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date	26-6-2020

Question 3

Given data

Resistance of load across the positive outer; $= 7\Omega$

Resistance of load across the negative outer is; $= 9\Omega$

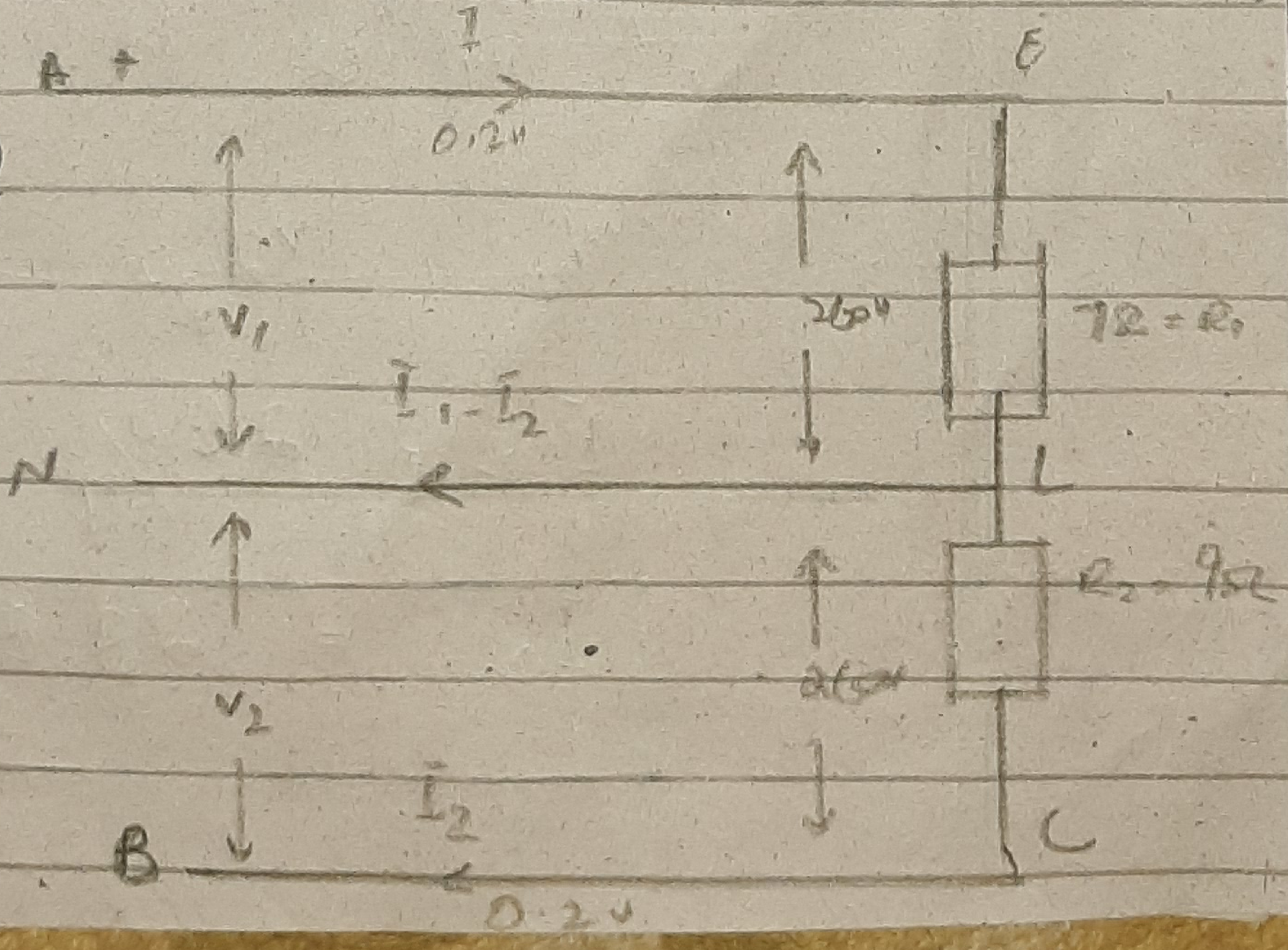
Resistance of each conductor is $= 0.2\ \Omega$

voltage between any outer and neutral is; $V = 260V$

Required data

feeding end voltage = ?

