Auxiliary equation is

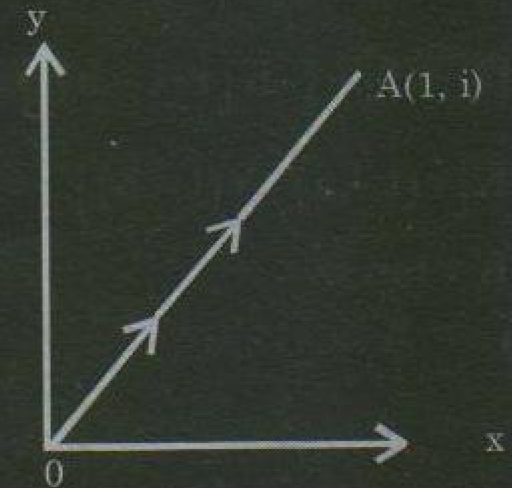
$$m^2 - 5m + 6 = 0$$

$$\Rightarrow m = 3, 2$$

2. Ans.(b)

Exp. Equation of straight line passing through (0, 0) and (1, 1)
i,e

$$y - 0 = \frac{1-0}{1-0}(x-0) \Rightarrow y = x$$



Let

$$\Rightarrow z = (x+iy) = x + ix = (1+i)x$$

$$dz = (1+i)dz$$

$$\int_{0A}\left((x-y+ix^2)dz = \int_0^1 (x-x+ix^2)(1+i)dx = \frac{i}{3}(1+i) = \frac{1}{3}(i-1)\right)$$

3. Ans.(b)

Exp. $\lim\limits_{x\to 5} \frac{2x^2-9x-5}{3x^2-10x-25} = \frac{0}{0}(\text{form})$

By L, hospital rule

$$= \frac{4x-9}{6x-10} = \frac{20-9}{30-10} = \frac{11}{20}$$

4. Ans.(d)

Exp. Trace $A = a_{11} + a_{22} + a_{33} + ... + a_{nn}$ i.e

$$\text{Trace } A = \begin{bmatrix} 5 & 2 & 3 \\ 1 & 5 & 3 \\ 3 & 9 & 15 \end{bmatrix} = 5 + 5 + 15 = 25$$

5. Ans.(c)

Exp. According to Z-transform

$$x(z) = \sum_{n=0}^{\infty} x(n) z^{-n}$$

6. Ans.(c)

7. Ans.(b)

Exp. 2 c = s for single-layer winding

Then $2 \times 45 = 90$

It is single layer winding

8. Ans.(d)

Exp. $\because R = \frac{z}{a^2}\frac{\rho\ell}{A}$

a = no. of parallel path

a = P for lap connection

then

$$0.01 = \frac{z}{36}\frac{\rho\ell}{A}$$

$$.01 \times 36 = z\frac{\rho\ell}{A} \quad ...(i)$$

$$R = \frac{z}{4}\frac{\rho\ell}{A} (\text{for wave connection } a = 2)$$

$$4R = z\frac{\rho\ell}{A} \quad ...(ii)$$

From (i) and (ii)

$$4R = .01 \times 36$$

$$R = .09\ \Omega$$

9. Ans.(a)

Exp. For lap winding A = P

$$E = \frac{nP\phi z}{A}, n = \frac{1500}{60} \text{rps}, z = 360, \phi = 20 \times 10^{-3}\ \omega b$$

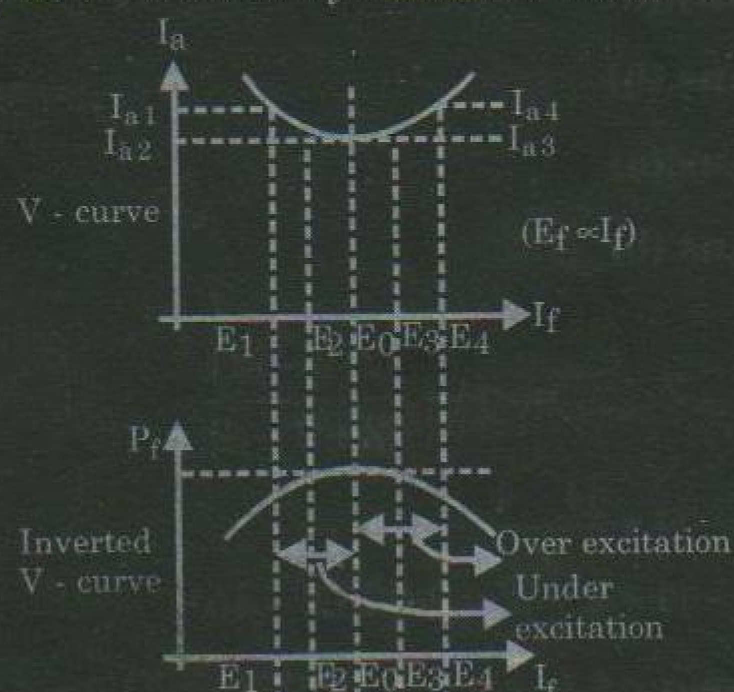
$$E = \frac{1500 \times 20 \times 10^{-3} \times 360}{60} = 180 \text{ V}$$

