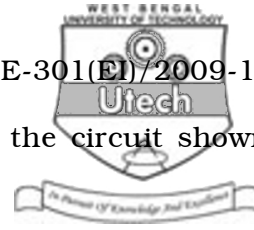
Dia.

b) Two impedances Z_1 = 20 + j 10 & Z_2 = 10 − j 30 are connected in parallel & this combination is connected in series with Z_3 = 30 + j X. Find the value of X which will produce resonance. 9 + 6

9. a) Find Z-parameters of the network shown in figure. Hence find the ABCD parameters for the same network.

Dia.

b) Calculate the effective inductance of the circuit shown in figure
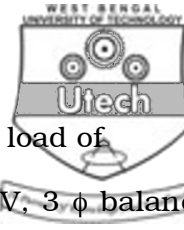
Dia.

10 + 5

10. a) Determine the load resistance to receive maximum power from the source. Also find the maximum power delivered to the load in the circuit shown.

Dia.

b) Determine the output voltage V_{out} in the circuit shown.

Dia.

9 + 6

11. a) A three phase, balanced delta connected load of ($4 + j\,8$) Ω is connected across a 400 V, 3 ϕ balanced supply. Determine the phase currents & line currents. Assume the phase sequence to be *RYB*. Also calculate the power drawn by the load.

   b) Calculate the total power input & readings of the two wattmeters connected to measure power in a three phase balanced load if the reactive power input is 15 kVAR & load p.f. is 0·8.   10 + 5

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