Solution



first we find

* Current on the +ve outer so we know that from Ohm law.

$$I_1 = V_1/R_1 \rightarrow (1)$$

put value in equation 1

$$I_1 = 260/7$$

$$I_1 = 37.14A$$

* Current on -ve outer $I_2 = ?$

So we know that

$$I_2 = V2/R^2 \rightarrow (2)$$

put value in (2)

$$I_2 = 260/9$$

$$\boxed{I_2 = 28.88A}$$

Current in neutral is $= I_1 - I_2 \rightarrow$

put value in equation 3)

$= 37.14 - 28.88$

$$\boxed{I_1 - I_2 = 8.26\,A}$$

Now voltage between +ve outer and neutral at feeding end is

$V_1 = V_{EL} + I_1 R_{AE} + (I_1 - I_2) R_{NL} \rightarrow (4)$

put value in equation (4)

$V_1 = 260 + 37.14 \times 0.2 + (8.26) \times 0.2$

$V_1 = 260 + 7.428 + 1.652$

$V_1 = 269.08\,v$

Now voltage b/w -ve outer and neutral is

$V_2 = V_{LC} - (I_1 - I_2) R_{NC} + I_2 R_{BC} \rightarrow 5)$

put value in Equation 5)

$V_2 = 260 - (8.26)(0.2) + 28.88 \times 0.2$

$V_2 = 260 - 1.652 + 5.776$

$V_2 = 265.776 - 1.652$

$$\boxed{V_2 = 264.124\,v}$$ Ans

Question 2

Given data

Supply load is

150 A , 200 A , 250 A , 100 A

distance of 500m , 1300 m ,

2300 , 3000m.

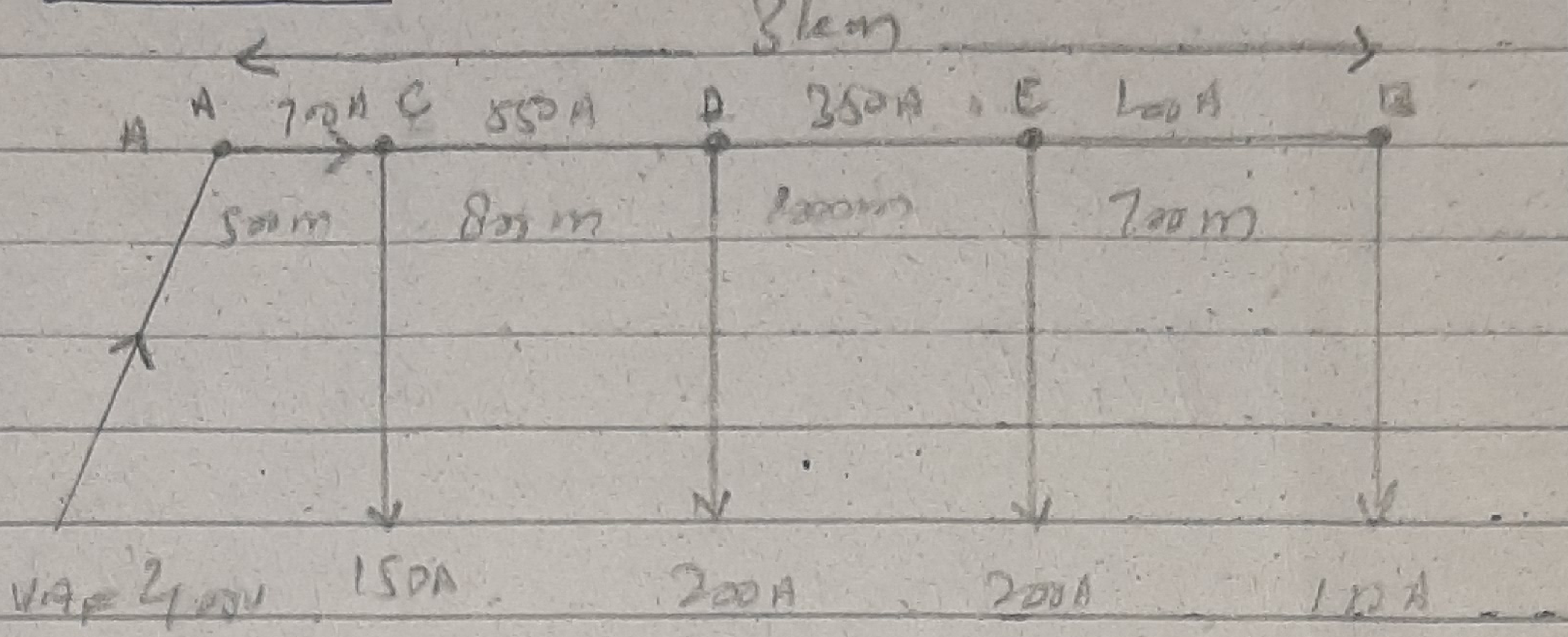
The Resistance of each Conductor is R = 0.02 per 1000m

potential difference at point A = 400V

Required data

potential difference at each load = ?

