VII. PROBLEMS:

1) **An inductive circuit has a resistance of 2.0 Ohms in series with an inductance of 0.015 henry? Find (a) Current (b) power Factor (c) Power consumed? When connected across 200 Volts, 50 Hz. Supply mains?**

Ans Given data

$R = 2.0$ Ohms , $L = 0.015$

$V = 200V$, $f = 50$ Hz.

Formula used

$$Z = \sqrt{R^2 + X_L^2}$$

$$X_L = 2 \prod f\ L$$

$$I = {}^V/_Z$$

$$P.F = {}^R/_Z$$

$$\text{Power} = VI \cos ¢\ (P.F)$$

$$X_L = 2 \times {}^{22}/_7 \times 50 \times 0.015 = 4.714 \text{ Ohms.}$$

$$Z = \sqrt{(2)^2 + (4.174)^2}$$

$$= \sqrt{26.22} = 5.121 \text{ Ohms.}$$

(a) $I = V/Z = 200/5.121 = 39.05$ Amps.

(b) Power Factor $= {}^R/_z = {}^2/_{5.121} = 0.39$

(c) Power Consumed $P = VI\ Cos Ø$

$= 200 \times 39.05 \times 0.39$

$= 3045.9$ Watts.

2) **Calculate the Line and Phase current of AC, 3 phase, 400 Volts, 7.5 B.H.P.? Motor with a power factor of 0.8 and efficiency 90%, when the winding is connected (a) in star (b) in Delta?**

Ans Given Data

$V_L = 400$ Volts , 3 Phase

BHP = 7.5, P.F = 0.8

$ŋ = 90\%$

Formula used -

Efficiency $ŋ = {}^{Output}/_{Input}$ or Input $= {}^{Output}/_{ŋ}$

Power $P = \sqrt{3}\ V_L\ I_L\ CosØ$

BHP $= 7.5 \times 746$ Watts.

$= 5595$ Watts.

Input (P) $= {}^{Output}/_{ŋ} = {}^{5595}/_{0.9}$

$P = 6216.66$ Watts.

$P = \sqrt{3}\ V_L\ I_L CosØ$

$6226.66 = \sqrt{3 \times 400 \times I_L \times 0.8}$

$I_L = \underline{6216.66}$

$\sqrt{3 \times 400 \times I_L \times 0.8}$

I_L = 11.2 Amps.

(a) In star Line current = Phase current

Therefore I_{Ph} = 11.2 Amps.

(b) In Delta Phase current

$I_{Ph} = I_L / \sqrt{3} = {}^{11.2} / \sqrt{3} = 6.4$ Amps.

3) A 250 KVA, 11000/400 Volts Delta / Star 3 phase transformer has load of 100 Amps. Find the line current on primary?

Ans Given Data

Primary Voltage V_P = 11000 Volts

Secondary Voltage Vs = 440 / $\sqrt{3}$ (Since star connected)

Secondary Voltage Is = 100 Amps.

Power = 250,000 VA

Formula : Vs/ Is = Ip/ Is

$$\frac{440/\sqrt{3}}{11,000} = \frac{Ip}{400}$$

$$\frac{440/\sqrt{3}}{11,000} \times 100 = \frac{40}{11 \times \sqrt{3}}$$

= 2.09 Amp.

4) Find the diameter of copper wire in mm, if the resistance of 1.5 Kilometer wire is 7.2 Ohms? (Specific Resistance of copper is 1.7 x 10^{-6} Ohm/cm^3)

Ans Given Data

Length = 1.5 Km

= 15,000 cm

Resistance = 7.2 Ohms.

$\rho = \frac{1.7}{10^6} = 1.7 \times 10^{-6}$

We Know R = ρ L/a

$7.2 = 1.7 \times 10^{-6} \times 1,50,000 / a$

a = 1.7 / 1,00,000 X 1,50,000 / 7.2

= 0.035 sq.cm.

Now $a = \pi d^2/4$

$0.035 = 22/7 \times (d)^2/4$

$d = \sqrt{\frac{0.035 \times 7 \times 4}{22}} = 0.21$ cm.

5) Find the capacity of pump (HP) to pump the water at the rate of 20 Gallons per minute, from the bore well of 250 ft. depth to the over head tank of height 100 ft. Neglect all friction losses. Take specific gravity of the water as '1' and take efficiency of the pumps as 60%?

Ans: Given Data

Discharge (Q) = 20 Gallons per minutes (GPM

Depth of bore well = 250 ft.

Height of the water tank = 100 ft.

Specific gravity of water (S.G) = 1.0

Efficiency of the pump (η) = 60% = 0.6

Pump capacity in Horse Power(HP) = $\frac{Q \times Head \times Specific\ Gravity}{3960 \times \eta}$

Total Head = Depth of bore well + Height of the Tank

(in feet) = 250 +100 = 350 Feet.

$$\text{Pump Capacity in HP} = \frac{Q \times \text{Head} \times \text{Specific Gravity}}{3960 \times \eta}$$

$$= \frac{20 \times 350 \times 1.0}{3960 \times 0.6}$$