Answer Keys

1	D	**2**	B	**3**	A	**4**	D	**5**	A	**6**	D	**7**	B
8	B	**9**	C	**10**	4	**11**	3.33	**12**	C	**13**	C	**14**	A
15	D	**16**	B	**17**	D	**18**	A	**19**	D	**20**	225	**21**	76.4
22	C	**23**	B	**24**	50	**25**	A	**26**	C	**27**	B	**28**	D
29	98.8	**30**	78	**31**	84	**32**	0.448	**33**	99.4	**34**	B	**35**	B
36	A	**37**	B	**38**	A	**39**	D	**40**	C	**41**	C	**42**	A
43	40	**44**	300	**45**	C	**46**	D	**47**	A	**48**	2	**49**	2.666
50	2500	**51**	7.5	**52**	C	**53**	D	**54**	A	**55**	D	**56**	C
57	D	**58**	A	**59**	C	**60**	A	**61**	D	**62**	B	**63**	C
64	D	**65**	D										

Explanations:-

1. $z = \frac{10\angle 0}{5\angle -30} = 2\angle 30;\ 10\cos\ \omega t + 30^o\ = 10\sin\ 90 - \omega t - 30^o\ = 10\sin\ 60 - \omega t$

$= -10\sin\ \omega t - 60\ = -10\angle -60 V, I = \frac{V}{Z} = \frac{-10\angle -60}{2\angle 30} = -5\angle -90 = 5\angle 90$

$= 5\sin\ \omega t + 90\ = 5\cos\omega t\ A$

2. $x\ 0\ = \lim_{s\to\infty} s\,x\ s\ = \lim_{s\to\infty} \frac{3+\frac{4}{s}}{1/s + 1\ \ s+2\ ^2} = 0$

4. With losses neglected $V_t = E_b$

When V_t is halved, E_b is halved.

Now for constant power

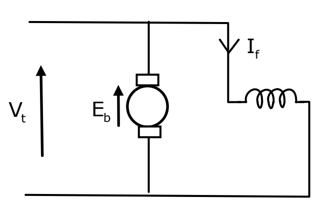
$E_b\ I_a\ = \text{constant}$ so I_a is doubled.

Again , with V_t halved, I_f is halved, so is ϕ

$E_b = \omega\phi$

E_b and ϕ are halved, $\omega = \text{constant}$

$T_\omega = \text{constant}$ so, T is constant



7. Since rank = 2

$\Rightarrow |A| = 0$

$\Rightarrow \begin{vmatrix} k & -1 & 0 \\ 0 & k & -1 \\ -1 & 0 & k \end{vmatrix} = 0 \Rightarrow k = 1$

8. we have $\int_a^b \frac{f(x)}{f(x)+f(a+b-x)}dx = \frac{b-a}{2}$

$$\therefore \int_2^4 \frac{\sqrt{x}}{\sqrt{x}+\sqrt{6-x}}dx = \frac{4-2}{2} = 1$$

9. $\frac{ds}{dt} = 32t - 2$

$$\Rightarrow ds = (32t-2)dt$$

$$\Rightarrow \int ds = \int (32t-2)dt$$

$$\Rightarrow s = 32\frac{t^2}{2} - 2t + c \quad ....(1)$$

given $s\left(\frac{1}{2}\right) = t$

$$\Rightarrow \text{when } t = \frac{1}{2}, s = 4$$

$$\text{from (1)}, 4 = 16\left(\frac{1}{2}\right)^2 - 2\left(\frac{1}{2}\right) + c$$

$$\Rightarrow c = 1$$

$$\therefore s = 16t^2 - 2t + 1$$

10. $f_1 = 20Hz;\ f_2 = 30Hz;$

Analog frequencies,Digital frequencies are $F_1 = \frac{20}{75} = \frac{4}{15} = \frac{K_1}{N_1}$

$$F_2 = \frac{30}{75} = \frac{2}{5} = \frac{K_2}{N_2};\quad \therefore\ N_1 = 15,\ N_2 = 5;\ K_1 = 4,\ K_2 = 2$$

