B.TECH/ECE/3RD SEM/ELEC 2102 (BACKLOG)/2018 CIRCUIT THEORY (ELEC 2102)

Time Allotted : 3 hrs

Full Marks: 70

 $10 \times 1 = 10$

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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:

- (i) The reciprocity theorem is applicable for a network containing
 - (a) Independent sources only
 - (b) Dependent sources only
 - (c) Both dependent & independent sources
 - (d) Any one of dependent & independent sources.
- (ii) Superposition theorem is not applicable for(a) Current Calculation
 - (b) Voltage Calculation (d) None of the above.

(d)LR.

- (c) Power Calculation
 (d) None of the above as
 (a) Short circuit
 (b) Open Circuit
 (c) Voltage Source
 (d) Current Source.
- (iv) Time constant of series RL circuit is (a) R/L (b) L/R (c) L+R
- (v) For a network having N nodes and B branches, the number of twigs will be
 (a)N
 (b)N-1
 (c)B-N+1
 (d) B+N-1.
- (vi) In a series RC circuit, if the output is measured across the capacitor, then the circuit can be considered as a
 - (a) Band Pass Filter(b) Band Reject Filter(c) Low Pass Filter(d) High Pass Filter.
- (vii) The condition for reciprocity for any two port network is
 - (a) $Y_{12} = Y_{21}$ (b) $Z_{22} = Z_{11}$ (c) A - BC = 1 (d) $Z_{12} = Y_{21}$
- (viii) Four capacitors each of 20 μF are connected in parallel, the equivalent capacitance of the system will be
 - (a) $40\mu F$ (b) $10\mu F$ (c) $20\mu F$ (d) $80\mu F$.

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- (ix) If the Laplace transform of f(t) is F(s), then the Laplace transform of e^{at}f(t) is
 - (a)F(s+a) (b) F(s-a) (c)F(s/a) (d)F(sa).
- (x) The 3dB frequency of a bandpass filter is calculated at
 (a) Peak power point
 (b) Half power point
 (c) Quarter power point
 (d) None of the above

Group – B

- 2. (a) Show that the maximum power will be delivered by a voltage source to a resistive load R_L when the load resistance is equal to the internal resistance of the voltage source.
- (b) Using superposition theorem find out the current I for the following network.



(c) Find the equivalent resistance across the terminals a, b of the following network.



4+5+3=12

6 + 6 = 12

- 3. (a) Show that for reciprocal two port network the transmission parameters should hold the following relation.
 - AD BC = 1.
 - (b) Find the value of i_0 and v_0 for the following circuit.



Group – C

- 4.(a) Derive the current expression for a series R-L network excited by a step voltage of height V considering zero initial condition. Also plot the current.
 - (b) Determine the capacitor current i(t) for t > 0 for the given circuit.



(5 +1) + 6 =12

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5.(a) The switch S in the network is opened at t = 0. Calculate the current i(t).



(b) Calculate the Laplace transform of the given periodic function.



Group - D

6. (a) Derive the Tie-set matrix for the network shown below.



(b) Find the voltage drop equations for the oriented graph given below.



6 + 6 = 12

6 + 6 = 12

- 7.(a) What are the admitance parameters and transmission parameters? Express transmission parameters in terms of admitance parameters.
- (b) Determine the z-parameters for the following two port network.



(2+4)+6=12

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- 8.(a) Design a 1st order low pass filter having a dc gain of 5 and corner frequency of 10kHz using ideal OPAMP.
- (b) Derive the transfer function of the following filter. Comment on the type of the filter.



- 9.(a) Write a short note on ac analysis using PSPICE.
- (b) Write the source file for the following circuit to find the voltage between the nodes (1, 2) and current through 4 ohm resistor.



6 + 6 = 12

6 + 6 = 12

3

4