Total number of printed pages: **6**

D/3rd Semester/DIE301

2024

ELECTRICAL CIRCUITS AND NETWORKS

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions.*

1. a) Choose the correct answer: 10

i) A circuit contains two un-equal resistances in parallel

a) Current is same in both
b) Large current flows in larger resistor
c) Potential difference across each is same
d) Smaller resistance has smaller conductance.

ii) What is the total capacitance when two capacitors C1 and C2 are connected in series?

a) (C1+C2)/C1C2
b) 1/C1+1/C2
c) C1C2/(C1+C2)
d) C1+C2

iii) The value of a given waveform at any instant time is termed as _____

a) Waveform
b) Instantaneous value
c) Cycle
d) Period

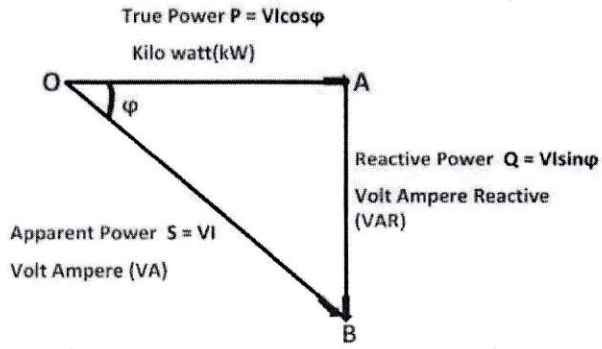
iv) An Inductor works as a _____ circuit for DC supply.

a) Open
b) Short
c) Polar
d) Non-polar

v) **Norton**'s equivalent circuit consists of a

a) Voltage source in series with a resistor
b) Current source in parallel with a resistor
c) Voltage source in parallel with a resistor
d) Current source in series with a resistor

vi) The relationship among True(P), Apparent(S) and Reactive Power(Q) can be expressed as



a) $S = P + jQ$
b) $S^2 = P^2 + Q^2$
c) $S = \sqrt{(P^2 + Q^2)}$
d) All of these

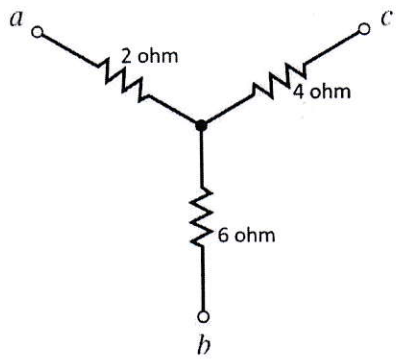
vii) Power Factor is defined as
a) The cosine of angle between the voltage and current phasor
b) The ratio of active power and apparent power
c) Both a) and b)
d) None of these

viii) In superposition theorem, when we consider the effect of one voltage source, all the other voltage sources are
a) Shorted
b) Opened
c) Removed
d) Undisturbed

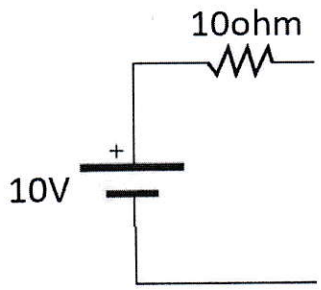
ix) What happens to the current in the series circuit if the resistance is halved ?
a) It becomes half its original value
b) It becomes double its original value
c) It becomes zero
d) It becomes infinity

x) Kilowatt-hour(kWh) is a unit of
a) Current
b) Power
c) Energy
d) Resistance

b) Find the total resistance across the points "a" and "c". 4

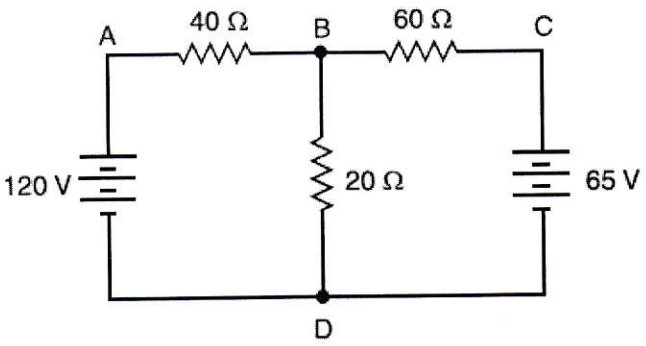


c) Convert the following voltage source into its corresponding current 5



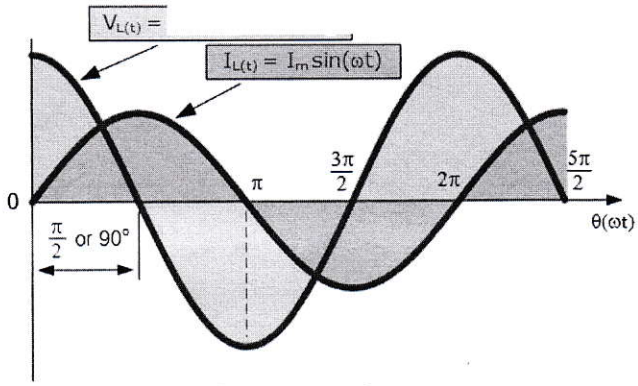
d) State the Ohm's Law. 1

2. a) Using Thevenin's Theorem find the value of current flowing through 20 ohm resistance. 7



