

**GURU NANAK INSTITUTE OF TECHNOLOGY**  
**An Autonomous Institute under MAKAUT**  
**2020-2021**  
**CIRCUIT THEORY AND NETWORKS**  
**EC302**

TIME ALLOTTED: 3 Hours

FULL MARKS: 70

*The figures in the margin indicate full marks.*

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

**GROUP – A**

**(Multiple Choice Type Questions)**

1. Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

- |        |   | Marks | CO No |
|--------|---|-------|-------|
| 1(i)   | The equivalent resistance of the figure between x and y is  | 1     | CO1   |
|        |   |       |       |
|        | a) $30\Omega$<br>b) $50\Omega$<br>c) $60\Omega$<br>d) $10\Omega$                                  |       |       |
| 1(ii)  | For a resistive load network maximum power transfer occurs at efficiency of                       | 1     | CO2   |
|        | a) 25%<br>b) 50%<br>c) 75%<br>d) 100%   |       |       |
| 1(iii) | A R-L series circuit has a time constant given by   | 1     | CO3   |
|        | a) $R/L$<br>b) $L/R$<br>c) $1/(RL)$<br>d) $2RL$   |       |       |
| 1(iv)  | Laplace transform of $\sin(at)u(t)$ is?   | 1     | CO2   |
|        | a) $s/a^2+s^2$<br>b) $a/a^2+s^2$<br>c) $s^2/a^2+s^2$<br>d) $a^2/a^2+s^2$                          |       |       |
| 1(v)   | In which of the following oscillations are not present?   | 1     | CO2   |
|        | a) Under damping<br>b) Over damping<br>c) Critical damping<br>d) Both 2 and 3                     |       |       |
| 1(vi)  | When a unit impulse voltage is applied to an inductor of 1H, the energy supplied by the source is | 1     | CO1   |
|        | a) Infinite<br>b) 0<br>c) 1/2J<br>d) 1J   |       |       |

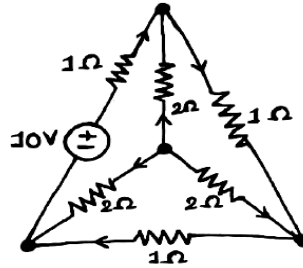
- |         |   |   |     |
|---------|---|---|-----|
| 1(vii)  | The no of Links for a graph having n nodes and b branches are<br>a) $b-n+1$<br>b) $n-b+1$<br>c) $b+n-1$<br>d) $b+n$   | 1 | CO5 |
| 1(viii) | Laplace transform of $f(t) = 1$ is<br>a) $1/S$<br>b) $1/S^2$<br>c) $S$<br>d) $S^2$  | 1 | CO5 |
| 1(ix)   | A two port network is symmetrical if and only if<br>a) $Z_{11}=Z_{22}$<br>b) $BC-AD= -1$<br>c) $A=D$<br>d) $Y_{11}=Y_{21}$  | 1 | CO4 |
| 1(x)    | For maximum power to be transferred between the load and the source the condition is<br>a) $R_S>R_L$<br>b) $R_S=R_L$<br>c) $R_S<R_L$<br>d) None of these.   | 1 | CO1 |
| 1(xi)   | The coefficient of coupling for two coils having $L_1=2H$ , $L_2=8H$ , $M=3H$ is<br>a) 0.75<br>b) 0.1875<br>c) 1.333<br>d) 5.333  | 1 | CO1 |
| 1(xii)  | A cut-set schedule gives the relation between<br>a) Branch current and link current<br>b) Branch voltage and tree branch voltage<br>c) Branch voltage and link voltage<br>d) d. Branch and tree current | 1 | CO5 |

**GROUP – B**

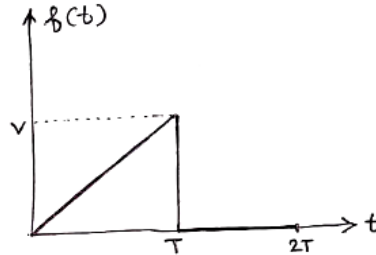
**(Short Answer Type Questions)**

(Answer any *three* of the following)     **3 x 5 = 15**

- |   |   |   |     |
|---|---|---|-----|
| 2 | Find the node voltage $V_2$ in the network of the following Figure.                     | 5 | CO1 |
|   |   |   |     |
| 3 | With reference to the figure draw the oriented graph and write down the Tie Set matrix. | 5 | CO5 |



- 4 Explain Source Transformation formula with suitable justification. 5 CO2
- 5 Find the laplace transform of the waveform shown in figure. 5 CO3



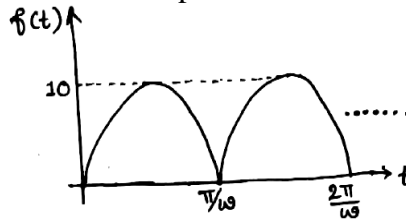
- 6 A Series resonant circuit has an impedance of 500 ohm at resonant frequency. Cut off frequencies are 10 kHz and 100 Hz. Determine (a) resonant frequency (b) value of L, C, and (c) quality factor at resonant frequency. 5 CO3

