GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2020-2021
CIRCUIT THEORY AND NETWORK
CS303

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)

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

		Marks	CO No
1(i)	The system y(t)= tx(t)+4 is	1	CO3

       a) non linear, time varying and unstable
       b) linear, time varying and unstable
       c) non linear, time- invariant and unstable
       d) non linear, time varying and stable

		Marks	CO No
1(ii)	The theorem that enables a number of voltage (or current) sources to be combined directly into a single voltage (or current) source is the ....theorem	1	CO1

       a) Superposition
       b) Reciprocity
       c) Milliman's
       d) . Thevenin

		Marks	CO No
1(iii)	A R-L series circuit has a time constant given by	1	CO3

       a) R/L
       b) L/R
       c) 1/(RL)
       d) 2RL

		Marks	CO No
1(iv)	Laplace transform if $\sin(at)u(t)$ is?	1	CO2

       a) s/a^2+s^2
       b) a/a^2+s^2
       c) s^2/a^2+s^2
       d) a^2/a^2+s^2

		Marks	CO No
1(v)	How is the discrete time impulse function defined in terms of the step function?	1	CO2

       a) d[n] = u[n+1] – u[n]
       b) d[n] = u[n] – u[n-1]
       c) d[n] = u[n] – u[n-2]
       d) d[n] = u[n+1] – u[n-1]

		Marks	CO No
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
       b) 0
       c) 1/2J
       d) 1J

1(vii) The no of Iinks for a graph having n nodes and b branches are   1   CO5
    a) b-n+1
    b) n-b+1
    c) b+n-1
    d) b+n

1(viii) A tie set matrix has 3 rows and 7 branches. The number of twigs is   1   CO5
    a) 3
    b) 5
    c) 2
    d) 4

1(ix) A two port network is symmetrical if and only if   1   CO4
    a) $Z_{11}=Z_{22}$
    b) BC-AD= -1
    c) A=D
    d) $Y_{11}=Y_{21}$

1(x) Under the condition of maximum power transformation, efficiency of the circuit is   1   CO1
    a) 100%
    b) 50%
    c) 25%
    d) 75%

1(xi) The coefficient of coupling for two coils having $L_1=2H$, $L_2=8H$, M= 3H is   1   CO1
    a) 0.75
    b) 0.1875
    c) 1.333
    d) 5.333

1(xii) The input and output of a continuous time system are respectively denoted by x(t) and y(t), which of the following description corresponds to a causal system?   1   CO3
    a) y(t)= x(t-2)+x(t-4)
    b) y(t)=x(t-4)x(t+1)
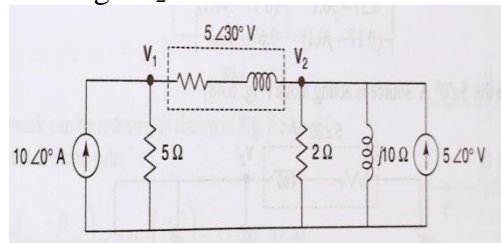   c) y(t)=x(t+4)x(t-1)
    d) y(t)=(t+5)x(t+5)

GROUP – B
### (Short Answer Type Questions)
(Answer any *three* of the following)   **3 x 5 = 15**

|		Marks	CO No
2.	Find the node voltage V_2 in the network of the following Figure.	5	CO1

3.b)	Explain the concept of mutual inductance with a suitable example.	2	CO1
3.b)	Derive the expression between self-inductances of two coils and the mutual inductance between them.	3	CO1

