21/04/24
sunday

(1) 5 mark

Example 2.10

Two resistors when connected in series and parallel, their equivalent resistances are 15 Ω and $\frac{56}{15}$ Ω respectively. Find the values of the resistances

Solution :

Series connection = 15 Ω

Parallel connection = $\frac{56}{15}$ Ω

$R_s = R_1 + R_2 = 15\,\Omega \rightarrow (1)$

$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{56}{15}\,\Omega \rightarrow (2)$

$1/R_P = \frac{R_1 + R_2}{R_1 R_2} = \frac{56}{15}$

$R_P = \frac{R_1 R_2}{R_1 + R_2} = \frac{56}{15} \rightarrow (3)$

$R_P = \frac{R_1 R_2}{15} = \frac{56}{15}$

$\frac{R_1 R_2}{15} = \frac{56}{15}$

$R_1 R_2 = \frac{56}{15} \times 15$

$R_1 R_2 = 56$

$R_2 = \frac{56}{R_1} \rightarrow (4)$

From equation (4)

$R_2 = \frac{56}{R_1}\,\Omega$

From equation 1

$R_1 + R_2 = 15\,\Omega$

$R_1 + \frac{56}{R_1} = 15$

$\frac{R_1(R_1) + 56}{R_1} = 15$

$$\frac{R_1^2+56}{R_1}=15$$

$$R_1^2+56=15R_1$$

$$R_1^2+56-15R_1=0$$

$$R_1^2-15R_1+56=0 \rightarrow (5)$$

fractorization method

$$(R_1-8)(R_1-7)=0$$

$$(R_1-8)(R_1-7)=0$$

$R_1-8=0$	$R_2-7=0$
$R_1=8\Omega$	$R_2=7\Omega$
From (1) equation	$R_1=7\Omega$
$R_1+R_2=15\Omega$	$R_1+R_2=15\Omega$
$R_1=8\Omega$	$7+R_2=15$
$8+R_2=15$	$R_2=15-7$
$R_2=15-8$	$R_2=8\Omega$
$R_2=7\Omega$	

colour coding for Resistor

colour	number	multiplier	Tolerance
Black	0	1	
Brown	1	10^1	
Red	2	10^2	
orange	3	10^3	
yellow	4	10^4	
Green	5	10^5	
Blue	6	10^6	
violet	7	10^7	

Gray	8	10^8	
white	9	10^9	
Gold		10^{-1}	5%
silver		10^{-2}	10%
colourless			20%

Resistore colour code

3 colour

Tolerance → ③

Gold = 5%.
Silver = 10%.
colourless = 20%.

2mark

1) Green
2) Green
3) orange
Gold

Tolerance

55000
55×1000
55×10^3
55 KΩ ± 5%.

Book
Book

1) Green, Blue, orange, gold tolerance

56000 ± 5%.

56×1000 ± 5%.

$56 \times 10^3 \pm 5\%$.

56 KΩ ± 5%.

10^{-3} → Kilo

10^{-3} → Milli

2) orange, orange, orange, gold tolerance

33000 ± 5%

33×000 ± 5%

33×10^3 ± 5%

33 KΩ ± 5%

7)

1 mark

3) yellow, violet, orange - silver

Book Back 1 mark

47000 ± 10%   yellow = 4

47×000 ± 10%   violet = 7

47×10^3 ± 10%   orange = 3

47 KΩ ± 10%   silver = 10%

8)