**GROUP – C**

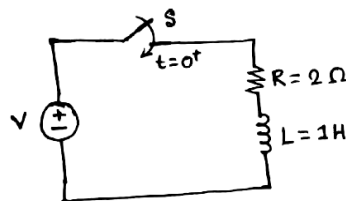
**(Long Answer Type Questions)**

(Answer any *three* of the following) 3 x 15 = 45

- S1 Question Marks CO No
- 7.a) Find the laplace transform of the periodic waveform shown in figure. 5 CO3

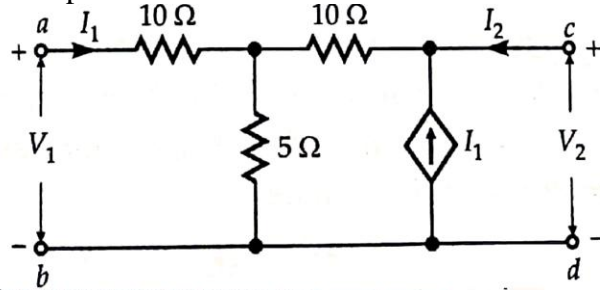


- 7.b) For an RL series circuit shown in figure, with no initial current in the inductor, a voltage  $V = 4e^{-t}$  volts is applied at  $t = 0$  sec. find the expression for the resulting current in the circuit for  $t \geq 0$  using laplace transform method. 5 CO2

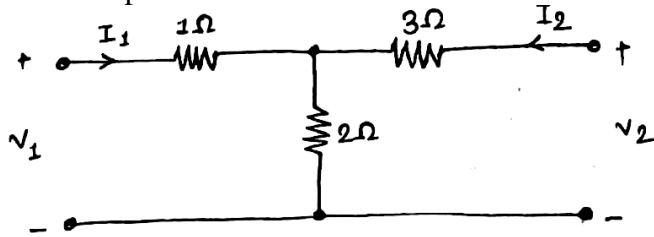


- 7.c) Find the inverse Laplace transform of  $F(s) = \frac{s^2 - 15s - 11}{(s+1)(s-2)^2}$  5 CO2
- 8.a) Find Z-parameters in terms of Y-parameters of a two port network. 5 CO4

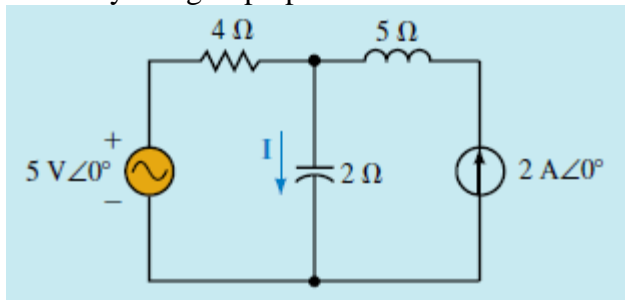
- 8.b) Determine the Z parameters of the network shown below: 5 CO4



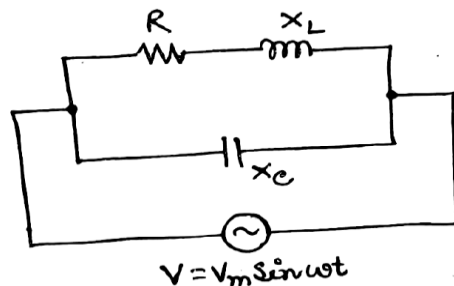
- 8.c) Find Y parameters for the network. Determine whether the network is symmetrical and reciprocal. 5 CO4



- 9.a) State and explain Norton theorem. 6 CO1  
 9.b) Find the current I by using Superposition theorem. 9 CO1



- 10.a) Derive the expression for resonant frequency for the parallel circuit shown in figure. 5 CO3



- 10.b) A series RLC resonance circuit has a impedance of 500Ω at resonant frequency. Cutoff frequencies are 10,000Hz and 100Hz. Determine 5 CO3

- i) Resonant frequency.
- ii) Value of L and C.
- iii) Quality factor at resonant frequency.

- 10.c) Two impedances  $Z_1 = (20 + j10) \Omega$  and  $Z_2 = (10 - j30) \Omega$  are connected in parallel and this combination is connected in series with  $Z_3 = (10 + jX) \Omega$ . Find the value of X which will produce resonance. 5 CO3

- 11.a) Define incident matrix of a graph and draw the orientation graph from the reduced incident matrix. 6 CO5

$$[A] = \begin{bmatrix} 0 & -1 & 1 & 1 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

- 11.b) For the network shown in figure obtain current, I through 8 V battery. 9 CO5

