Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. If there are "b" branches and "n" nodes, the number of tie set equations **1** given by-
(a) b   (b) n-1   (c) b-n+1   (d) b+n+1

ii. The "sharpness" of the resonance in a resonant circuit is measured **1** quantitatively by-
(a) Bandwidth   (b) Quality factor
(c) Resonant frequency   (d) None of these

iii. Which of the following theorems enables a number of sources to be **1** combined directly into a single source:
(a) Compensation theorem   (b) Reciprocity theorem
(c) Superposition theorem   (d) Millman's theorem

iv. In a linear system, several sources acting simultaneously produce an **1** effect which is the sum of the separate effects caused by individual sources acting at a time. This is-
(a) Thevenin theorem   (b) Norton's theorem
(c) Reciprocity theorem   (d) Superposition theorem

v. In the passive bandpass filter, the shunt element is- **1**
(a) Capacitive
(b) Inductive
(c) Series combination of L & C
(d) Parallel combination of L & C

vi. If a capacitor is energized by a symmetrical square wave current source, **1** then the steady state voltage across the capacitor will be –
(a) Square wave   (b) Triangular wave
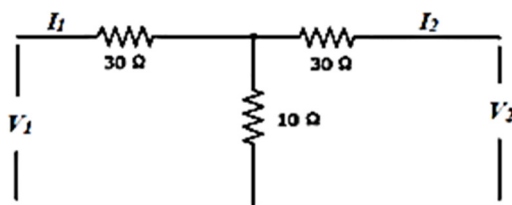(c) Step Function   (d) Impulse function

iii. With the help of frequency response curves, give the classification of **5** passive filters.
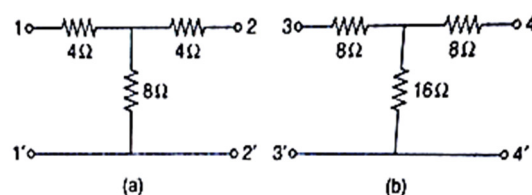
Q.5 Attempt any two:

i. For the symmetrical two port network shown in the given figure, find **5** the Z parameters and ABCD parameters.

ii. Calculate the driving point impedance Z(s) of the network shown in the **5** given figure. Plot the poles and zeros of the driving point impedance function on the s-plane.
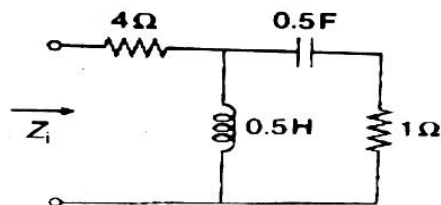
iii. Two networks shown in given figure are connected in series. Determine **5** the Z-parameters of the cascaded network.

Q.6 Attempt any two:

i. What are the properties of a positive real function? Explain the **5** procedure of testing of positive real function.

ii. Explain how one port R-L network can be synthesised using Foster **5** form –I, Cauer form – I method.

iii. Test whether the following polynomial is Hurwitz or not- **5**

$$F(s) = \frac{2s^4 + 6s^3 + 11s^2 + 10s + 5}{s^4 + 5s^3 + 8s^2 + 9s + 6}$$

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vii. When the two 2-port networks are connected in parallel, it is convenient to use- **1**
    (a) Z parameter   (b) h parameter
    (c) ABCD parameter   (d) Y parameter

viii. When the two 2-port networks are connected in cascade, it is convenient to use- **1**
    (a) Z parameter   (b) h parameter
    (c) ABCD parameter   (d) Y parameter

ix. Foster Form-I is defined only for- **1**
    (a) Admittance function   (b) Impedance functions
    (c) Both (a) and (b)   (d) None of these

x. The poles and zeros of a positive real function cannot have- **1**
    (a) Negative real parts   (b) Positive real part
    (c) Imaginary part   (d) None of these

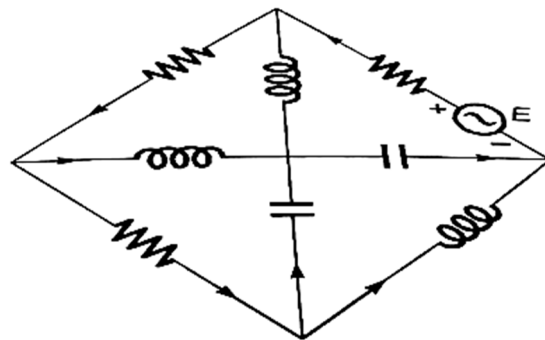Q.2 i. Count the number of branches and nodes in the following graph: **2**
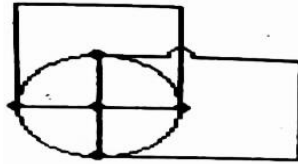
ii. Draw the incidence matrix of the following graph – **3**
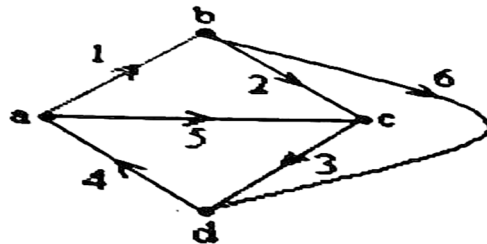
iii. In a parallel RLC circuit tuned to frequency $f_o = 10^6$ Hz and Bandwidth = 10 KHz. Given that L = 50 μH. Find (a) Q Factor (b) Capacitance at f_o and (c) Resistance **5**

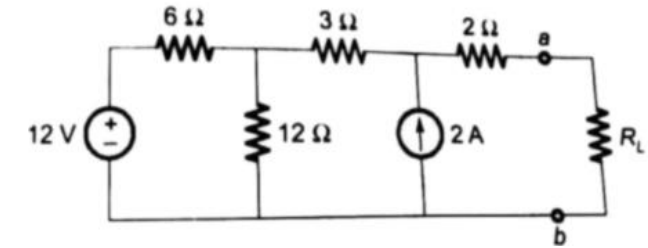OR iv. Develop tie-set schedule of the network shown below: **5**

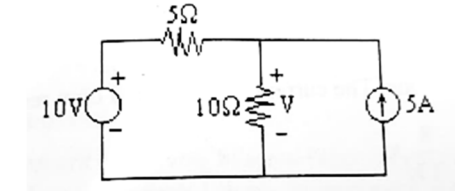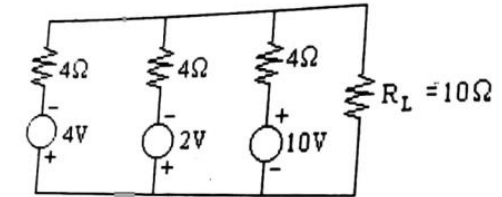Q.3 Attempt any two:

i. Find the value of R_L for maximum power transfer in the circuit of given figure. Find the maximum power. **5**

ii. Calculate the voltage V in the given circuit shown below using superposition theorem. **5**

iii. Using Millman's theorem, find the current through load R_L in the circuit shown in figure given below. Also find the voltage drop across R_L? **5**

Q.4 Attempt any two:

i. The circuit shown in the given figure consists of R, L, and C in series with a 100 V constant source. When the switch is closed at t=0, find the transient current. **5**
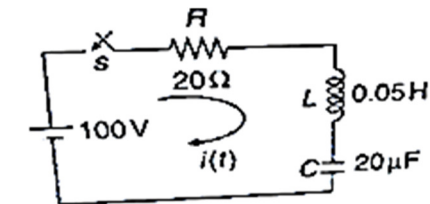
ii. For the given circuit, find the complete solution for current i(t) using Laplace transformation when the switch is closed. Assume zero charge across the capacitor before switching. **5**