10. Ans.(d)

11. Ans.(c)

12. Ans.(a)

Exp. The v – curve of synchronous motor



Over excitation

$\Rightarrow E_4 > E_3$

$\Rightarrow I_{a4} > I_{a3}$

$\Rightarrow E_S\uparrow \Rightarrow Ia\uparrow$

Hence armature current increases.

13. Ans.(c)

14. Ans. (b)

Exp. $\because P_1 + P_2 = 30\ k\omega$ ... (i)

p.f is $\cos\phi = 0.4$ (given)

$\because \phi = 66^\circ 24\ \&\ \tan\phi = 2.289$

By equation

$$\tan\phi = \sqrt{3}\frac{P_1 - P_2}{P_1 + P_2}$$

$$\Rightarrow 2.289 = \sqrt{3}\frac{P_1 - P_2}{30}$$

$$P_1 - P_2 = 39.7\ kW$$

By solving we get

$$P_1 = 34.85\ kW\ \&\ P_2 = -4.85\ kW$$

15. Ans.(d)

16. Ans.(b)

17. Ans.(a)

18. Ans.(b)

19. Ans.(a)

20. Ans.(d)

21. Ans.(d)

22. Ans.(b)

23. Ans.(a)

24. Ans.(b)

Exp. $$Z_{input} = -j4 + \frac{j2(2-j2)}{j2+2-j2}$$

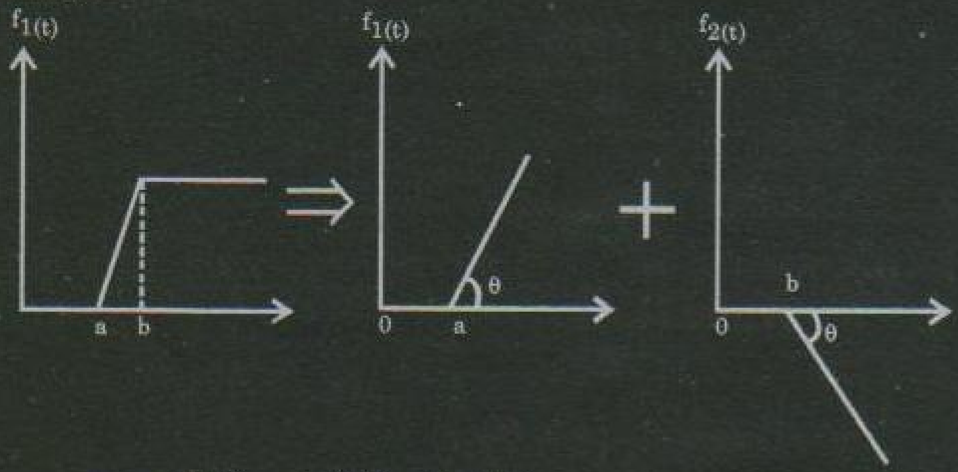
$$= -j4 + \frac{j4+4}{2}$$

$$= -j4 + 2 + j2 = 2.828\angle -45^\circ$$

Input p.f. is $\cos 45^\circ = .707(\text{lead})$

25. Ans.(d)

Exp.