Solution



The Single Line diagram of the distributer with its tapped current.

Resistance per 1000m distributer is $= 2 \times 0.02 = 0.04\,\Omega$

Resistance of Section AC, R_{AC}

$$AC,\ R_{AC} = 0.04 \times 500/1000$$

$$= 0.04 \times 0.5$$

$$AC,\ R_{AC} = 0.02\,\Omega$$

Resistance of section ACD, R_{ACD}

~~AC, R_{AC}~~ CD, $R_{CD} = 0.04 \times \frac{800}{1000}$

$= 0.04 \times 0.8$

CD, $R_{CD} = 0.032\ \Omega$

Resistance of section DE, R_{DE}

DE, $R_{DE} = 0.04 \times 1000/1000$

$= 0.04 \times 1$

DE, $R_{DE} = 0.04\ \Omega$

Resistance of section

EB, $R_{EB} = 0.04 \times 700/1000$

$= 0.04 \times 0.7$

EB, $R_{EB} = 0.028\ \Omega$

The current in the various section of distributer are

$I_{EB} = 100A$, $I_{DE} = 100 + 250$

$= 350A$

$I_{CD} = 350 + 200 = 550 A$

$I_{AC} = 550 + 150 = 700 A$

potential difference at point C = ?

V_C = voltage at A - voltage drop in A.C

$= V_A - I_{AC} \cdot R_{AC}$

$= 400 - 700 \times 0.02$

$= 400 - 14$

$V_C = 386 V$

Potential difference at point D = ?

$V_D = V_C - I_{CD} \cdot R_{CD}$

$= 386 - 550 \times 0.032$

$= 386 - 17.6$

$= 368.4 V$

$V_D = 368.4 V$

potential difference at point D = ?

$V_E = V_D - I_{DE} \cdot R_{DE}$
$= 368.4 - 350 \times 0.04$
$= 368.4 - 14$
$= 354.4V$

$V_E = 354.4V$

potential difference at load point B

$V_B = V_E - I_{EB} \cdot R_{EB}$

$= 354.4 - 100 \times 0.028$
$= 354.4 - 2.8$

$V_B = 351.6V$

Question 1

Given data

Total length of D.C distributor 2-wired is = 500m

Voltage Load, 10A, 40A, 30A, 40A

distance at various Load is from end (X) 100m, 250m, 350m and 450m.

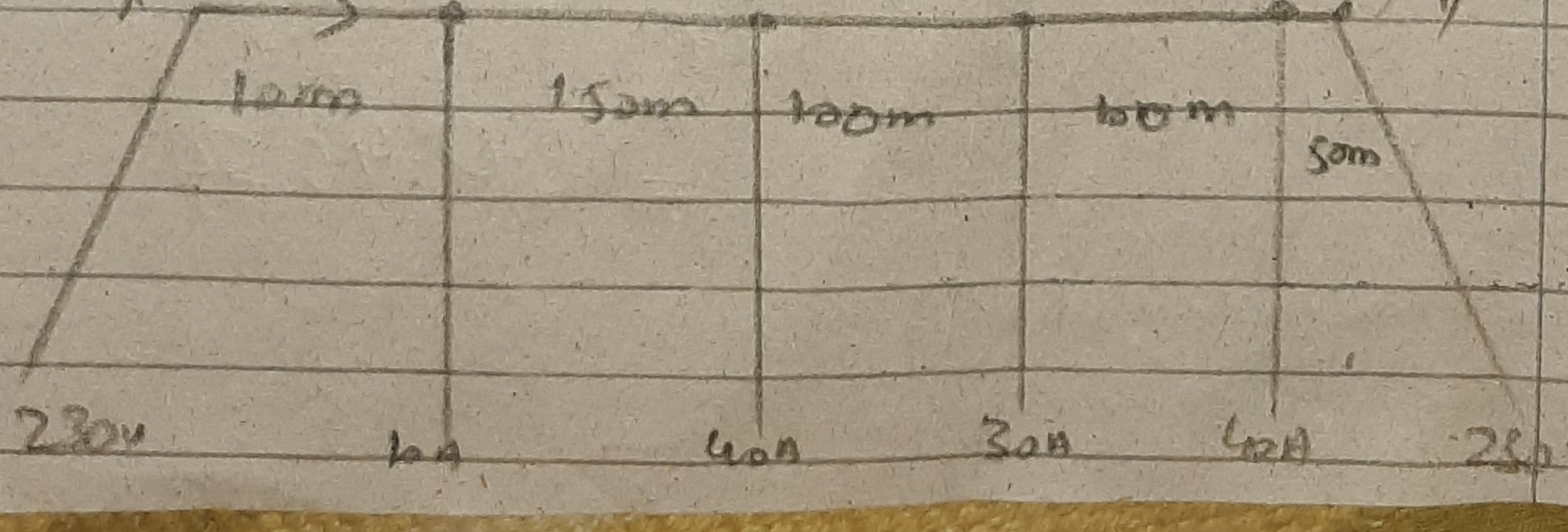
Cross-Sectional area of Conductor = $2 cm^2$

