Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/BME(N)/SEM-3/BME(EC)-301/2012-13

2012

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 : $10 \times 1 = 10$

i) The value of the unity impulse function at $t = 0$ is

a) 0 b) 1

c) ∞ d) $\frac{1}{2}$

e) interminate.

ii) Laplace transform analysis gives

a) time domain response only

b) frequency domain response only

c) both (a) and (b)

d) real response only.

iii) A transistor belongs to the group of

a) active circuit elements

b) passive circuit elements

c) both (a) and (b)

d) none of these.

iv) The inverse Laplace Transform of $\frac{(s+\alpha)}{(s+\alpha)^2+\omega^2}$ is

a) $e^{-\alpha t}\sin(\alpha t)$ b) $e^{\alpha t}\sin(\omega t)$

c) $e^{-\alpha t}\cos(\alpha t)$ d) $e^{\alpha t}\cos(\omega t)$.

v) The impedance of an ideal current source is

a) 0 b) ∞

c) both (a) and (b) d) none of these.

vi) For a series R-L-C circuit at resonance, the current is

a) zero

b) maximum

c) cannot be told.

vii) Kirchhoff's voltage law is related to

a) node analysis b) mesh analysis

c) both (a) and (b) d) none of these.

viii) Maximum power transfer occurs at an efficiency of

a) 100% b) 25%

c) 50% d) 75%

e) none of these.

ix) The Tie-Set matrix gives the relation between

a) branch currents and link currents

b) branch voltages and link voltages

c) branch currents and link voltages

d) branch voltages and link currents.

x) In an ideal R-L circuit, the phase angle between voltage and current is

a) 0° b) 90°

c) 180° d) none of these.

xi) Normally, industrial power factor is ..... domestic power factor.

a) more

b) less

c) equal to.

GROUP – B

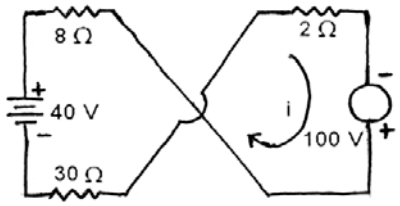
(Short Answer Type Questions)

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

2. Write an application of cut set matrix of a graph. Draw the graph corresponding to the reduced incidence matrix [*A*], given by

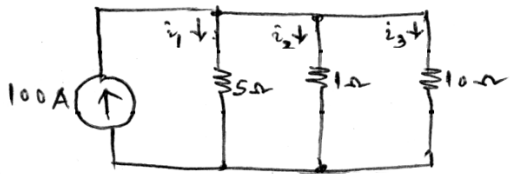
$$[A] = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 \\ -1 & 1 & 0 & 1 & 0 \\ 0 & -1 & 1 & 0 & 0 \end{bmatrix} \qquad 1 + 4$$

3. In the circuit given, find the current and the voltage across the 30 Ω resistor.



4. Find the impulse response of a series R-L circuit using Laplace Transform with proper circuit diagram.

5. Find the currents in the resistors for the circuit :



6. Describe maximum power transfer theorem and establish the requisite relationship.

GROUP – C

(Long Answer Type Questions)

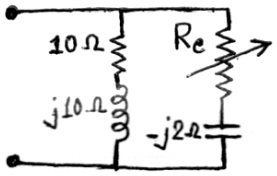
Answer any *three* of the following. $3 \times 15 = 45$

7. a) Write necessary mathematical expression, define quality factor.

   b) Draw the characteristic curve for a series RLC resonant circuit showing the variations of impedance, current, capacitive reactance, inductive reactance and net reactance respectively with frequency.

c) A coil having an inductance of 50 mH and resistance of 10 Ω is connected in series with a 25 μF capacitor across a 200 V *ac*. Calculate (i) resonant frequency of the circuit, (ii) current at resonance and (iii) value of Q_0.

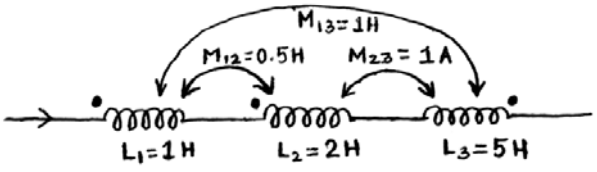
d) Calculate the value of R_c in the circuit shown below to yield the resonance. 2 + 4 + 5 + 4



8. a) If L_1 and L_2 be the self inductances of two coupled coils respectively, M be their mutual inductance and K be the coefficient of coupling, then prove that $M = K(L_1 L_2)^{\frac{1}{2}}$.

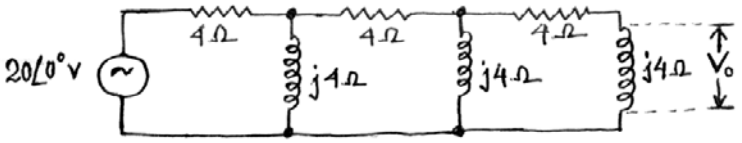
b) Two coupled coils have self inductances L_1 = 10 mH and L_2 = 20 mH. The coefficient of coupling being 0·75 in the air, find the voltage in the second coil and the flux of the first coil, provided the second coil has 500 turns and the circuit is given by $i = 2\sin(314t)$ amp.

c) Find the total inductance of the three series connected coupled coil as shown below.

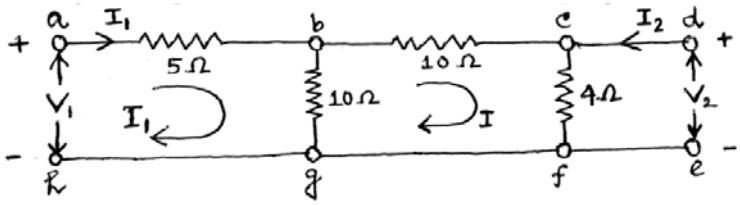


5 + 5 + 5

9. a) Find the voltage V_0 of the circuit using mesh analysis by matrix method :



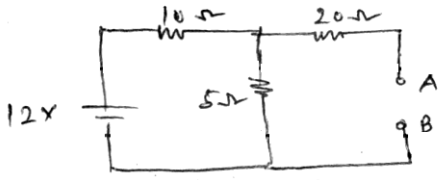
b) Find the impedance parameters of the network shown.



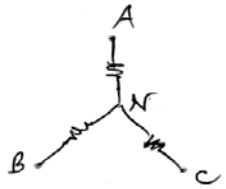
7 + 8

10. a) State Thevenin's theorem.

b) Find the Thevenin resistance between *A* and *B* and also find I_{AB} when a load $Z_{AB} = 25\,\Omega$ is placed between *A* and *B*.



c) Convert the star circuit to its equivalent delta between the points *A, B* & *C*.



Deduce the necessary relationships. 3 + 5 + 7

11. Write short notes on any *three* of the following : 3 × 5

a) Series resonance of an R-L-C circuit

b) Compensation theorem

c) Norton's theorem

d) Initial & final value theorem.

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