$$\Rightarrow f(t) = f_1(t) + f_2(t)$$

$$= K[r(t-a)] + \{-K[r(t-b)]\}$$

$$f(t) = K[r(t-a) - r(t-b)]$$

Where $K = \tan\theta$

26. Ans.(c)

Exp. Given

$$P_i = 1300\ \omega, P_{cf\ell} = 1200\ \omega, \cos\phi = 1$$

$$\eta_{f\ell} = \frac{o/p}{o/p + \text{losses}} = \frac{V_2 I_2\cos\phi}{V_2 I_2\cos\phi + P_i + P_{cf\ell}}$$

$$= \frac{100\times1000\times1}{100\times1000\times1 + 1300 + 1200} = .9756\ \text{pu} = 97.56\%$$

27. Ans.(a)

Exp. In delta-delta operation

$$\because I_L = \frac{900\times10^3}{\sqrt{3}\times2300} = 225.9\ A$$

Then primary current per phase

$$I_{P_1} = \frac{1}{\sqrt{3}}\times I_L = 130.4A$$

Secondary current per phase

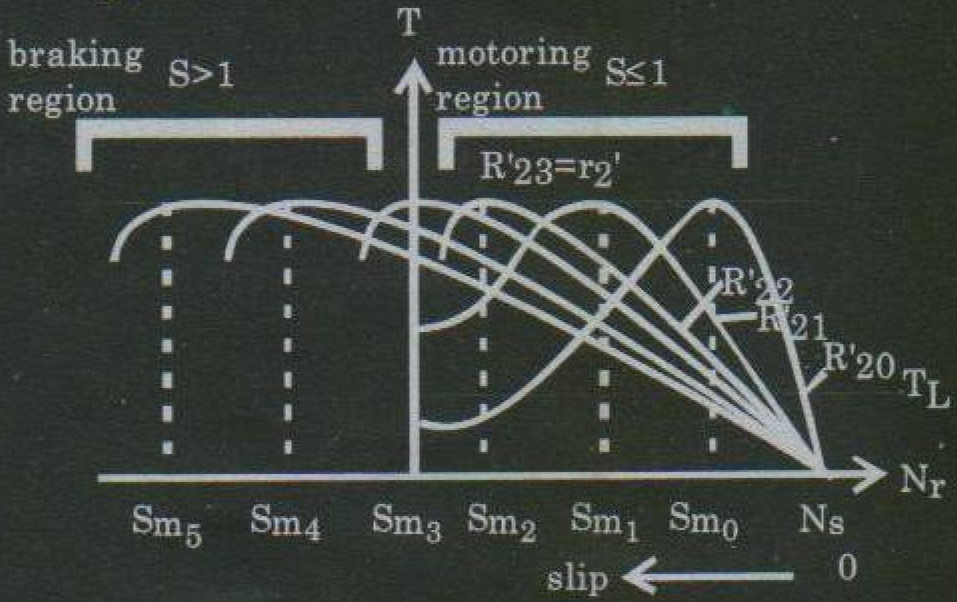
$$I_{P_2} = 130.4\times\frac{2300}{230} = 1304\ A$$

$\Rightarrow$ in open delta the line is in series with the w/d of the transformer, therefore the secondary line current is equal to rated secondary current.

28. Ans.(a)

Exp. In this for increasing resistance the starting torque is increased till $S \le 1$

That means it increase only in motoring region it will decrease at $S>1$ in braking region.



29. Ans.(d)

Exp.

$$N_s = \frac{120f}{P} = \frac{120\times50}{6} = 1000 \text{ rpm}, S = \frac{1000-930}{1000} = .07$$

Friction and windage los

$$= 10000 \times \frac{1}{100} = 100\ \omega$$

$$P_m = P_{sh} + F \,\&\, \omega \text{ loss}$$

$$= 10000 + 100$$

$$P_m = 10100\omega$$

$$P_g = \frac{P_m}{(1-S)} = \frac{10100}{(1-.07)} = 10.86 \text{ k}\omega$$

Stator i/p power = 10.86 + stator loss

= 10.86 + 600 = 11.46 kω

30. Ans.(d)

Exp. $E_1 = V - I_{a_1}R_a = 250 - 50\times.25 = 237.5$ V

$\phi_2 = 0.9\phi_1$ (given)

& $\tau \propto I_a\phi$

Torque same

Then $\tau_2 = \tau_1$

$$I_{a_2} = \frac{\phi_1}{\phi_2} I_{a_1} = 55.56\text{A}$$

$$E_g = V - I_{a_2}R_a = 236.1 \text{ V}$$

$$\frac{N_2}{N_1} = \frac{E_2\phi_1}{E_1\phi_2} \Rightarrow \frac{236.1\times750}{237.5\times0.9} = N_2$$