b) By using Superposition Theorem, find the current in resistance 20 Ω shown in Figure above of question Q2(a). 8

c) Write the expression of voltage as displayed in the plot below: 5



3. a) State and prove the Maximum Power Transfer Theorem as applicable to dc networks. 10

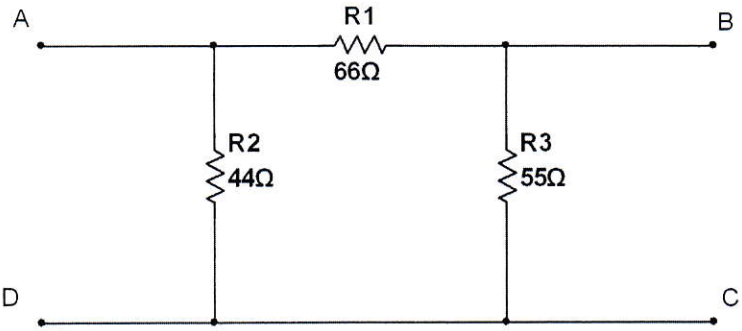
b) State "TRUE" or "FALSE". 5

i) When a short-circuit takes place, the fuse wire melts and breaks the circuit.
ii) A resistor is a device that controls current in electric circuits.
iii) Maximum power is transferred if load resistance is equal to internal resistance of the source.
iv) An ideal voltage source has zero internal resistance.
v) A real voltage source can be converted to an equivalent real current source and vice-versa.

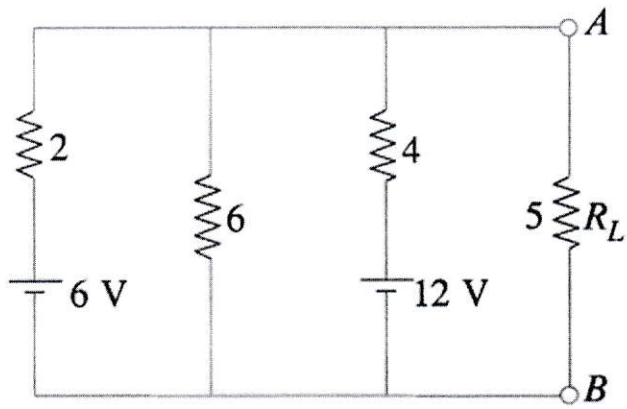
c) Match the resistor values in column A with the correct colour coding from column B. 5

column A	column B
110 Ω	Red-red-red
5.5 M Ω	Brown-brown-brown
440 K Ω	Violet-violet-violet
2.2 K Ω	Yellow-yellow-yellow
770 M Ω	Green-green-green

4. a) Convert the following delta to its equivalent star connection. 10



b) Use Millman's theorem, to find the current flowing through the 5 Ω load resistance R_L. 10



5. a) A 50-μF capacitor is connected across a 230-V, 50-Hz supply. Calculate the reactance offered by the capacitor and the maximum current. 6

b) An alternating current of frequency 60 Hz has a maximum value of 150 A. Write down the equation for its instantaneous value. 4

c) A 60-Hz voltage of 115 V (r.m.s.) is impressed on a 100Ω resistance: (i) Write the time equations for the voltage and the resulting current. Let the zero point of the voltage wave be at t = 0 (ii) Show the voltage and current on a time diagram. (iii) Show the voltage and current on a phasor diagram. 10

6. Write short notes on : 5x4

a) Form Factor

b) Resonance

c) Power Factor

d) Power Triangle

7. a) In a series circuit containing pure resistance and a pure inductance, the current and the voltage are expressed as : 10

$i(t) = 12 \sin(314t + \pi/6)$ and $v(t) = 12 \sin(314t + \pi/2)$

(a) What is the impedance of the circuit?

(b) What is the value of the resistance?

(c) What is the inductance in henry?

(d) What is the power factor?

b) A resistance of 12 Ω, an inductance of 0.5 H and a capacitance of 50 μF are connected in series across 220-V, 50-Hz mains. Determine the followings (a) impedance (b) current (c) voltage across R, L and C (d) power in watts and VA (e) p.f. and angle of lag. 10

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