Subject: NETWORKS AND TRANSMISSION LINES

Time: 3 Hours **DECEMBER 2010** **Max. Marks: 100**

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. If one of the resistors in a parallel circuit is removed, what happens to the total resistance?

(A) decreases **(B)** increases
(C) remains constant **(D)** exactly doubles

b. The voltage V is always equal to (Fig.1)

(A) 9V
(B) 5V
(C) 1V
(D) depends on the current I

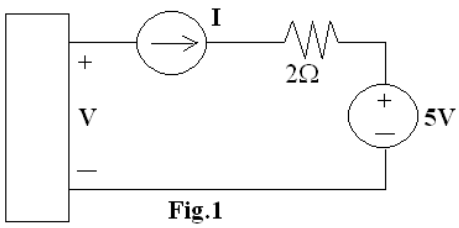

Fig.1

c. Superposition theorem is valid only for

(A) linear circuits **(B)** non linear circuits
(C) both linear and non linear **(D)** neither for linear nor for non-linear circuits

d. The reciprocity theorem is applicable to

(A) linear networks only **(B)** bilateral networks
(C) linear bilateral networks only **(D)** neither of the three

e. What is the total reactance of a series RLC circuit at resonance?

(A) equal to X_L **(B)** equal to X_C
(C) equal to R **(D)** zero

f. In a series RLC circuit operating below the resonant frequency, the current, if the applied voltage is v_s,

(A) I leads v_s **(B)** I lags behind v_s
(C) I is in phase with v_s **(D)** I is reversed

g. Mutual inductance is a property associated with

(A) only one coil
(B) two or more coils
(C) 2 or more coils with magnetic coupling
(D) two or more coils placed far apart

h. A 2-port Network is a network inside a black box and the network has only

(A) 2 terminals
(B) 2 pairs of accessible terminals
(C) 2 pairs of ports
(D) one terminal on each side of the black box

i. For 2 port network to be reciprocal, must satisfy the conditons

(A) $Z_{11} = Z_{22}$
(B) $Y_{21} = Y_{22}$
(C) $h_{21} = -h_{12}$
(D) AD – BC = 0

j. The propogation constant of a symmetrical T & π sections are the same

(A) True
(B) False
(C) Reverse of each other
(D) Complex conjugates

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

Q.2 a. Using source transformations, convert the given circuit in Fig.2 into an equivalent circuit with a single voltage source, single resistance. **(8)**

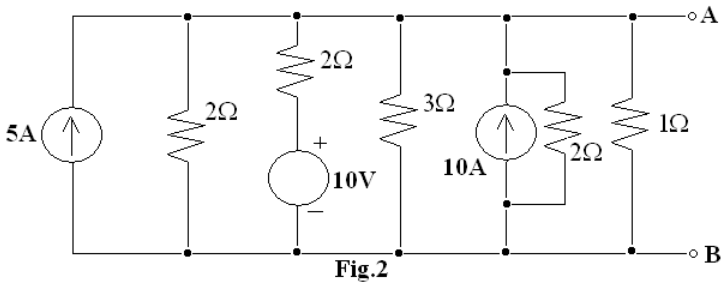

Fig.2

b. Given [illegible] currents i_1 and i_3. **(8)**

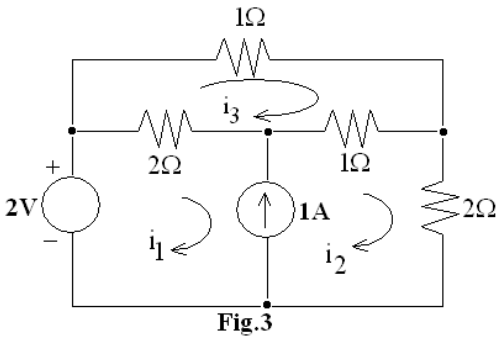

Fig.3

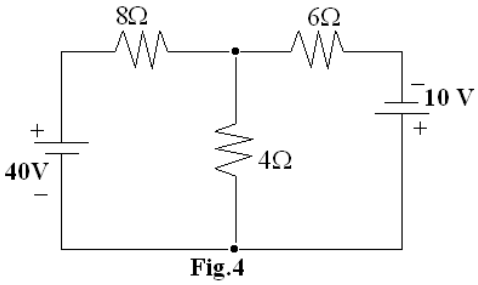

Fig.4

Q.3 a. Using node voltage analysis, find the current in all branches of the given network (Fig.4). **(8)**

b. For the network shown in Fig.5, write mesh equations. Draw the dual network and write its equations. **(8)**