4) yellow - green - violet - gold

450000000

45×10000000

45×10^7 ± 5%

9

5) Brown, Black, orange, colourless

10000

10×1000 ± 20%   Brown = 1

10×10^3 ± 20%   Black = 0

10 KΩ ± 20%   orange = 3

colourless = 20%

6) white, gray, orange, gold - T

98000 ± 5%   white = 9

98×1000 ± 5%   gray = 8

98×10^3 ± 5%   orange = 3

98 KΩ ± 5%   gold = 5%

3 mark

7) Brown, Black, yellow

a) 100 k Ω b) 10 k Ω c) 1 k Ω d) 1000 k Ω

Brown = 1 Black = 0 yellow = 4

100000

100×10³

100 k Ω

8) Brown, Black, orange

a) 100 k Ω b) 10 k Ω c) 1 k Ω d) 1000 k Ω

10000

10×1000

10×10³

10 k Ω

Brown = 1

Black = 0

orange = 3

9) Red - Red - Black

a) 2.2 Ω b) 22 Ω c) 2202.2 Ω d) 2.2 k Ω

22 × 1

22 Ω

Joules' law (or) Heating law

$H = I^2 R t$

H → Heat

I → current

R → Resistance

t → taken time

$\frac{t}{1}$ → Time Period

t → taken time

3 mark

Example 2.27

Find the heat energy produced in a resistance of 10 Ω when 5 A current flows Through in for 5 minutes

2/4/24
Monday

$R = 10\,\Omega$

$I = 5A$

$t = 5$ minutes $= 5 \times 60 = 300$ second

$H = ?$

$H = I^2 R t$

$H = (5)^2 \times 10 \times 5 \times 60$

$H = 25 \times 10 \times 300$

$H = 250 \times 300$

$H = 75000 J$

$H = 75 \times 1000$

$H = 75 \times 10^3$

$H = 75 kJ$

2) Creative Question

$R = 10\,\Omega$

$I = 5A$

$t = 5$ second

$H = ?$

$H = I^2 R t$

$H = (5)^2 \times 10 \times 5$

$H = 25 \times 10 \times 5$

$H = 25 \times 50$

$H = 1250 J$

02/04/24

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22/4/24
Monday

current density

current density - J

$$J = \frac{I}{A}$$

$$I = Q/t$$

J → current density

I → current

A → cross sectional area

$$J = \frac{I}{A} = \frac{A}{m^2}$$

$$= A m^{-2}$$

current density : vector quantity

1M current : scalar quantity

Resistivity (Ω m)

unit: Ωm

$$R = \frac{l}{\sigma A} \rightarrow (1)$$

R → Resistance

l → length of the wire

σ → conductivity

A → cross sectional area

σ → conductivity

ρ → Resistivity

$$\rho = \frac{1}{\sigma} \rightarrow (2)$$

From equation (1)

$$R = \frac{l}{\sigma A}$$

$$R = \frac{1}{\sigma}\left(\frac{l}{A}\right)$$

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$l = 1m$

$A = 1m^2$

$R = \rho \rightarrow (4)$

Book Back

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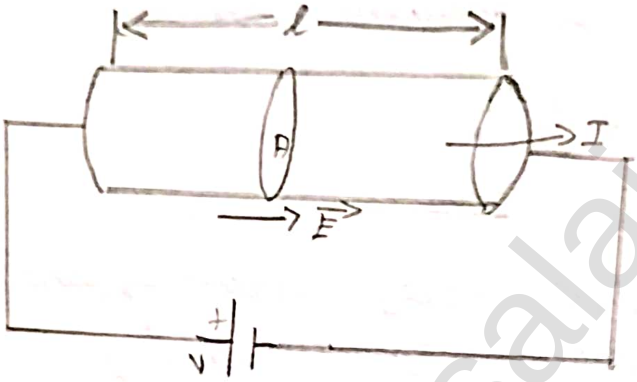
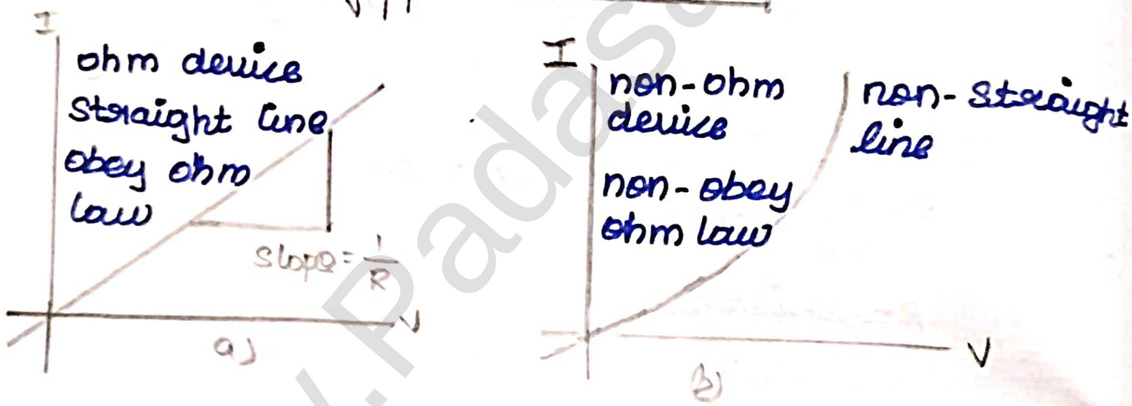
L/A

