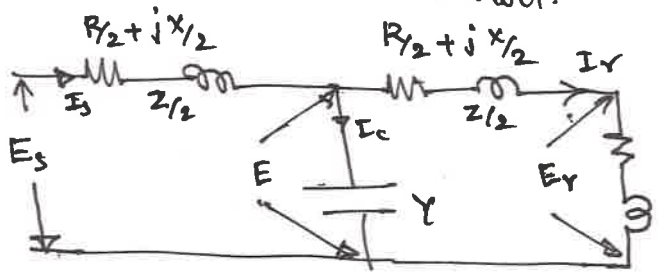
Q.P. 20824

Solution

Q 2 (b)

(1)

Nominal T Method.



$Z = 28 + j63 \rightarrow Z/2 = 14 + j31.5$ ohm

$\therefore E_{r/ph} = \frac{132}{\sqrt{3}} = 76.23$ kV — Voltage at receiving end

This voltage is taken as reference.

$\therefore I_r = \frac{75 \times 10^3}{\sqrt{3} \times 132} \angle \cos^{-1} 0.8 = 262.5 - j196.9$ amp.

$\therefore E = E_r + I_r (Z/2) = 86.1 + j5.5$ kV

$I_c = YE = j4 \times 10^{-4} (86.1 + j5.5) \cdot 10^3 = j34.44 - 2.2$ Amp

Now $I_s = I_c + I_r = 260.3 - j162.46$ — (4)

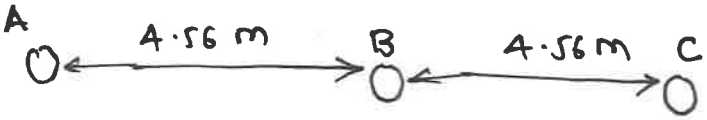
$E_s = E + I_s (Z/2) = 94.9 + j11.5$ kV — (4)

$\phi_s = 38°$. — (2)

$\therefore$ P.f $= \cos \phi_s = 0.78$ lagging

Q3 (b).

(2)



Radius of each conductor $r = \frac{22.4}{2}$

$= 11.2\,mm = 1.2\,cm$

Spacing betn conductor

$d_1 = AB = 456\,cm$

$d_2 = BC = 456\,cm$

$d_3 = CA = 912\,cm$ (2)

Capacitance per phase per m $= \frac{2\pi\epsilon_0}{\log_e \frac{(d_1 d_2 d_3)^{1/3}}{r}}$ F

$= 8.915 \times 10^{-12}$ F (4)

Capacitance of 100 km line.

$C = 8.915 \times 10^{-12} \times 100 \times 10^3$

$= 0.8915\,\mu F$ (2)

Charging current $I_c = \omega C V_{ph}$

$= 2\pi \times 50 \times 0.8915 \times \frac{132 \times 10^3}{\sqrt{3}}$

$I_c = 21.345\,A$ (2)

Q4(b) Calculate.

$A = 0.917 + j\,0.08514$

$B = 10.2715 + j\,64.44$

~~$= 0.000582$~~

$C = -0.00016996 + j\,0.0005818$

$D = 0.91956 + j\,0.082115$

Receiving end voltage $V_R = \frac{1,10,000}{\sqrt{3}} = 63,500\ V$

$I_R = 200\ A$ (Given)

$V_S = AV_R + BI_R$

$= 64147 + j\,16,998 = 66361 \angle 14.84^\circ$ — phase voltage

$V_S = \sqrt{3} \times 66361 = 114.94\ kV$ — line voltage.

$I_S = CV_R + DI_R$

$= 178.723 - j\,4.8828$

$= 178.8 \angle -1.56^\circ$.

(4)

Q5(b)

Diameter of conductor 'd' = $\sqrt{\frac{4A}{\pi}}$

$= \sqrt{\frac{4 \times 1.25}{\pi}} = 1.26\ M$ (2)

Weight of conductor per meter length $W_c = 1\ kg$

Horizontal wind force per meter length $W_w = \frac{100 \times 1 \times 1.26}{100}$

$W_w = 1.26\ kg$

Resultant force = $\sqrt{W_c^2 + W_w^2}$

$W_r = 1.608\ kg$ (4)

Sag = 3.5 m (Given)

Allowable tension in the conductor

$T = \frac{W_r L^2}{8S} = \frac{1.608 \times (150)^2}{8 \times 3.5}$

$= 1290\ kg$ (2)

Factor of Safety = $\frac{\text{Breaking stress} \times \text{Area of C.S}}{T}$

$= 4.$ (2)