BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR

B.E. (EE) 3rd Semester Final Examination 2011

Subject: Network Theory

Paper / Code No: EE – 301 **Branch:** Electrical Engineering

Time: 3 Hrs. **Full Marks:** 70

i) Answer any SIX questions taking THREE from each half.
ii) TWO marks are reserved for neatness in each half

FIRST HALF

1. (a) State and prove the Millman's Theorem.

   (b) In the circuit of Fig.1 find the current through Z_L using Millman's Theorem.

[5+6]

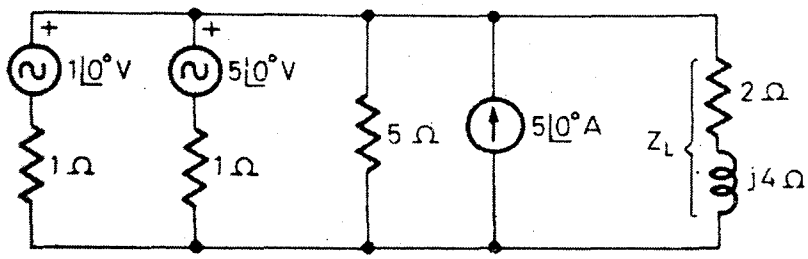


Fig. 1

2. (a) State and prove the Compensation Theorem for AC networks.

   (b) In the circuit of Fig.2, a 0.5 Ω resistor is added in series with the existing 1Ω resistor. Using Compensation Theorem, determine the change in current through 1Ω resistor after adding the new resistor,

[5+6]

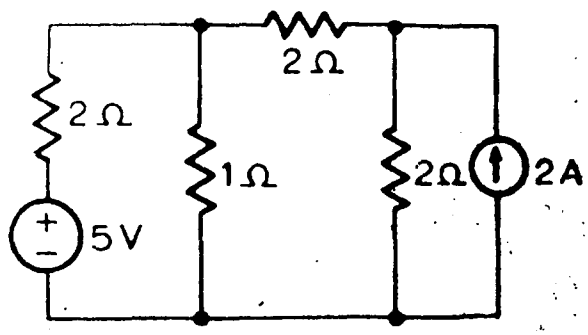


Fig. 2

[P.T.O.]

3. (a) State and prove the Maximum Power Transfer Theorem for AC networks.

(b) Find the current through the resistor R_L in Fig.3 using Norton's Theorem.

[5+6]

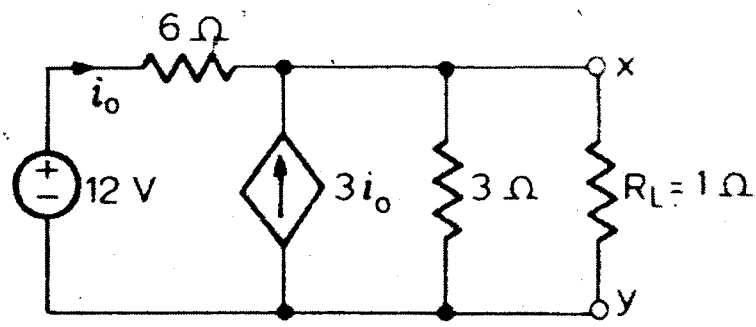


Fig. 3

4. (a) State and prove the Time Shift Theorem in Laplace Transform.

(b) Prove that impulse function is the first order derivative of a unit step function and hence obtain the Laplace Transform of a time-shifted impulse function: $\delta(t - t_0)$

[5+6]

5. (a) Derive the Exponential form of the Fourier series from Trigonometric form of the series.

(b) Obtain the Trigonometric Fourier series of the waveform shown in Fig.4

[5+6]

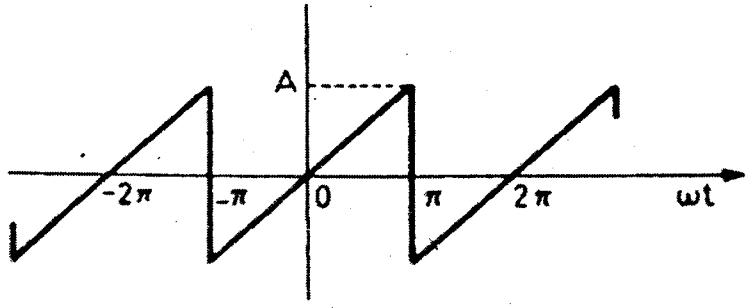


Fig. 4

SECOND HALF

6. a) Find the current transfer function $\alpha_{21}(s)$ for the network shown in Fig. 6. Find the poles and zeros of the network function and plot them on s-plane.

