Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering / Science
End Sem Examination Dec-2023
EN3ES17 / BC3ES01 Basic Electrical Engineering

Programme: B.Tech. / B.Sc. Branch/Specialisation: All

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. If there are 5 nodes then the number of nodal equations are _____. **1**

(a) 5 (b) 0 (c) 1 (d) 4

ii. If there are 3 Resistors R_1, R_2 and R_3 in series and V is total voltage and I is total current then Voltage across R_2 is- **1**

(a) $V R_3/ (R_1 + R_2 + R_3)$ (b) $V R_2/ (R_1 + R_2 + R_3)$

(c) $V R_1/(R_1 + R_2 + R_3)$ (d) V

iii. Peak value divided by the rms value gives us- **1**

(a) Peak factor (b) Form factor

(c) Power factor (d) None of these

iv. If we apply a sinusoidal voltage to a circuit, the product of voltage and current is- **1**

(a) True power (b) Apparent power

(c) Average power (d) Reactive power

v. Transformer ratings are given in _____. **1**

(a) kVAR (b) HP (c) kVA (d) kW

vi. What are the materials used for brushes in dc machines? **1**

(a) Iron (b) Carbon (c) Aluminum (d) Steel

vii. What is the principal on which MCB works? **1**

(a) Magnetic effect of electric current

(b) Lenz law

(c) Faradays law of electric current

(d) Flemings Right hand rule

viii. SMPS is used for- **1**

(a) Obtaining controlled ac power supply

(b) Obtaining controlled dc power supply

(c) Storage of dc power

(d) Switch from one source to another

P.T.O.

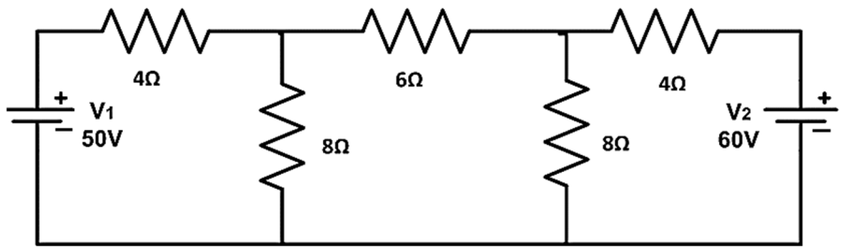
ix. Power generation can be done by- **1**
(a) Thermal power plant (b) Nuclear power plant
(c) Hydropower plant (d) All of these

x. Welding transformer is _____. **1**
(a) Step-up transformer (b) Step-down transformer
(c) Auto transformer (d) One-one transformer

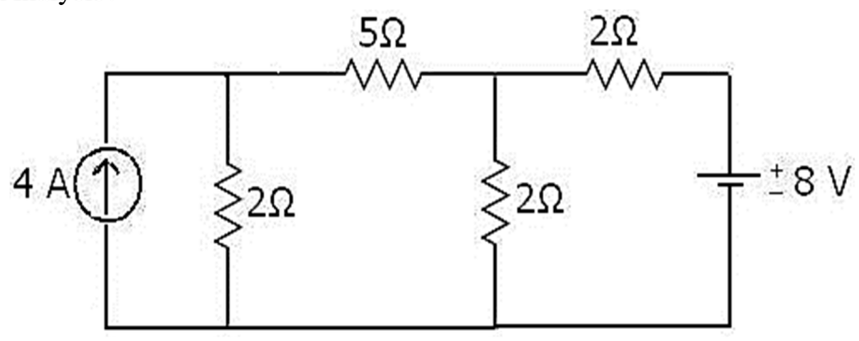
Q.2 i. Define linear and non-linear elements with examples. **2**

ii. With respect to DC circuit, state and explain Kirchhoff's law. **2**

iii. Find the value of current across resistor 6Ω resistor using Thevenin's Theorem. **6**



OR iv. Find the current in 5Ω resistance for the given network by using Nodal Analysis? **6**



Q.3 i. Write relation between line and phase quantities in star and delta connection in three phase system. **2**

ii. Find the impedance of a series R-L-C circuit, when R=6Ω, X_L=20Ω, and X_C=10Ω. **2**

iii. A 4 Ω resistor is series connected to a 10mH inductor across a 100 V, 50 Hz voltage source. Find input current, impedance, voltage drop across R and L, power factor of the circuit and the real power consumed in the circuit. **6**

OR iv. Draw & explain the phasor diagram of RLC series circuit and give the condition for resonance in this circuit. **6**

Q.4 i. Explain the working principle of single-phase transformer. **2**

ii. Write the applications of single-phase induction motor. **2**

iii. With a neat diagram, explain the working principle & constructional details of DC motor. **6**

OR iv. Explain the working principle & construction of three phase induction motor. **6**

