KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCE 321: NETWORK ANALYSIS AND SYNTHESIS

DATE: **Wednesday 18th April 2012** **TIME:** **11.00a.m -1.00p.m**

INSTRUCTIONS:

(i) There are **Five** questions.

(ii) Question No.1 is **Compulsory** and carries **30 Marks.**

(iii) Select any **other Two** questions, each of which carries 20 Marks.

(iv) Define all symbols used.

(v) Marks will be awarded for procedure, methodologies used and not necessarily on the final answer.

Q1. (a) (i) Determine whether the following two rational functions are positve real:-

1. $Y(s) = \frac{s^2 + s + 2}{s^3 - s + 2}$ (4 MARKS)

2. $Z(s) = \frac{(s-1)(s+2)}{(s+3)+(s+4)}$ (4 MARKS)

(ii) Obtain the Laplace Transform for $y(t) = \frac{1}{2}(e^{-t} - e^{-3t})$. (2MARKS)

(b) (i) Consider the graph shown in Fig.Q1 and draw its two (2) Trees. (4 MARKS)

(ii) Draw the shematic diagram of a symetrical Lattice Network and derive its Impedance Matrix. (6 MARKS)

(c) (i) What is a Filter Network? (4 MARKS)

(ii) Explain with the help of a filter characteristics of thefollowing term:-

1. Pass Band. (2 MARKS)
2. Attenuation Band. (2 MARKS)
3. Cut Off frequency. (2 MARKS)

Q2. (a) (i) Distinguish between a Tie Set and a Cut Set. (2 MARKS)

(ii) Branch *n* of a given Network is depicted in Fig. Q2.(a). Derive its equilibrium equation(s). (2 MARKS)

b) Find all trees of the the Directed Four Node Graph depicted in Fig.Q2(b). (16 MARKS)

Q3 (a) (i) Define the open cuircuit impendance and the short circuit parameters of a four terminal network. (4 MARKS)

(ii) Two four terminal networks are connected in series.

1. Draw the schematic diagram of the combined network. (2 MARKS)
2. Find its Z-parameters. (4 MARKS)

(b) Derive the Z-parameters of the Ladder Network given in Fig. Q3. (10 MARKS)

Q4 (a) (i) Demonstrate through understandig positive realness. (3 MARKS)

(ii) Using relevant expansion of the driving point impedance, demonstrate the Cauer Form of network synthesis. (7 MARKS)

(b) Obtain the second Cauer relisation of the driving point impeance of the following function:-

$$Z(s) = \frac{s^4 + 4s^2 + 3}{s^5 + 2s^3 + s}$$ (10 MARKS)

Q5. (a) (i) What is a Constant *K* Ladder Filter. (4 MARKS)

(ii) Give the draw backs of the constant K ladder section. (5 MARKS)

(b) (i) Outline the steps of modern filter design and state why Approximation is neccessary in the process. (5 MARKS)

(ii) Discuss the *Butterworth Approximation.* (6 MARKS)

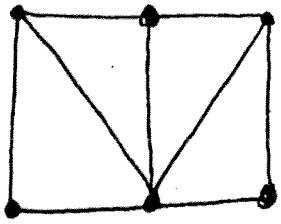

fig Q1.

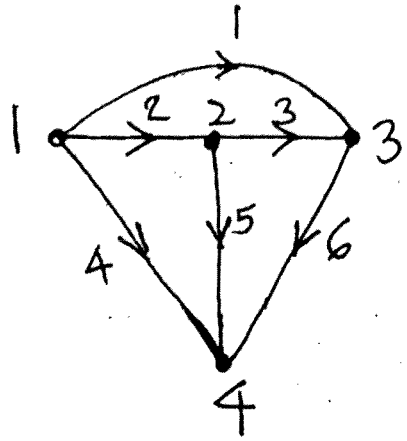

fig Q2b.