11. $L_1 = 1H, \qquad L_2 = 2H$

$$i(0^+) = \frac{L_1}{L_1+L_2} i(0^-) = \frac{1}{3}\times 10 = \frac{10}{3}A = 3.33A$$

13. $\text{Reactive power } Q = \frac{E_f V_t}{X_d}\cos\delta - \frac{V_t^2}{X_d} - V_t^2\left(\frac{1}{x_q} - \frac{1}{x_d}\right)\sin^2\delta$

$V_t^2\left(\frac{1}{x_q} - \frac{1}{x_d}\right)\sin^2\delta$ is always positive, so for maximum Q,

$\cos\delta$ needs to be maximum

$\sin^2\delta$ needs to be minimum

So Q_{max} occurs at $\delta = 0$

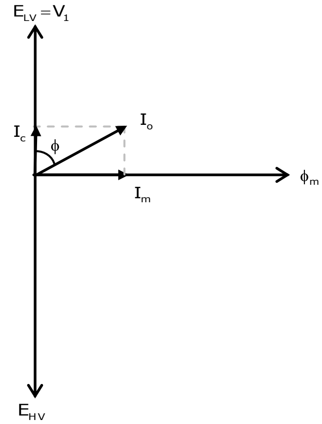
14. $I_o = 6A$

The low voltage side of transformer is excited.
So, care-loss component of no load current

$$I_C = \frac{250}{200} = 1.25A$$

Magnetizing component $I_m = \sqrt{I_o^2 - I_c^2} = 5.87A$

No-load p.f. = $\cos\phi = \frac{I_c}{I_o} = 0.208$



16. $$y\ s = G_2\ s\left[X\ s + x\ s\ G_1\ s + y\ s\ G_1\ s\right]$$

$$= \left[G_2\ s + G_1\ s\ G_2\ s\right]X\ s + y\ s\ G_1\ s\ G_2\ s$$

$$\frac{y\ s}{X\ s} = \frac{G_2\ s\left[1 + G_1\ s\right]}{1 - G_1\ s\ G_2\ s}$$

17. The expression is simply

Answer $= \bar{x} \pm \sigma_x$

σ_x is the standard deviation $= 0.2$ sec

$\bar{x}$ is the mean $= 3.6$ secs

18. $D_s = 0.7788r = 0.233\,cm$

$$GMD = D_m = \sqrt[3]{D_{ab}D_{bc}D_{ca}} = 2.29m$$

$$L = \frac{\mu_o}{2\pi}\ln\frac{D_m}{D_s} = 1.38 \times 10^{-6} H/m = 1.38\,mH/km$$

$$L = 1.38 \times 10^{-3} \times 125 = 0.1725H$$

$$X_L = \omega L = 2 x \pi x f x L = 2 x \pi x 50 x 0.1725 = 54.19\Omega$$

19. We have

$$\text{Res } f(z) = \lim_{z \to x}\left\{\frac{1}{n-1\ !}\frac{d^{n-1}}{d2^{n-1}}\left[(z-a)^n f(z)\right]\right\}$$

at $z = a$

$$\Rightarrow \text{Res } f(z) \text{ at } z = -1 = \lim_{z \to -1}\left\{\frac{1}{2-1\ !}\frac{d^{2-1}}{dz^{2-1}}\left[(z+1)^2\frac{2}{(z-1)(z+1)^2}\right]\right\} = \lim_{z \to -1}\frac{d}{dz}\left(\frac{z}{z-1}\right)$$

at $z = a$

$$= \lim_{z \to -1}\left\{\frac{(z-1)\times(1) - z \times (1)}{(z-1)^2}\right\} = \lim_{z \to -1}\frac{z-1-z}{(-1-1)^2} = -\frac{1}{4}$$

20. Utilization factor $= \dfrac{\text{capacity factor}}{\text{Load factor}} = \dfrac{0.750}{0.65} = 0.7692$

$\therefore$ Plant capacity $= \dfrac{\text{Maximum demand}}{\text{utilization factor}} = \dfrac{750}{0.7692} = 975.039\text{ MW} \approx 975\text{MW}$