Q.5 i. What is the necessity of earthing in domestic buildings? **2**

ii. Describe the following in few words: **2**
(a) Fuse (b) MCB

iii. What is a electric power supply system? Explain and draw a block diagram of a liner power supply. **6**

OR iv. Describe and illustrate an SMPS block diagram. **6**

Q.6 Attempt any two:

i. Draw a neat schematic diagram of a hydro-electric power plant and explain the functions of various components. **5**

ii. Draw a neat schematic diagram of a thermal power plants and explain its operation. **5**

iii. Explain the principle of induction heating and write down its applications. **5**

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Scheme of Marking

	Faculty of Engineering End Sem Examination Dec-2023 Basic Electrical Engineering (T) - EN3ES17 (T)	
MEDI-CAPS UNIVERSITY Knowledge is Power	Programme: B.Tech.	Branch/Specialisation:All

Note: The Paper Setter should provide the answer wise splitting of the marks in the scheme below.

Q.1 i) If there are 5 nodes then the number of nodal equations are _____ **1**

d) 4

ii) If there are 3 Resistors R_1, R_2 and R_3 in series and V is total voltage and I is total current then Voltage across R_2 is **1**

b) $V R_2 / R_1 + R_2 + R_3$

iii) Peak value divided by the rms value gives us? **1**

a) Peak factor

iv) If we apply a sinusoidal voltage to a circuit, the product of voltage and current is? **1**

b) apparent power

v) Transformer ratings are given in _____ **1**

c) kVA

vi) What are the materials used for brushes in dc machines? **1**

b) Carbon

vii) What is the principal on which MCB works ? **1**

a) Magnetic effect of electric current

vii) SMPS is used for **1**

b) obtaining controlled dc power supply

ix) Which of the following is a type of power plant? **1**

d) All of the mentioned

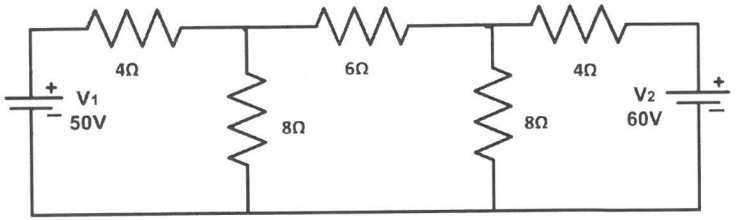
x) Welding transformer is _____ **1**

b) step-down transformer

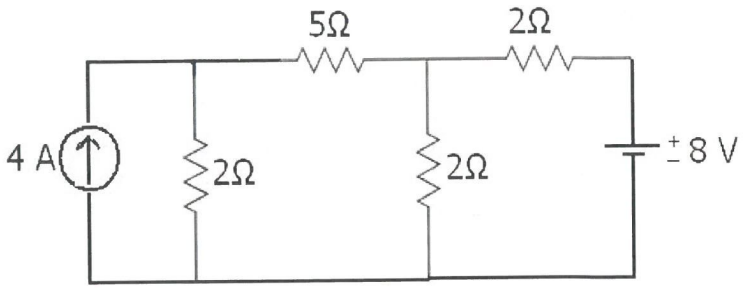
Q.2 i. Define linear – 01 **2**
non-linear elements. – 01

ii. With respect to DC circuit, state -01 **2**
explain Kirchhoff's law. -01

iii. Find the value of current across resistor 6Ω resistor using Thevenin's **6**
Theorem. Ans: Va=33.3, Vb=40,
Vab=Vth=-6.67V, -02
Rth=5.33, -02
I=-0.589A -02



OR iv. Find the current in 5Ω resistance for the given network by using Nodal Analysis? Ans: I5ohm=0.5A **6**
First Eq -----02
Second Eq -----02
I=0.5A -------02



Q.3 i. Write relation between line and phase quantities in star -01 and delta connection in three phase system.– 01 **2**

ii. Find the impedance of a series R-L-C circuit, when R=6Ω, X_L=20Ω, and X_C=10Ω. Ans: Z=11.66 Ω – 02 **2**

iii. A 4 Ω resistor is connected to a 10mH inductor across a 100 V, 50 Hz voltage source. Find input current, impedance, voltage drop across R and L, power factor of the circuit and the real power consumed in the circuit. **6**
I=19.66A, Z=5.08Ω, Vr=78.65V, V_L=61.75V, p.f.=0.787(Lag), P=1546W -01 for each

OR iv. Draw & explain the phasor diagram of RLC series – 03 **6**
circuits and give the condition for resonance in this circuit. – 03