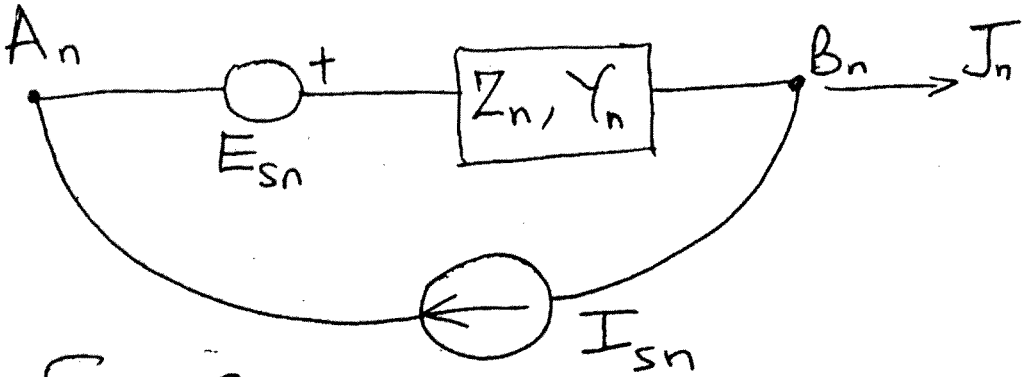

fig Q2a

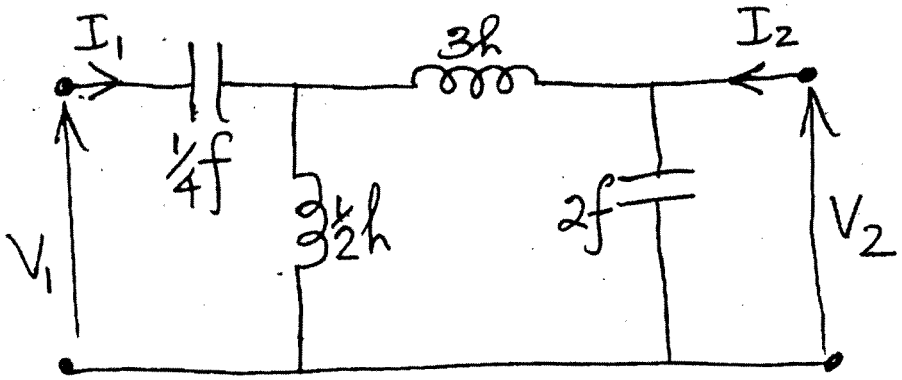

fig Q3

f(t), t≥0	F(ω)
1. $U_{-1}(t)$ *or* 1	$\frac{1}{s}$
2. $U_{-1}(t-a)$	$\frac{e^{-as}}{s}$
3. $t^n, n \geq 0$	$\frac{n!}{s^{n+1}}$
4. e^{-at}	$\frac{1}{s+a}$
5. te^{-at}	$\frac{1}{(s+a)^2}$
6. $\frac{t^{n-1}}{(n-1)!}e^{-at}$	$\frac{1}{(s+a)^n}$
7. $\frac{1}{(b-a)}(e^{-at}-e^{-bt})$	$\frac{1}{(s+a)(s+b)}$
8. $\frac{1}{(a-b)}(ae^{-at}-be^{-bt})$	$\frac{s}{(s+a)(s+b)}$
9. Sinωt	$\frac{\omega}{s^2+\omega^2}$
10. Cosωt	$\frac{s}{s^2+\omega^2}$
11. e^{-at} Sinωt	$\frac{\omega}{(s+a)^2+\omega^2}$
12. e^{-at} Cosωt	$\frac{s+a}{(s+a)^2+\omega^2}$
13. Sinh *at*	$\frac{a}{s^2-a^2}$
14. Cosh *at*	$\frac{s}{s^2-a^2}$
15. *t*Sin*at*	$\frac{2as}{(s^2+a^2)^2}$
16. *t*Cos*at*	$\frac{s^2-a^2}{(s^2+a^2)^2}$