ROLL NO. _____

Code: AE59 **Subject: CIRCUIT THEORY & DESIGN**

AMIETE – ET (NEW SCHEME)

Time: 3 Hours **JUNE 2012** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. The number of branches in a tree is equal to number of

(A) Nodes **(B)** Loops
(C) (Nodes-1) **(D)** (Loops+1)

b. The equivalent form of an inductive element having initial current of I_o in terms of its final condition of the element is

(A) Current source **(B)** Current source in parallel with short path
(C) Voltage source **(D)** Voltage source in series with open circuit

c. When $\xi = 1$, the roots are

(A) real and repeated **(B)** real and distinct
(C) imaginary **(D)** complex conjugates

d. Laplace transform of te^{-at} is

(A) $\frac{1}{s^2}$ **(B)** $\frac{1}{s+a}$

(C) $\frac{1}{(s-a)^2}$ **(D)** $\frac{1}{(s+a)^2}$

e. Final value of current for the network described by the equation

$$I(s) = \frac{s^3 + 7s^2 + 5}{s(s^3 + 3s^2 + 4s + 2)}$$ is

(A) 2.5 A **(B)** 5 A
(C) 2 A **(D)** 1 A

f. The response of the network remains bounded if all poles are on the

(A) right half of the S-plane **(B)** left half of the S-plane
(C) repeated poles on the $j\omega$ axis **(D)** none of the above

g. The delay at $\omega=2$ for $F(s)=\frac{1}{s+2}$

(A) $\frac{2}{5}$ **(B)** 2

(C) $\frac{1}{2}$ **(D)** $\frac{1}{4}$

h. Time constant is defined as the time taken by the waveform to reach

(A) 50% of its peak value **(B)** 10% to 90% of its peak value
(C) 100% for the first time **(D)** 37% of its peak value

i. Frequency transformation is the technique used to transform low pass filter into

(A) High pass filter **(B)** Band pass filter
(C) Band elimination filter **(D)** All of the above

j. Superposition theorem is applied to the network when

(A) Only one independent source in the network
(B) More than one independent source in the network
(C) More than one dependent source in the network
(D) The circuit is complex

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Find the node voltage V_1, V_2 and V_3 in the circuit as shown in Fig. 1. **(8)**

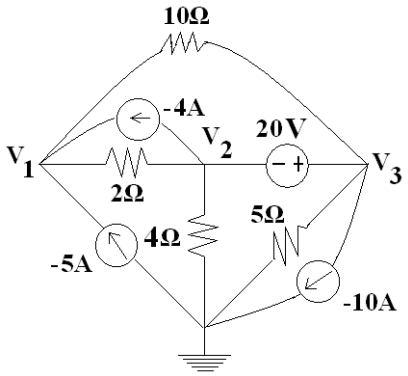

Fig.1

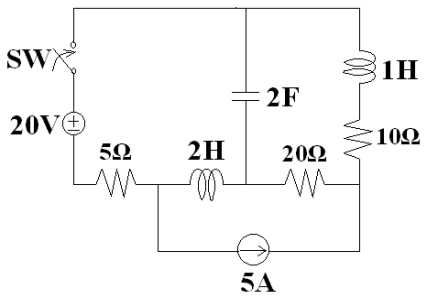

Fig. 2

b. Draw the dual of the network as shown in Fig. 2. **(8)**

Q.3 a. For the circuit shown in Fig. 3, switch 'K' is moved from 'a' to 'b' at t=0. Find i, v_2, $\frac{di}{dt}$ and $\frac{dv_2}{dt}$ at $t=0^+$ **(8)**

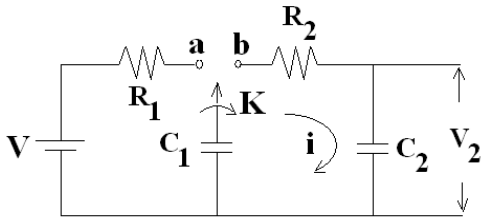

Fig. 3

b. Consider a series RLC circuit excited by dc source. Find the general solution for the current through the network. **(8)**

