ROLL NO. _____

Code: AE59/AE110 **Subject: CIRCUIT THEORY & DESIGN**

AMIETE – ET (Current & New Scheme)

Time: 3 Hours **December 2016** **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. In $s = \sigma + j\omega$ the term σ is known as

(A) real frequency **(B)** complex frequency
(C) neper frequency **(D)** none of these

b. Z Parameters of network shown in Fig.1 are

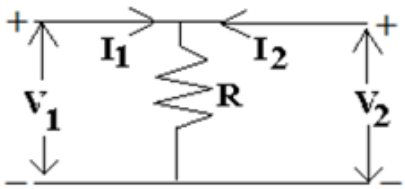

Fig. 1

(A) $Z = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ **(B)** $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} R & R \\ R & R \end{bmatrix}$ **(D)** Does not exist

c. An L-C impedance or admittance function:
(A) has simple poles and zeros in the left half of the s-plane
(B) has no zero or pole at the origin or infinity
(C) is the ratio of odd to even or even to odd polynomials
(D) has all poles on the negative real axis of the s-plane

d. A network function can be completely specified by:
(A) Real parts of zeros **(B)** Poles and zeros
(C) Real parts of poles **(D)** Poles, zeros and a scale factor

e. To a highly inductive circuit, a moderate value capacitance is added in series. The angle between voltage and current will
(A) decrease **(B)** remain same
(C) increase **(D)** indeterminist

f. Laplace transform of a unit impulse function is
(A) $1/s^2$ **(B)** 1
(C) 1/s **(D)** s

g. Ideal voltage source should have
(A) Zero internal resistance **(B)** Infinite internal resistance
(C) Large value of EMF **(D)** Low value of current

h. 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

i. Any n^{th} order differential equation requires minimum
(A) n initial conditions
(B) n+1 initial conditions
(C) n–1 initial conditions
(D) None

j. The Crest Factor (CF) is defined as the ratio of
(A) RMS value to the DC voltage
(B) RMS value to the Peak voltage of periodic waveform
(C) Peak voltage of periodic waveform to the RMS value
(D) DC voltage to the RMS value

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

Q.2 a. Explain the following terms **(4)**
(i) Graph of a network
(ii) tree of a graph.

b. Using source transformation technique find the equivalent voltage source between the points A and B for the network as shown in Fig.2 **(4)**

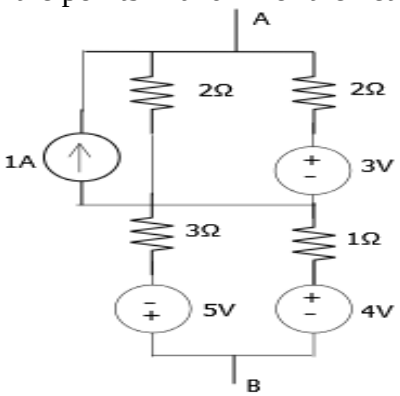

Fig.2

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

Q.3 a. In the given network of Fig.3, the switch S is closed at t=0.The voltage source follows the law $v(t) = Ve^{-\alpha t}$, where α is a constant. Solve for the current assuming that (i) $\alpha \neq R/L$ (ii) $\alpha = R/L$. **(8)**

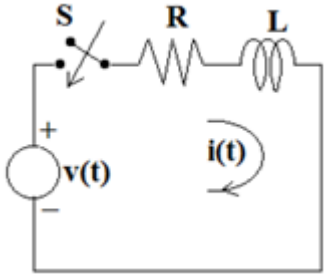

Fig.3

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

Q.4 a. Find the current i(t) for the network using Laplace Transform shown in Fig.4. **(8)**

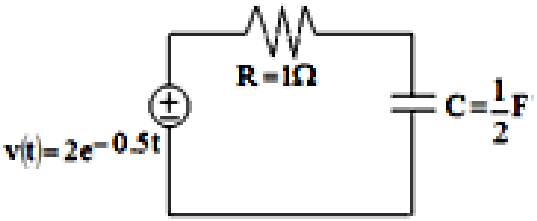

Fig.4

b. Switch K in the circuit shown in Fig.5 is opened at $t = 0^+$ Draw the Laplace transformed network for $t > 0^+$ and find the voltages $V_1(t)$ and $V_2(t)$, $t > 0^+$. **(8)**