$N_2 = 828.5$ rpm

31. Ans.(c)

Exp. Source current $I_1 = \frac{1000}{50} = 20\text{A}$

Load current $I_2 = \frac{1000}{40} = 25\text{A}$

Current in common section winding

$= I_2 - I_1 = 5\text{A}$

32. Ans.(a)

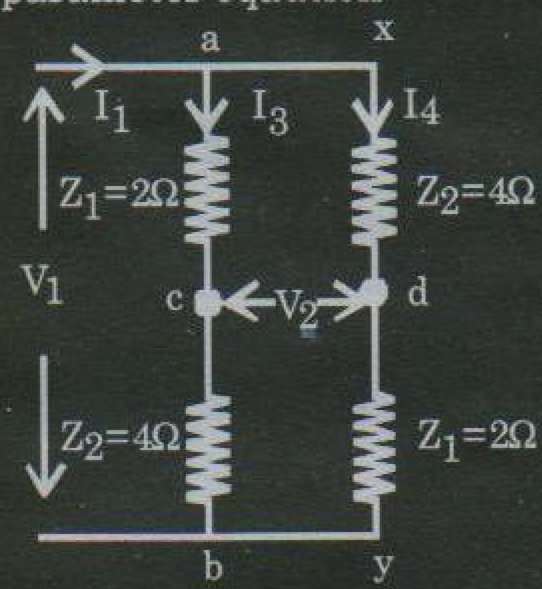
Exp. $E_{ph} = \sqrt{2}\ \Pi f\phi\ N_{ph}.k\omega$

$\because k\omega = 0.955, (\text{assume}), \phi = 2.08\times10^{6}\times10^{-8} = 2.08\times10^{-2}\,\omega b$

$E_{ph} = \sqrt{2}\Pi\times50\times2.08\times10^{-2}\times240\times.955 = 1058.9$ V

33. Ans.(b)

Exp. By h-parameter eqaution



$$V_1 = I_1\left(\frac{Z_1+Z_2}{2}\right)$$

$$\frac{V_1}{I_1} = Z_{11}\Big/ I_2 = 0 = \frac{Z_1+Z_2}{2}$$

$$V_2 = V_c - V_d = (V_1 - I_3Z_1) - (V_1 - I_4Z_2)$$

$$= I_4Z_2 - I_3Z_1$$

$$V_2 = \frac{I_1}{2}\times Z_2 - \frac{I_1}{2}\times Z_1 = \frac{Z_2-Z_1}{2}.I_1$$

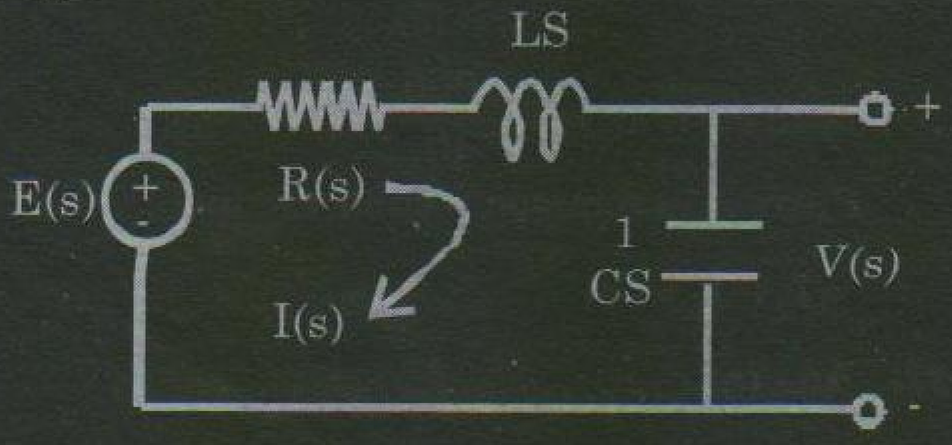
$$\frac{V_2}{I_1} = Z_{21}\Big/ I_2 = 0 = \frac{Z_2-Z_1}{2}$$