Q.4 a. For the waveform shown in Fig. 4, find the Laplace transform. **(8)**

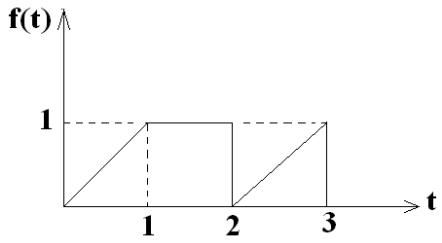

Fig. 4

b. In the network shown in Fig. 5, the switch 'K' is moved from position 'a' to position 'b' at t=0, a steady state having previously been established at position 'a'. Solve the current i(t) using the Laplace transformation method **(8)**

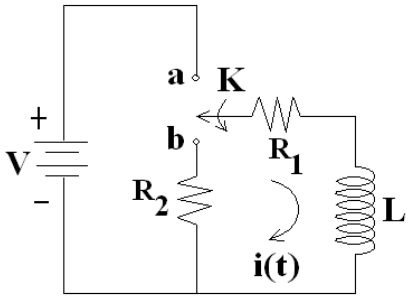

Fig. 5

Q.5 a. In the network shown in Fig. 6, the switch 'K' is closed at t=0 and at $t = 0^-$ the indicated voltages are on the two capacitors. Draw the transform network for analysis on the loop basis representing all elements and all initial conditions. **(8)**

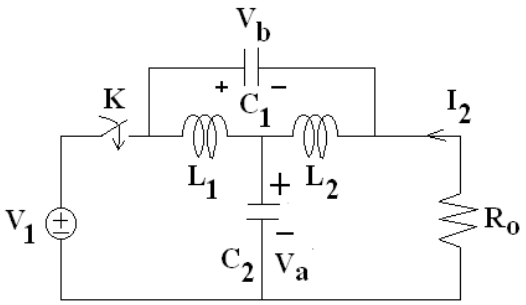

Fig. 6

b. State and prove Thevenin's theorem. **(8)**

Q.6 a. For the bridge –T network shown in Fig. 7 determine $y_{12.}$ **(10)**

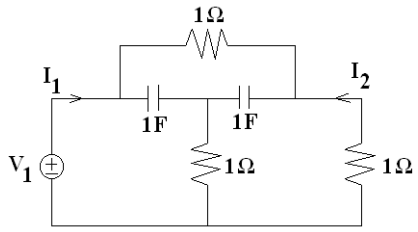

Fig. 7

b. Test the following polynomial for the Hurwitz property $F(s)=s^7+s^5+s^3+s$ **(6)**

Q.7 a. For the network shown in Fig. 8, find the Z-parameters. **(8)**

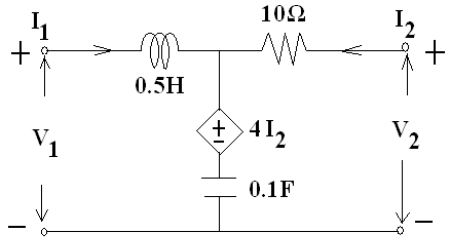

Fig. 8

b. Show that the admittance matrix of parallel connection of two port networks is the sum of admittance matrices of the individual two port networks. **(8)**

Q.8 a. Determine the foster form of realization of the given driving point impedance function $Z(s) = \dfrac{4(s^2+1)(s^2+9)}{s(s^2+4)}$ **(10)**

b. Discuss the properties of RC-driving point impedances. **(6)**

Q.9 a. Synthesize the following function into the form as shown in Fig. 9 **(8)**

$$Z_{21} = \frac{s}{s^3+3s^2+3s+2}$$

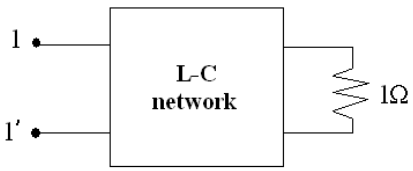

Fig. 9

b. Explain the design of maximally flat low pass filter **(8)**