Printed Pages : 4

EEC304

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

PAPER ID : 0325

Roll No. 1 1 0 9 1 2 0 0 5 2

B. Tech.

(SEMESTER-III) THEORY EXAMINATION, 2012-13

FUNDAMENTALS OF NETWORK ANALYSIS AND SYNTHESIS

Time : 3 Hours]

[Total Marks : 100

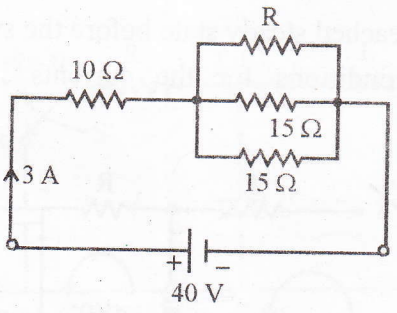
1. Attempt **all** parts. $10 \times 2 = 20$

(a) Draw the line spectra for the signal $S(t) = 3 \sin\left(t + \frac{\pi}{4}\right)$.

(b) Define frequency transformation and frequency normalization.

(c) Draw the even and odd signal functions for the unit-step function.

(d) In the below figure, calculate the value of R.



(e) Two capacitors of 1 μF and 2 μF and connected in parallel across a 25 V dc battery. After the capacitors have been charged, calculate the charge across the two capacitors.

(f) The current wave shape shown in figure (a) is applied to a circuit element. The voltage across the element is shown in figure (b). Find the type of element used.

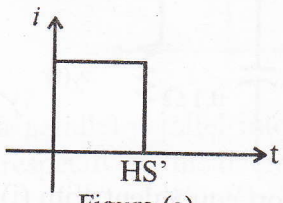


Figure (a)

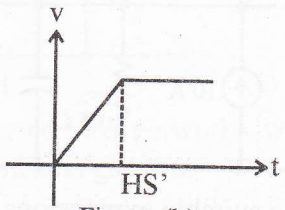
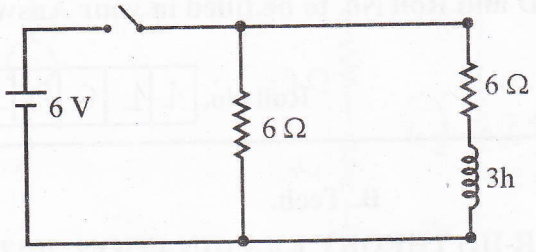
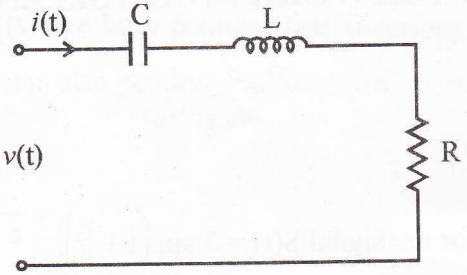


Figure (b)

(g) In figure below, the switch is closed at t = 0. At t = 0^+, calculate the value of current supplied by battery.



(h) For the figure below, calculate the ratio V(s) / I(s).

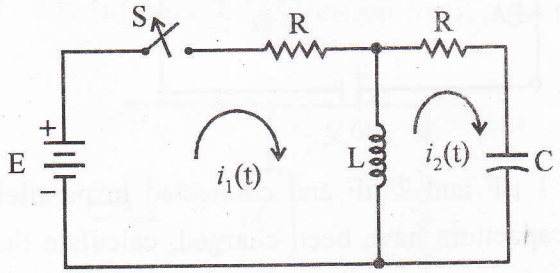


(i) List the three properties to recognize an R-C impedance in synthesis.

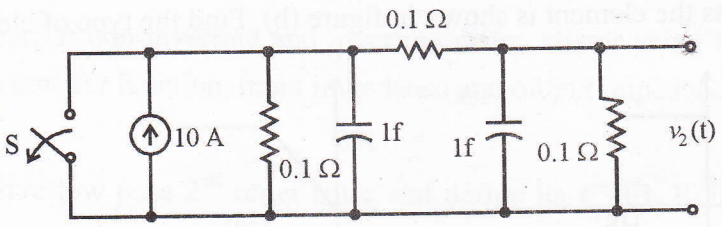
(j) Enlist the two important properties of positive real functions.

2. Attempt any **three** parts : **3 × 10 = 30**

(a) The network shown has reached steady state before the switch S is opened at t = 0. Determine the initial conditions for the currents $i_1(t)$ and $i_2(t)$ and their derivatives.



(b) For the circuit shown, the switch S is opened at t = 0. Use Thevenin's or Norton's theorem to determine the output voltage $v_2(t)$. Assume zero initial energy.



(c) Explain with the suitable expressions, two-port equivalent with (i) one controlled-voltage source and (ii) one controlled-current source.