On solving

$$h_{21} = \frac{-Z_{21}}{Z_{22}} = \frac{-1}{3}$$

34. Ans.(a)

Exp.



$$I(s) = \frac{E(s)}{R + LS + \frac{1}{CS}}$$

$$V(s) = I(s) \times \frac{1}{CS} = \frac{E(s)}{R + LS + \frac{1}{CS}} \cdot \frac{1}{CS}$$

$$\frac{V(s)}{E(s)} = \frac{1}{LCS^2 + RCS + 1}$$

35. Ans.(b)

Exp. By KVL

$$-12 + i \times 1 + i \times 10 + 2i = 0$$

$$i = 0.92\,A$$

$$V_{rL} = .92 \times 10 = 9.2\ V$$

36. Ans.(b)

Exp. By routh-hurwitz criterion

$$S^4 + 10S^3 + 10S^2 + 2S + K = 0$$

S^4	1	10	K
S^3	10	2	
S^2	9.8	K	
S^1	$\frac{19.6 - 10K}{9.8}$		
S^0	K		

For stability $K > 0 \Rightarrow 19.6 - 10K > 0$

$$0 < K < 1.96$$

37. Ans.(c)

Exp.1. 1st line having a slope of +20 db/dec therefore a turm 's' in numerator

2. At $\omega = 1$, slope changes to zero i.e. = (S+1) in denominator

3. At $\omega = 10$, slope changes to -20 db/deca ie.

$$= \left(1 + \frac{S}{10}\right) \text{ in denominator}$$

4. 20 log K = 6

$$K = 1.99 \approx 2.0$$

$$\Rightarrow G(s) = \frac{20S}{(S+1)(S+10)}$$

38. Ans.(a)

Exp. By balance equation i.e. $R_1R_4 = R_2R_3$

$$\Rightarrow (R_1 + j\omega L_1)R_4 = (r_2 + R_2 + j\omega L_2)R_3$$

$$R_1R_4 + j\omega L_1R_4 = +j\omega L_2R_3 + (R_2 + r_2)R_3$$

On comparing real and imaginary part

$$R_1R_4 = (R_2 + r_2)R_3$$

$$R_1 = \frac{R_3}{R_4}(r_2 + R_2), L_1 = \frac{R_3}{R_4}L_2$$

39. Ans.(b)

Exp. True value of temp. At

$$= A_m + \delta_c = 95.45 - 0.08 = 95.37°C$$

40. Ans.(a)

Exp. The inductive reactance of the coil for 100% neutralizer will be

$$\omega L = \frac{1}{3\omega c} = \frac{1}{3 \times 314 \times 1 \times 10^{-6}} = \frac{10^6}{3 \times 314} = 1061\Omega$$

41. Ans.(d)

Exp. The system is  full load at 0.8 p.f

Series impedance the approximate drop in

volt $= V_r \cos\phi_r + V_x \sin\phi_r$

% drop of volts $V_r \approx 0$(negligible)

Then

$$= V_x \sin\phi_r = 3 \times 0.6 = 1.8\%$$

42. Ans.(a)

Exp. ∵ LV side is delta connection, the CT_s on the that side will be star connected.

i.e. 400 A = line current

$C.T_s$ on secondary current is = 5 Amp

i.e. line current on the star side of the power transformer

$$400 \times \frac{6.6}{33} = 80 \text{ amp}$$

⇒ current in C.T secondary is $\frac{5}{\sqrt{3}}$

⇒ C.T ratio on the H.V side will be $= 80 : \frac{5}{\sqrt{3}}$

43. Ans.(b)

Exp. The penalty factor $= \frac{10}{8}$

Received power cos

$$= \frac{dF_1}{dP_1} L_1 = (0.1 \times 10 + 3)\frac{10}{8}$$

$= \text{Rs. } 5 / \text{Mwhr}$

44. Ans. (b)

Exp. Heater resistance $R = \frac{230^2}{1000}\Omega$

rms value of o/p volt $V_{or} = \frac{\sqrt{2} \times 230}{2}$

Power observed by heater-elemen

$$= \frac{V_{or}^2}{R} = 500 \ \omega$$

45. Ans. (a)

Assuming the active power fixed and equal to P. the rating of the generator for p.f 0.95 will

