

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0325

Roll No.

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B. Tech.

(Sem. III) Theory Examination, 2011-12

FUNDAMENTALS OF NETWORK ANALYSIS

AND SYNTHESIS

Time : 3 Hours

Total Marks : 100

Note : Attempt questions from all Sections. Assume missing data, if any.

Section-A

1. Answer *all* parts in brief explanation : $2 \times 10 = 20$
 - (a) Write the mathematical expression of unit impulse signal used in network analysis.
 - (b) Draw characteristic curve of ramp signal used in analysis.
 - (c) Explain an exponential function.
 - (d) What is the derivative of parabolic function?

- (e) Write mathematical expression of final value theorem.
- (f) Explain the concept of initial condition and final condition in network analysis.
- (g) Enlist two advantages of cascading of the network.
- (h) What is a positive real function?
- (i) What do you mean by cut-off frequency of active filter?
- (j) Define 'transfer function' of a network.

Section-B

2. Answer any *three* parts of the following : $10 \times 3 = 30$

- (a) Synthesize the waveform as shown in Fig. 1.

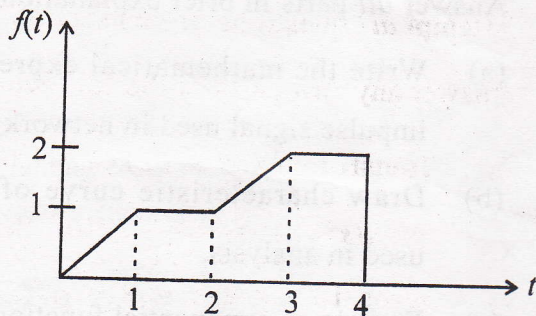


Fig. 1

- (b) Find the current $i(t)$ in a series RLC circuit comprising $R = 3\Omega$, $L = 1\text{H}$ and $C = 0.5\text{F}$ when ramp voltage of 10 volts is applied.
- (c) State and prove the maximum power transfer theorem in a.c. circuit.
- (d) Enlist the properties of transfer impedance function of a network.
- (e) Design a constant k low-pass T-section and π -section filters having cut-off frequency $= 3000\text{ Hz}$ and nominal characteristic impedance $= 600\Omega$.

Section-C

Attempt *all* questions of this section. $10 \times 5 = 50$

3. Answer any *two* parts of the following :

- (a) Transform current $I(s)$ of a network is given by $I(s) = \frac{5s}{(s+1)(s+2)}$. Plot the poles and zeros in s -plane and hence obtain time-domain response of it.

- (b) Determine the driving point impedance function of the network shown in Fig. 2. Also plot the poles and zeros of $Z(s)$ in s -plane.

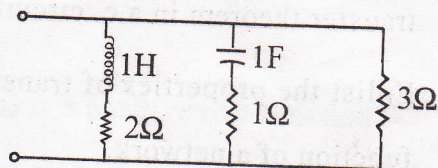


Fig. 2

- (c) Define initial and final values theorem. Also find initial and final values of the function :

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

4. Answer *both* parts of the following :
- (a) Explain the concept of reciprocity and symmetry. Derive the above conditions for g and $ABCD$ parameters.
- (b) Find the h -parameters of the network shown in Fig. 3.

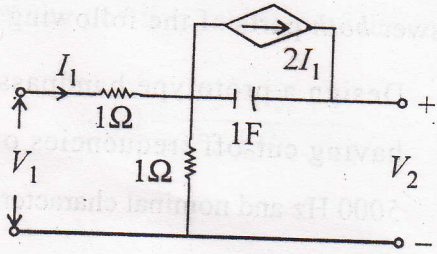


Fig. 3

5. Answer any *two* parts of the following :

(a) An impedance function is given by :

$$Z(s) = \frac{(s+1)(s+4)}{s(s+2)(s+5)}$$

Find the RC representation of Foster-II and Cauer-II forms.

(b) Determine Foster-I and Cauer-II forms after synthesizing RL driving point impedance

$$\text{function } Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+4)}$$

(c) Define positive realness of the function with its properties. Also write the properties of RL, RC and LC driving point functions.

6. Answer *both* parts of the following :
- (a) Design a prototype bandpass filter section having cut-off frequencies of 2000 Hz and 5000 Hz and nominal characteristic impedance of 600Ω .
 - (b) Explain nominal characteristic impedance R_0 of a band-stop filter or band-reject filter. Derive design parameters R_1 , R_2 , C_1 and C_2 of a band-reject filter in terms of corner frequencies.

7. Answer any *two* parts of the following :
- (a) Define image parameters and find image parameters in terms of short-circuit and open-circuit parameters.
 - (b) Prove that in a parallel-parallel interconnected two-networks with admittance matrix $[Y_A]$ and $[Y_B]$ respectively. The overall Y -matrix is given by :

$$[Y] = [Y_A] + [Y_B].$$

(c) Test the positive realness of the function :

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

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