2) Soln: S = 144, Z/S = 10, ϕ = 0.03 Wb, N = 375 r.p.m, f=?, Eph=?, E_L =?

f=PN/120=(16*375)/120=50 Hz

Total no of conductor Z = number of slots x conductor/ slot = 144 x 10= 1440

Conductor per phase Zph= 1440/3=480

Therefore Eph = 2.22 Kp Kd f Φ Zph

= 2.22 x 1 x 1 x 50 x 0.030 x 480

= 1598.4 volts

The line Voltage EL = $\sqrt{3}$ Eph

= $\sqrt{3}$ x 1598.4 = 2768.51 volts

(4) $E_L = 4kV$, $f = 50Hz$, $N = 500 rpm$, $S/P/ph = 3$, $Z/S = 12$

i) $P = ?$, ii) $\phi = ?$, Assume $k_d = 1$, $k_c = 1$, star connected

$\Rightarrow$ i) $f = \frac{PN}{120} \Rightarrow P = \frac{120f}{N} = \frac{120 \times 50}{500} = 12$

$\Rightarrow E_L = \sqrt{3} E_{ph} \Rightarrow E_{ph} = \frac{E_L}{\sqrt{3}} = 2309.4011 V$

$E_{ph} = 2.22 k_w k_d k_c \cdot f \phi Z_{ph}$

$\phi = 48.16 mWb$

$S/P/ph = 3 \times 12 = 108$

$Z = S \times Z/S = 108 \times 12 = 1296$

$Z_{ph} = \frac{1296}{3} = 432$

(1) $P = 12$, $\frac{N}{60} = 5 r.p.s$, Y, $S = 60$, $Z/S = 20$, $\phi = 0.02 Wb$, $k_w = 0.97$, i) $f = ?$, ii) $= E_{ph}$, iii) $E_L = ?$

$\Rightarrow$ i) $f = \frac{PN}{120} = \frac{12 \times 5 \times 60}{120} = 30Hz$

ii) $E_{ph} = 2.22 k_w f \phi Z_{ph}$

$= 516.82 V$

iii) $E_L = \sqrt{3} E_{ph} = 895.15 V$

$Z = 60 \times 20 = 1200$

$Z_{ph} = \frac{1200}{3} = 400$

(3) $P = 6$, $f = 50Hz$, $S/P = 12 \times 6 = 72$, $Z/S = 4$, $\phi = 25 mWb$, $E_L = ?$, Y, $k_d = 0.96$, $k_c = 1$

$\Rightarrow E_{ph} = 2.22 k_d k_c f \phi Z_{ph}$

$= 255.744 V$

$E_L = \sqrt{3} E_{ph} = 442.962 V$

$Z = 72 \times 4 = 288$

$Z_{ph} = 96$

(5) $Z_{ph} = ?$, $P = 10$, $f = 50\,Hz$, $S = 90$, Y, $E_L = 11\,kV$, $\phi = 0.16\,wb$,

$\Rightarrow E_{ph} = 2.22 \times k_w \times f \times \phi \times Z_{ph}$

$E_{ph} = \frac{E_L}{\sqrt{3}}$

$Z_{ph} = 357.593$ conductors → 360 → check

(6) $N = ?$, E_L & $E_{ph} = ?$, $P = 4$, $f = 50\,Hz$, Y, $S = 36$

$Z_S = 30$, $\phi = 0.05\,wb$, $k_w = 0.96$

$\Rightarrow f = \frac{PN}{120} \Rightarrow N = \frac{120f}{P} = \frac{120 \times 50}{4} = 1500\,rpm$

$E_{ph} = 2.22 \times k_w \times f \times \phi \times Z_{ph}$

$= 1918.08\,V$

$E_L = \sqrt{3}\, E_{ph} = 3322.21\,V$

$Z = S \times Z_S$

$= 36 \times 30$

$= 1080$

$Z_{ph} = 360$