

GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2020-2021

Electrical Circuit Analysis

EE301

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: **0×1=10**

| | | Marks | CO No |
|----|---|-------|-------|
| 1. | i) The coefficient of coupling for two coils having $L_1=2H$, $L_2=8H$, $M= 3H$ is a) 0.75 b) 0.1875 c) 1.333 d) 5.333 | 1 | CO2 |
| | ii) For maximum power to be transferred between the load and the source the condition is a) $R_S > R_L$ b) $R_S = R_L$ c) $R_S < R_L$ d) None of these. | 1 | CO1 |
| | iii) A periodic function $f(t)$ with time period T repeats itself after half time period T/2. The Fourier series of $f(t)$ would contain a) cosine terms only b) even harmonic terms only c) odd harmonic terms only d) sine terms only | 1 | CO2 |
| | iv) The no of links for a graph having n nodes and b branches are a) $b-n+1$ b) $n-b+1$ c) $b+n-1$ d) $b+n$ | 1 | CO2 |
| | v) Maximum Power transfer occurs at a a) 100% efficiency b) 75% efficiency c) 10% efficiency d) 50% efficiency | 1 | CO1 |

| | | | |
|-------|---|---|------|
| vi) | The System $y(t)=t x(t)+4$ is 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 | 1 | CO3 |
| vii) | In a linear circuit when the ac input is doubled the ac output becomes a) One fourth b) half c) two times d) four time | 1 | CO4 |
| viii) | Laplace transform analysis gives a) Time domain response onty b) Frequency domain response only c) Both A and B d) None of these | 1 | CO1 |
| ix) | For hybrid parameters the condition of symmetry is a) $h_{11}h_{22}-h_{12}h_{21}=1$ b) $h_{12}=h_{21}$ c) $h_{11}=h_{22}$ d) None | 1 | CO.2 |
| x) | To determine the polarity of the voltage drop across a resistor, it is necessary to know a) value of current through the resistor b) direction of current through the resistor c) value of resistor d) e.m.fs. in the circuit | 1 | 3 |
| xi) | Can we use Norton's theorem on a circuit containing a BJT? a) Yes b) No c) Depends on the BJT d) Insufficient data provided View | 1 | 1 |
| xii) | The minimum amount of hardware required to make a lowpass filter is a) a resistance, a capacitance and an opamp. b) a resistance, an inductance and an opamp. c) a resistance and a capacitance. d) a resistance, a capacitance and an inductance | 1 | 2 |

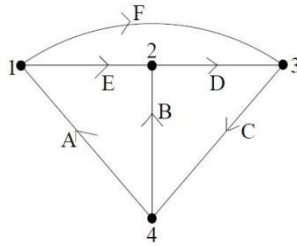
GROUP – B

(Short Answer Type Questions)

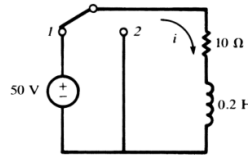
Answer any *three* from the following: **3×5=15**

| | | Marks | CO No |
|----|---|--------------|--------------|
| 2. | a) State Thevenin's Theorem with the help of suitable diagrams? | 2 | CO1 |
| | b) Show the all steps for delta to star transformation of impedances with the circuit diagrams. | 3 | CO1 |
| 3. | a) What are links and twigs? | 2 | CO.2 |

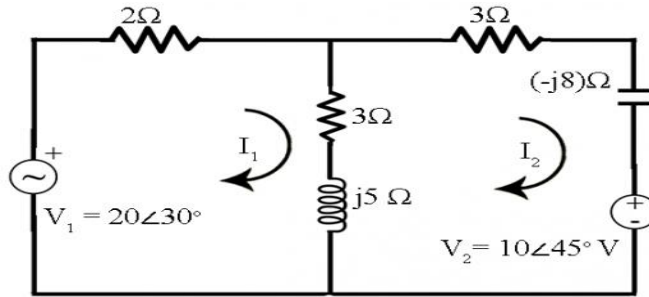
- b) Find out the incidence matrix of the given graph. 3 CO2



4. In the series RL circuit of Fig., the switch is in position 1 long enough to establish the steady state and is switched to position 2 at $t = 0$. Find the current. 5 CO.4