Resistivity = 1.5×10^{-5} Ω cm

Required data

minimum Consumer voltage = ?

Solution



Let I_x amperes be the current supplied from the feeding end (x).
When curren in the various section of the distributed are show in fig

Resistance of 1m length of distributed $= \frac{2 \times 1.5 \times 10^{-5} \times 100}{1}$

$= 2 \times 1.5 \times 10^{-3} \Omega$

or

$= 3 \times 10^{-3} \Omega$

Resistance of section xp. R_{xp}

$xp.\ R_{xp} = (3 \times 10^{-3}) \times 100$

$xp.\ R_{xp} = 0.3 \Omega$

Resistance of section PQ, R_{PQ}

$PQ,\ R_{PQ} = (3 \times 10^{-3}) \times 150$

$= 0.45 \Omega$

Resistance of Section QR, R_{QR}

$= (3\times10^{-3}) \times 100$

$= 0.3\,\Omega$

Resistance of Section R_S, R_{RS}

$= (3\times10^{-3}) \times 100$

$= 0.3\,\Omega$

Resistance of Section S_y, R_{Sy}

$= (3\times10^{-3}) \times 50$

$= 0.15\,\Omega$

Now

Voltage at y = Voltage at x - Drop over Length xy

$V_y = V_x - (I_x R_{xp} + (I_x - 10) R_{PQ} + (I_x - 50) R_{QR} + (I_x - 80) R_{RS} + (I_x - 120) R_{Sy}) \rightarrow 1$

$V_y = 230 - (0.3 I_x + 0.45(I_x - 10) + 0.3(I_x - 50) + 0.3(I_x - 80) + 0.15(I_x - 120))$.

$V_y = 230 - (0.3 I_x + 0.45 I_x - 4.5 + 0.3 I_x - 15 + 0.3 I_x - 24 + 0.15 I_x - 18)$

$230 = 230 - (1.65 I_x - 61.5$

$$280 = 280 - 1.65 I_x + 61.5$$

$$1.65 I_x = 61.5$$

$$I_x = \frac{61.5}{1.65}$$

$$\boxed{I_x = 37.27 A}$$

knowing the value of I_x, current is any section can be determind thus current in Section PQ

$$I_{PQ} = I_x - 10 \Rightarrow 37.27 - 10$$

$$I_{PQ} = 27.27 A$$

Section QR.

from Q to R = -12.73
R to Q = 12.73

$$I_{QR} = I_x - 50$$
$$= 37.27 - 50$$
$$I_{QR} = -12.73 A$$

Section IR_s = ?

