(b) Find the admittance parameters for a two port network in shown Fig. 9.

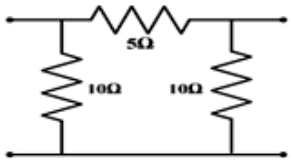


Fig. 9

Check the symmetry and reciprocity of the above network.

(4 + 2) + 6 = 12

7. (a) Fig. 10 represents a series RLC circuit. Find the value of capacitor C needed to have critically damped response for i (t). The values of R and L are given as 40Ω and 4H respectively.

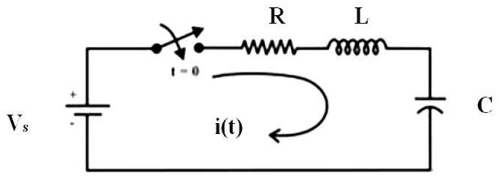


Fig. 10

(b) The capacitor, shown in Fig. 11, is initially charged to +10 V. The switch closes at time t=0. Find the value of $V_c(t)$ at time t=10 ms.

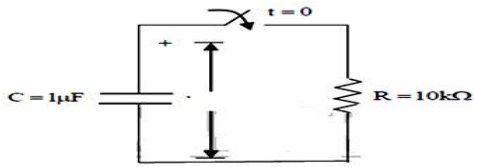


Fig. 11

6 + 6 = 12

Group – E

8. (a) Draw the frequency response of band pass and band reject filters.

(b) Draw the circuit and explain the operation of 1st order HP Butterworth filter.

(2 + 2) + 8 = 12

9. (a) The driving point impedance of a circuit is given by $Z(s)=\frac{(s+1)}{s(s+2)}$. Draw a circuit showing the components and their values.

(b) Propose the type of the filter circuit as shown in Fig.12.

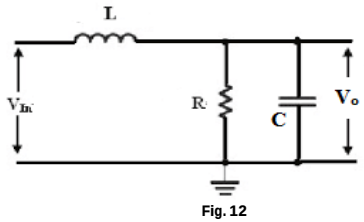


Fig. 12

8 + 4 = 12

CIRCUIT THEORY AND NETWORK ANALYSIS
(AEIE 2103)

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.

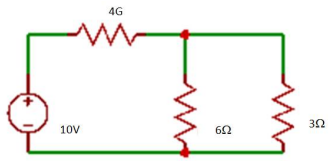
Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) In Superposition theorem, while considering a source, all other voltage sources are----------.
(a) open circuited (b) short circuited
(c) change its position (d) removed from the circuit

(ii) In a parallel RLC circuit, the currents through the capacitor and inductor are equal. What is the power factor of the circuit?
(a) lagging (b) leading (c) unity (d) 0.5.

(iii) Find the current through 3Ω resistor in the circuit shown below.



(a) 1 (b) 2 (c) 3 (d) 4.

(iv) The most elementary form of a loop which cannot be further divided into other loops is called
(a) node (b) branch (c) loop (d) mesh.

(v) The impedance of an element is given by (2 - j 3)Ω. The element comprises of
(a) resistor and inductor (b) resistor and capacitor
(c) capacitor and inductor (d) all of the above.

(vi) Which of the followings is correct for Y_{21} in a two-port network?
(a) $\frac{Z_{11}}{\det Z}$ (b) $-\frac{Z_{21}}{\det Z}$ (c) $\frac{Z_{21}}{\det Z}$ (d) $\frac{\det Z}{Z_{21}}$.

(vii) A voltage dependent current source is realized using a/an
(a) inductor (b) bipolar junction transistor
(c) field effect transistor (d) diode.

(viii) In a series RLC circuit, voltages across the resistor, inductor and capacitor are 3 V, 4 V and 4 V respectively, then the applied voltage is
(a) 3 V (b) 4 V (c) 5 V (d) 7 V.

(ix) A network, described by ABCD parameters, will be reciprocal if
(a) A=D (b) (AD-BC)=1 (c) (AC-BD)=1 (d) (AD-BC)=0.