5. Find the mesh currents I_1 and I_2 in the network shown below 5 CO2



6. Two combined inductance of two coils connected in series is 0.6 H and 0.1 depending on relative directions of currents in the two coils. If one of the coils has a self-inductance of 0.2 H, find i) mutual inductance and ii) coefficient of coupling. 5 CO1

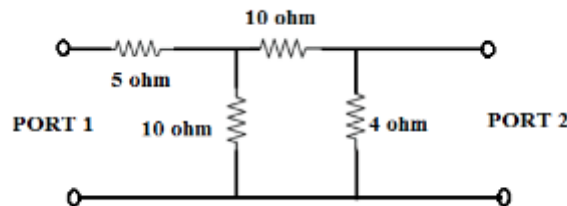
GROUP – C

(Short Answer Type Questions)

Answer any *three* from the following:

15×3=45

- | | Marks | CO No |
|---|-------|-------|
| 7. a) Define the ABCD parameters of a 4 terminal network. | 3 | 2 |
| b) Prove that $AD-BC=1$ | 5 | 2 |
| c) Find the condition of reciprocity and symmetry for short-circuit parameters of a 2 port network. | 7 | 2 |
| 8. a) Find the z-parameter of the network shown in the figure. | 8 | 3 |



- b) Currents I_1 and I_2 entering ports 1 and 2 respectively of a two port network are given by the following equations: $I_1 = 0.5V_1 - 0.2V_2$
 $I_2 = -0.2V_1 + V_2$:
 Where V_1 and V_2 are the voltages at ports 1 and 2 respectively, Find the Y and ABCD Parameters.

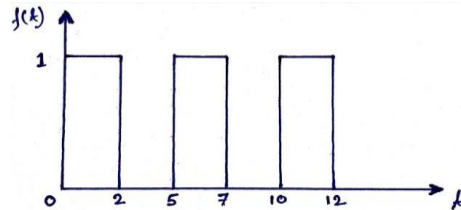
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3

- 9 a) Find the Laplace transform of the periodic function shown in figure below:

8

CO2



- b) Design a high pass filter with a corner frequency of 3 kHz and a high frequency gain of 10.

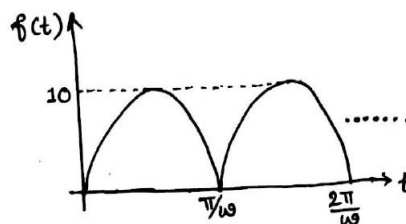
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CO3

10. a) Find the Laplace transform of the periodic waveform shown in figure.

5

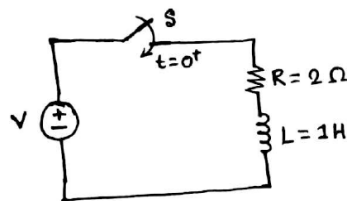
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- b) For an RL series circuit shown in figure, with no initial current in the inductor, a voltage $V = 4e^{-t}$ volts is applied at $t = 0$ sec. find the expression for the resulting current in the circuit for $t \geq 0$ using Laplace transform method.

5

4



- c) Find the inverse Laplace transform of $F(s) = \frac{s^2 - 15s - 11}{(s+1)(s-2)^2}$

5

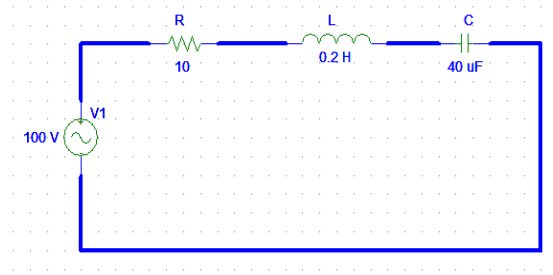
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- 11 a) A R-L-C series circuit with a resistance of 10 ohm, inductance of 0.2 H and a capacitance of 40 μ F is supplied with a 100 V supply at variable frequency. Find the following to series resonant circuit.
 i) The resonant frequency
 ii) find the max current
 iii) power
 iv) power factor

9

CO2

- v) voltage across R-L-C at that time
- vi) quality factor
- vii) Bandwidth



- b) For the network shown below, find the voltages V_1 , V_2 and V_3

6

CO2

