ROLL NO. ___________________

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

AMIETE – ET {Current & New Scheme}

JUNE 2016

Time: 3 Hours **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. A network is said to be non linear if it does not satisfy

(A) Superposition condition **(B)** Homogeneity condition
(C) **(A)** OR **(B)** **(D)** Associative condition

b. An inductor at $t = \infty$ with zero initial conditions act as a

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

c. The voltage across inductor for the circuit shown in Fig.1

(A) 4V **(B)** 2V
(C) 0V **(D)** 8V

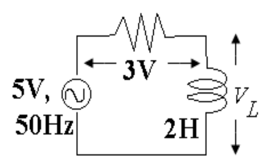

Fig.1

d. Which of the following theorems enables a number of voltage (or current) source to be combined directly into a single voltage (or current) source?

(A) Compensation Theorem **(B)** Reciprocity Theorem
(C) Superposition Theorem **(D)** Millman's Theorem

e. Laplace transform of tf(t) is

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

(C) $\int_s^\infty F(s)ds$ **(D)** $\int_0^\infty F(s)ds$

f. When a source is delivering maximum power to a load, the efficiency of the circuit

(A) is always 50% **(B)** depends upon the circuit
(C) is always 75% **(D)** is 100%

g. For the one-port network shown in Fig.2, the short circuit natural frequency is given by

(A) $s = 0$
(B) $s + 1 = 0$
(C) $s + 2 = 0$
(D) $s^2 + 2 = 0$

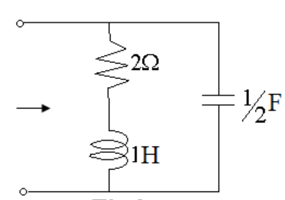

Fig.2

h. For a two port network to be reciprocal it is necessary that

(A) $z_{11} = z_{22}$ and $y_{21} = y_{12}$ **(B)** $z_{11} = z_{22}$ and $AD - BC = 0$

(C) $h_{11} = -h_{12}$ and $AD - BC = 0$ **(D)** $y_{12} = y_{21}$ and $h_{21} = -h_{12}$

i. The cut off frequencies of constant K filters of all types are represented by

(A) $\frac{z_1}{4z_2} = 1$ **(B)** $\frac{z_1}{4z_2} = 0$

(C) $\frac{z_1}{4z_2} = -1$ **(D)** None of these

j. The function $Z(s) = \frac{2s^2 + 5}{s(s^2 + 1)}$ is

(A) Hurwitz polynomial and a positive real function
(B) Not a Hurwitz polynomial and positive real function
(C) A Hurwitz polynomial but not a positive real function
(D) Not a Hurwitz polynomial but is a positive real function

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

Q.2 a. Determine the current I and I_1 in the circuit shown in Fig.3 by using nodal analysis. **(8)**

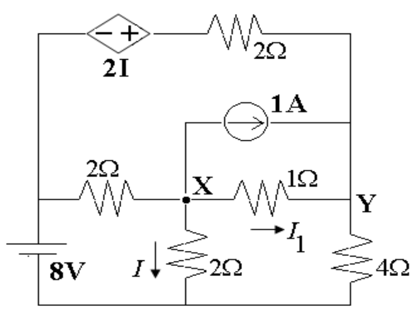

Fig.3

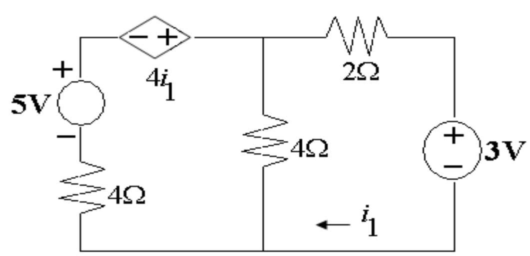

Fig.4

b. Determine the current i_1 in the circuit of Fig.4. **(8)**

Q.3 a. Find the current i(t) for t > 0 in the circuit shown in Fig.5. Assume that the circuit has reached steady state at $t = 0^-$. **(8)**

