(vii) A function that repeats itself after fixed intervals is said to be
(a) a phasor (b) harmonic
(c) periodic (d) reactive.

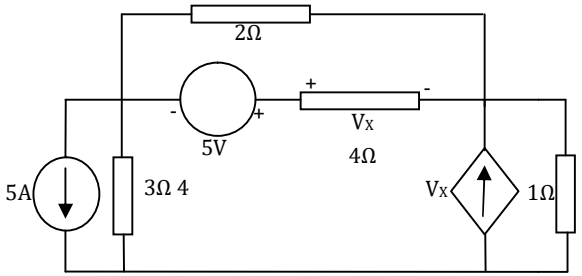
(viii) The imaginary part of impedance is called
(a) resistance (b) admittance
(c) reactance (d) conductance.

(ix) The coefficient of coupling for two coils having L_1 = 2H, L_2 = 8H and M = 3H is
(a) 0.1875 (b) 0.75 (c) 1.333 (d) 5.333.

(x) A transformer is used in stepping down or stepping up
(a) dc voltage (b) ac voltage
(c) both dc and ac voltage (d) direct current.

Group - B

2. (a)



Find the voltage across 4Ω using Nodal analysis.

(b) In a transformer the primary coil have a leakage flux (φ_{11}) of 0.5 mWb and they have mutual flux (φ_{12}) of 0.3 mWb. If the number of turns are 100 and 500 respectively in primary and secondary and if current flow through primary is 1 amp, then find (i) K, the coefficient of coupling, (ii) the inductances L_1 and L_2, and (iii) M, the mutual inductance.

6 + 6 = 12

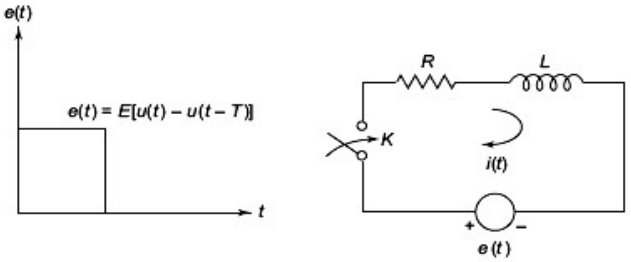
3. (a) Establish a relation between Q-factor, bandwidth and resonant frequency of a series RLC circuit.

(b) A series RLC circuit has R = 4 Ω, L = 6 mH and C = 8 μF. Calculate (i) the Q-factor, (ii) the bandwidth, (iii) the resonant frequency, (iv) the half-power frequencies and also (v) find the frequency at which V_c (voltage across capacitor) is maximum.

4 + 8 = 12

Group - C

4. (a) Obtain the pulse response for the series RL circuit, shown i below. Find transient as well as steady state current in the circu

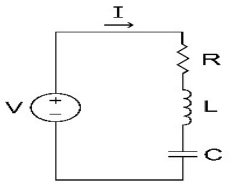


(b) A transfer function is given by $F(s) = \frac{s^2+10s+}{(s+1)(s+2)(s+3)}$; find $F($ steady state value of $F(t)$.

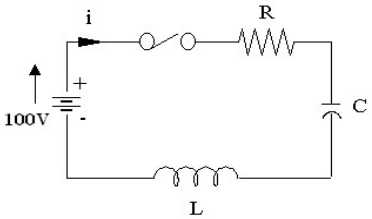
(c) Find the final value of current using final value theorem in a RL circuit following step response.

6 + 3 + 3

5. (a) Derive the step response of the series RLC circuit as shown i below. Then define the following terms from the derived equ (i) neper frequency, (ii) angular resonance frequency (iii) damping factor.



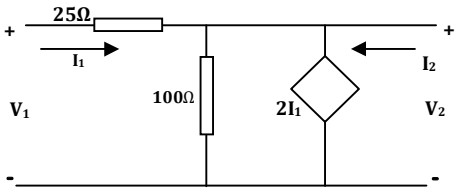
(b) The circuit shown consists of R, L and C in series with a constant source when the switch is closed at t = 0. Find (transient and steady state current, (ii) damping factor and a resonance frequency.



(2 + 3 + 3) + (2 + 2

Group – D

6. (a)



Find the short circuit parameters of the circuit shown in the above figure. Does it satisfy the condition of symmetry or reciprocity?

(b) Find the symmetry condition for the h parameters.

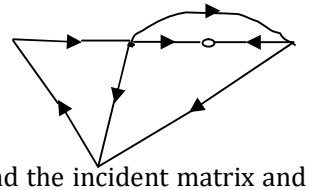
(6 + 2) + 4 = 12

7. (a) Reduced incident matrix of a graph is given by

Nodes ↓	Branches →					
	0	1	0	-1	-1	1
	0	-1	1	0	1	0
	1	0	-1	0	0	0

Draw the oriented graph. Select a tree and find the cut set matrix.

(b)



Find the incident matrix and tie-set matrix of the graph as shown in figure above.

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

Group - E

8. (a) Design an active band pass filter with bandwidth 10khz and pass band gain 3.

(b) Explain with proper diagram how all pass filter can be used as delay unit.

6 + 6 = 12

9. An impedance is given by

$$Z(S) = \frac{8(S^2+1)(S^2+3)}{S(S^2+2)(S^2+4)}$$

Realize the network in FOSTER form I and CAUER form II.

(6 + 6) = 12

CIRCUIT THEORY & NETWORKS
(AEIE 2102)

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

Figures out of the right margin indicate full marks.

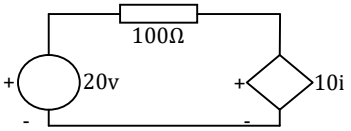
Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

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

(i) Find the value of i form the circuit diagram



(a) 0.18A (b) -0.81ª (c) 1.81A (d) 18.18A.

(ii) To design an active band pass filter, the LPF and HPF are connected in
(a) parallel (b) series
(c) both series and parallel (d) none of these.

(iii) If A = 8, B = 5, C = 11, D = 7, then it will satisfy:
(a) symmetry condition (b) reciprocity condition
(c) dual condition (d) none of these.

(iv) If $Z_L = R_L + jX_L$ and $Z = R + jX$, where X_L is fixed then the condition of maximum power transfer will be
(a) $R_L^2 = R^2 + X^2$ (b) $R_L^2 = R^2 + (X + X_L)^2$
(c) $R_L^2 = R^2 + X_L^2$ (d) none of these.

(v) The condition of reciprocity for h parameter is
(a) $h_{11} = h_{22}$ (b) $h_{12} = h_{21}$
(c) $h_{12} = -h_{21}$ (d) none of these.

(vi) In a series RLC circuit, setting R = 0 will produce
(a) an overdamped response (b) a critically damped response
(c) an underdamped response (d) an undamped response.