Q.4 i. Define transformer. – 02 **2**
principle – 01
explanation – 01

Any two application (1 mark each)

	ii.	Explain the working principle of single-phase transformer. – 01 – 01	**2**
	iii.	With a neat diagram, explain the working principle & constructional details of DC motor. – 02 – 02 – 02	**6**
OR	iv.	Explain the working principle & construction of three phase induction motor. – 03 – 03	**6**
Q.5	i.	What is the necessity of earthing in domestic buildings? – 02	**2**
	ii.	Write a short note on (i)Fuse and (ii) Electric shock. – 01 – 01	**2**
	iii.	What is an electric power supply system? – 02 Explain and – 02 draw a block diagram of a liner power supply. – 02	**6**
OR	iv.	Describe and illustrate an SMPS block diagram. – 03 – 03	**6**
Q.6		Attempt any two:	
	i.	Draw a neat schematic diagram of a hydro-electric power plant and explain the functions of various components. – 2.5 – 2.5	**5**
	ii.	Draw a neat schematic diagram of a thermal power plants and explain its operation. – 2.5 – 2.5	**5**
	iii.	Explain the principle of induction heating and write down its applications. – 3 – 2	**5**

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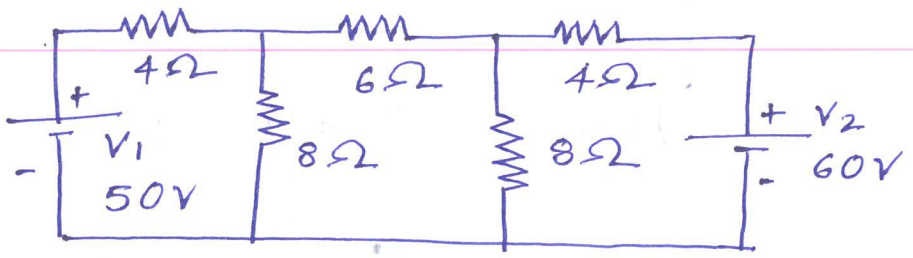
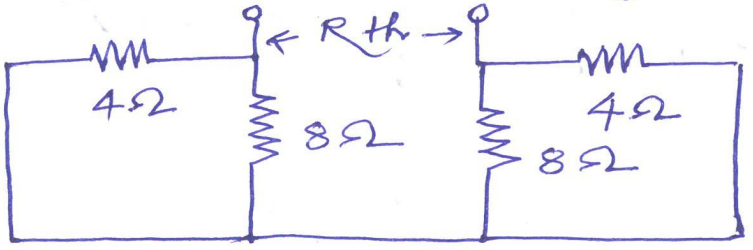
Solution

Q. 2 (iii)



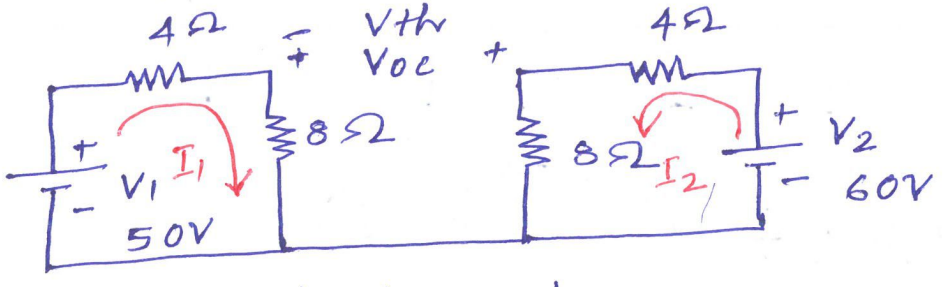
step-1 calculation of Rth



$$R_{th} = 4 \| 8 + 4 \| 8 = \frac{4 \times 8}{4+8} + \frac{4 \times 8}{4+8} = 2.667 + 2.667$$

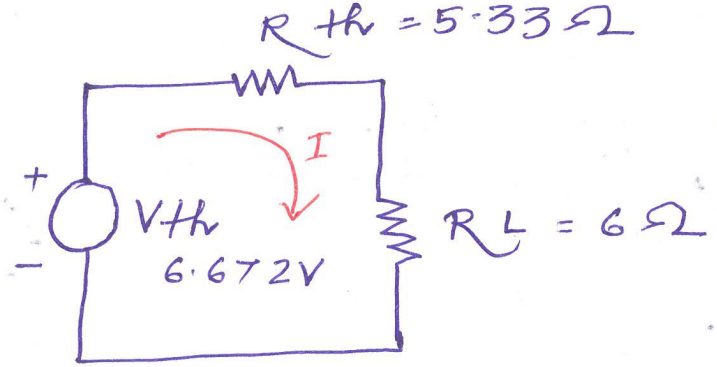
$$= \boxed{5.333\,\Omega} \quad \ldots \quad |2$$

