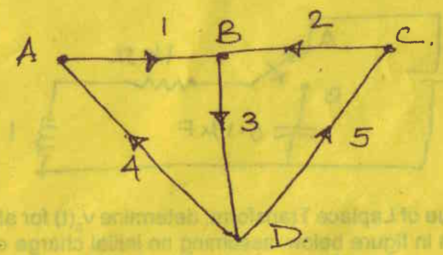
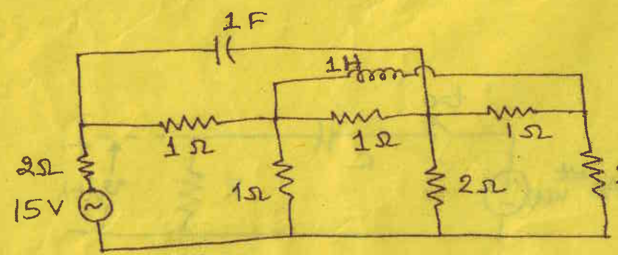
Question 4

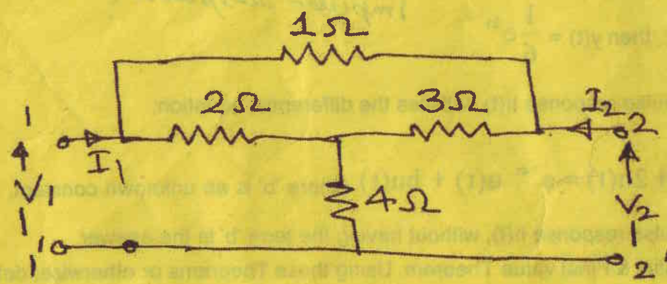
(a) Differentiate between: node & junction, mesh & loop, tree & co-tree, with the help of examples. For the graph shown in the figure below, draw an arbitrary circuit, given that A,B,C & D are nodes and 1 to 5 are branches. (3)



(b) For the given bridged - ladder circuit, draw the graph and selecting the branches having 1 Ω resistances as the twigs, write down the cut-set and tie-set matrices, (3)



(c) Find the short-circuit admittance parameters for the given bridged - T network: (4)



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FIRST – TERM EXAMINATION

Third Semester (B.Tech.) – September 2007

Time : 1 Hr. 30 Min. *Maximum Marks : 30*

Paper Code : ETEC205 **Subject : Circuits & Systems**

***Note:** Question No. 1 is compulsory. Attempts two more questions.*

Question 1 (Compulsory) (1×10)

(a) What are active sources and passive elements?

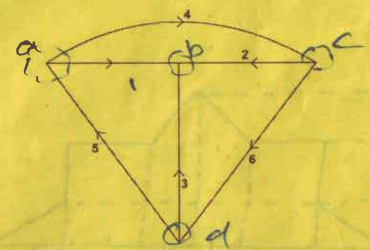
(b) Differentiate between Zero Input Response and Zero State Response.

(c) What is the origin of Time constant, τ of a circuit? Why does a Pure L-C circuit not possess any time constant?

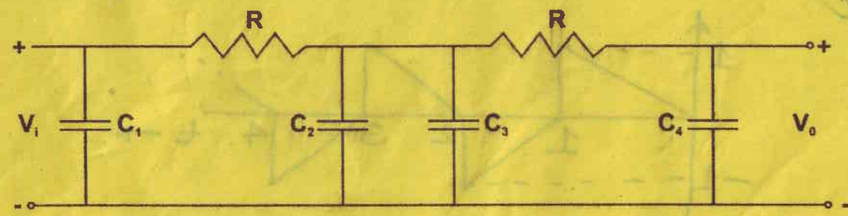
(d) Define Transfer Function of a System. Can the order of input-output relation in time-domain be ascertained by looking at the Transfer-function?

(e) Is an Unit Impulse function (i) even function or (ii) odd function? Explain briefly.

(f) For the graph shown in the given figure, draw and indicate the fundamental cut-sets:

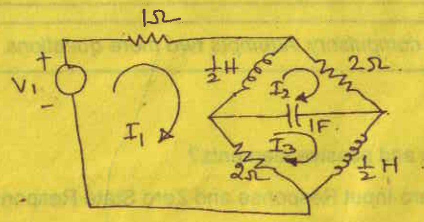


(g) For the circuit shown in the figure, the order of the differential equation relating v_0 & v_i is to be found. Without writing down the equations, find out the order and give reason for your answer.