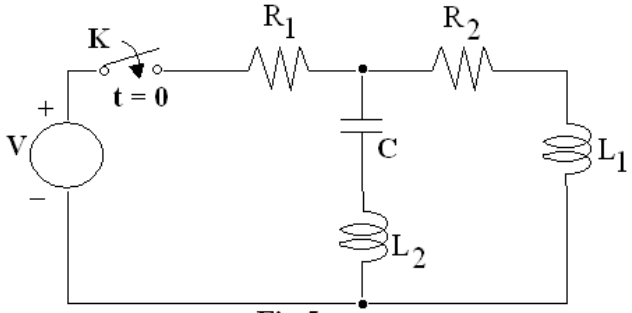

Fig.5

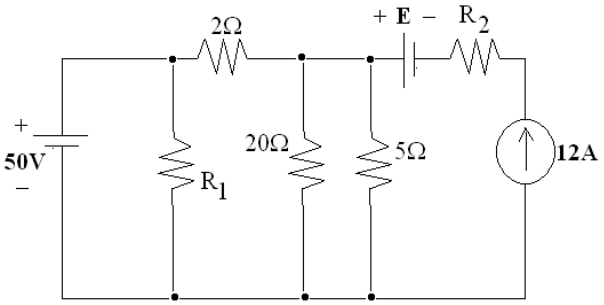

Fig.6

superposition theorem voltage source E can have any value. **(8)**

b. State
(i) maximum power transfer theorem
(ii) reciprocity theorem **(8)**

Q.5 a. Derive the equations for quality factor, bandwidth, selectivity of a series R–C circuit. **(8)**

b. A series RLC circuit has a quality factor of 5 at 50 rad/sec. The current flowing through the circuit at resonant is 10 amps and the supply voltage is 100V. The total impedance of the circuit is $20\,\Omega$. At $\omega = 40$ rad/sec, find the circuit constants. **(8)**

Q.6 a. Find the Laplace transform of the functions

(i) Unit step function $u(t)$

(ii) Exponential function $x(t) = e^{at}u(t), |a| < 1$

(iii) Sinusoidal function $x(t) = \sin(\omega t)$

(iv) Hyperbolic sine function $x(t) = \sinh(\omega t)$ **(8)**

b. Derive the equation for input impedance of a transmission line, in terms of: Z_O, Z_L and transmission constant γ and length l. **(8)**

Q.7 a. The characteristic impedance of uniform transmission line is 2039.6 Ω, at f = 800 Hz. At this frequency the propogation constant was found to be $0.054 \angle 87.9^\circ$. Determine the values of the constants R, L, G & C. **(8)**

b. Derive the equations for the elements of an m derived T & π sections. **(8)**

Q.8 a. Derive the hybrid parameters & transmission (ABCD) parameters, for a two-port network. **(8)**

b. For the network shown in Fig.7 determine
(i) Z-parameters (ii) y-parameters **(8)**

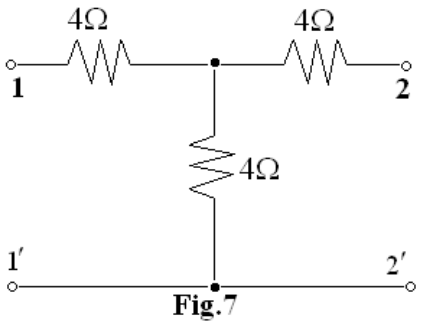

Fig.7

Q.9 Write short notes on any **TWO** of the followings:
(i) Symmetrical T attenuator
(ii) Symmetrical Lattice attenuator.
(iii) Impedance matching of a transmission line.
(iv) Thevenin's theorem and Norton's theorem. **(8+8)**