ROLL NO. _____

Code: AE59 **Subject: CIRCUIT THEORY & NETWORK SYNTHESIS**

AMIETE – ET

Time: 3 Hours **DECEMBER 2013** **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. Ideal voltage source should have

(A) Zero internal resistance **(B)** Infinite internal resistance
(C) Large value of EMF **(D)** Low value of current

b. One of the following laws of electrical network is used in the node voltage analysis of networks

(A) KVL **(B)** KCL
(C) Ohms Laws **(D)** Faraday laws

c. In nodal analysis, if there are N nodes in the circuit, then how many equations will be written to solve the network?

(A) N **(B)** N-1
(C) N+1 **(D)** N-2

d. The Laplace transform of $e^{-at}\cos\omega t$ is

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

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

e. Superposition theorem is not applicable for

(A) Voltage calculation **(B)** Bilateral elements
(C) Power calculation **(D)** Passive elements

f. In a two port network , the condition for reciprocity in terms of 'h' parame is

(A) $h_{12} = h_{21}$ **(B)** $h_{11} = h_{12}$
(C) $h_{11} = -h_{22}$ **(D)** $h_{12} = -h_{21}$

g. A pole of driving point admittance function implies.

(A) Zero current for a finite value of driving voltage
(B) Zero voltage for a finite value of driving current
(C) An open circuit condition
(D) None of these

h. A Hurwitz's polynomial has

(A) Only zeros in the left-half of s-plane
(B) Poles on ' jω ' axis
(C) Only poles in the left-half of s-plane
(D) None of these

i. The Laplace transform of V(t) shown in Fig.1 is

(A) $\frac{1}{s}e^{-s} - \frac{3}{s}e^{-2s}$
(B) $\frac{2}{s} - \frac{3}{s}e^{-2s}$
(C) $\frac{2}{s} + \frac{1}{s}e^{-s}$
(D) $\frac{2}{s} + \frac{1}{s}e^{-s} - \frac{3}{s}e^{-2s}$

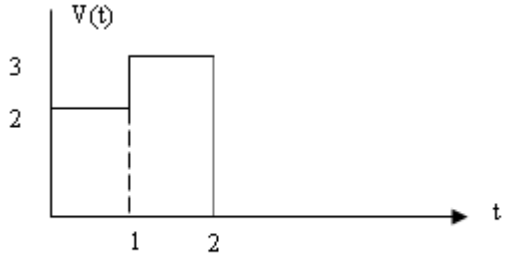

Fig.1

j. Poles and zeros of a driving point function of a network are simple and interlace on the ' jω ' axis. The network consists of elements

(A) R and C **(B)** L and C
(C) R and L **(D)** R, L and C

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

Q.2 a. Explain dependent and independent, voltage and current source with an example. **(8)**

b. Find I_1 and I_2 in Fig.2. **(4)**

c. Obtain a single current source for the network shown in Fig.3. **(4)**

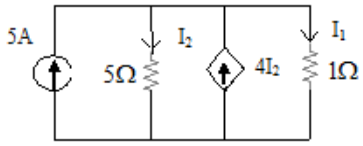

Fig.2

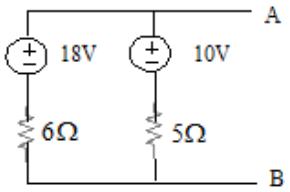

Fig.3

Q.3 a. A D.C voltage of 100V is applied in the circuit as shown in Fig.4 with the switch K as open. Find the complete expression for the current i(t) after the switch k is closed at t = 0. **(8)**

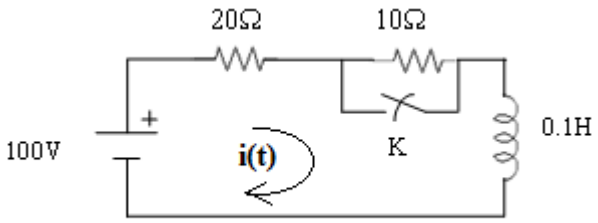

Fig.4

b. Explain the single tuned circuits and double tuned circuits. **(8)**

Q.4 a. Find the inverse Laplace transform of $I(s) = \dfrac{s+1}{s(s^2+4s+4)}$ **(8)**

b. A series RL circuit is energized by D.C voltage of 1.0V by switching it at t=0. If R=1Ω and L=1H. Find the expression for the current in the circuit. **(8)**

Q.5 a. Explain the superposition theorem with the help of a suitable example. **(8)**

b. Find the Thevenin's equivalent to the left of terminals x-y in the network of Fig.5. **(8)**

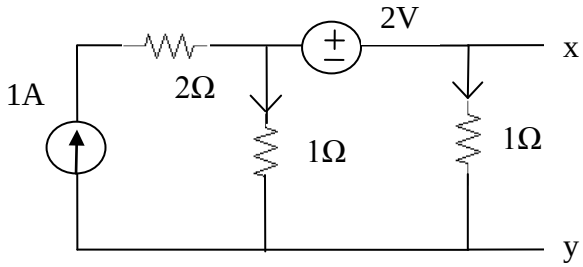

Fig.5

Q.6 a. Test the following polynomial for the Hurwitz property. **(8)**

$P(s) = s^4 + 2s^3 + 4s^2 + 12s + 10$

b. Find the pole zero locations of the current transfer ratio I_2/I_1 in S- doma

for circuit shown in Fig.6. **(8)**

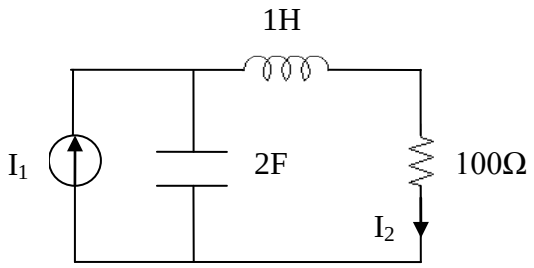

Fig.6

Q.7 a. Draw the parallel connection of a two port network and find the y- parameters of parallel connection of a two port network. **(8)**

b. Find the open circuit parameters of the two port network shown in Fig.7. **(8)**

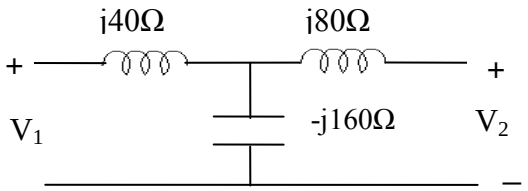

Fig.7

Q.8 a. Write the properties of RL impedances. **(6)**

b. The driving point impedance of a one port LC network is given by

$$Z(s) = \frac{8(s^2+4)(s^2+25)}{s(s^2+16)}$$

Obtain the foster form of equivalent network **(10)**

Q.9 a. Define the Transfer Function and write the properties of the Transfer Function. **(8)**

b. Explain the following:

(i) Magnitude and frequency normalization
(ii) The approximation problem in network theory **(8)**