Reserve capacity $=$ Plant capicity $-$ max.demand $= 975 - 750 = 225$ MW

21. Number of parallel paths = 6

$\Rightarrow$ Number of series devices $= \dfrac{60}{6} = 10$

$\therefore$ series string efficiency $= \dfrac{\text{Final rating}}{\text{Number of devices} \times \text{device rating}}$

$$= \frac{10 \times 10^3}{10 \times 1.2 \times 10^3} = 0.833$$

Parallel string efficiency $= \dfrac{5.5}{6\text{x}1} = 0.9167$

$\therefore$ totalstringefficiency $= 0.833 \times 0.9167 = 0.76385$

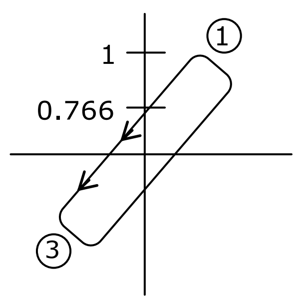
$\therefore$ % efficiency $= 76.4\%$

22. $8V = 1600I_D + V_{DS} + 400I_D,\ \ 8 = 2000I_D + V_{DS};\ \ 2000I_D = 8 - V_{DS}$

$I_D = \dfrac{8}{2000} - \dfrac{V_{DS}}{2000} = \left(\dfrac{-1}{2000}\right)V_{DS} + \left(\dfrac{8}{2000}\right),\ \ \boxed{m = \dfrac{-1}{2000}};\ \ y = I_D;\ x = V_{DS}$

24. $\phi = \sin^{-1}\left[\dfrac{Y_1}{Y_2}\right]$

$$= \sin^{-1}\left(\frac{0.766}{1}\right) = 50^\circ$$



25. $f' = x'y'z' + x'y'z + x'yz' + x'yz + xy'z' + xy'z + xyz$

x	y	Z	f′
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	1	1	1
1	0	0	0
1	1	1	1

$\therefore$ f=xyz'

26. After closing the switch,

$V_+ = Ve^{-t/\tau} = 100e^{-1000t}, V_- = V\ 1 - e^{-t/\tau}\ = 100\ 1 - e^{-100t}$

$V_x = 0 \Rightarrow V_+ = V_-;\ 100e^{-1000t} = 100\ 1 - e^{-100t}\ , 2e^{-1000t} = e^{1000t} = 2,$

$t = \ln\ 2$ msec=0.693msec

27. When V_i=+1V, $\frac{V_o}{V_i} = -2;\ V_o = -2V$, When V_i=-1V, $\frac{V_o}{V_i} = -4;\ V_o = 4V$

28. Characteristic equation of 'A' is $|A - \lambda I| = 0$

$$\Rightarrow \begin{vmatrix} 1-\lambda & 2 \\ -1 & 3-\lambda \end{vmatrix} = 0$$

$$\Rightarrow \lambda^2 - 4\lambda + 5 = 0$$

By Hamliton theorem $\Rightarrow A^2 - 4A + 5I = 0$

$\Rightarrow A^2 = 4A - 5I$ ....(1)

$\Rightarrow A(A^2) = A(4A - 5I)$

$\Rightarrow A^3 = 4A^2 - 5A$ ....(2)

$\Rightarrow A^4 = 4A^3 - 5A^2$ ....(3)

$\Rightarrow A^5 = 4A^4 - 5A^3$ ....(4)

$\Rightarrow A^6 = 4A^5 - 5A^4$ ....(5)

Now $A^6 - 4A^5 + 8A^4 - 12A^3 + 14A^2$

$= 4A^5 - 5A^4 - 4(4A^4 - 5A^3) + 8(4A^3 - 5A^2) - 12(4A^2 - 5A) + 14(14A - 5I)$

$= -4A + 5I$ ($\because$ by applying equations (1), (2), (3), (4) & (5))

