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

PAPER ID : 0325 **Roll No.** | | | | | | | | | | |

B. Tech.

(SEM. III) ODD SEMESTER THEORY

EXAMINATION 2013-14

FUNDAMENTALS OF NETWORK ANALYSIS AND SYNTHESIS

Time : 3 Hours *Total Marks : 100*

Note : Attempt all questions.

1. Attempt any **four** parts : **(5×4=20)**

(a) Define the signal, also explain different types of standard signals with proper figure.

(b) Consider a system S with input x[n] and output y[n] related by :

$$y[n] = x[n]\ \{g[n] + g(n-1)\},$$

(i) If g[n] = 1, for all n, show that S is time invariant.

(ii) If g[n] = n, show that S is not time invariant.

(c) For the network shown, write the mess equation in terms of (i) Differential equation and (ii) the complex frequency variables.

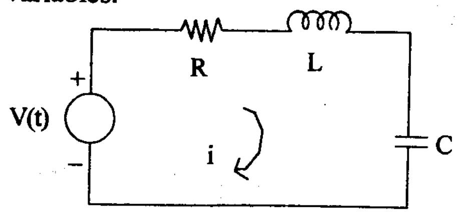

Fig. 1

(d) If the system function of a network is given as :

$$H(s) = \frac{1}{(s+2)(s+3)},$$ find the response R(s), if the excitation is unit step signal.

(e) Prove that (i) $\dot{\delta}(x) = -\dot{\delta}(-x)$, (ii) $-\delta(x) = x\dot{\delta}(x)$, where $\delta(x)$ is impulse function.

2. Attempt any **four** parts : **(5×4=20)**

(a) The port currents of a two port network are given by :

$I_1 = 2.5V_1 - V_2$

$I_2 = -V_1 + 5V_2$.

Find equivalent π network.

(b) Derive the condition of reciprocity for ABCD-parameters.

(c) The transform of current is $I(s) = \frac{2s}{(s+1)(s+2)}$. Sketch its pole-zero plot and obtain time domain response i(t). Also write a short note on significance of the network transfer function.

(d) Using Thevenin's theorem, find the current through load impedance Z_L shown in the Fig. 2.

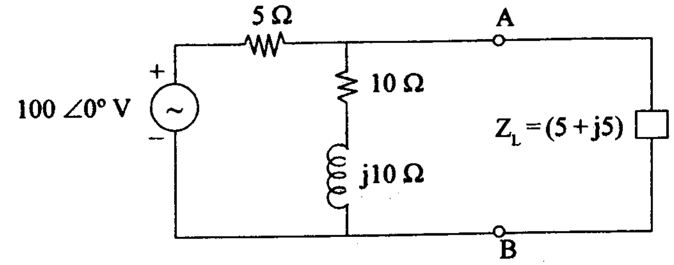

Fig. 2

(e) Using the initial and final value theorems find f(0+) and f(∞) for the following :

(i) $F(s) = \frac{(s+1)(s+2)}{(s+3)(s+4)}$

(ii) $F(s) = \frac{s^2 + 2s + 3}{s(s+1)(s+4)}$.

3. Attempt any **four** parts : **(5×4=20)**

(a) Discuss why the following functions are not positive real function :

(i) $\frac{s^2 + 2s + 1}{s^2}$

(ii) $\frac{(s^2+1)(s^2+2)}{s(s^2+3)}$.

(b) Given the admittance function :

$$Y(s) = \frac{H_0(s^2 + b_1 s + b_0)}{s^2 + a_1 s + a_0}.$$

(c) Test whether following polynomial are Hurwitz or not :

(i) $Q(s) = S^3 + 4S^2 + 5S + 20$

(ii) $Q(s) = S^5 + 8S^4 + 24S^3 + 28S^2 + 23S + 6.$

(d) Determine Foster I form of following driving point impedance function :

$$Z(s) = \frac{(s^2 + 1)(s^2 + 9)}{s(s^2 + 4)}.$$

(e) Write the properties of LC driving point Immitance function.