step-2 calculation of Vth



Applying KVL to Loop-1

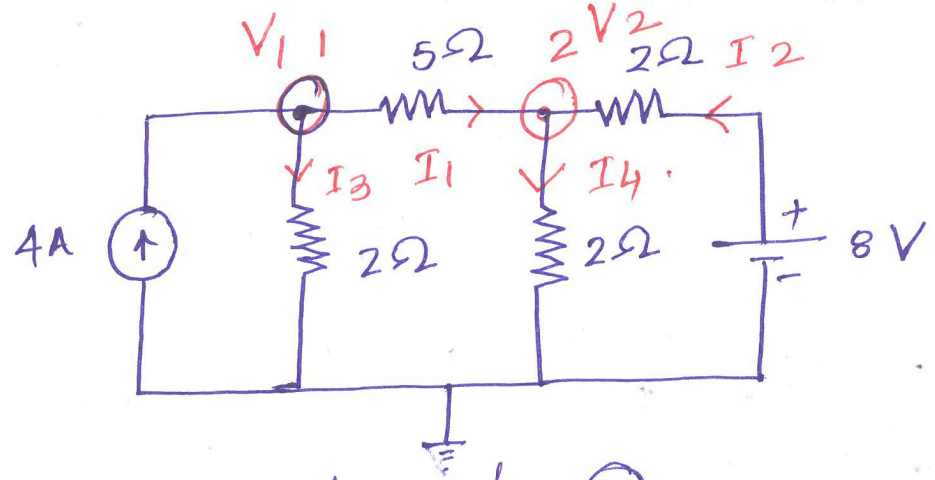
Step-3 calculation of current through 6Ω



$$I = \frac{V_{th}}{R_{th} + R_L} = \frac{6.672}{5.33 + 6} = \boxed{0.589\ A} \quad \ldots\ldots 2$$

OR

Nodal analysis method



Applying KCL at node – 1

$$4 = I_1 + I_2 \Rightarrow 4 = \frac{V_1 - V_2}{5} + \frac{8 - V_2}{2}$$

$$\Rightarrow \frac{V_2}{2} = \frac{2V_1 - 2V_2 + 840 - 5V_2}{10}$$ (3)

$$\Rightarrow 10V_2 = 4V_1 - 4V_2 + 80 - 10V_2$$

$$\Rightarrow 20V_2 + 4V_2 - 4V_1 - 80 = 0 \Rightarrow \boxed{24V_2 - 4V_1 - 80 = 0} \quad \cdots (1)$$

2 ...

At node-1

$$4 = I_1 + I_3 = \frac{V_1 - V_2}{5} + \frac{V_1}{2}$$

$$\Rightarrow 40 = 2V_1 - 2V_2 + 5V_1$$

$$\Rightarrow \boxed{2V_2 - 7V_1 + 40 = \cdots (2)}$$ 2

from (1) & (2)

$$24V_2 - 4V_1 - 80 = 0$$

$$12 \times \; 2V_2 - 7V_1 + 40 = 0$$

$$24V_2 - 4V_1 - 80 = 0$$

$$-24V_2 + 84V_1 - 480 = 0$$

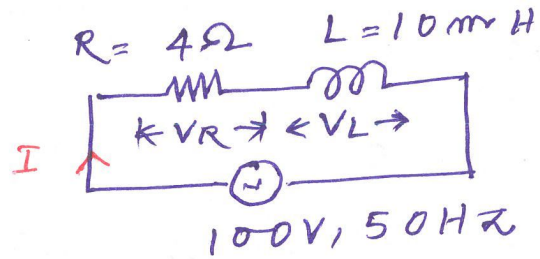
$$80V_1 - 560 = 0$$

$$\Rightarrow V_1 = \frac{560}{80} = \boxed{7V}$$

$$2V_2 - 49 + 40 = 0 \Rightarrow 2V_2 = 9 \Rightarrow V_2 = \boxed{4.5V}$$

Now current through 5Ω.

(iii)



4

L. $R = 4\Omega$, $L = 10mH = 10 \times 10^{-3} H = 0.01 H$.

$X_L = 2\pi f L = 2\pi \times 50 \times 0.01 = 3.141\ \Omega$

$\therefore Z = \sqrt{R^2 + X_L^2} = \sqrt{4^2 + (3.141)^2} = \sqrt{25.8658}$

$= \boxed{5.08\ \Omega}$ 1

$I = \frac{V}{Z} = \frac{100}{5.08} = \boxed{19.685\ A}$ 1

$V_R = IR = 19.685 \times 4 = \boxed{78.74\ V}$

$V_L = I X_L = 19.685 \times 3.141 = \boxed{61.83\ V}$

p.f $= \cos\phi = \frac{R}{Z} = \frac{4}{5.08} = \boxed{0.787\ (\text{lagging})}$

real power $= VI\cos\phi$

$= 100 \times 19.685 \times 0.787$

$= \boxed{1549.2\ W}$