2) obtain the macroscopic from of ohm's law from its microscopic from and discuss its limitation





$J = \sigma E \rightarrow (1)$

J → current density

$J = I/A$

σ → conductivity

E → Electric field

$V = El \rightarrow (2)$

V → potential difference

E → Electric field

l → length of the conductivity

$V = El$

$E = V/l \rightarrow (3)$

Exam equation ④

$J = \sigma E$

$J = \sigma\left(\frac{V}{l}\right)$

$J = \frac{I}{A}$

$\frac{I}{A} = J\left(\frac{V}{l}\right) \rightarrow ④$

$\frac{Il}{A} = \sigma(V)$

$\frac{Il}{\sigma A} = V$

$V = I\left(\frac{l}{\sigma A}\right)$

$V = IR \rightarrow ⑤$

$R = \frac{V}{I} \rightarrow ⑥$

pg: 89 **Example 2.6**

5 mark The resistance of a wire is 20 Ω what will be now resistance If it is stretched uniformly 8 times its original length?

$R_1 = 20\,\Omega \quad R_2 = ?$

$R = \rho\frac{l}{A}$

$R_1 = \rho\frac{l_1}{A_1} \rightarrow ①$

$R_2 = \rho\frac{l_2}{A_2} \rightarrow ②$

$R_2 = \rho\frac{8l}{A_2} \rightarrow ③$

$$\frac{R_2}{R_1} = \frac{\rho\frac{8l}{A_2}}{\rho\frac{l_1}{A_1}}$$

$$\frac{R_2}{R_1} = \frac{\frac{8l}{A_2}}{\frac{l_1}{A_1}}$$

$$\frac{R_2}{R_1} = \frac{8l}{A_2} \times \frac{A_1}{l_1}$$

$$l_1 = l$$

$$\frac{R_2}{R_1} = \frac{8l}{A_2} \times \frac{A_1}{l}$$

$$\frac{R_2}{R_1} = \frac{8l}{l} \times \frac{A_1}{A_2}$$

$$\frac{R_2}{R_1} = \frac{A_1}{A_2} \times 8 \rightarrow (4)$$

Initial volume = Final volume

$$A_1 l_1 = A_2 l_2$$

$$l_1 = l \quad l_2 = 8l$$

$$A_1 l = A_2 8l$$

$$\frac{A_1}{A_2} = 8 \rightarrow (5)$$

From equation (4)

