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17 EEB 409

GI - 2134

GROUP - 07

Q Design a transmission line to transmit 120 MW of power to a distance of 150 km at a power factor of 0.95?

Given → V_L = Calculate

L_1 = 150 km

P = 120.0 MW

$\cos\phi$ = 0.95

STEP-1 To find V_L

$$V_L = 5.5\sqrt{\left[\frac{L_1}{1.6} + \frac{P \times 1000}{150 \times N_c \times \cos\phi}\right]} \text{ KV}$$

V_L = Selected transmission line voltage in kV

L_1 → length of transmission line in km

N_c → no. of circuit

for single circuit line → $N_c = 1$

$$V_L = 5.5\sqrt{\frac{150}{1.6} + \frac{120 \times 1000}{150 \times 1 \times 0.95}} \text{ KV}$$

$$V_L = 168.25 \text{ KV}$$

So, for single circuit line nearest value

$$V_L = 132 \text{ KV}$$

for double circuit line. $N_c = 2$

$$V_L = 5.5 \times \sqrt{\frac{225}{1.6} + \frac{120 \times 1000}{150 \times 2 \times 0.95}}$$

$\cos\phi = 0.95$

$V_L = 124.790$ KV

for double circuit line its nearest value

$V_L = 132.0$ KV

STEP-2 for surge impedance loading

for single circuit $Z_0 = 400\,\Omega$

$$SIL = \frac{(V_{kV})^2}{Z_0}$$

$$SIL = \frac{132^2}{400} = 43.56 \text{ MW}$$

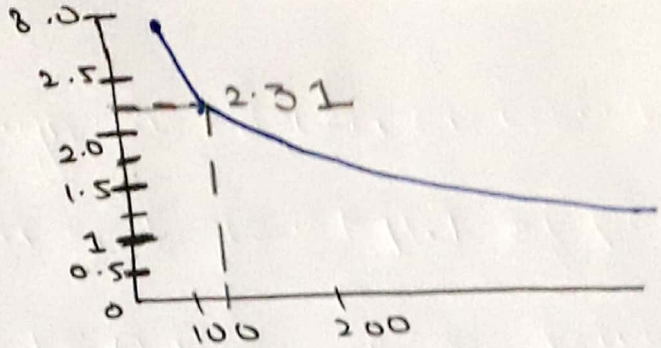
for double circuit $Z_0 = 200\,\Omega$

$$SIL = \frac{(V_{L\,kV})^2}{Z_0} = \frac{132^2}{200}$$

$$= 87.12 \text{ MW}$$

Multiplying factor mf is taken from graph which is approx

mf = 2.31



STEP-3 for maximum Power transfer

for single circuit

$$P_t = SIL \times mf$$

$$= 43.56 \times 2.31$$

$$P_{t_1} = 100.508\ MW$$

for double circuit

$$P_t = SIL \times mf$$

$$= 87.12 \times 2.31$$

$$P_{t_2} = 201.2472\ MW$$

Since we have to transfer Power = 120 MW and P_{t_1} have smaller value so it will be not consider.

Thus we have maximum Power transmission

$$P_{t_2} = 201.247\ MW$$

∴ we need a 132 KV single line circuit