ROLL NO. _____

Code: AE08 **Subject: CIRCUIT THEORY & DESIGN**

AMIETE – ET (OLD 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. A passive network has

(A) no emf source **(B)** no current source
(C) neither **(A)** nor **(B)** **(D)** both **(A)** and **(B)**

b. The supply voltage V=230 V AC, 50 Hz is given to circuit as shown in Fig.1. The ammeter reading will be

(A) 46 A **(B)** 73.3 A
(C) 7.33 A **(D)** 23 A

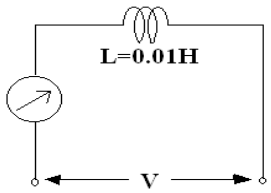

Fig. 1

c. In the circuit shown in Fig.2, the voltage function v(t)=100 sin ωt volts and R=100 Ω. The average power is given by

(A) 100 W **(B)** 200 W
(C) 400 W **(D)** 50 W

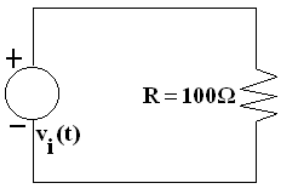

Fig. 2

d. The series circuit as shown in Fig.3, has a current i=2 cos500t A. The applied voltage will be

(A) $22.4\sin(5000t+63.4^\circ)$ V
(B) $22.4\cos(500t-63.4^\circ)$ V
(C) $22.4\sin(500t-63.4^\circ)$ V
(D) None of these

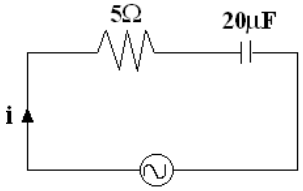

Fig. 3

e. A network working under the maximum power transfer condition has an efficiency

(A) 100% **(B)** 97%
(C) 50% **(D)** 0%

f. Tellengen's theorem is applicable to
(i) a linear network only
(ii) time invariant network only
(iii) passive and active combinations

(A) (i) and (ii) **(B)** (ii) and (iii)
(C) (i) and (iii) **(D)** none of these

g. Consider the following statements regarding positive real function F(s):
(i) F(s) is real when s is real
(ii) $F(s) \geq 0$ when $Re(s) \geq 0$
(iii) The poles and zeros of F(s) are in the right half of s-plane of these statements

(A) (i) and (ii) are correct **(B)** (i) and (iii) are correct
(C) (ii) and (iii) are correct **(D)** all are correct

h. A Hurwitz polynomial has

(A) zeros only in the left half of the s-plane
(B) poles only in the left half of the s-plane
(C) zeros anywhere in s-plane
(D) none of these

i. When a graph has 'b' branches and 'n' nodes the number of chords is given by

(A) b **(B)** b–n
(C) b–n+1 **(D)** b+n–1

j. In the circuit as shown in Fig.4, the switch is closed at t=0. The capacitor initially has value $V_{ab}(0^-)= -20$ V. The current response will be

(A) $3e^{-t}$ A
(B) $4e^{-2t}$ A
(C) $5e^{-3t}$ A
(D) $10e^{-2t}$ A

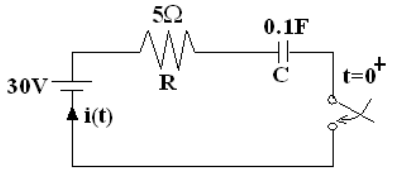

Fig. 4

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

Q.2 a. What do you understand by source transformation in reference to network analysis? **(8)**

b. Calculate V in the circuit as shown in Fig. 5 **(8)**

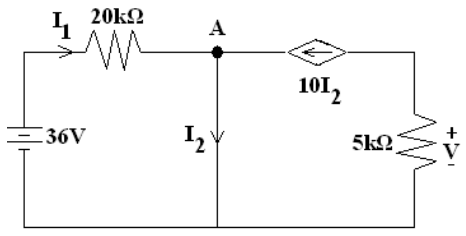

Fig. 5

Q.3 a. A d.c voltage of 200 V is suddenly applied to a series R L circuit having R=20 Ω and L=0.2 H. Determine the voltage drop across the inductor at the instant of switching on and 0.02 sec later. **(8)**

b. In the circuit as shown in Fig. 6, switch S is 1 for a long time and moved to position 2 at t=0. Find the voltage across the capacitor $v_i(t)$ for t > 0. **(8)**