be $S_1 = \frac{P}{0.95} = 1.0525 \text{ P}$ and that for p.f 0.8

it will be $\frac{P}{.8} = 1.25 \text{P mVA}$

The increase in mVA rating for same Mw is

$$\frac{1.25 - 1.0525}{1} = 19.75\%$$

46. Ans. (b)

for 40 A line current, $E_{a1} = V_t - I_a(r_a + r_s)$

$= 230 - 40(.2 + .1) = 218V$

For a line current of 20A

$E_{a2} = 230 - 20(.3) = 224$ volts

New flux at 20 A i.e. $\phi_2 = 0.6$ times at 40A

i.e. $\frac{E_{a1}}{E_{a2}} = \frac{n_1\phi}{n_2\phi_2} \qquad \frac{218}{224} = \frac{1000\phi_1}{n_2(0.6\phi_1)}$

$$n_2 = \frac{1000 \times 224}{218 \times .6} = 1712.53$$

$n_2 \cong 1713 \text{ rpm} = 1713 \text{ rpm}$

47. Ans. (c)

Per phase load current $= \frac{100000}{\sqrt{3} \times 430} A$

Voltage at the output side of regulator = 430 V

Maximum variation of voltage from 430 V

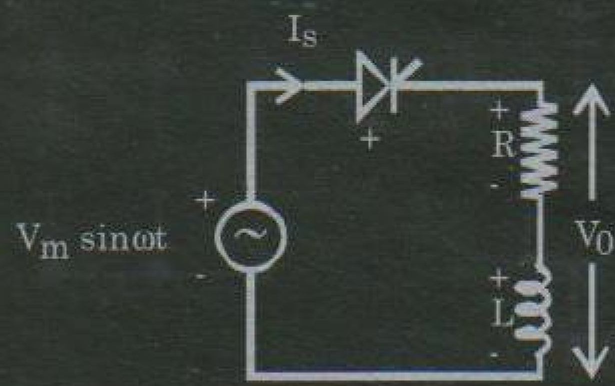
$= 430 - 380 = 50V$

$$= \sqrt{3}(50)\left(\frac{100000}{\sqrt{3} \times 430}\right)$$

$$= \frac{50 \times 100}{430} \text{KVA} = 11.627 \text{KVA}$$

48. Ans.(b)

Exp.



Circuit turn off time $t_c = \frac{2\pi - \beta}{\omega}$

$$= \frac{(360 - 210)\pi}{180 \times 2\pi \times 50} = 8.333 \text{ m-sec}$$

49. Ans.(b)

Exp. Average o/p voltage

$$V_0 = \frac{\sqrt{2}.230}{2\pi}\left[\cos 40 - \cos 210^\circ\right]$$

$= 54.477$ V

50. Ans.(b)

Exp. Current through coil

$$I=\frac{(+.238-j.085)}{1.0}=.238-j.085A$$

Voltage across the coil

$$V=10(0.3375+j.232)=3.375+j2.32V$$

Impedance of the coil

$$=\frac{V}{I}=\frac{3.375+j2.32}{0.238+j.085}=9.49+j13.13\Omega$$

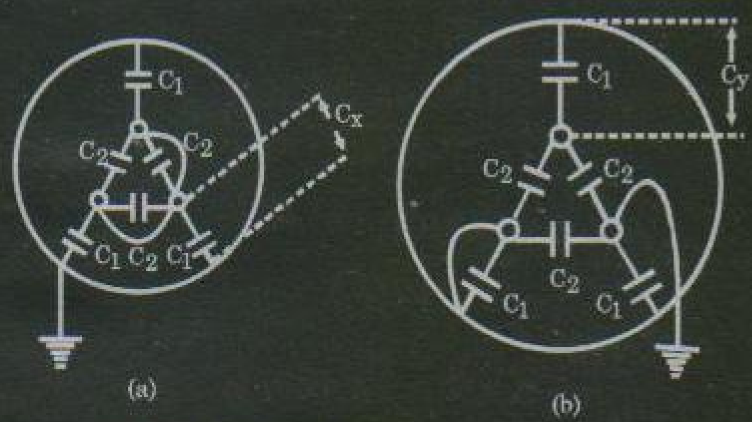
$\Rightarrow$ resistance of the coil is $R=9.49\Omega$