4. Attempt any **two** parts : **(10×2=20)**

(a) Discuss the properties of transfer functions, also find the residue condition for the following circuit :

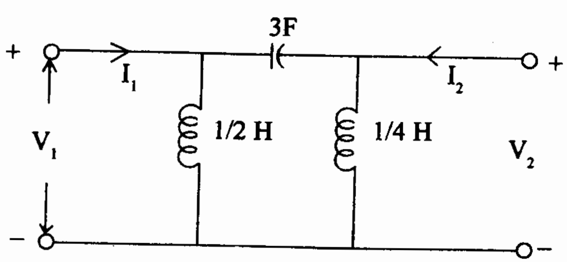

Fig. 3

(b) Synthesize N_a with termination resistors $R_2 = 4$ ohm, $R_1 = 1$ ohm to give $\frac{V_2}{V_1} = \frac{12s^2}{15s^2 + 7s + 2}.$

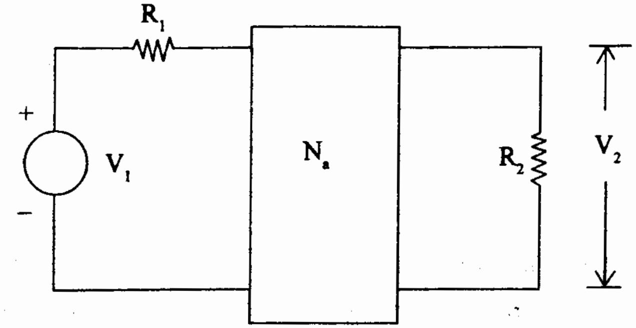

Fig. 4

(c) For the network shown in Fig. 5, 6 below, find the voltage ratio transfer functions V_2/V_1.

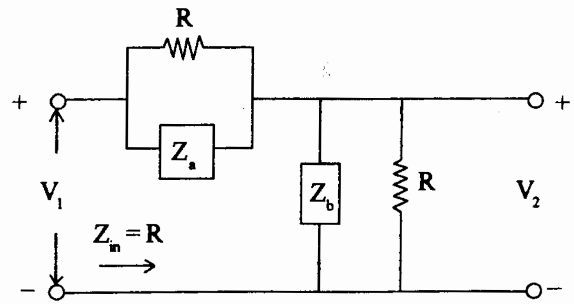

Fig. 5

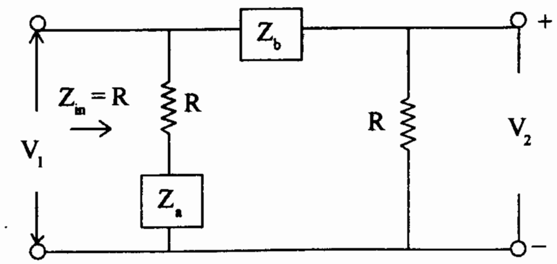

Fig. 6

5. Attempt any **two** parts : **(10×2=20)**

(a) For the circuit shown below compute the output V_o. Also determine the input resistance R_i as seen by the source.

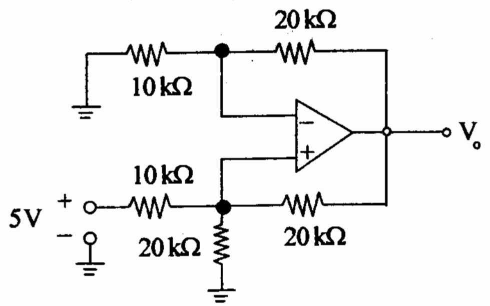

Fig. 7

(b) Compute the gain V_o/V_i for the Op-Amp circuit given below. Also find the input resistance R_i.

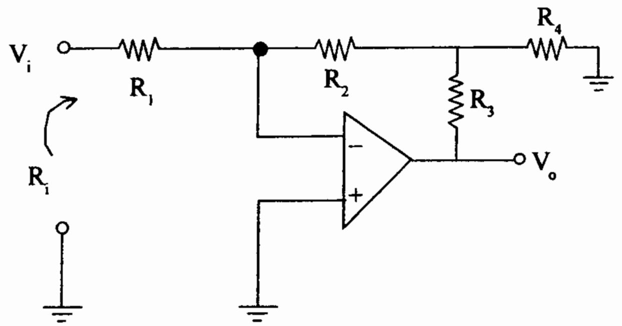

Fig. 8

(c) Design the low pass and high pass active filters using Op-Amp.