

Total number of printed pages – 8

B. Tech
CPES 5201

Third Semester Examination – 2008

NETWORK THEORY

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory
and any five from the rest.*

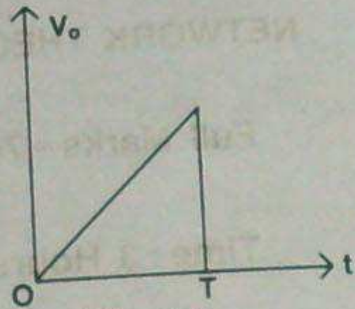
*The figures in the right-hand margin
indicate marks.*

Answer the following questions : 2×10

- (i) Two coils in differential connection have self inductance of 2 mH and 4 mH and a mutual inductance of 0.15 mH. What is the equivalent inductance ?

P.T.O.

- (ii) Under what condition the power in a series RLC circuit will be half of that at resonance ?
- (iii) What are the Laplace transform of the following voltage waveform shown in Fig.1 ?



(Fig. 1)

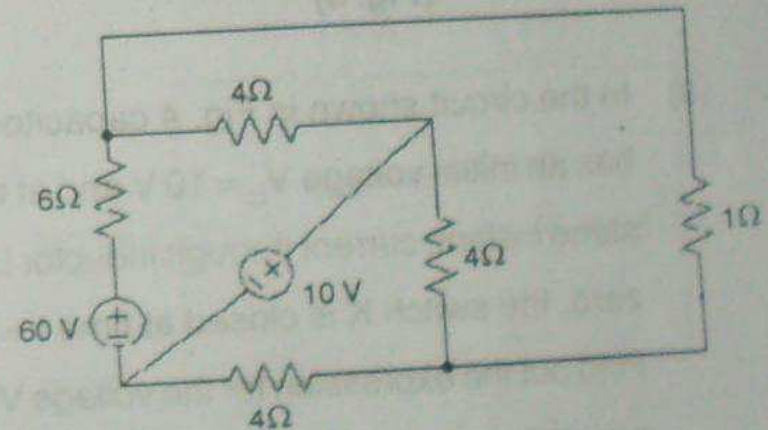
- (iv) Check whether the following function is positive real.

$$F(s) = \frac{s^2 - s - 8}{s^2 + 2s - 2}$$
- (v) Compare a first order low-pass filter to a second order low-pass filter in terms of (i) Voltage gain, (ii) cut-off frequency etc.
- (vi) Why Z-parameters are known as open circuit parameters ?
- (vii) A two-port device is defined by the following pair of equations $i_1 = 2V_1 + V_2$ and $i_2 = V_1 + V_2$. Write its impedance parameters $Z_{11}, Z_{12}, Z_{21}, Z_{22}$.

- (viii) For a π network having series impedances as Z_1 and shunt impedance is $2Z_2$, what is the image impedance ?
- (ix) Can you design a filter (low and high pass) for cut-off frequency 50 Hz. If you can, what is the value of parameters ?
- (x) Synthesize

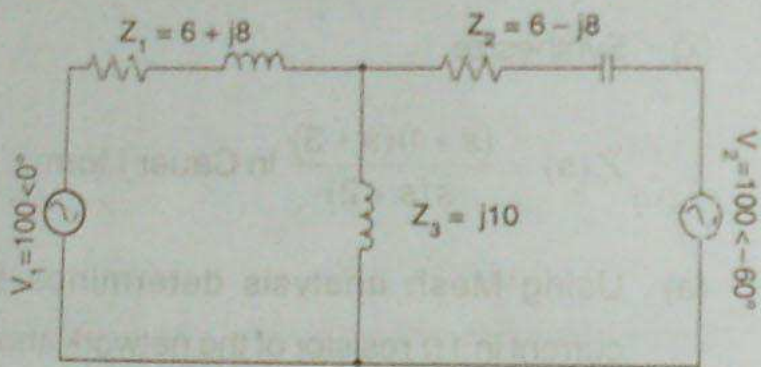
$$Z(s) = \frac{(s+1)(s+3)}{s(s+2)} \text{ in Cauer I form.}$$

2. (a) Using Mesh analysis determines the current in 1Ω resistor of the network shown in Fig. 2. 5



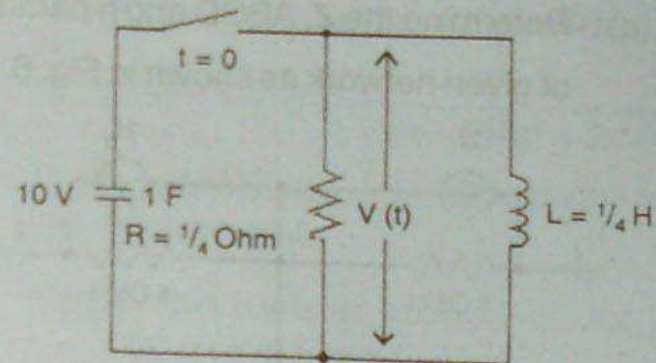
(Fig. 2)

(b) In the network system shown in Fig. 3 find the current through Z_3 using Nodal Method, the values of voltages are given in volts and the impedances are in Ohms. 5



