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B.TECH. III SEM MAIN/BACK (NEW SCHEME)

ACADEMIC SESSION 2023-24

**(ELECTRICAL AND ELECTRONICS
ENGINEERING) III And Other Branches**

3EX4-01 - Electrical Circuit Analysis-I

Common to EE, EX

Time : 3 Hours]

[Max. Marks : 70

[Min. Passing Marks :

Instructions to Candidates :

Part-A : Short Answer Type Questions (up to 25 words) $10 \times 2 = 20$ marks. All 10 questions are compulsory.

Part-B : Analytical/Problem Solving questions $5 \times 4 = 20$ marks. Candidates have to answer 5 questions out of 7.

Part-C : Descriptive/Analytical/Problem Solving questions 3×10 marks = 30 marks. Candidates have to answer 3 questions out of 5.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of the following supporting materials is permitted during examination. (Mentioned in form no. 205).

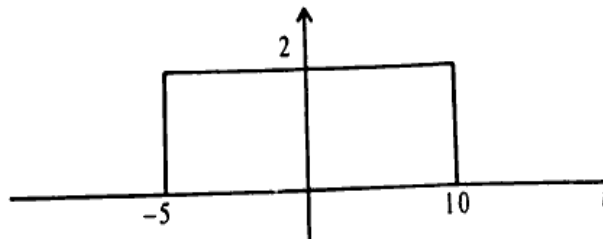
1 _____

2 _____

Part-A

10×2=20

- Q. 1. What are the initial conditions ? Why are they needed ? [2]
- Q. 2. Define quality factor of series resonance circuit. [2]
- Q. 3. State thevenin theorem. [2]
- Q. 4. Let a parallel LR network is connected to a DC source. Find the voltage across resistance 'R' at steady state. [2]
- Q. 5. What is meant by short and open circuits ? [2]
- Q. 6. Draw the phasor diagram of RL Circuit. [2]
- Q. 7. Define dual networks. [2]
- Q. 8. $Q = 2000$ VAR, $Pf = 0.9$ (leading). The power in complex form is [2]
- Q. 9. Write the expression describe the function plotted here ?

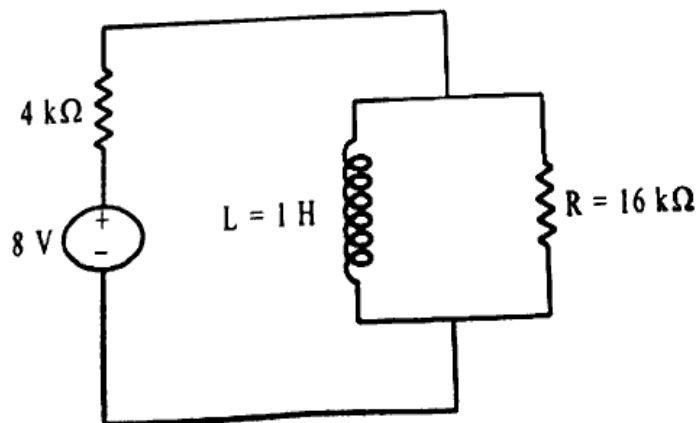


Q. 10. Define the tree in graph theory.

Part-B

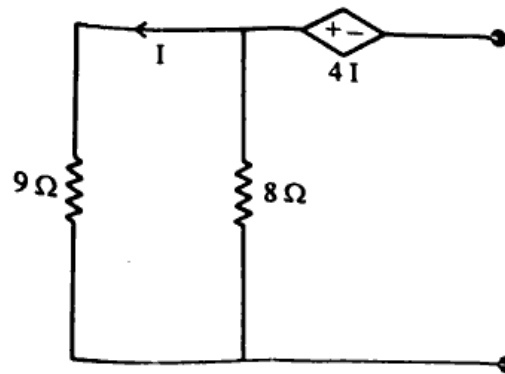
5×4=20

Q. 1. A parallel combination of $R = 16 \text{ k}\Omega$ and $L = 1 \text{ H}$ is excited by a constant voltage source of 8 volts, having internal resistance of $4 \text{ k}\Omega$. Obtain the current through inductance in steady state and the time constant of the circuit. [4]