29. Full load current $= \dfrac{100(10^3)}{\sqrt{3}\times 440} = 131.2A$

Field loss $= \dfrac{200^2}{150}\,w = 267\,w$

Armature loss $= 3\times\left(\dfrac{131.2}{2}\right)^2\times 0.02$

$= 258\,W$

Total losses $= 1304.87\,W$

Losses $= \left(\dfrac{1}{\eta}-1\right)$output

output $= 100$kw

$1304.87 = \left(\dfrac{1}{\eta}-1\right)100$kw

$\eta = 98.8\%$

or

Output $= 100$kw

Input $= 100 + 1304.87 = 101304.87$

$\therefore \eta = \dfrac{100}{101304.87} = 98.8\%$

30. L-G-fault

$I_{base} = \dfrac{100\,MVA}{11K} = 9.09\,KA$

$I_f = 3I_{R0} = \dfrac{3E_{R1}}{X_{1eq}+X_{2eq}+X_{0eq}}$

$= \dfrac{3\times 1.0}{0.15+0.15+0.05} = \dfrac{3}{0.35} = 8.57\ PU$

I_f in KA $= IPU \times I_{base} = 8.57\times 9.09 = 78\,KA$

31. Given $f_1 = 1MHz$; $c_1 = 420\ PF$

$f_2 = 1.5MHz$; $c_2 = 140\ PF$

$c_d = \dfrac{n^2c_2 - c_1}{1-n^2}$; $n = \dfrac{f_2}{f_1} = \dfrac{1.5}{1} = 1.5$

$\Rightarrow c_d = \dfrac{420\times 2.25(140)}{2.25-1} = 84\ PF$

32.

The turn on loss $= \frac{1}{6} \times v_{dc} \times I_o \times T_{on}$

$\therefore$ Turn on energy loss $= \frac{1}{6} \times v_{dc} \times I_o \times T_{on}$

Turnoff energy loss $= \frac{1}{6} \times v_{dc} \times I_o \times T_{off}$

$\therefore$ Swtching loss $= \frac{1}{6} \times 100 \times 20 \times 0.1 \times 10^{-6} + \frac{1}{6} \times 100 \times 20 \times 0.1 \times 10^{-6} = 66.67 \times 10^{-6}$ J

conduction energy loss $= v_o \times I_o + I_o{}^2 \times R_d \times 0.1 \times 10^{-3}$

$= [1x20 + (20)^2 xR_d]x10^{-4}$

$\therefore$ Avergage power loss $= \frac{\left(66.67 \times 10^{-6} + [20 + 400R_d] \times 10^{-4}\right)}{0.2 \times 10^{-3}} = \frac{\Delta T}{\theta_{JC}}$

$\Rightarrow 66.674 \times 10^{-6} + 20 \times 10^{-4} + 400R_d \times 10^{-4} = 100 \times 0.2 \times 10^{-3} \Rightarrow R_d = 0.448\Omega$

33. Ohmic loss at $\frac{5}{4}^{th}$ loading is 100 W, so ohmic-loss at rated condition (S.C. loss)

$P_{sc} = 100 \times \left(\frac{4}{5}\right)^2 = 64\,W.$

Let maximum efficiency occurs at 'x' th loading.
For maximum efficiency
Variable loss = fixed loss
ohmic loss = core-loss

$\Rightarrow x^2.64 = 50$

$x = 0.88$

so, $\eta_{max} = \frac{20 \times 1 \times 0.88}{20 \times 1 \times 0.88 + 0.05 + 0.064 \times 0.88^2} = 0.994 = 99.4\%$

34. Given $\cos\phi = 0.3 \Rightarrow \phi = 1.266$

$R_p = 2500\,\Omega;\ L = 20\,mH;\ V = 120V;\ I = 10A$

Power consumed by load, $P_T = VI\cos\phi = 120 \times 10 \times 0.3 = 360W$

$\beta = \tan^{-1}\left(\frac{X_L}{R_p}\right) = \tan^{-1}\left(\frac{2\pi fL}{R_p}\right) = \tan^{-1}\left(\frac{2\pi \times 50 \times 20 \times 10^{-3}}{2500}\right) = 0.00251$ rad

Actual wattmeter reading = $= [1 + \tan\phi\ \tan\beta]$ true power

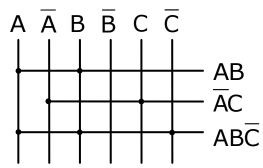
$= [1 + \tan\ 72.54^\circ\ \ \tan\ 0.143^\circ]360 = 362.87\,w$

Power loss, $P_L = \frac{V^2}{R_p} = \frac{120^2}{2500} = 5.76W$

Total wattmeter reading $= 362.84 + 5.76 = 368.63\,W$

$\therefore \%\,\text{Error} = \frac{P_w - P_T}{P_T} \times 100 = \frac{368.63 - 360}{360} \times 100 = 2.397\%$

35.