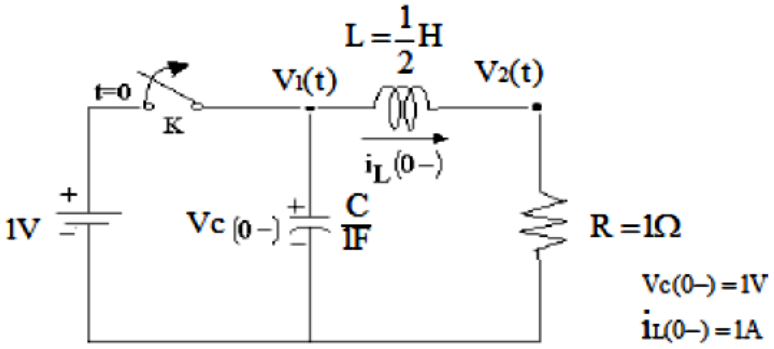

Fig.5

Q.5 a. In the network shown in Fig.6, find the voltage across R_L=10Ω using Thevinin's theorem. **(8)**

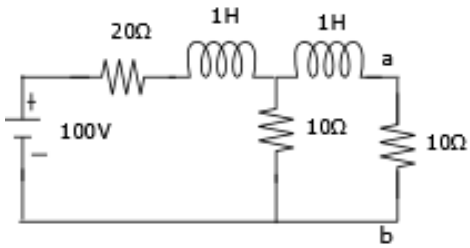

Fig.6

b. State and prove superposition theorem **(8)**

Q.6 a. Draw Pole- Zero Plot for $Z(s) = \frac{s+1}{s^2+2s+2}$ **(4)**

b. Test the following polynomial for the Hurwitz property. **(8)**

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

c. For the circuit shown in Fig.7 obtain voltage transfer function. **(4)**

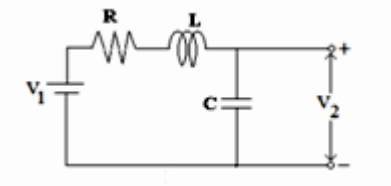

Fig.7

Q.7 a. Derive the Relationship between Z and Y parameter. **(8)**

b. For the circuit as shown in Fig.8, find the Y-parameters. **(8)**

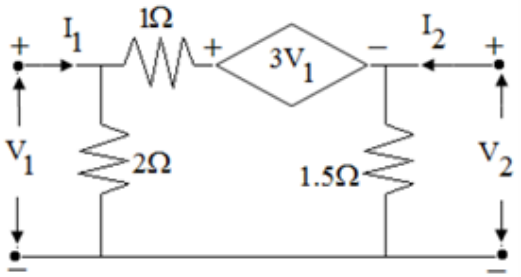

Fig.8

Q.8 a. Obtain the driving point impedance of the given network across A-B shown in Fig.9 using Transform network. **(8)**

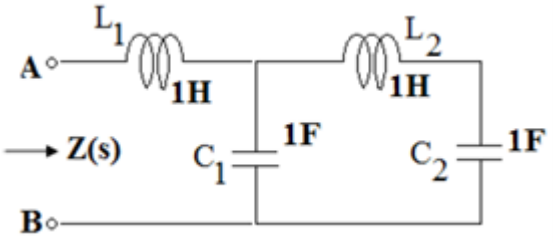

Fig.9

b. Discuss the properties of RC-driving point impedances. **(8)**

Q.9 a. Synthesise the network that has a transfer impedance

$Z_{21}(s) = \frac{2}{s^3+3s^2+4s+2}$ and 1Ω termination at the output. **(8)**

b. What are the error criteria in any approximation problem in network theory? Derive amplitude approximation for maximally flat low pass filter approximation. **(8)**