AMIETE – ET (NEW SCHEME) – Code: AE59

Subject: CIRCUIT THEORY & DESIGN

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

DECEMBER 2010

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 half an hour 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 name of the topological structure shown in Fig.1 is

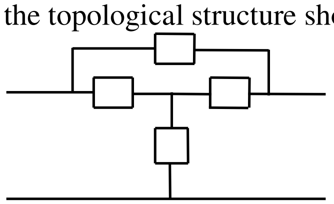

Fig. 1

(A) T-Network **(B)** Ladder Network
(C) Bridged T-Network **(D)** Bridge Network

b. When uncharged capacitor is connected to a energy source, the conditions of the capacitor at t = 0 and at t = ∞ is

(A) Short circuit and Open circuit **(B)** Open circuit and Short circuit
(C) Short circuit and Short circuit **(D)** Open circuit and Open circuit

c. The Laplace transform of the function Cos ωt is

(A) $\frac{\omega}{s^2+\omega^2}$ **(B)** $\frac{1}{s^2+\omega^2}$
(C) $\frac{s}{s^2+\omega^2}$ **(D)** $\frac{1}{s+\omega}$

d. In the analysis of networks using Norton's theorem, the impedance between the open circuited terminals (R_{th}) is calculated by

(A) Both voltage sources and current sources must be open circuited
(B) Short circuiting current sources and open circuiting voltages sources
(C) Both voltage sources and current sources must be short circuited
(D) Short circuiting voltage sources and open circuiting current sources

e. The value of Z_{11} for the network shown in Fig.2 is

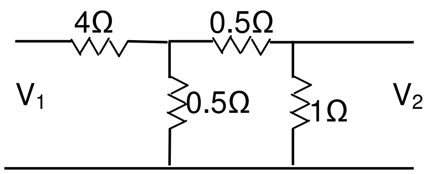

Fig. 2

(A) 4.25Ω **(B)** 4.375Ω
(C) 1.9Ω **(D)** 1.125Ω

f. The poles and zeros of L-C immittance functions lie on
(A) Y axis **(B)** Z axis
(C) X axis **(D)** jω axis

g. The equivalent current source (I_s) and resistance (R_s) for a voltage source of 6V in series with 3Ω resistance is
(A) 2A and 3Ω in parallel with I_s **(B)** 2A and 3Ω in series with I_s
(C) 6A and 3Ω in parallel with I_s **(D)** 6A and 3Ω in series with I_s

h. The critical resistance (R_{cr}) of the homogeneous second order equation is given by
(A) $\frac{1}{2LC}$ **(B)** $2\sqrt{\frac{C}{L}}$
(C) $2\sqrt{\frac{L}{C}}$ **(D)** 2LC

i. 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

j. The number of branches present in a tree having n number of nodes is
(A) n-1 **(B)** n+1
(C) n/2 **(D)** 2n

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

Q.2 a. Using Kirchhoff's laws find the current flowing through ammeter for the network shown in Fig.3. **(8)**

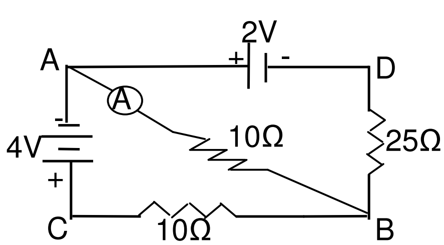

Fig. 3

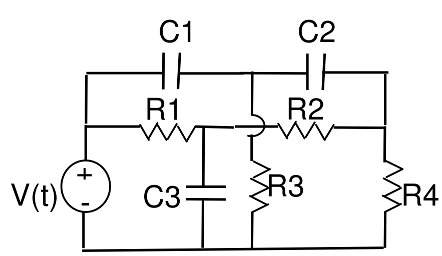

Fig. 4

b. Draw the Dual network for the circuit shown in Fig.4.

Q.3 a. Explain the terms i) RMS value ii) Duty cycle **(8)**

b. In the network shown in Fig.5, the switch k is closed at t=0. Find the values of $i, \frac{di}{dt} and \frac{d^2i}{dt^2}$ at t=0+ if R=10Ω, L=1H, C=10μf and V=10V. **(8)**

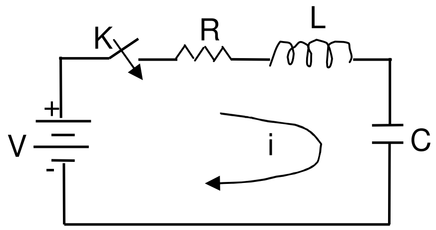

Fig. 5

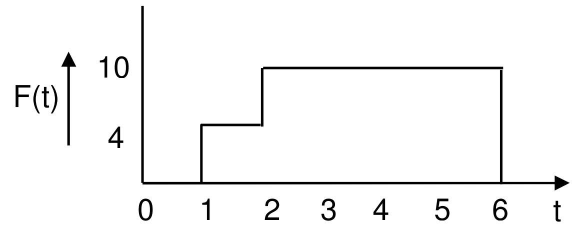

Fig. 6

Q.4 a. State and Prove Initial and Final value theorems **(8)**

b. Find the Laplace transforms of the waveform shown in Fig.6. **(8)**

Q.5 a. State and prove superposition theorem **(8)**

b. Find the Thevenin's equivalent circuit at the terminals AB for the network shown in Fig.7 **(8)**

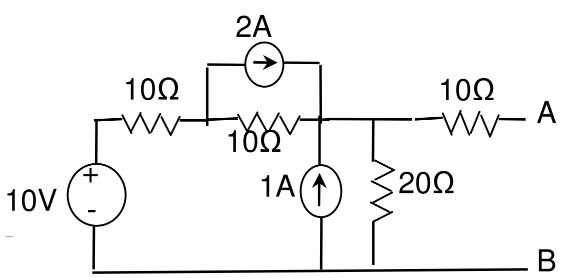

Fig. 7

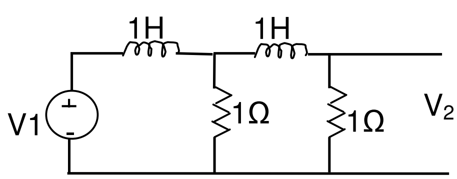

Fig. 8

Q.6 a. Discuss the restrictions on the location of poles and zeros in the s-plane **(8)**

b. For the network shown in Fig.8, show that the voltage ratio transfer function G_{12} is s^2+3s+1. **(8)**

Q.7 a. Draw the h-parameter equivalent circuit for a two-port network and hence define different h-parameters **(6)**

b. Find Z and Y parameters for the network shown in Fig.9 **(10)**

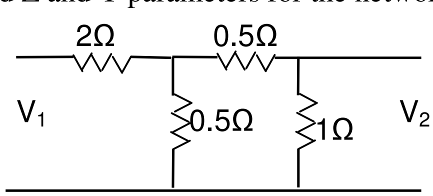

Fig. 9

Q.8 a. Discuss the properties of LC immittance functions

b. Synthesis the following functions in Cauer form and show the synthesized network $Z(s) = \dfrac{(s^2+1)(s^2+3)}{s(s^2+2)}$ **(10)**

Q.9 a. Explain using frequency transformation how the elements of the normalized lowpass filter are changed in to elements of highpass filter. **(8)**

b. Synthesize the voltage ratio $\dfrac{V_2}{V_1} = \dfrac{(s+2)(s+4)}{(s+3)(3s+4)}$ as a constant resistance lattice terminated in a 1Ω resister. **(8)**