Clock Cycles

Clock cycle	Q_A	Q_B	Q_C	Q_D
	0	0	0	0
1	1	0	0	0
2	1	1	0	0
3	0	1	1	0
4	0	0	1	1
5	0	0	0	1
6	0	0	0	0

36. (A) Given $P(A)=\frac{20}{100}=\frac{1}{5},\ P(B)=\frac{30}{100}=\frac{3}{10},\ P(C)=\frac{50}{100}=\frac{1}{2}$

Let 'D' denote that the bolt is defective

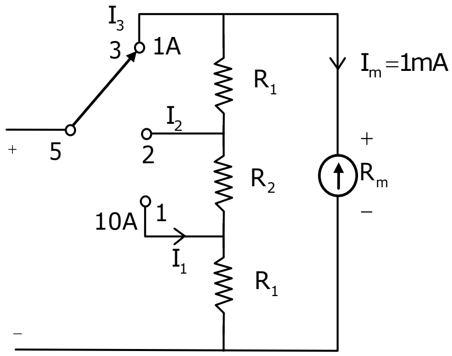
Given $P(D/A)=\frac{6}{100}=\frac{3}{50},\ P(D/B)=\frac{3}{100},\ P(D/C)=\frac{2}{100}=\frac{1}{50}$

$$\therefore \text{By Bayes's theorem } P(C/D)=\frac{P(C)P(D/C)}{P(A)P(D/A)+P(B).P(D/B)+P(C)P(D/C)}$$

$$=\frac{\frac{1}{2}.\frac{1}{50}}{\frac{1}{5}.\frac{3}{50}+\frac{3}{10}.\frac{3}{100}+\frac{1}{2}.\frac{1}{50}}=\frac{10}{31}$$

37. $$A_v=\frac{-h_{fe}R_c}{hie+(1+h_{fe})R_e}=-20$$

38.



In position 1, R_1 is in shunt with $R_2 + R_3 + R_m$

$\therefore I_1R_1 = I_m \; R_2 + R_2 + R_3$

Given $I_1 = 10A$

$I_m = 1mA$

$R_m = 50\Omega$

$\therefore 10R_1 = 1 \times 10^{-3}\left[R_2 + R_3 + 50\right] \Rightarrow R_1 = 10^{-4}\left[R_2 + R_3 + 50\right]$

In position 2, $R_1 + R_2$ is in shunt with $R_3 + R_m$

$I_2 \; R_1 + R_2 = I_m \; R_3 + R_m$

$\uparrow$

$5A \; 5 \; R_1 + R_2 = I_m \; R_3 + R_m$

$5 \; R_1 + R_2 = 1 \times 10^{-3}\left[R_3 + 50\right]$

$\therefore R_1 + R_2 = 1 \times 10^{-3}\left[R_3 + 50\right] \Rightarrow R_1 + R_2 = 2 \times 10^{-4}\left[R_3 + 50\right]$

In position 3, $R_1 + R_2 + R_3$ is in shunt with R_m

$I_3 \; R_1 + R_2 + R_3 = I_mR_m$

$\downarrow$

$1A \; \therefore R_1 + R_2 + R_3 = 1 \times 10^{-3} \times 50 = 0.05$

$R_1 + R_2 + R_3 = 0.05$

$R_1 + R_2 = 2 \times 10^{-4}\left[R_3 + 50\right] \Rightarrow R_3 = 0.0399\,\Omega$