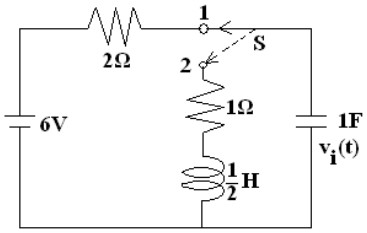

Fig. 6

Q.4 a. Determine the average power stored in purely inductive circuit. **(5)**

b State and explain Thevenin's theorem. Obtain the Thevenin's equivalent of the circuit as shown in Fig. 7. **(2+3)**

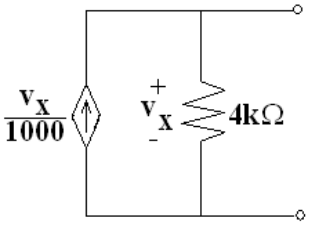

Fig. 7

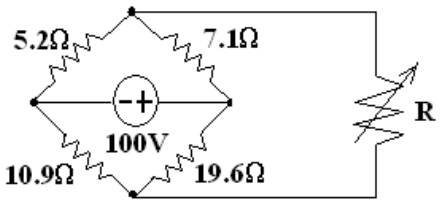

Fig. 8

c. Find the value of R (Fig 8) for which we will receive maximum power across it. Also determine the value of power. **(6)**

Q.5 Obtain the y-parameters of the circuit as shown in Fig. 9 **(16)**

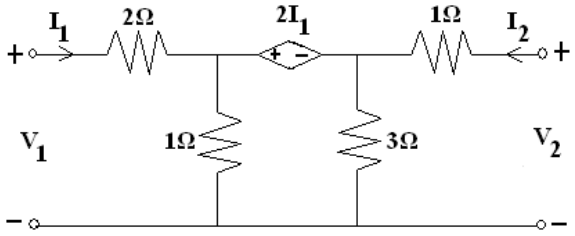

Fig. 9

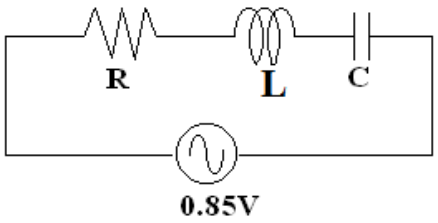

Fig. 10

Q.6 a. Give a brief description of phenomenon of resonance in series RLC circuit. **(5)**

b. Consider the following series RLC circuit (Fig. 10).
The Q of the coil is 50 and value of capacitor is 320 pF. The resonant frequency of the circuit is 175 kHz. Find the value of inductance, the circuit current, and the voltage across capacitor under resonance. **(5)**

c. State and explain Reciprocity theorem. Check when the given circuit (Fig.11) satisfied the Reciprocity or not. **(3+3)**

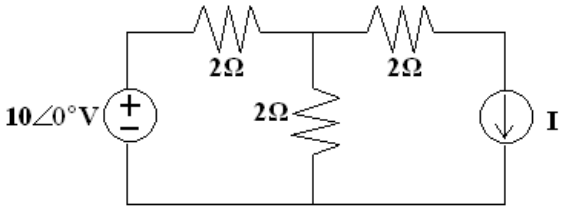

Fig. 11

Q.7 a. Synthesize the following impedance function in Foster-I form

$$Z(s) = \frac{2(s+1)(s^2+9)}{s(s^2+4)}$$ **(5)**

b. An impedance function is given by $Z(s) = \frac{(s+1)(s+4)}{s(s+2)(s+5)}$. Find RC representation of Cauer-I form. **(5)**

c. Check when the function $Z(s) = \frac{2s^2+2s+1}{s^3+s^2+s+2}$ is a positive real function. **(6)**

Q.8 a. Design a low pass constant K type T-section and Π section filters with fc=3kHz and nominal characteristic impedance $500\,\Omega$. Also determine the frequency at which the filter offers attenuation of 20 dBs. Determine β for f=2 kHz and f=10 kHz. **(10)**

b. The network function F(s)= $\frac{s+1}{s^2+2s+5}$ is given. Plot the poles and zeros on s-plane. Obtain the amplitude and phase response for F(j2). **(6)**

Q.9 Determine Z(s) for the given network (Fig.12). If this is represented by $Z(s) = \frac{K(s-z_1)}{(s-p_1)(s-p_2)}$ and determine z_1, p_1 and p_2 in terms of R, L and C. **(16)**

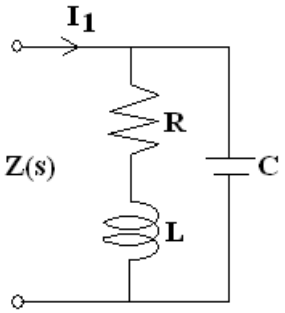

Fig.12