(h) For the ladder network shown in the figure, find the z-parameters z_{11} & z_{22}.

(i) For the network shown in the figure, write down the loop-basis transform equations that describe the system when all initial conditions are zer

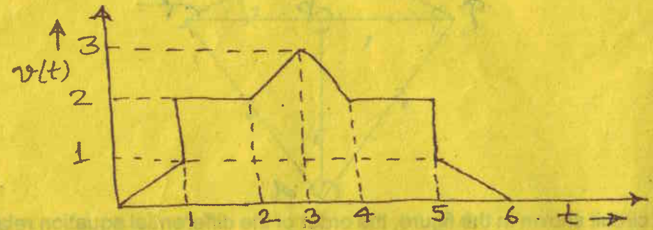


(j) Find the current i(t) by direct Laplace Transform Inversion if

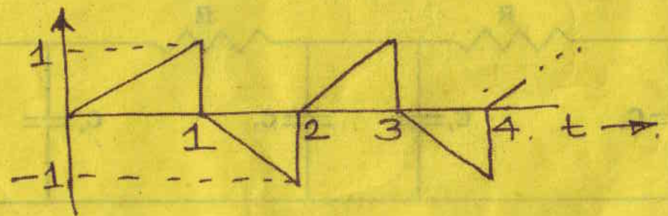
$$I(s) = \frac{1}{s^2 + 4s + 8}$$

Questions 2

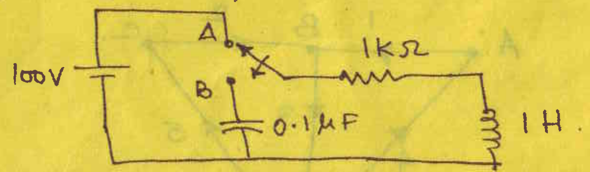
(a) Synthesize the given waveform using step and ramp signals, without using gate function: (3)



(b) Find the Laplace Transform of the periodic Waveform shown in the figure below: (3)



(c) In the given circuit shown below, switch S is changed from position A to B at t = 0. Determine the values of i, $\frac{di}{dt}$ & $\frac{d^2i}{dt^2}$ at t = 0 using classical method of transient analysis. (4)

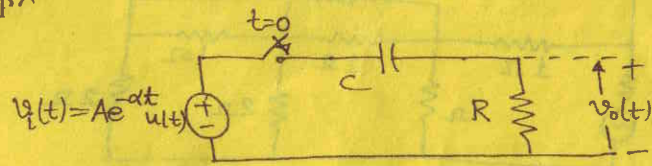


Question 3

(a) Using the technique of Laplace Transform, determine $v_0(t)$ for all $t \geq 0$ after switching ON of the circuit given in figure below, assuming no initial charge on the capacitor, for the conditions (4)

(i) $\alpha \neq \frac{1}{RC}$

(ii) $\alpha = \frac{1}{RC}$



(b) A causal LTI system with impulse response h(t) has the following properties; (4)

(i) When the input to the system is

$x(t) = e^{2t}$, then $y(t) = \frac{1}{6}e^{2t}$

(ii) The impulse response h(t) satisfies the differential equation:

$$\frac{dh(t)}{dt} + 2h(t) = e^{-4t}\,u(t) + bu(t)$$ where 'b' is an unknown constant. Determine the impulse response h(t), without having the term 'b' in the answer.

(c) State Initial & Final value Theorem. Using these Theorems or otherwise, determine the initial and final values of current i(t), given that $I(s) = \frac{5(s^2 + 2s + 1)}{s(s^2 + 7s + 6)}$ (2)

Q.4.

(a) (i) State whether the given polynomial is Hurwitz or not? [2×2.5]

$p(s) = s^5+s^4+2s^3+2s^2+s+1$

(ii) Determine whether the function

F(s) is a p.r.f. or not?

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

(b) Write short notes on any ***Two*** of the following: [2×2.5]

(i) Tellegen's Theorem.

(ii) Permissibility of Interconnection for two 2 port networks

(iii) Network functions.

