7. Write short note on any three of the following:
   i. constant current source
   ii. Differentiator
   iii. Comparator
   iv. Divider

Group - E

8.(a) What do you mean by precision rectifier? Explain full wave precision rectifier.

(b) Explain the following Op-amp circuits with a neat circuit diagram.
i. Peak detector ii. Instrumentation amplifier iii. Voltage to current conve

2+4

9.(a) Explain using neat circuit diagram and waveforms, the application of timer IC a monostable multivibrator.

(b) Write a short note on Peak detector.

8+

Circuit Theory and Networks
(AEIE 2102)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

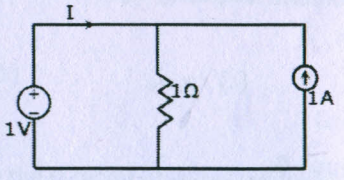
Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

Choose the correct alternatives for the following: **10 x 1=10**

) A current dependent current source is realized using
(a) inductor (b) bipolar Junction transistor
(c) field effect transistor (d) diode.

) The current passing through the resistor in the following circuit will be



(a) 0A (b) 1A (c) 2A (d) 4A.

) Two additively coupled coils, with self and mutual inductances L1, L2, and M , are connected in series. The overall inductance will be
(a) L1+L2+2M (b) L1+L2-2M
(c) $\frac{L1L2 - M^2}{L1 + L2}$ (d) $\frac{L1L2 - M^2}{L1 - L2}$

) A voltage source is described by v(t) = (1 + sint) volts. The RMS value of v(t) in volts is

(a) $\sqrt{\frac{3}{2}}$ (b) $\sqrt{\frac{2}{3}}$ (c) 1 (d) $\sqrt{\frac{1}{2}}$.

) If a R, L are connected through a switch to a supply voltage(v), the value of the current through the capacitor at t=0 and infinity will be
(a) V/R,0 (b) 0,V/R
(c) ∞,0 (d) 0,∞.

(vi) Number of cut-sets in a graph will be equal to
(a) number of twigs. (b) number of links.
(c) number of branches. (d) number of nodes.

(vii) To find h-parameters in a two port network,
(a) Both the ports are kept open.
(b) Input port open and output port shorted.
(c) Input current shorted and output port open.
(d) Both the ports are shorted.

(viii) Which of the followings is correct for Y_{11} in a two port network?
(a) $\frac{Z_{11}}{\det Z}$ (b) $\frac{Z_{22}}{\det Z}$ (c) $\frac{Y_{11}}{\det Y}$ (d) $\frac{Y_{22}}{\det Y}$.

(ix) An active low pass filter with RC passive components has the cut-off frequency
(a) $\frac{1}{2\pi RC}$ (b) $2\pi RC$ (c) $2\pi\sqrt{RC}$ (d) $\frac{1}{2\pi\sqrt{RC}}$.

(x) In a parallel resonating circuit, the resonance frequency ω_0 in terms of lower(ω_L) upper (ω_H) cut-off frequencies is given by
(a) $\frac{\omega_L}{\omega_H}$ (b) $\sqrt{\frac{\omega_L}{\omega_H}}$ (c) $\omega_L\omega_H$ (d) $\sqrt{\omega_L\omega_H}$.

Group - B

2.(a) State Superposition theorem. What are the limitations of Superposition theorem.

(b) Find the Thevenins's equivalent circuit of the circuit shown in Fig.1, to left of terminals ab. Also find the current through R_L = 16 ohm.

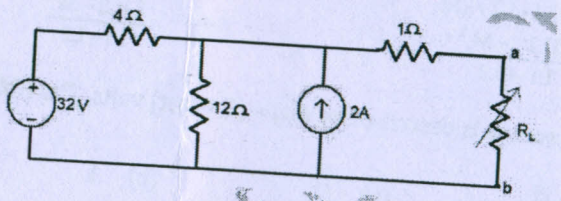


Fig.1

(c) How will you write the constraint equation for a dependent source? Explain with example.