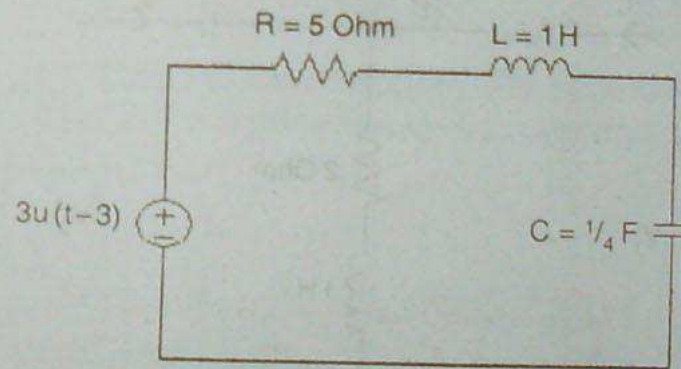
(Fig. 3)

3. (a) In the circuit shown in Fig. 4 capacitor C has an initial voltage $V_C = 10$ V and at the same instant, current through inductor L is zero, the switch K is closed at time $t = 0$. Find out the expression for the voltage $V(t)$ across in inductor L. 5



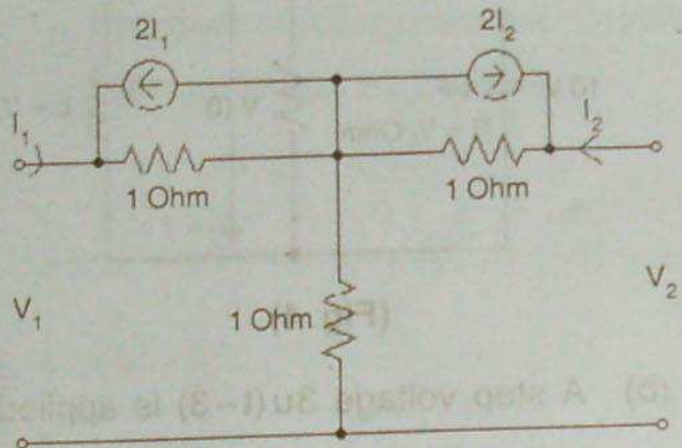
(Fig. 4)

(b) A step voltage $3u(t-3)$ is applied to a series RLC circuit comprising resistor $R = 5\Omega$, inductor $L = 1$ H and capacitor $C = \frac{1}{4}$ F, find expression for current $i(t)$ in the circuit. 5



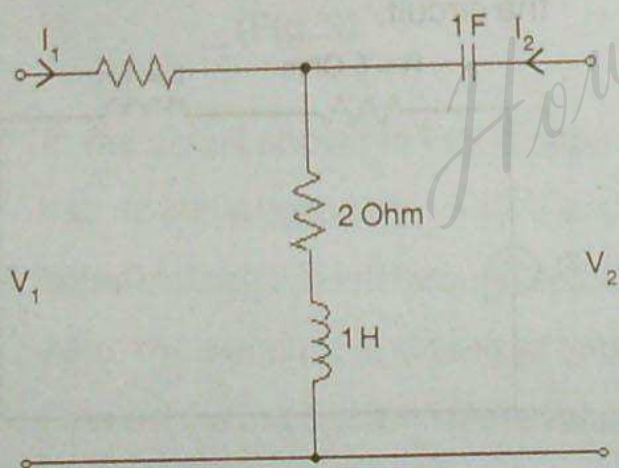
(Fig. 5)

4. (a) Determine the Z, ABCD and h parameters of given network as shown in Fig. 6. 6



(Fig. 6)

- (b) Determine the Y-parameters of the given network shown in Fig. 7. 4



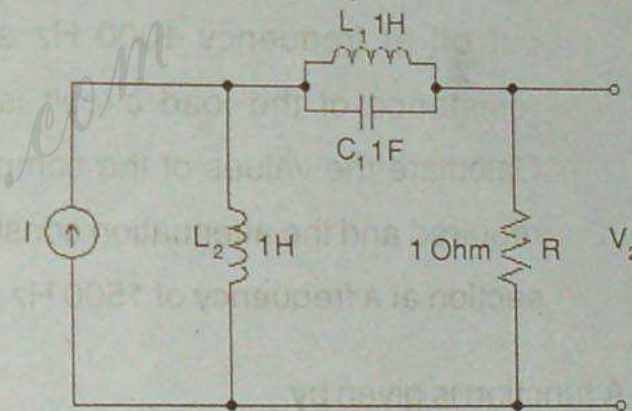
(Fig. 7)

5. (a) The transform current $I(s)$ in a given network

$$I(s) = \frac{s}{(s+2)(s^2+2s+2)}$$

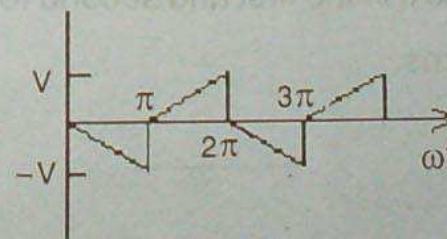
is given by obtain the pole zero plot and hence the time domain response. 5

- (b) Obtain the transfer impedance for the circuit shown in Fig. 8. 5



(Fig. 8)

6. Find (a) the trigonometric and (b) exponential form of Fourier series for the waveform shown in Fig. 9. 10



(Fig. 9)

7. (a) A constant K high pass filter is required for a cut-off frequency of 1500 Hz. The resistance of the load circuit is 600 Ω . Determine the values of the components required. 4

(b) A constant K low pas filter is designed to cut off at frequency 1000 Hz and the resistance of the load circuit is 50 Ω . Calculate the values of the components required and the attenuation constant per section at a frequency of 1500 Hz. 6

8. A function is given by

$$Z(s) = \frac{(s^2 + 1)(s^2 + 16)}{s(s^2 + 4)}$$

Realise it in the first and second form of Foster LC forms. 10