(d) Given $F(s) = \frac{4(S+1)(S+3)}{(S+2)(S+6)}$, obtain a partial fraction expansion, with all positive residues and hence realize the network in foster form when

(i) F(s) is an impedance z(s).

(ii) F(s) is an admittance y(s).

(e) (i) Enlist the main properties of a ACTIVE FILTERS.

(ii) Draw the attenuation characteristics of LPF, BPF, HPF and BRF.

Answer **all** the questions : **5 × 10 = 50**

3. (a) The unit-step response of a linear system is

$x(t) = (2e^{-2t} - 1)\, u(t)$

(i) Find the response r(t) to the input f(t).

(ii) Sketch the response. Show all pertinent dimensions.

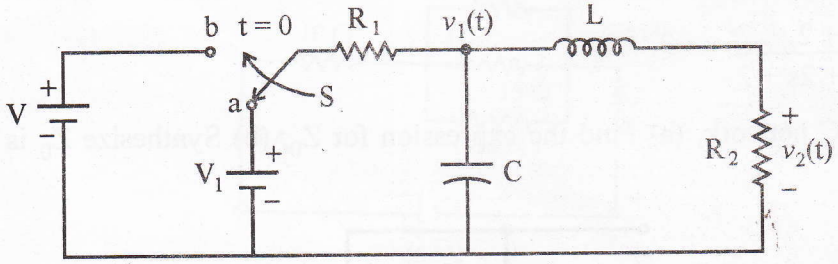
(b) For the following driving point functions find their simplest network realizations.

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

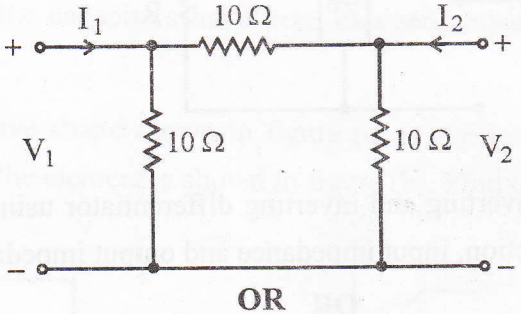
(ii) $y(s) = 2s + \frac{3s}{s+2}$

OR

The network shown has reached steady-state before the switch moves from a to b. Determine the initial conditions for the voltages $V_1(t)$ and $V_2(t)$ and their first derivatives.



4. For the two-port network shown in figure below, determine the admittance matrix.

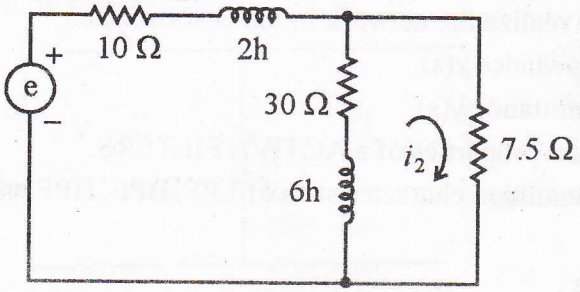


OR

Prove that in a parallel-parallel interconnected two networks with admittance matrix $[Y_A]$ and $[Y_B]$ respectively, the overall y-matrix is given as

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

5. In figure below, find $i_2(t)$ suing Thevenin's theorem. The excitation is e(t) = 100 cos 20 u(t). Assume zero initial energy.



OR

Suppose $F_1(s)$ and $F_2(s)$ are both positive real functions. Discuss the conditions such that $F(s) = F_1(s) - F_2(s)$ is also positive real function.

6. Given $z(s) = \dfrac{s^2 + xs}{s^2 + 5s + 4}$

(i) What are the restrictions on X for Z(s) to be a positive real function ?

(ii) Find X for Re[Z(jw)] to have a second order zero at w = 0.

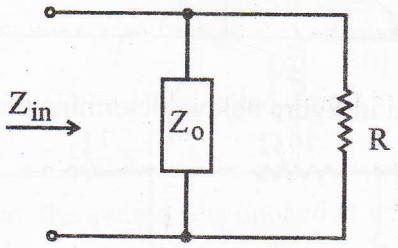
(iii) Choose a numerical value for X and synthesize Z(s).

OR

The input impedance for the network shown is

$$Z_{in} = \frac{2s^2 + 2}{s^3 + 2s^2 + 2s + 2}$$

If Z_0 is an L-C network, (a) Find the expression for Z_0, (b) Synthesize Z_0 is a Foster series form.



7. Draw the circuit of non-inverting and inverting differentiator using ideal Op-Amp and determine it's transfer function, input impedance and output impedance.

OR

Design an active low pass 2nd order filter and define its f-3dB, Roll-off-rate and also draw it's phase response.