ROLL NO. _____

Code: AE110 **Subject: CIRCUIT THEORY AND DESIGN**

AMIETE – ET *{NEW SCHEME}*

Time: 3 Hours **DECEMBER 2014** **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 equivalent resistance for the circuit shown in Fig.1 across the terminal 'A' and 'B' is

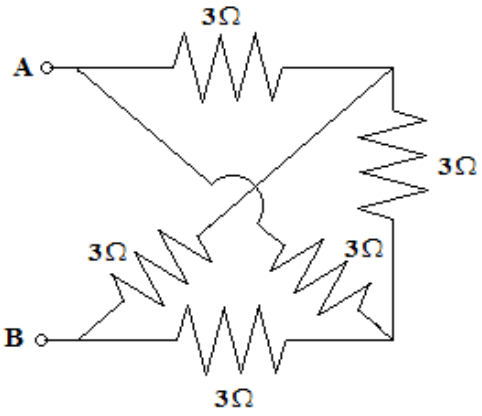

Fig. 1

(A) 15Ω
(B) 3Ω
(C) 3/5Ω
(D) 5/3Ω

b. The equivalent voltage source for the circuit shown in Fig.2 across terminal 'x' and 'y' can be represented as_____ resistance.

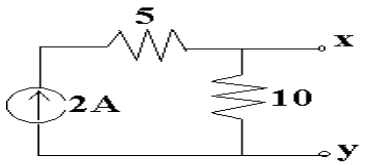

Fig.2

(A) 20V in series with 10Ω **(B)** 20V in series with 15Ω
(C) 30V in series with 10Ω **(D)** 30V in series with 15Ω

c. A capacitor with zero initial conditions at $t = 0^+$ act as a

(A) short circuit **(B)** open circuit
(C) current source **(D)** voltage source

d. A unit ramp function when integrated yields

(A) unit parabolic function **(B)** unit ramp function
(C) unit impulse function **(D)** unit step function

e. The Laplace transform of e^{-at} f(t) is

(A) $-\frac{d}{ds}F(s)$ **(B)** F(s + a)

(C) $F(s)e^{-at}$ **(D)** $\frac{F(s)}{s+a}$

f. The maximum power transfer through the load as shown in Fig.3

(A) 25W
(B) 30.6W
(C) 62.5W
(D) 110W

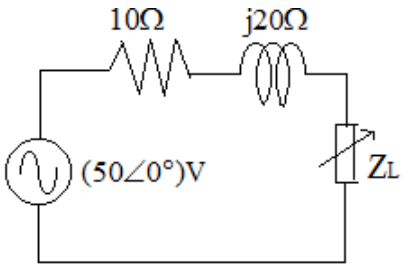

Fig. 3

g. The condition for reciprocity in ABCD-parameter is

(A) AD-BC = 1 **(B)** AD = BC
(C) A= D **(D)** AC – BD = 1

h. For a prototype high pass filter, the series element is

(A) Resistive
(B) Inductive
(C) Capacitive
(D) Combination of inductance and capacitance

i. The adjoining figure of synthesized LC circuit in Fig.4 represents.

(A) Cauer Form I
(B) Foster Form I
(C) Foster Form II
(D) Cauer Form II

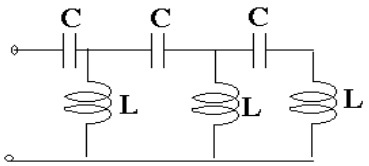

Fig.4

j. H(s) = $\frac{V(s)}{I(s)} = \frac{2(s+3)}{(s+2)^3}$ when i(t) is a unit step function. The value of v(t) in the steady state is given by

(A) 3/2 **(B)** 3/4
(C) 1 **(D)** 0

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

Q.2 a. Determine Vx in the circuit shown in Fig.5 **(8)**

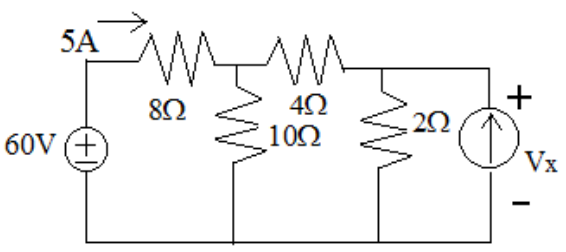

Fig. 5

b. For the circuit shown in Fig.6, obtain the value of current through 2Ω resistor. **(8)**

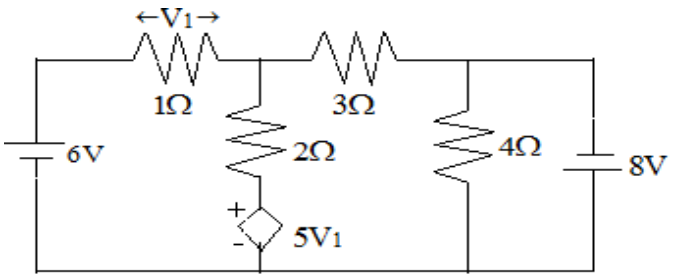

Fig.6

Q.3 a. In the network shown in Fig.7, if the switch k is opened at t = 0, then find the following quantities at $t = 0^+$ (i) v_1 & v_2 (ii) $\frac{dv_1}{dt}$ & $\frac{dv_2}{dt}$. **(8)**

