Questions should be —
WRITTEN IN LEGIBLE HANDWRITING IN BLACK INK.
SIGNS, SKETCHES OR FIGURES IF ANY BE DRAWN IN NEAT BLACK INK,
so as to avoid mistakes in the printed question papers.

Duration .....03... Hours. Total Marks assigned to the paper ...80..

Q. No.	N.B. :	Marks

Q2 (c) solution:

Fig (a) shows the circuit diagram for the line.

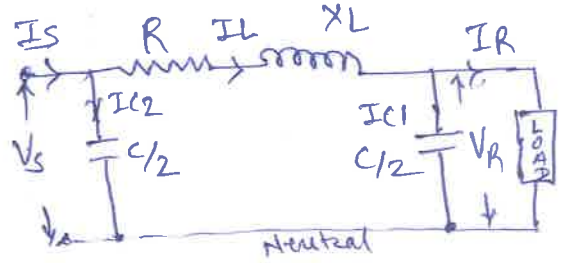

fig (a)

Total Resistance/phase
$R = 0.1 \times 150 = 15\ \Omega$

Total Reactance/phase, $X_L = 0.5 \times 150 = 75\ \Omega$

Capacitive admittance/phase $Y = 3 \times 10^{-6} \times 150 = 45 \times 10^{-5}$ S

Receiving End voltage/phase, $V_R = 110 \times 10^3/\sqrt{3} = 63508$ V

Load current $I_R = \frac{50 \times 10^6}{\sqrt{3} \times 110 \times 10^3 \times 0.8} = 328$ A

$\cos\phi_R = 0.8$, $\sin\phi_R = 0.6$

Taking receiving End voltage as the reference phasor,

$\bar{V}_R = V_R + j0 = 63508$ V

Load current $\bar{I}_R = I_R(\cos\phi_R - j\sin\phi_R) = 328(0.8 - j0.6)$
$= 262.4 - j\,196.8$

Charging current at load end is

$\bar{I}_{C_1} = \bar{V}_R j Y/2 = 63508 \times j\frac{45 \times 10^5}{2} = j\,14.3$

Line current, $\bar{I}_L = \bar{I}_R + \bar{I}_{C_1} = (262.4 - j\,196.8) + j\,14.3$
$= 262.4 - j\,182.5$

Sending End voltage, $\bar{V}_S = \bar{V}_R + \bar{I}_L Z = \bar{V}_R + \bar{I}_L(R + jX_L)$
$= 63,508 + (262.4 - j\,182.5)(15 + j\,75)$
$= 81,131 + j\,16,942.5 = 82881 \angle 11^\circ 47'$ Volt

∴ Line to Line Sending End voltage $= 82881 \times \sqrt{3} = 1,43,550$ V $= 143.55$ KV

02

Q. No. 02(c) Soln ⇒

Marks

charging current at the sending is

$$I_{C2} = j\bar{V}_S Y/2 = (81.131 + j\,16.942.5)\, j\,\frac{45\times10^{-5}}{2}$$

$$= -3.81 + j\,18.25$$

Sending end current, $\bar{I}_S = \bar{I}_L + \bar{I}_{C2} = (262.4 - j\,18.25) + (-3.81 + j\,18.25)$

$$= 258.6 - j\,164.25$$

$$= 306.4\angle -32.4^\circ \text{ A}$$

∴ Sending end current = 306.4 A

—x—

Q3

Q3 (b) Q. No. Solution :-

Marks

Here, $l = 214$ m, $w = 1.125$ kg, $Ww = 1.5$ kg

Total weight of one meter length of conductor is

$$W_t = \sqrt{w^2 + Ww^2} = \sqrt{(1.125)^2 + (1.5)^2} = 1.875 \text{ kg}$$

If f is the factor of safety, then

$$\text{Working tension, } T = \frac{\text{Breaking stress} \times \text{Conductor area}}{\text{Safety factor}}$$

$$= 2540 \times 3.225 / f$$

$$= 8191 / f \text{ kg}.$$

$$\text{Slant Sag } S = \frac{\text{vertical Sag}}{\cos\theta} = \frac{2.35 \times 1.875}{1.125}$$

$$= 3.92 \text{ m}$$

$$S = \frac{W_t \cdot l^2}{8T} \quad \text{OR} \quad T = \frac{W_t \cdot l^2}{8S}$$

$$\therefore \frac{8191}{f} = \frac{1.875 \times (214)^2}{8 \times 3.92}$$

$$\text{Safety factor } f = \frac{8191 \times 8 \times 3.32}{1.875 \times (214)^2} = 3.$$

—x—