***

(Please write your Roll No. immediately) Exam Roll No.: 031

SECOND – TERM EXAMINATION

Third Semester (B. Tech.) – November 2007

Time: 1Hr. 30 Min. *Maximum Marks: 30*

Paper Code: ETEC-205 **Subject:** Circuits & Systems

Note: Questions No. 1 is compulsory. Attempt any two more questions. Assume missing data, if any.

Q.No.1 **[1×10]**

(a) State the conditions for (i) Symmetrical (ii) Reciprocal two-port networks in terms of ABCD parameters and hybrid parameters.

(b) Shown that $[Y]_{2\times2} = [Z]_{2\times2}^{-1}$ for a two port network.

(c) State Millman's Theorem as applied to A.C. networks for both voltage & current sources.

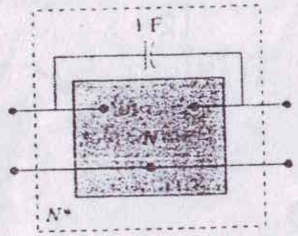
(d) Write down the limitations of Thevenin's Theorem with brief explanation.

(e) List the necessary & sufficient conditions for a function to be a positive real function.

(f) For the two port Network, N shown in figure below, the open circuit impedance parameters are

$z_{11} = 7\Omega$, $z_{12} = 2\Omega$, $z_{21} = 10\Omega$ & $z_{22} = 3\Omega$

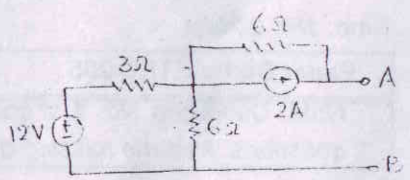
Find the short circuit admittance parameters of the new two-port network N represented by dotted box, represented by *N**



(g) For question 1(f) convert the final admittance parameters to an equivalent circuit representing hybrid parameters.

(Short circuit to hybrid parameters conversion)

(h) Draw the Norton's equivalent circuit for the circuit shown below:



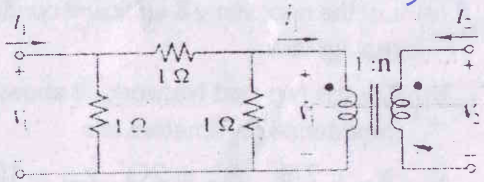
(i) A network supplies a load current of 5A when it is satisfying maximum power transfer condition in a simple Thevenin's equivalent circuit. Now, if we want the load to be twice its previous value, what should be the load resistance?

(j) Is the polynomial s^5+s^3+s a Hurwitz polynomial? Not a Hurwitz polynomial

Q.2.

(a) Show that for the given two-port network: [5]

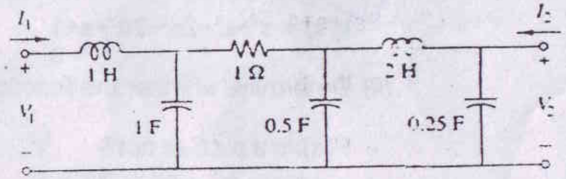
$I_2 = -1$



The Y parameters matrix is given by

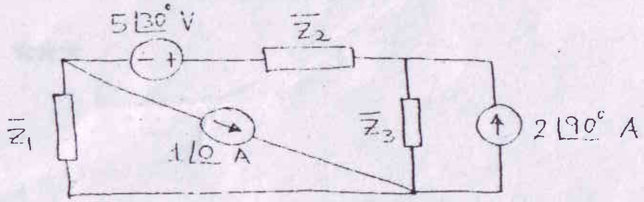
$$[Y] = \begin{bmatrix} 2 & -\frac{1}{n} \\ -\frac{1}{n} & \frac{2}{n^2} \end{bmatrix}$$

(b) Find the Inverse Transmission parameters of the circuit of the given two port network, using properties of interconnection. [5



Q.3.