$R_1 + R_2 = 0.01, \quad R_2 = 0.01 - R_1$

$R_1 = 10^{-4} \; R_2 + R_3 + 50$

$R_1 = 10^{-4}\left[0.01 - R_1 + 0.0399 + 50\right]$

$\therefore R_1 = 0.005\,\Omega, \quad R_2 = 0.005\Omega$

39. By Stoke's theorem, we have

$$\int_C \bar{F}.d\bar{r} = \int_S \text{curl } \bar{F}.\bar{N}\, ds$$

$$\text{Finding curl } \bar{F} = \begin{vmatrix} \bar{i} & \bar{j} & \bar{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ yz & xz & xy \end{vmatrix} = 0$$

$$\Rightarrow \int_S \text{curl } \bar{F}.\,\bar{N}\, ds = 0 \Rightarrow \int_C \bar{F}\,.\,d\bar{r} = 0$$

40. Given c = 25nF

When device is off

The voltage across capacitor $C = V_c = -V_s.e^{-1/RC.t} + V_s$

$V_s = 100V \Rightarrow V_c = -100 \times e^{-1/RC.t} + 100$

$\therefore \frac{dV_c}{dt} = \frac{100}{RC}$

Given minimum charging current $10mA = C_J \times \left(\frac{dv_C}{dt}\right)$

$\Rightarrow 10 \times 10^{-3} = \frac{100}{R \times C} \times C_J = \frac{100}{R \times 25 \times 10} \times 20 \times 10^{-12}$

$\therefore R = 8\Omega$

$\therefore$ minimum value of $R = 8\Omega$

41. We have $\frac{dT}{dt} = -K(T - C)$ $T \rightarrow$ temperature at any time 't'

$C \rightarrow$ Room temperature

given $\frac{dT}{dt} = -15$; at $t = 0, T = 190, c = 70$

$\Rightarrow -15 = -k(190 - 70)$

$\Rightarrow \boxed{k = 0.125}$

$\Rightarrow \frac{dT}{dt} = -0.125(T - 70)$; $T(0) = 190 \Rightarrow dT = -0.125(T - 70)dt$

$\Rightarrow \int \frac{1}{T - 70} dT = \int -0.125 dt$

$\Rightarrow \log_e(T - 70) = -0.125t + c$

$\Rightarrow T - 70 = e^{-0.125+c} = e^{-0.125}.e^c$

$= e^{-0.125}.a$ where $a = e^c$

$\Rightarrow T = ae^{(-0.125)t} + 70$

$\Rightarrow T(t) = ae^{(-0.125)t} + 70$

$T(0) = 190$

$\Rightarrow T(0) = ae^0 + 70$

$\Rightarrow \boxed{a = 120}$

$\therefore T(t) = 120\,e^{-0.125t} + 70$ .....(1)

given $T(t) = 143^oF \Rightarrow t = ?$

from (1), $t = 3.98$ min

42. For unit step input, Laplace Transform is $\frac{1}{s}$.

Taking iv option, $L\left[F\ t\right] = -\frac{0.1}{s}\frac{1}{s} = \frac{-0.1}{s^2}$

Taking iii option, $L\left[f\ t\right] = \frac{-5}{-20s + 1}.\frac{1}{s}$, $y = \frac{-5}{-20}\left[\frac{1}{s - \frac{1}{20}}.\frac{1}{s}\right] = 5\ e^{t/20} - 1$

43. $t_c = \frac{CV_s}{I_0} = \frac{2 \times 10^{-6} \times 200}{10} = 40\,\mu s$

44. Internal voltage drop = ZI = $\frac{1200}{200} \times 50 = 300$ V

46. $h[n] = e^{2n}u[n-1]$

For stability

$$\sum_{n=-\alpha}^{\infty} |h\ n| < \infty$$

$$\sum_{n=-\alpha}^{\infty} e^{2n}u[n-1] = \sum_{n=1}^{\infty} e^{2n} = \sum_{n=1}^{\infty} e^{2} \quad 4$$

$\therefore e^2 > 1 \rightarrow$ as $n \rightarrow \infty$, summation tends to ∞ hence $h\ n$ is unstable.