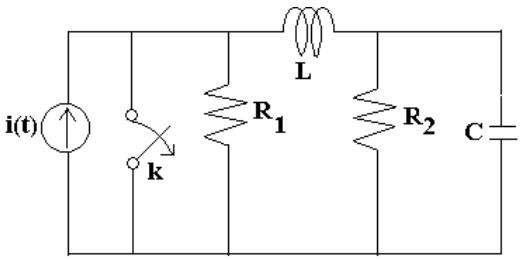

Fig.7

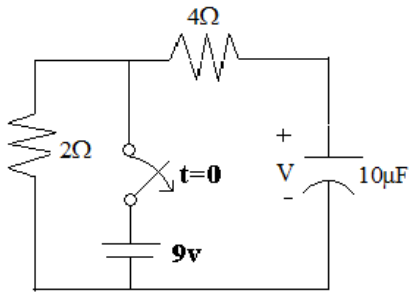

Fig.8

b. For the circuit shown in Fig.8, find the voltage labelled v at t = 200 μ sec. **(8)**

Q.4 a. Obtain the Laplace transform of
(i) The delayed step, function k[u(t-a)]. **(4)**
(ii) The ramp function k t u(t). **(4)**

b. Consider the R-L circuit with R = 4Ω and L = 1H **(8)**
excited by a 48V dc source as shown in Fig.9. Assume the initial current through the inductor is 3A. Using Laplace transform method, determine the current i(t); at t ≥ 0. Also draw the s-Domain representation of the circuit.

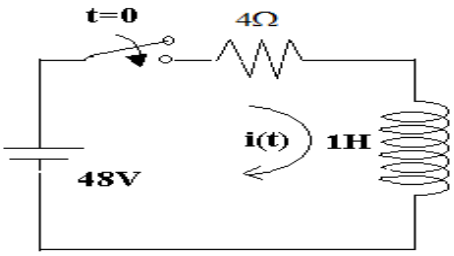

Fig.9

Q.5 a. Obtain the Thevenin's equivalent circuit across the terminal A & B of ckt shown in Fig.10. **(8)**

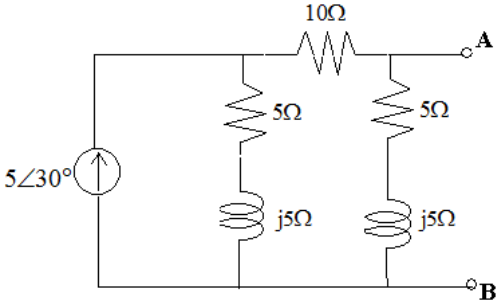

Fig.10

b. Derive the condition for maximum power transfer to take place at a load impedance $Z_L = R_L + jX_L$, when the source is an ac source having an internal impedance of $Z_{in} = R + jX$. **(8)**

Q.6 a. Find the transfer impedance function $Z_{21}(s) = \frac{V_2(s)}{I_1(s)}$ of the network shown in Fig.11 **(8)**

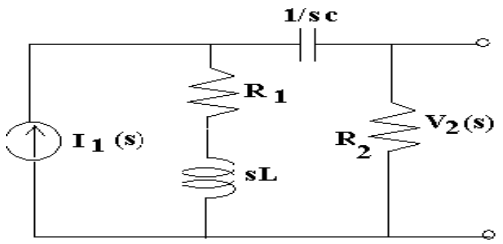

Fig.11

b. Check whether the given polynomial P(s) is Hurwitz or not.
$P(s) = s^4 + s^3 + 2s^2 + 4s + 1$ **(8)**

Q.7 a. Obtain the condition for reciprocity and symmetry in terms of h-parameters. **(8)**

b. Calculate the Z – Parameters of the network shown in Fig.12. Determine whether the network is symmetrical or not? **(8)**

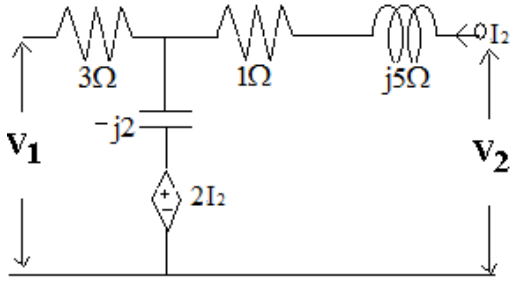

Fig.12

Q.8 An impedance function given by $Z(s) = \frac{s(s+2)(s+5)}{(s+1)(s+4)}$ find the R-L represetion of **(16)**

(i) FOSTER I and II forms.
(ii) CAUER I and II forms.

Q.9 a. Find the driving point impedance of the network shown in Fig.13. Find the poles and zeros of the network and locate them in s-plane. **(8)**

b. If a T-section of a constant k- low pass filter has series inductance 85 mH and shunt capacitance of 0.025μF, calculate its cut off frequency and the nominal design impedance R_o. Design an equivalent π-section too. **(8)**

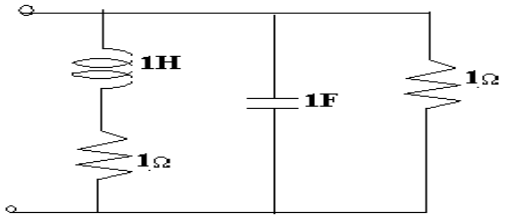

Fig.13