$$I_{Rs} = I_x - 80$$

$= 37.27 - 80$

$$\boxed{I_{RS} = -42.73A}$$

from R to S = -42.73
S to R = 42.73

Section $I_{SY} = ?$

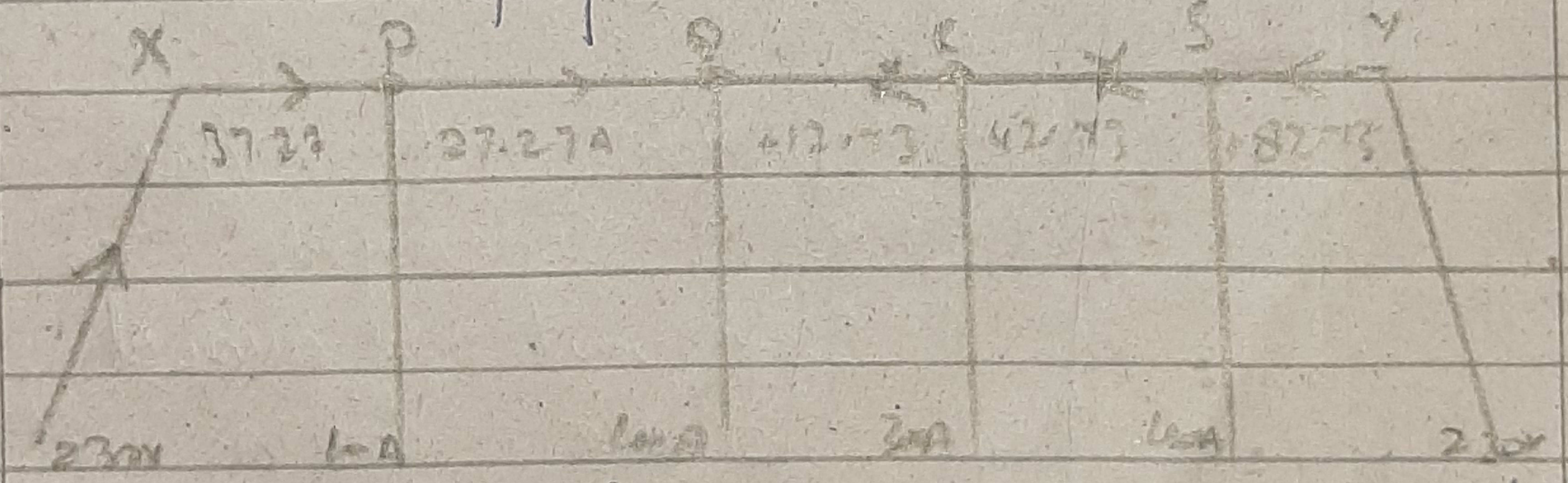
$I_{SY} = I_x - 120$

$= 37.27 - 120$

$$\boxed{I_{SY} = -82.73A}$$

from S to Y = -82.73
from Y to S = 82.73

The actual distribution current of various Section is shown in fig



From the figure its clear that current are coming to Load point Q from both end. Hence Q is the point of maximum potential difference

$V_Q = V_x - (I_x \cdot R_{xp} + I_{PQ} \cdot R_{PQ}) \rightarrow (1)$

$= 230 - (37.27 \times 0.3 \times 27.27 \times 0.45)$

$= 230 - (11.181 + 12.2715)$

$= 230 - 23.4525$

$$\boxed{V_Q = 206.54V}$$ Ans.

Question 4 (a)

Answer

When the insulating material used for underground cable is hygroscopic. So it must be enclosed in a water proof covering like a lead sheath.

To protect cable from moisture and the break down cable.

while when it has low electric strength so it can not avoid the break down of the cable.

Q4 B)

Ans

Rubber cannot be used as an insulating

material for underground

Cable. Because

* Rubber may be obtained from Silky Sap of tropical trees.

* It has relative permitivity varying between 2 and 3 dielectric strength.

* Although pure rubber has reasonably high insulating properties. It suffer from some major draw backs.

Q5 (A)

ANSWER

↳ A trench of about 1.5 meters deep and 45 cm wide is dug.

↳ The cable is laid over the sand bed. The sand bed protects the cable from the moisture from the ground

↳ When multiple cables are to be laid in the same trench a horizontal or verticle spacing of about 30 cm is provided to reduce the effect of mutual heating. This method is the most popular as it is simple and cheap. The cables to be laid using this method must have the serving of bituminised paper and hessian tape so as the provide protection against corrosion and electrolysis.

Qs 3

Answer

The solid system of cable laying is mainly performed where the cable is laid in the wood, cast iron, or another non soil surface. Normally cable is laid in the manner which provide good mechanical strength of cable.

* Solid system is expensive compare to the direct laid system and heat dissipation capacity is not much good compare

with other system. But for toughing material woods are much cheap so it is widely used by Considering the economical impacts.