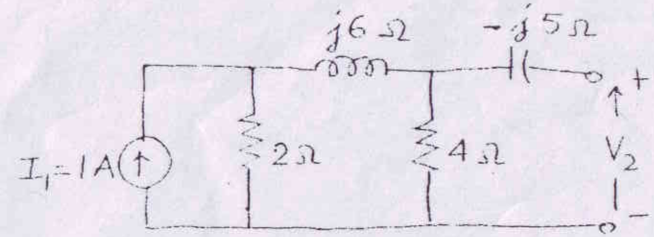
(a) For the given A.C. circuit, find the currents following through the impedances $\overline{Z}_1, \overline{Z}_2$ and $\overline{Z}_3$ using Superposition Theorem given that $\overline{Z}_1 = (3 + j4)\Omega$, $\overline{Z}_2 = (5 - j12)\Omega$ and $\overline{Z}_3 = (6 + j14.4)\Omega$. [5



(b) State Maximum Power Transfer Theorem. Derive the relation for maximum power delivered to the impedance, $Z_L = R_L + jX_L$.

[

(c) Verify Reciprocity Theorem in the network given below: [



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END-TERM EXAMINATION

THIRD SEMESTER [B.TECH.]– DECEMBER-2007

Paper Code:ETEC-205(Batch-2004-2006) Paper Code: 28205	Subject: Circuits and Systems

Time : 3 Hours | Maximum Marks : 75

Note: Attempt any five questions including Q.No.1 which is compulsory. Symbols have their usual meanings.

Q.1 Choose the best or correct alternative in the following: -

(a) The sinusoidal signal x[n] has fundamental period N = 5 samples. The smallest angular frequency for which x[n] is periodic, given by: - **(2)**

(i) $\frac{\pi}{5}$ rad/cycle (ii) $\frac{3\pi}{5}$ rad/cycle

(iii) $\frac{2\pi}{5}$ rad/cycle (iv) $\frac{\pi}{6}$ rad/cycle

(b) For the current and voltage variables that are defined in Fig.1, state which of the circuits shown are characterized by the equation v(t) = -R i(t). **(2)**

(i) circuit 1 (ii) circuit 2 (iii) circuit 3 (iv) some other answer

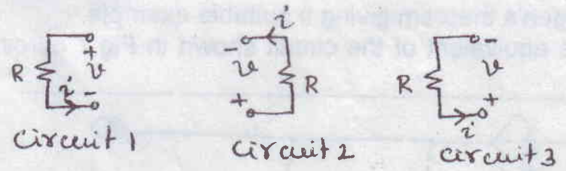


Fig - 1

(c) If a charged, linear, time-invariant capacitor is connected in parallel with an uncharged one, what is the waveform of the charging current: - **(2)**

(i) a step (ii) a ramp (iii) an impulse (iv) an exponential

(d) The Thevinin's voltage in the circuit of Fig.2 is: - **(2)**

(i) 4V (ii) 2V (iii) 2.5V (iv) 0.1V

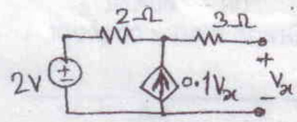


Fig - 2

(e) In order that f(t) be Laplace transferable, it is sufficient that:- **(2)**

(i) $\int_0^{\infty} |f(t)|.e^{-\sigma t}dt > \infty$ (ii) $\int_0^{\infty} |f(t)| e^{\sigma t}dt < \infty$

(iii) $\int_0^{\infty} |f(t)| e^{\sigma t}dt < \infty$ (iv) $\int_0^{\infty} |f(t)| e^{\sigma t}dt > \infty$

(f) For the circuit shown in Fig.3. **(3)**

(i) transmission parameters do not exist

(ii) h-parameters do not exist

(iii) z-parameters do not exist

(iv) none of the above

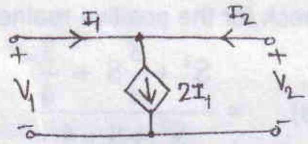


Fig - 3

(g) The input immitance of an LC network must have: - **(2)**

(i) a zero at infinity

(ii) a pole at infinity

(iii) neither a pole nor a zero at infinity

(iv) either a pole or a zero at infinity

Q.2 (a) Show that any arbitrary sequence can be represented as a linear combination of shifted unit impulses. **(7)**

(b) For the circuit shown in Fig.4, the switch 'SW is opened at t = 0, find $v_c(t)$ for t ≥ 0. **(8)**