(x) In a pure inductive circuit if the supply frequency is reduced to ½ (half), the current will be
(a) reduced by half (b) doubled
(c) reduced to one fourth (d) four times as high.

Group – B

2. (a) The circuit shown in Fig. 1, find the mesh currents I_1, I_2 and I_3.

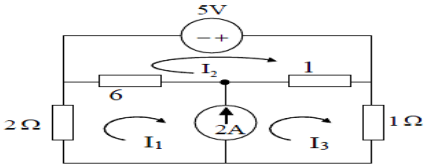


Fig. 1

(b) In the circuit of Fig. 2, superposition is applied. When V_1 is set to 0 V, the current I_1 is +12A. When V_2 is set to 0V, the current is –12A. Find Current I_3, when both sources are present in the circuit.

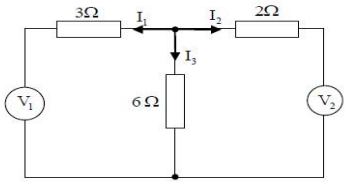


Fig. 2

OR

Find the magnitude of current through the resistor R_2 shown in the Fig. 3.

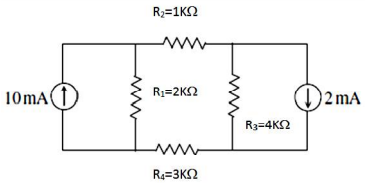


Fig. 3

6 + 6 = 12

3. (a) For the circuit shown in the Fig. 4, find the Thevenin's voltage and Thevenin's resistance.

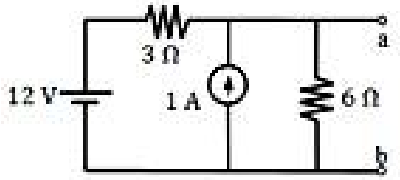


Fig. 4

(b) Find the current **I** flowing through the 2 Ω resistor in the circuit shown in Fig. 5.

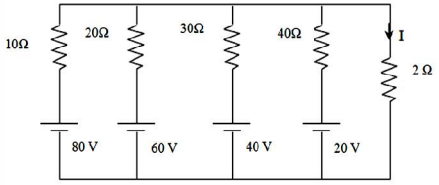


Fig. 5

Calculate the power dissipation through the 2 Ω resistor.

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

Group – C

4. (a) The circuit shown in fig. 6, a 230 V, 50 Hz single phase source is coupled to an RLC load. Find the magnitude of the active power (in VAr) supplied by the source.

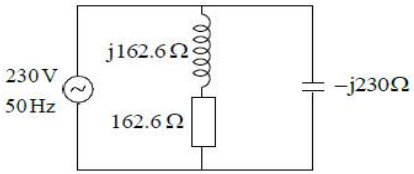


Fig. 6

(b) Determine the source voltage connected across an RL circuit (Fig. 7) if voltages across the resistor and inductor are 70 V and 20 V respectively. Show the associated phasor diagram.

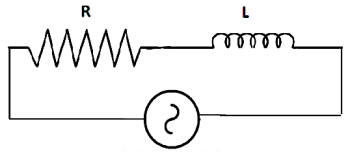


Fig. 7

(4 + 2) + 6 = 12

5. (a) The voltage across and the current through a load are expressed as follows:
$v(t) = -20\sin 314(t - 60^0)$ and $i(t) = 10\cos(314t + 60^0)$
Find the average power consumed by the load.

(b) Fig. 8 shows a circuit that has two sources connected in series. The instantaneous voltage of the AC source is given by v (t) = 12 sin t. If the circuit is in steady-state, then find the RMS value of the current flowing in the circuit.

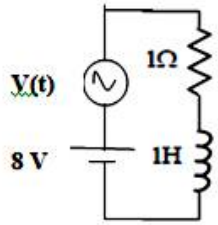


Fig. 8

6 + 6 = 12

Group – D

6. (a) Express Z parameters in terms of ABCD parameters.