(2+ 2) +4+ (2+2)=

In the circuit shown in Fig.2, the Norton equivalent current in amperes with respect to terminals P and Q is

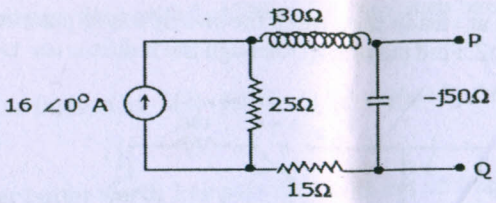


Fig.2

Derive the condition for parallel resonance.

Reduce the circuit in Fig.3 into a single voltage source by using source transformation.

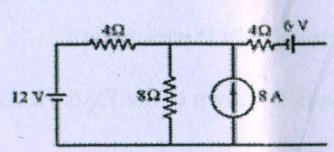


Fig.3

6 + 6 = 12

Group - C

Derive the Q-factor of series resonance circuit.

One RLC circuit has R= 30Ω, L=40mH and C= 50μF. Find the resonant frequency. Under resonant conditions, Calculate
i) The current and voltage drops across the R, L, and C if applied voltage is 120 V.
ii) Power factor
iii)Maximum power absorbed by the RLC circuit.

4 + (2+3+1+2) = 12

Derive the expression for damping factor in a series RLC circuit. Determine the value of R when the circuit is critically damped with L=2H, and C=5μF.

Find the Thevenin's equivalent resistance in kΩ and Thevenin's voltage between the terminals C and D in the circuit of Fig.4.

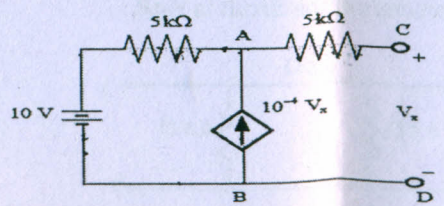


Fig.4

(4+2) + (3+3) = 12

Group - D

6.(a) The circuit in Fig.5 was at steady state when the switch was at position1. At t=0, the switch toggled to position2. Find current i(t)through the inductor for t>0.

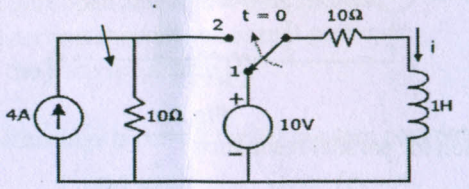


Fig.5

(b) Find the condition of reciprocity for ABCD parameters.

(c) A conventional two port network is shown in the Fig.6. Find Z and Y parameters of the circuit.

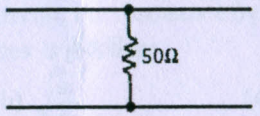


Fig.6

4+4+(2+2)= 12

7. (a) For the graph shown in Fig. 7.show the cut sets and establish the cut set matrix.

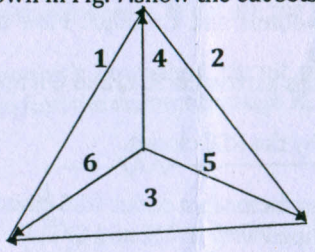


Fig.7

(b) Find the short circuit parameters of the circuit in Fig.8,

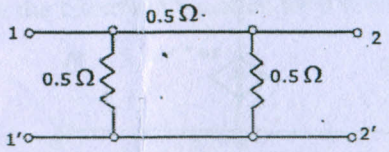


Fig.8

(3+3)+(3+3)= 12

an expression of the transfer function for a 2nd order high pass filter.

n a wide band pass filter with f_{ch}=500hz ,f_{cl}=2.5hz, pass band gain =2. **6+6=12**

riving function is given by $Z(s)=4s(s^2+4)/(s^2+2)(s^2+5)$. Design the circuits using and II forms.

n a third order butter worth low pass filter with cut off frequency 10khz. **6+6=12**