4 Find a tree from the graph of the network shown in the below figure.   5   CO5
Make the tie-set matrix and write the equations loop currents. All the
values given in the figure are in ohms.
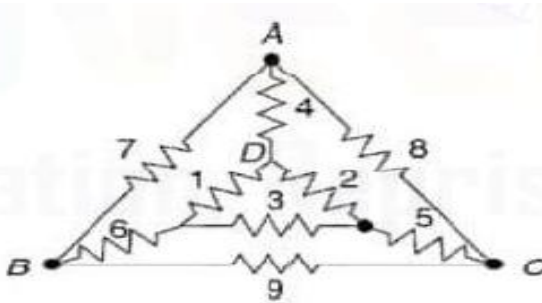
5 Find the laplace transform of the waveform shown in figure.   5   CO3
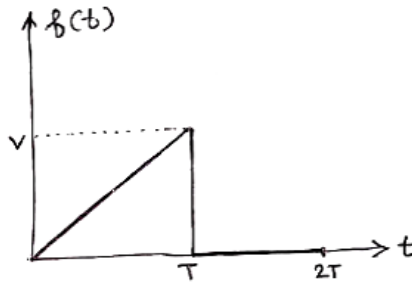
6 A Series resonant circuit has an impedance of 500 ohm at resonant   5   CO3
frequency. Cut off frequencies are 10 kHz and 100 Hz. Determine (a)
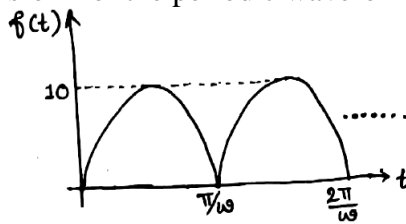resonant frequency (b) value of L, C, and (c) quality factor at resonant
frequency.

GROUP – C
(Long Answer Type Questions)
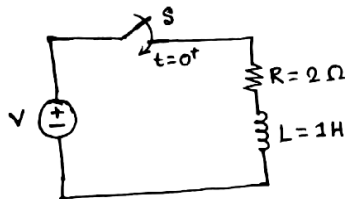(Answer any *three* of the following)   **3 x 15 = 45**

|		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   5   CO2
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.

|			
7.c)	Find the inverse Laplace transform of $F(s) = \dfrac{s^2 - 15s - 11}{(s+1)(s-2)^2}$	5	CO2
8.a)	What are the conditions for system to be a linear system? Give one practical example each of an ideal voltage source and ideal current source.	5	CO3
8.b)	Find the effective value of the inductance for the following connection	5	CO1
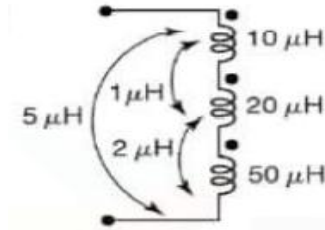
8.c)	Prove, $k = \dfrac{M}{\sqrt{L_1 L_2}}$, Where k= coupling co-efficient, M= Mutual inductance and $L_1 L_2$ are the self inductance of a coupled circuit.	5	CO1
9.a)	State and explain Norton theorem.	6	CO1
9.b)	Find the current I by using Superposition theorem.	9	CO1
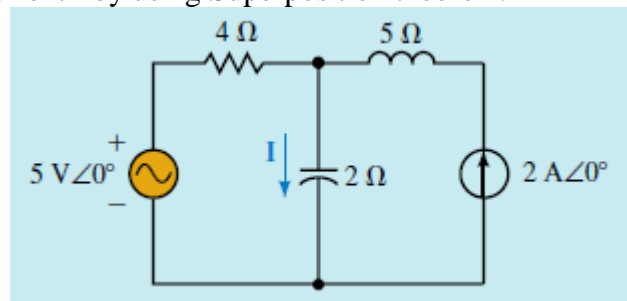
10,a)	A capacitor of 5 micro Farad is charged initially to 10V and connected to 10KOhm resistance. It is allowe to discharge through it by witching of a switch k. find the discharging current.	5	Co2
10.b)	Obtain the Laplace transform of the given square wave train.	6	Co2
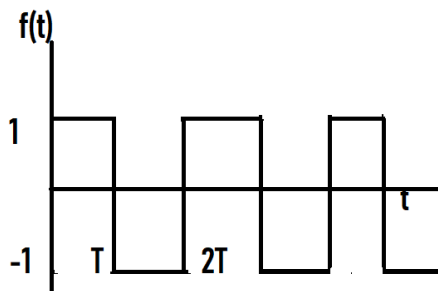
10.c)		4	Co2
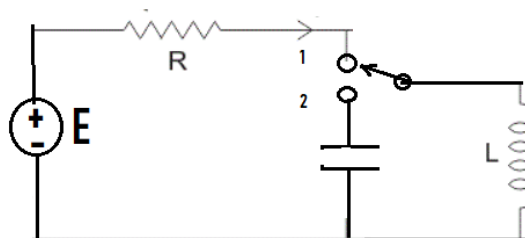
Obtain expression for current flowing through the circuit.

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