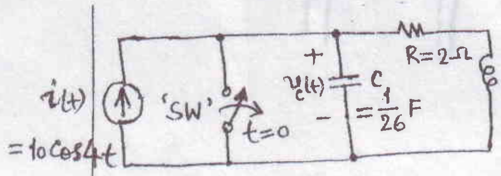


Fig - 4

Q.3 (a) Write the equation of the waveform shown in Fig.5, in terms of steps, ramp and other related functions. (7)

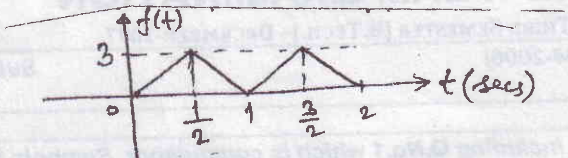


Fig - 5

(b) Show that for the circuit of Fig.6 (for $\beta = 1$). (8)

$$h_{21} = \frac{R_A}{R_B} \qquad h_{22} = 0$$

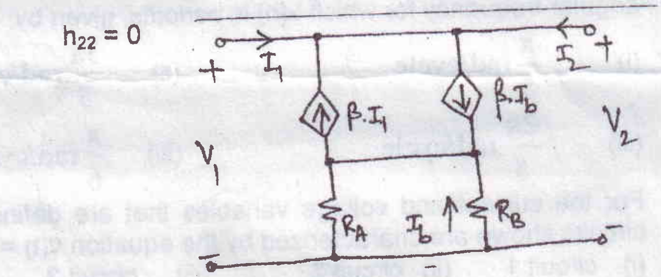


Fig - 6

Q.4 (a) State and explain Tellegen's theorem giving a suitable example. (7)

(b) Determine the Norton's equivalent of the circuit shown in Fig.7 across the terminals (a) – (b). (8)

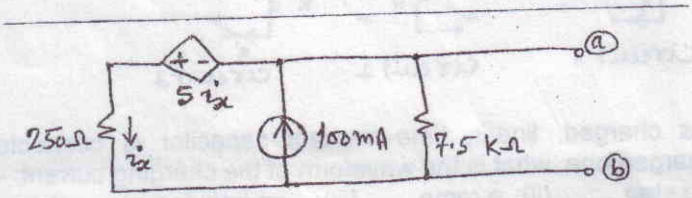


Fig - 7

Q.5 (a) Explain the following: - (3+2+2)

(i) Isomorphic graphs (ii) cutest

(b) In the circuit of Fig.8, find i_x using Graph theory concept. (8)

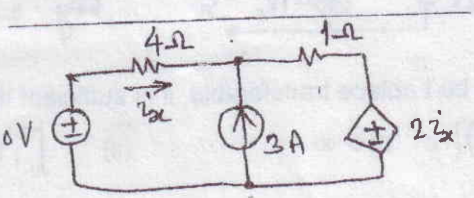
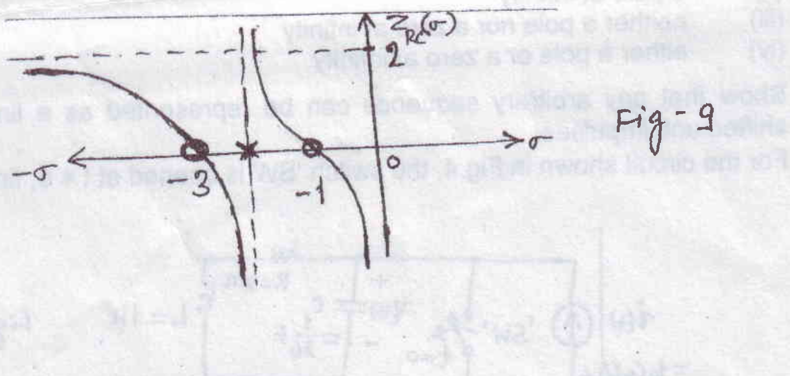


Fig - 8

Q.6 (a) Check for the positive realness of the following function: - (7)

$$F(s) = \frac{S^2 + \frac{3}{4}S + \frac{3}{4}}{S^2 + S + 4}$$

(b) The impedance of an RC network is sketched for real values of S as shown in fig.9. What is $Z_{RC}(S)$? Synthesize $Z_{RC}(s)$ in Foster's second form. (8)



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