51. Ans.(d)

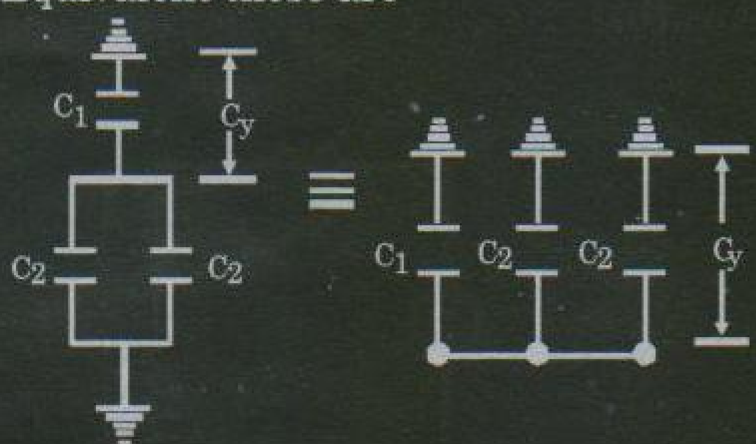
Exp. Reactance of the coil is $X = 13.13\Omega$

52. Ans.(c)

Exp.



Equivalent these are



$$\Rightarrow C_x=3C_1=0.625$$

$$C_y=C_1+2C_2=0.4$$

$$\Rightarrow C_0=\frac{3}{2}C_y-\frac{C_x}{6}=\frac{3}{2}\times0.4-\frac{.0625}{6}-0,496\ \mu F=km$$

i.e. capacitance b/w any two conductors $=0.248\ \mu F/km$

53. Ans.(d)

Exp. The charging current per phase per km will be

$$\frac{V}{\sqrt{3}}\omega c_0\times10^3\text{amps}=\frac{10}{\sqrt{2}}\times314\times0.496\times10^{-6}\times10^3$$

$=0.899$ A

54. Ans.(c)

Exp. $\because$ 5A dc source, X_c will be charged at $t=\infty$ (steady state)

i.e. $V_c(t=\infty)=5\left(\frac{1}{X_c}\right)=1V$

55. Ans.(d)

Exp. The discharge current at $t=0^+$ will be given by

$$i_{discharge}(t=0^+)=\frac{V_c(0^+)}{5+5}=0.1A$$

56. Ans.(c)

Exp. Average after 16 innings = 85 -3 × 17 = 34
Average after 17 innings = 85 – 3 (17 - 1) = 37

57. Ans.(d)

58. Ans.(d)

Exp. Both knife and chopper are used for the same purpose i.e. cutting, similarly, both quilt a n blanket are used for protection from cold.

59. Ans.(b)

60. Ans.(c)

61. Ans.(a)

Exp. On squaring

$$\left(\sqrt{3y+1}\right)^2=\left(\sqrt{y-1}\right)^2 \qquad 3y+1=y-1$$

i.e. $y=-1$ means $\sqrt{y-1}=\sqrt{-2}$ no real no.

$\Rightarrow$ no real root exist

62. Ans.(d)

Exp. We analyse the group
From graph:

In 1996 – no. of students left = 250 and no. of students joined = 350

In 1997 – no. of students left = 450 and no. of students joined = 300

In 1998 – no. of students left = 400 and no. of students joined = 450

In 1999 – no. of students left = 350 and no. of students joined = 500

In 2000 – no. of students left = 450 and no. of students joined = 400

In 2001 – no. of students left = 450 and no. of students joined = 550

From questions

In 1999 no. of students are = 3000 – 350 + 500 = 3150

63. **Ans.(b)**

Exp. Formula :

Quantity to be added

$$= \frac{\text{solution (required \% value} - \text{present \% value)}}{(100 - \text{required \% value})}$$

$$= \frac{40(20\% - 10\%)}{(100 - 20\%)}$$

$= 5$ litres

64. **Ans.(d)**

65. **Ans.(b)**

Exp. This is in A.P. in which a = 6, d = 6 &

$S_n = 1800$

i.e.

$$\frac{n}{2}(2a + (n-1)d) = 1800 \Rightarrow \frac{n}{2}[2 \times 6 + (n-1) \times 6] = 1800$$

$$\Rightarrow n^2 + n - 600 = 0 \Rightarrow n(n+25) - 24(n+25)$$

$$\Rightarrow (n+25)(n-24) = 0$$

$$\Rightarrow n = 24$$