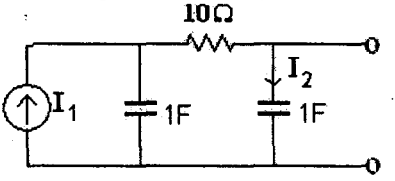


Fig. 6

b) Draw the gain-frequency plot of the output current response on semilog graph paper.

c) Verify whether the following satisfies the conditions of valid driving point function or valid transfer functions or both.

(i) $N_1(s) = \dfrac{s^2 + s + 2}{3s^2 + 2s + 1}$ (ii) $N_2(s) = \dfrac{4}{s^3 + 2s}$

[3 + 6 + 2]

7. a) Find the short circuit parameters of the network shown in Fig.-7(a)

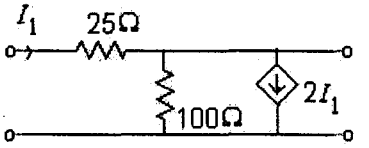


Fig. 7(a)

b) Determine the transmission parameters of the network shown in Fig. 7(b) considering two identical sections connected in cascade manner.

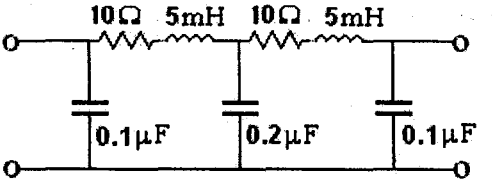


Fig. 7(b)

c) Establish the conditions of reciprocity and symmetry for the g-parameters.

[4 + 4 + 3]

8. Write the equilibrium equations of the mechanical system shown in Fig.8. Draw the electrical analogous network for the system using *T-i / f-i* analogy. [11]

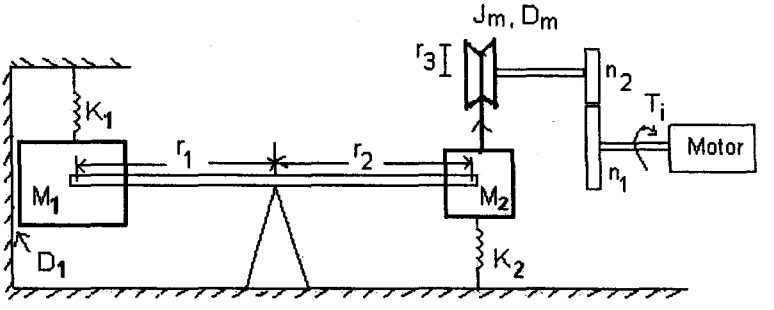


Fig. 8

9. a) Find the energy stored in two mutually coupled inductors and hence determine the maximum possible value of the mutual inductance in terms of the self inductances of the coils.

b) Find the voltage across 5Ω resistance in the magnetically coupled network shown in Fig. 9(b).

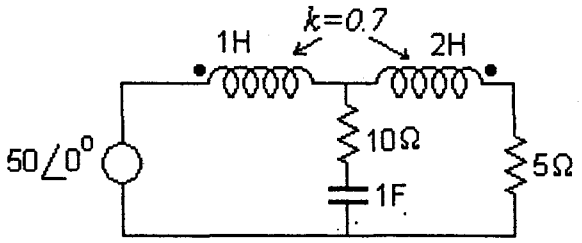
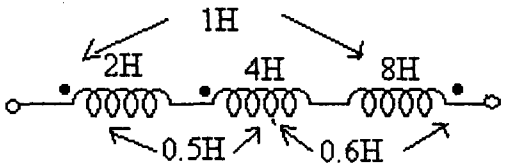


Fig. 9(b)

c) Calculate the equivalent inductance of three mutually coupled inductors connected in series as shown in Fig. 9(c).



[4 + 4 + 3]

Fig. 9(c)

10. Write short notes on <u>(any two)</u> [5½ x 2]

i) Electrical analogous network of two tank liquid level system.

ii) T-parameters in terms of h-parameters

iii) Necessary conditions of a Transfer Function

iv) Effect of poles and zeros on time domain response