Subject: CIRCUIT THEORY & DESIGN

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

JUNE 2011

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. If ‘l’ is number of links and ‘b’ is number of branches, then the size of the Tie-set matrix of a graph is _____ and the number of Tie-sets will be _____.

(A) l + b, b **(B)** l x b, l
(C) l – b, l x b **(D)** l / b, l+b

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

c. The Laplace transform of the function Sin 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 Thevenin’s theorem, the equivalent impedance between the open circuited terminals (Z_{Th}) is calculated by

(A) Open circuiting all voltage sources and current sources.
(B) Short circuiting current sources and Open circuiting voltages sources.
(C) Short circuiting all voltage sources and current sources
(D) Short circuiting voltage sources and Open circuiting current sources

e. The value of Z_{11} for the network shown in Fig.1 is

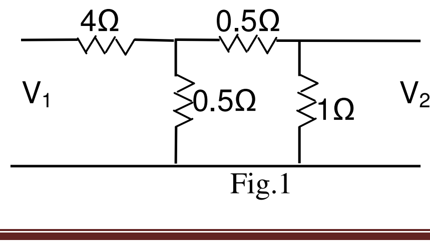

Fig.1

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

f. A RC series circuit energized by a step input has a resulting current ______

(**A**) $I_{(s)} = \frac{V}{R} e^{\frac{-t}{RC(t)}}$ (**B**) $I_{(s)} = VRe^{\frac{-t}{RC}}$
(**C**) $I_{(s)} = \frac{V}{R} e^{\frac{t}{RC}}$ (**D**) $I_{(s)} = \frac{V}{R} e^{\frac{-RC}{t}}$

g. A current source I_s of 10A in shunt with an admittance of 100 milli mhos has an equivalent voltage source V_s given by
(**A**) 2A and 3Ω in parallel with I_s (**B**) 10V in shunt with 100 milli mhos
(**C**) 10V in series with 100 milli mhos (**D**) 100V in series with 10Ω

h. In the arrangement shown in Fig.2, the ammeter reads

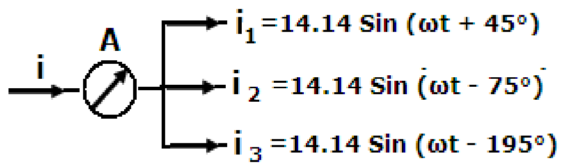

Fig.2 Ammeter Reading

(**A**) 1.6 L0° A (**B**) 0.6 L0° A
(**C**) 1.6 L-30° A (**D**) 0.0 L0° A

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. A voltage signal with peak amplitude of 200V is represented as in Fig.3; its rectangular form of representation is
(**A**) 200 + j0
(**B**) 173.2 + j100
(**C**) 173.2 - j100
(**D**) 200 L30°

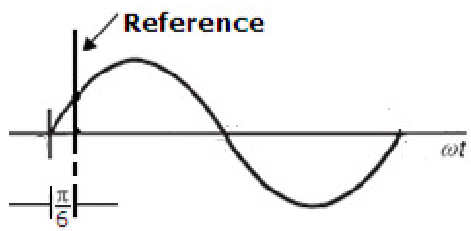

Fig.3 Vector Diagram

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

Q.2 a. Explain with an example
(i) Unilateral and Bilateral networks.
(ii) Linear and Non-linear networks. **(6)**

b. For the network shown in Fig.4, using Maxwell's loop analysis, find the value of V_2 such that its power dissipation is zero. **(10)**

Q.3 a. A voltage of v= 200 Sin (314t-30°) is applied to a 50mH, 15Ω coil; calculate the current and the power factor for the arrangement. **(8)**

b. For the network shown in Fig.5, find the power dissipated by 50V source.

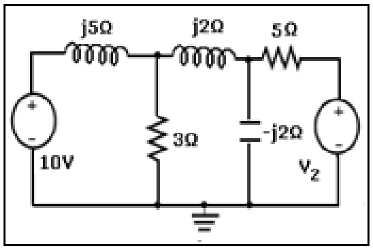

Fig.4

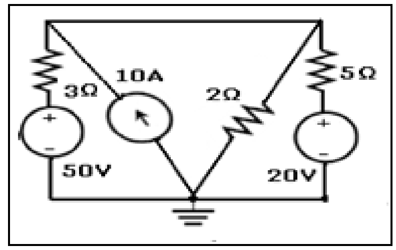

Fig.5

Q.4 a. Explain the terms (i) RMS value (ii) Duty cycle **(8)**

b. In the network shown in Fig.6, the switch K is closed at time t=0. Find the values of $i, \frac{di}{dt}$ and $\frac{d^2 i}{dt^2}$ at t = 0+, given R=10Ω, L=1H, C=10μf and V=10V. **(8)**

Q.5 a. State and Prove Initial and Final value theorems. **(8)**

b. Find the Laplace transformation of the waveform shown in Fig.7. **(8)**

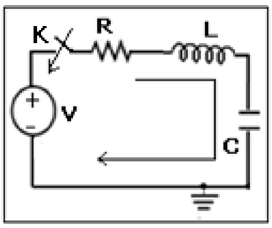

Fig.6

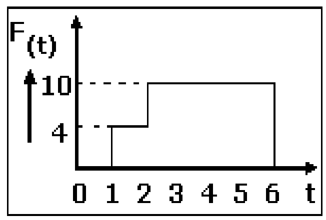

Fig.7

Q.6 a. What is Super Position Principle (SPP)? Explain. **(6)**

b. Using Thevenin's theorem find the current flowing through the galvanometer of the bridge network shown if Fig.8. **(10)**

Q.7 a. What are the restrictions laid on the location of poles and zeros of a system transfer function in the S-plane? **(8)**

b. For the network shown in Fig.9, obtain the dual network. **(8)**

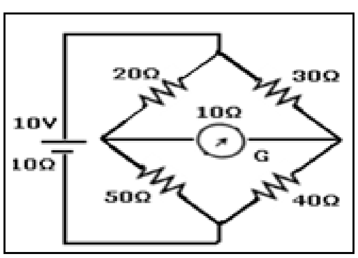

Fig.8

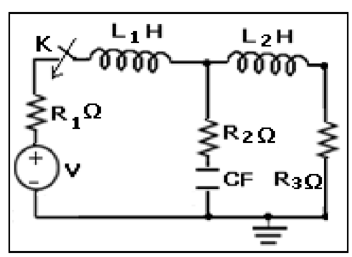

Fig.9

Q.8 a. Draw the h-parameter equivalent circuit and hence define different h-parameters **(6)**

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

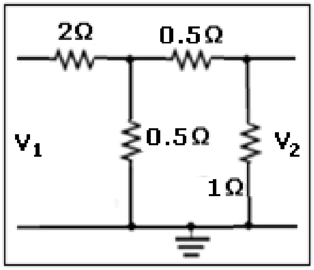

Fig.10

Q.9 a. Draw the pole-zero diagram of a driving point function $Z_{(s)} = \frac{s^4 + 10s^2 + 9}{s^3 + 4s}$. **(6)**

b. Synthesize the following functions in Cauer form andshow the synthesized network.

$$Z_{(s)} = \frac{(s^2+1)(s^2+3)}{s(s^2+2)}$$ **(10)**