$$\frac{R_2}{R_1} = \frac{A_1}{A_2} \times 8$$

$$= 8 \times 8$$

$$\frac{R_2}{R_1} = 64$$

$$R_2 = 64 \times R_1$$

$$R_2 = 64 \times 20$$

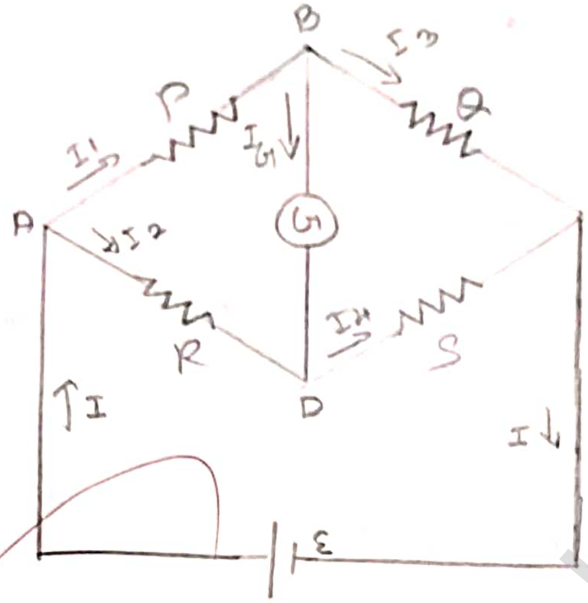
$$R_2 = 1280\,\Omega$$

28/4/24
Tuesday

PG:120
II/A

6) obtain the condition for bridge balance in wheatstone's bridge

5 mark



Kirchhoff's rule

current Rule (or) Junction Rule

voltage Rule (or) Loop Rule

PQRS → Resistance

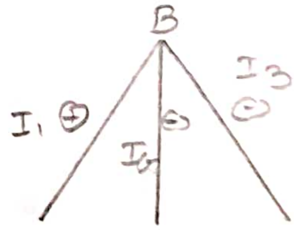
I_1, I_2, I_3, I_4 → current

ABCD → Junction

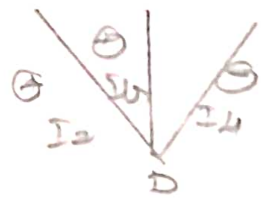
ε → emf

I_G → Galvanometer

emf → electro motive force



B Junction } current law
D Junction

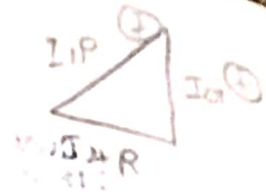


B Junction (current Rule law)

$$I_1 - I_G - I_3 = 0 \rightarrow (1)$$

D Junction (current Rule)

$I_2 + I_G - I_4 = 0 \rightarrow (2)$



ABDA (voltage Rule)

Junction

$I_1 P + I_G G - I_3 R = 0 \rightarrow (3)$

ABCDA Junction

$I_1 P + I_3 Q - I_4 S - I_2 R = 0 \rightarrow (4)$

no current Galvanometer null deflection

$I_G = 0$

From equation (1)

$I_1 - I_G - I_3 = 0$

$I_1 - 0 - I_3 = 0$

$I_1 - I_3 = 0$

$\boxed{I_1 = I_3} \rightarrow (5)$

From equation (2)

$I_2 + I_G - I_4 = 0$

$I_2 - 0 - I_4 = 0$

$I_2 - I_4 = 0$

$\boxed{I_2 = I_4} \rightarrow (6)$

From equation (3)

$I_1 P + I_G G - I_2 R = 0$

$I_1 P + 0 - I_2 R = 0$

$I_1 P - I_2 R = 0$

$\boxed{I_1 P = I_2 R} \rightarrow (7)$

From equation (4)

$$I_1P + I_3Q - I_4S - I_2R = 0$$

$$I_1P + I_1Q - I_2S - I_2R = 0$$

$$I_1(P+Q) - I_2(S+R) = 0$$

$$\boxed{I_1(P+Q) = I_2(S+R)} \rightarrow (8)$$

$$I_1 = I_3 \rightarrow (5)$$

$$I_2 = I_4 \rightarrow (6)$$

$$I_1P = I_2R \rightarrow (7)$$

(8)/(7)

$$\frac{I_1(P+Q)}{I_1P} = \frac{I_2(S+R)}{I_2R}$$

$$\frac{P+Q}{P} = \frac{R+S}{R}$$

$$1+\frac{Q}{P} = 1+\frac{S}{R}$$

$$\frac{Q}{P} = \frac{S}{R}$$

$$\boxed{\frac{P}{Q} = \frac{R}{S}} \rightarrow (9)$$

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2 mark

Example 2.23

In a wheatstone's bridges $P = 100\,\Omega$, $Q = 1000\,\Omega$ and $R = 40\,\Omega$. If the galvanometer shows zero deflection determine the value of S

Solution:

$P = 100\,\Omega$

$Q = 1000\,\Omega$

$R = 40\,\Omega$

$S = ?$

$$\frac{P}{Q} = \frac{R}{S}$$

$$\frac{P}{Q} = R\left(\frac{1}{S}\right)$$

$$\frac{P}{RQ} = \frac{1}{S}$$

$$S = \frac{RQ}{P}$$

$$S = \frac{40 \times 1000}{100}$$

$$S = 40 \times 10$$

$$S = 400\,\Omega$$

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