ROLL NO. _____

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

AMIETE – ET (OLD SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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 following constitutes a bilateral element

(A) A resistor **(B)** A diode
(C) A transistor **(D)** A graph

b. A constant voltage source with 10 V and series internal resistance of 100 ohm is equivalent to a current source of

(A) 100 mA in parallel with 100 ohm
(B) 1000 mA in parallel with 100 ohm
(C) 100 A in parallel with 10 ohm
(D) 100 mA in parallel with 1000 ohm

c. Kirchoff's Voltage Law (KVL) is indicating conservation of

(A) Power **(B)** Energy
(C) Flux **(D)** Charge

d. Which of the following quantities possess the dimension of time?

(A) RC **(B)** L/R
(C) $(LC)^{1/2}$ **(D)** All of the above

e. Superposition theorem is not applicable in:

(A) Voltage responses **(B)** Power responses
(C) Current responses **(D)** All of the above three

f. A series resonant circuit is inductive at f = 1200 Hz. The circuit will be capacitive some where at

(A) f > 1200 Hz
(B) f < 1200 Hz.
(C) f equal to 1200 Hz and by adding a resistance in series
(D) f = 600 + f_o (where f_o = resonance frequency).

g. If the load connected to the source is inductive for a maximum transfer of power from source to load, the source impedance should be

(A) Inductive **(B)** Capacitive
(C) Resistive **(D)** Combination of L & C

h. The junction of two or more branches is known as

(A) graph **(B)** node
(C) ground **(D)** chord

i. An attenuator is

(A) R- L-C network **(B)** R's network
(C) R-L network **(D)** R-C network

j. An ideal filter should have

(A) Zero attenuation in the pass band
(B) Zero attenuation in the attenuation band.
(C) Infinite attenuation in the pass band
(D) None of the above

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

Q.2 a. Explain the following:
(i) Ideal Voltage Source
(ii) Energy and power in an inductor.
(iii) Resonance
(iv) Pole-zero diagram **(8)**

b. A circuit consist of a voltage source $v(t) = V e^{(-\alpha t)}$ $t > 0$; a switch (k), and R-L elements all connected in series. Draw the circuit. If at t=0 the switch is closed. Find i(t) for
(i) $\alpha \neq R/L$ and (ii) $\alpha = R/L$. **(8)**

Q.3 a. State and prove Reciprocity theorem. Also, state the applications of Reciprocity theorem. **(8)**

b. Explain Duality. Obtain dual network for the circuit shown in Fig.1. **(4+4)**

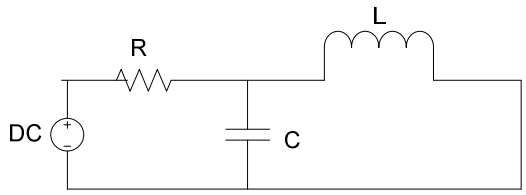

Fig. 1

Q.4 a. A resistive network is described by the following set of Nodal equations. Develop the possible network and calculate the nodal voltages.

$$\begin{aligned} 7V_1 - 3V_2 - 4V_3 &= -11 \\ -3V_1 + 6V_2 - 2V_3 &= 3 \\ -4V_1 - 2V_2 + 11V_3 &= 25 \end{aligned}$$ **(12)**

b A 0.2 H inductor is in parallel with a 100 Ohm resistor. The inductor current is 4 A at t=0. Determine the inductor current $i_L(t)$ at 0.8 m sec. **(4)**

Q.5 a. Realise $T(s) = \dfrac{s^2}{(s+2)(s+5)}$ **(8)**

b. With the help of flow-chart, explain the method of determining the steady – state response using phasors. **(8)**

Q.6 a. From the following Z(s) develop a reliable network $Z(s) = \dfrac{2(s^2+1)(s^2+9)}{s(s^2+4)}$ **(8)**

b. "Total average power supplied to one port network from the source is the sum of P_{av} for each element of the network". Prove it. **(8)**

Q.7 a. Differentiate the term network analysis and network synthesis. Realise a RLC network whose driving point impedance is given by

$$Z(s) = \frac{(s^2+2s+6)}{s(s+3)}$$ **(2+6)**

b. Find the Foster-I and Cauer-II form , from the following impedance function

$$Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)}$$ **(4+4)**

Q.8 a. Discuss the frequency scaling. **(4)**

b. Explain basic synthesis procedure. **(4)**

c. Obtain the Z- parameter for the Circuit shown in the Fig.2. Draw the Z- parameter equivalent model. State whether the network is reciprocal or symmetrical. Assume R1 =1 ohm and R2 = 2 ohms. **(8)**

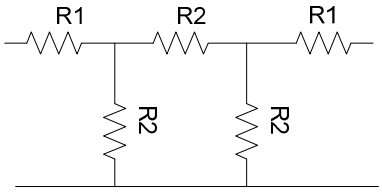

Fig. 2

Q.9 a. Describe the method of frequency transformation with a typical example. **(8)**

b. Differentiate single tuned and double tuned circuit. A tank circuit have a capacitor of 100 pF and an inductor of 150 μ H. The resistance of the inductor is 5 Ω. Calculate
(i) resonant frequency
(ii) impedance at resonance
(iii) Q-factor
(iv) bandwidth. **(8)**