Q. 2. Determine the thevenin resistance for the circuit shown in figure :

[4]



Q. 3. Compute the Laplace transform of the function :

[4]

$$f(t) = (1 + 3e^{-2t} + 4te^{-2t})u(t)$$

Q. 4. Define and state the properties of incidence matrix.

Q. 5. A resistor of 50Ω , inductance of 100 mH and a capacitance of $100 \mu\text{F}$ are connected in series across 200 V , 50 Hz supply. Determine the following :

(i) Impedance

(ii) Current flowing through the circuit

(iii) Power factor

(iv) Voltage across R, L & C

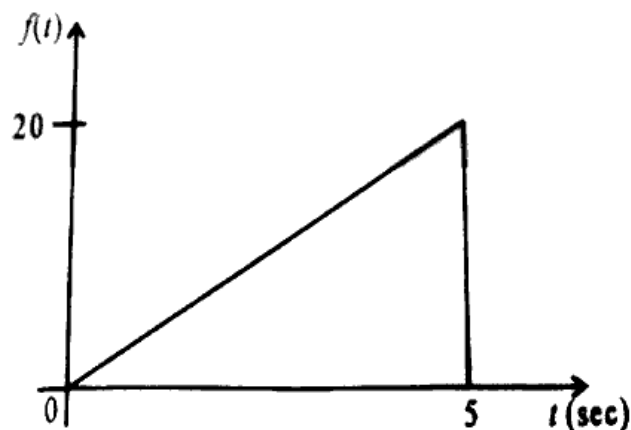
[4]

Q. 6. The power consumed in a three phase balanced star-connected load is 2 kW at a power factor of 0.8 lagging. The supply voltage is 400 V , 50 Hz . Calculate the resistance and reactance of each phase.

[4]

Q. 7. Use step function to write the expression for the following waveform :

[4]

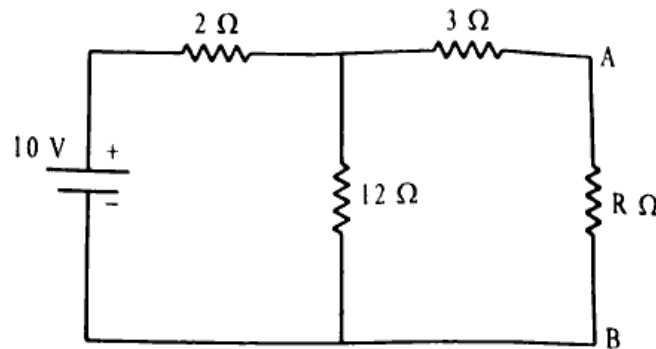


(3)

Part-C

3×10=30

- Q. 1. Derive the expression for the current in a series RL circuit ($R = 10 \Omega$, $L = 10 \text{ mH}$) excited by a sinusoidal voltage of 100 V, 50 Hz if the supply is connected at $t = 0$. Assume zero initial conditions. [10]
- Q. 2. Derive expression for half power frequencies of a R-L-C series network. [10]
- Q. 3. (a) Explain the concept of source transformation. [5]
 (b) Find the maximum power delivered to the load by using maximum power transfer theorem for the following circuit. [5]



- Q. 4. Find the value of $i(0^+)$ using the initial-value theorem for the function given :

$$I(s) = \frac{2s + 3}{(s + 1)(s + 3)}$$

verify the result by solving it for $i(t)$. [10]

- Q. 5. A series RC circuit consists of a resistor of 10Ω and a capacitor of 0.1 F as shown in fig. A constant voltage of 20 V is applied to the circuit at $t = 0$. Obtain the current equation. Determine the voltage across the resistor and the capacitor.

