

Total number of printed pages – 7

B. Tech
CPES 5201

Fourth Semester Examination – 2008

NETWORK THEORY

Full Marks – 70

Time : 3 Hours

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

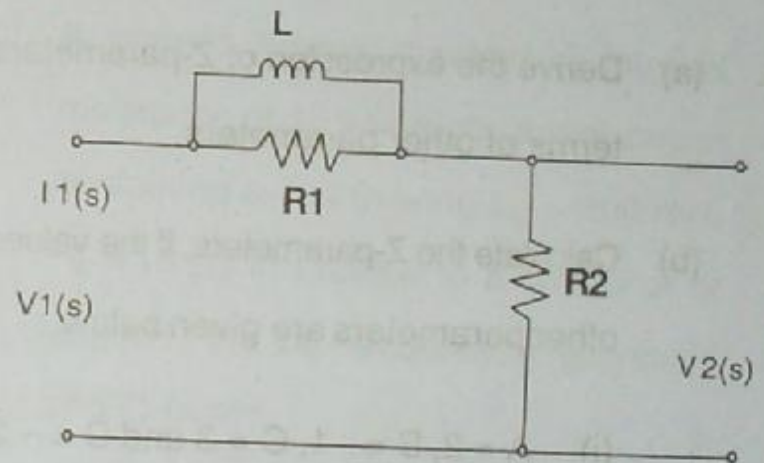
*The figures in the right-hand margin
indicate marks.*

1. Answer the following questions : 2×10
- (i) Give at least three properties of parallel resonance circuit.
 - (ii) What are half power frequency points ? Explain.

P.T.O.

- (iii) What is the difference between an ideal filter and a practical filter ?
- (iv) Give the properties of a filter.
- (v) What are even and odd functions ? Give examples.
- (vi) What is the nature of the impulse response of an RL circuit ?
- (vii) For the band pass filter what is the normal characteristic impedance ?
- (viii) What is the value of ramp function at $t=0$?
- (ix) What is the reciprocal of a driving point function ?
- (x) State final value theorem.

- 2. (a) Define the following network functions with reference to a 2-port network : 4
 - (i) driving point impedance
 - (ii) transfer impedance.
- (b) For the given network, find the transfer functions $G_{21}(s)$, $Z_{21}(s)$ and driving point impedance $Z_{11}(s)$. 6



- 3. (a) What do you understand by : 4
 - (i) zeros of a function, and
 - (ii) zeros of transmission.

- (b) What information do poles and zeros provide in respect of a network to which they relate? Draw pole and zeros for :

$$\frac{s^2 + 3s + 2}{s^2 + 7s + 12}$$

And evaluate $v(t)$ either analytically or by making use of pole-zero diagram.

4. (a) Derive the expression of Z-parameters in terms of other parameters. 5
- (b) Calculate the Z-parameters, if the values of other parameters are given below : 5
- (i) $A = 2, B = -1, C = 3$ and $D = -2$
- (ii) $h_{11} = 1, h_{12} = -2, h_{21} = -3, h_{22} = 2$
- (iii) $Y_{11} = 1/3, Y_{12} = 2/3, Y_{21} = -1/3, Y_{22} = 1/6$

5. (a) Draw and discuss the profile of circuit parameters with frequency in a parallel resonant circuit. 3

- (b) Derive the relationship between Bandwidth, Detuning Factor, Quality factor, Impedance and selectivity of a parallel resonant circuit. 3

- (c) A current source, having an internal resistance of $10 \text{ K}\Omega$ feeds a tank circuit containing a coil (having $L_C = 200 \text{ mH}$, $R_C = 10 \Omega$) in parallel to a capacitor of $100 \mu\text{F}$. Find the frequency of resonance and Q factor. 4

6. (a) Discuss the basic concept of working of low pass and high pass filters using reactive elements. 3

(b) Analyze a prototype High Pass Filter. 3

(c) Design the T and π section of a prototype High Pass Filter having cut-off frequency of 20 kHz and design impedance of 450 Ω s. Also find its characteristics impedance and phase constant at 25 kHz as well as determine the attenuation at 4 kHz. 4

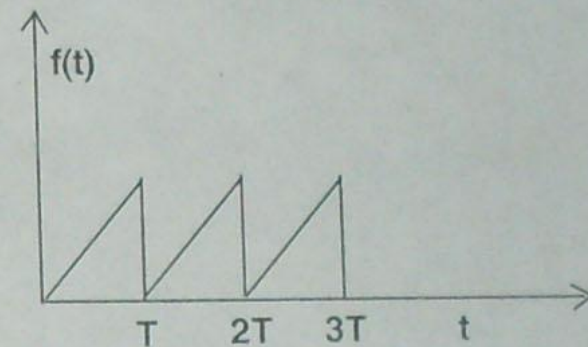
7. (a) Represents the given impedance function using Cauer-I form. 5

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

(b) Synthesize the Foster-II form of given admittance function 5

$$Y(s) = \frac{(s^2 + 1)(s^2 + 5)}{s(s^2 + 3)}$$

8. (a) Determine the effective value of $f(t)$ of the waveform shown in the figure below. 5



(b) Obtain the Fourier coefficients for the function given by 5

$$f(t) = (t + \pi) \text{ when } -\pi < t < \pi; f(x+2\pi) = f(x)$$