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Answer 1

- Spacing of Conductors, $d = 2m = 200\ cm$
- Radius of Conductor, $r = 1.2/2 = 0.6 cm$
- Loop Inductance per meter length of the line = ~~10 (1 + 4~~ $= 10^{-7}(1 + 4 \log_e d/r)\ H$
- $= 10^{-7}(1 + 4 \log_e 200/0.6)\ H = 24.23 \times 10^{-7} H$
- Loop Inductance per km of the line
  $= 24.23 \times 10^{-7} \times 1000\ H$
- $= 24.23 \times 10^{-4} H$
  $= 2.423\ mH$

Answer 2

Spacing of Conductors, $d = 300 cm$

Radius of Conductor. $r = 1 cm$

Loop Inductance = $= 10^{-7}(1 \mu_r + 4 \log_e d/r)\ H/m$

(i) with Copper Conductors. $\mu_r = 1$

$\therefore$ Loop Inductance/m $= 10^{-7}(1 + 4 \log_e d/r)\ H = 10$

-7 (1+4 loge 300/1) H = 23.8 = 10 -7H

Loop Inductance/km = 23.8 = 10

-7 x 1000 = 2.38 = 10

-3H = 2.38 mH

(ii) with Steel Conductors. μI = 100

∴ Loop Inductance/m = 10

-7 (100 + 4 loge 300/1) H = 122.8 x 10 -7 H

Loop Inductance/km = 122.8 x 10

-7 x 1000 = 12.28 x 10

-3H = 12.28 mH

Answer: 4 B

Fig. 10.7 Shows the Single diagram of the transmission System Here the voltage drop will be due to the Impedance of transmission line and also due to the Impedance of tranformer

Resistance each Conductor = 20 x 0.4 = 8 Ω

Reactance of each Conductor 20 x 0.5 = 10 Ω

Let us tranfer the impedance of transformer Secondialy to high tension Side i.e 33 kV Side
Equivalent resistance of transformer refered to 33 kV Side

$= \text{Primary resistance} + 0.35(33/6.6)^2$

$= 7.5 + 8.75 = 16.25\,\Omega$

Equivalent reactance of transformer referred to 33 kV Side

$= \text{Primary reactance} + 0.65(33/6.6)^2$

$= 13.2 + 16.25 = 29.45\,\Omega$

Total resistance of line and transformer is

$R = 8 + 16.25 = 24.25\,\Omega$

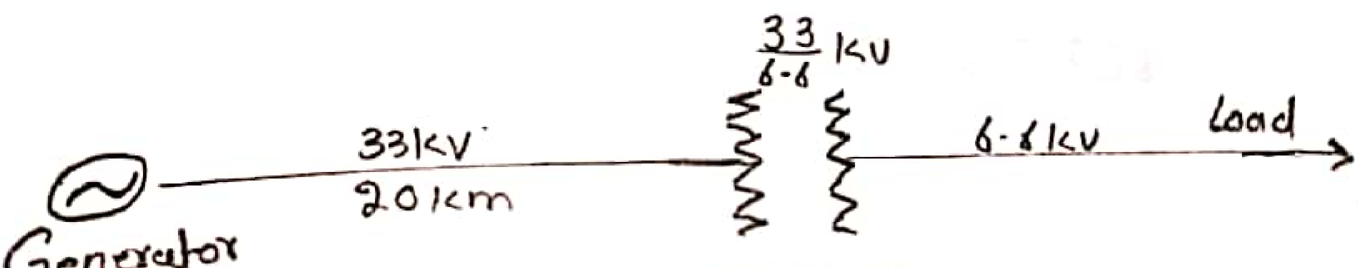

Fig 10.7

Total reactance of line and transformer is

$X_L = 10 + 29.45 = 39.45\,\Omega$

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Receiving end voltage per phase is

$V_R = 33{,}000/\sqrt{3} = 19052\,V$

Line Current $I = \frac{2000 \times 10^3}{\sqrt{3} \times 33000} = 35A$

Using the approximate expression for sending end voltage V_s per phase

$$V_s = V_R + IR\cos\phi_R + IX_L\sin\phi_R$$

$$= 19052 + 35 \times 24.25 \times 0.8 + 35 \times 39.45 \times 0.6$$

$$= 19052 + 679 + 828 = 20559\ V = 20.559\ KV$$

Spending end line voltage

$$= \sqrt{3} \times 20.559\,KV = 35.6\,KV$$

Sending end P.f $\cos\phi_s = \frac{V_R\cos\phi_R + IR}{V_s} = \frac{19052 \times 0.8 + 35 \times 24.25}{20559}$

$$= 0.7826\ \text{lag}$$

Line losses $= \frac{3I^2R}{1000}\,KW = \frac{3 \times (35)^2 \times 24.25}{1000} = 89.12\,KW$

output Power = 2000 KVA × 0.8 = 1600 KW

∴ Transmission efficiency $= \frac{1600}{1600 + 89.12} \times 100 =$ ~~94.2~~ 94.72%

Answer 5

$$r = \frac{1.956}{2} = 0.978 \text{ cm}$$

$$E_c = \frac{30}{\sqrt{3}} = 21.2 \text{ (r.m.s)}$$

$m_o = 1$ (Smooth Conductor)

$\delta = 1$ (stander Pressure and temperature)

$$V_o = 21.1\, m_o\, \delta\, r \ln \frac{d}{r}$$

Disruptive Voltage/Phase $= \frac{210}{\sqrt{3}} = 121.25$ KV

$$\therefore 121.25 = 21.1 \times 1 \times 1 \times 0.978 \times \ln \frac{d}{r}$$

$$\ln \frac{d}{r} = 5.84 \Rightarrow d = 341 \text{ cm}$$

Answer 3

A long transmission line can be considered to compose a considerably high amount of capacitance and inductance distributed across the entire length of the line. Ferranti Effect occurs when current drawn by the distributed capacitance of the line itself is greater then the current associated with the load at the receiving end of the line (during light or no load)

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The Capacitor Charging Current leads to a voltage drop across the line Inductor of the transmission System which is in Phase with the Sending end Voltage. This voltage drop keeps on Increasing additively as we move towards the load end of the line and Subsequently the receiving. entire length of the line. Ferrenti Effect occurs when Current drawn by the distributed Capacitance of the line it self is greater then the Current associated with the load at the receiving end of the line (during light or no load) This Capacitor Charging Current leads to a voltage drop across the line Inductor of the transmission System which is in Phase with the Sending end Voltages. This Voltage drop keeps on Increasing additively as we move towards the load end of the line and Subsequently the receiving end Voltage tends to get larger than applied Voltage leading to the Phenomena Called Ferranti effect in Power System.