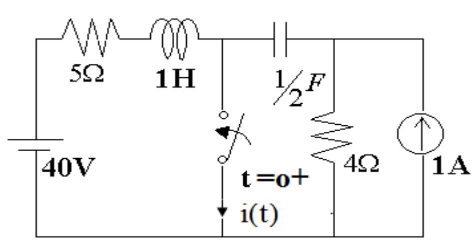

Fig.5

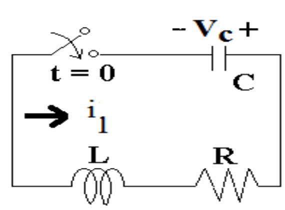

Fig.6

b. In the circuit of Fig.6, $L = 2H, R = 12\Omega$ and $C = 62.5mF$. The initial conditions are $V_c(0^+) = 100V$ and $i_1(0^+) = 1.0A$. The switch is closed at t = 0. Find i(t). **(8)**

Q.4 a. Given the function $F(s)=\dfrac{5s+3}{s(s+1)}$. Find the initial value $f(0^+)$, final value $f(\infty)$ and the corresponding time function f(t). **(8)**

b. Consider the differential equation $\dfrac{d^2y(t)}{dt^2}+\dfrac{3dy(t)}{dt}+2y(t)=5u(t)$ where $u(t)$ is unit step function. The initial conditions are $y(0^+)=-1$ and $\dfrac{dy(0^+)}{dt}=2$. Determine $y(t)$ for $t\ge 0$. **(8)**

Q.5 a. Find the current I in the circuit shown in Fig.7 using superposition theorem. **(8)**

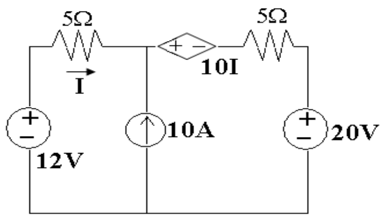

Fig.7

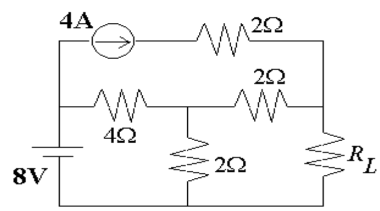

Fig.8

b. Find the value of load resistance for the circuit shown in Fig.8, so that Maximum Power Transfer takes place through it. Also find the value of maximum power transferred to the load. **(8)**

Q.6 a. Obtain the open-circuit driving-point impedance (Z_{11}), transfer impedance (Z_{21}) and voltage transfer function (G_{21}) for the network shown in Fig.9. **(8)**

b. Test, whether the following function is a positive real function or not $F(s)=\dfrac{s^3+4s^2+3s+5}{s^2+6s+8}$ **(8)**

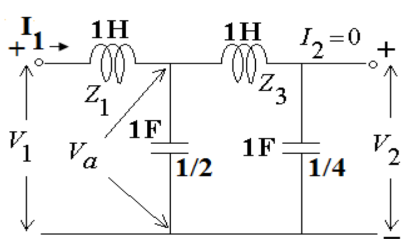

Fig.9

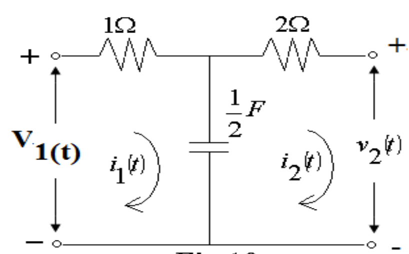

Fig.10

Q.7 a. Calculate the Y parameters for the network shown in Fig.10. **(8)**

b. Obtain the condition for reciprocity and symmetry in terms of ABCD parameters. **(8)**

Q.8 a. Write the properties of R-C impedance of R-L admittance function. **(8)**

b. Realize the R-C admittance in Cauer-I and Foster-II forms.

$Y(s)=\dfrac{s^2+7s+6}{s+2}$ **(8)**

Q.9 A k – constant low-pass filter has 2.4 kHz cut off frequency and the design resistance R_o is 650Ω. Design the filter and determine the frequency at which this filter would give 20dB attenuation. Also calculate its characteristic impedance, pass band and stop band frequencies. **(16)**