

**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.

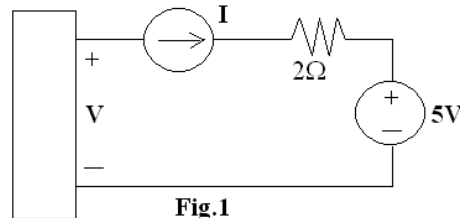
**Q.1 Choose the correct or the best alternative in the following: (2×10)**

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  $I$



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

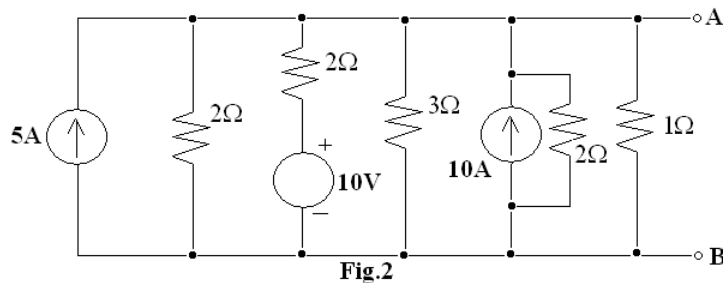
f. In a series RLC circuit operating below the resonant frequency, the current, if the applied voltage is  $v_s$ ,

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

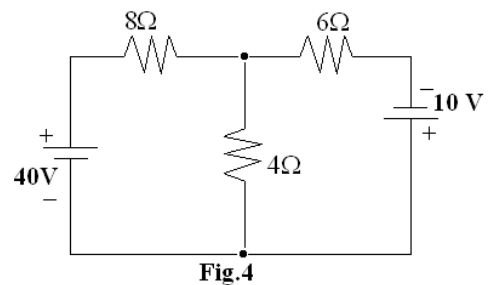
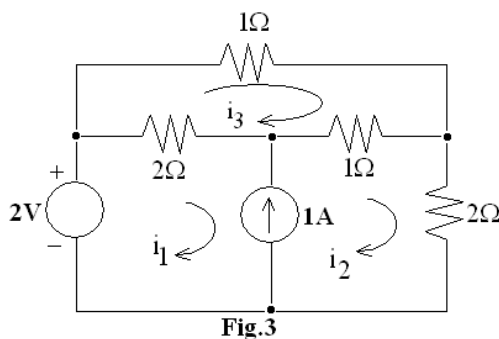
- g. Mutual inductance is a property associated with
- (A) only one coil
  - (B) two or more coils
  - (C) 2 or more coils with magnetic coupling
  - (D) two or more coils placed far apart
- h. A 2-port Network is a network inside a black box and the network has only
- (A) 2 terminals
  - (B) 2 pairs 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 &  $\pi$  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)



- b. Given the circuit in Fig.3, find the currents  $i_1$  and  $i_3$ . (8)



- Q.3** a. Using node voltage analysis, find the current in all branches of the network (Fig.4). (8)
- b. For the network shown in Fig.5, write mesh equations. Draw the dual network and write its equations. (8)

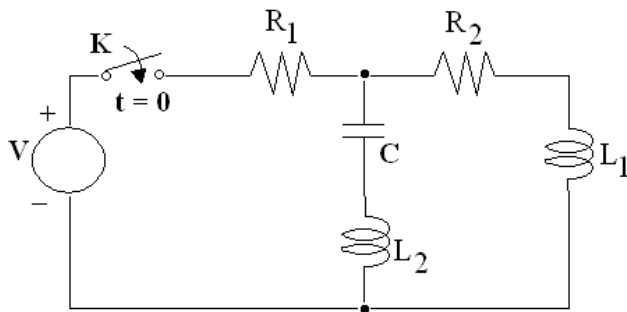


Fig.5

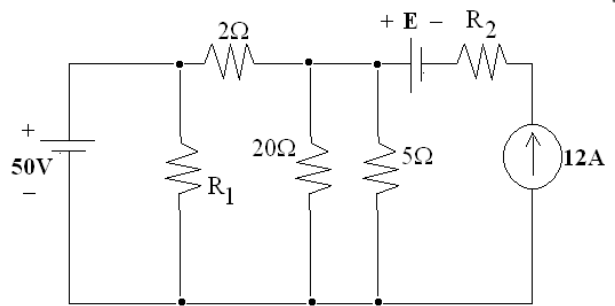


Fig.6

- c. Find the current in  $20\Omega$  resistor using 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:  $Z_0, Z_L$  and transmission constant  $\gamma$  and length  $l$ . (8)
- Q.7** a. The characteristic impedance of uniform transmission line is  $2039.6\Omega$ , at  $f = 800$  Hz. At this frequency the propagation 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 &  $\pi$  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)

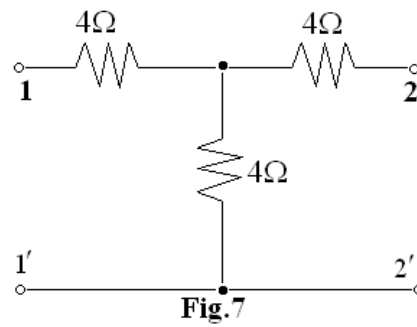


Fig.7

- 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)