For causal

$h\ n = 0$ For $n < 0$

$$e^{2n}u[n-1] = \begin{cases} e^{2n} & n \geq 1 \\ 0 & n < 1 \end{cases}$$

$\therefore$ Hence it is causal

For Memory system

Any system o/p depends upon present 1/p and past o/p and the past 1/p then that system is

memory system

$\therefore h[3] = e^6 u[2]$

$\therefore$ It is memory system

47. Given $E_o = 5v, E_{dc(max)} = 13.5,\ E_{dc(min)} = 10\,V, I_o = 10A, \Delta I = 500\text{ mA}$

From Equation, $\left(\alpha = \frac{E_o}{E_{dc}}\right) \therefore \frac{T_{oN}}{T} = \frac{E_o}{E_{dc}}$

$\therefore T_{on(max)} = \frac{E_o}{E_{dc_{min}} f} = \frac{5}{10 \times 50 \times 10^3} = 10\,\mu\text{sec}$

$\therefore$ Maximum period of conduction for switch $= 10\ \mu\text{sec}$

48. KCL across Loop 1, $\frac{10\text{-}V_1}{20} = i_1 + \frac{V_1}{20}$

$V_2 - V_1 = 1$ and $V_2 = 10i_1$

$\therefore V_1 = 2v$

49. $\frac{10 - V_{th}}{20} = i_1$

$10i_1 - V_{th} = 1$

$i_1 = \frac{V_{th} + 1}{10}$

$\frac{10 - V_{th}}{20} = \frac{V_{th} + 1}{10}$

$10 - V_{th} = 2V_{th} + 2$

$3V_{th} = 8$

$V_{th} = \frac{8}{3} = 2.666$

50&51. $Z_1 = 200\,\Omega \qquad Z_2 = 500\,\Omega$

$Z_3 = 1000\,\Omega \qquad V_f = 2000\,v$

$i_f + i_r = i_1 + i_2$

$\frac{V_f}{Z_1} - \frac{V_r}{Z_1} = \frac{V_t}{Z_2} + \frac{V_t}{Z_3}$

$V_f - V_r = V_t\left[\frac{1}{Z_2} + \frac{1}{Z_3}\right] Z_1 = V_t\left[\frac{1}{500} + \frac{1}{1000}\right]200$

$= V_t\left[\frac{3}{1000}\right] \times 200 = \left(\frac{3}{5}\right)V_t$

Also $V_f + V_r = Vt \Rightarrow V_f - V_r = \frac{3}{5}V_t$

Add $2V_f = \frac{8}{5}V_t \Rightarrow V_f = \frac{4}{5}V_t$

$2000 = \frac{4}{5}V_t \qquad V_f = 2000V$

$V_t = 2500V$

Reflected voltage $= V_r = V_t - V_f = 2500 - 2000 = 500V$

Current transmitted in the $500\,\Omega$ line, $i_1 = \frac{V_t}{Z_2} = \frac{2500}{500} = 5A$

Current transmitted in the $1000\,\Omega$ line, $i_2 = \frac{V_t}{Z_3} = \frac{2500}{1000} = 2.5A$

Current in cable = $i_1 + 1_2 = 5 + 2.5 = 7.5A$

52. $x_1 = x_2 = 3r_1 = 3r_2$

$$T_e = \left(\frac{3V^2}{C\nu_s}\right)\left[\frac{1}{\left(r_1 + \frac{r_2}{s}\right)^2 + (x_1 + x_2)^2}\right]\left(\frac{r_2}{s}\right)$$

$$425 = \left(\frac{3V^2}{C\nu_s}\right)\frac{1}{\left[\left(H\frac{1}{0.04}\right)^2 + (3+3)\right]r_2}\left[\frac{r_2}{0.04}\right]$$

$$425 = \left(\frac{3v^2}{w_s}\right)\frac{1}{28.48}$$

$$\boxed{\frac{3v^2}{c\nu_s} = 12104}$$

$$\text{Test} = \left(\frac{3v^2}{c\nu_s}\right)\left[\frac{1}{\left[(1+1)^2 + (3+3)^2\right]r_2}\right]\left(\frac{t_2}{1}\right)$$

$$= (12104)\left(\frac{1}{40}\right) = 302.6\text{N} - \text{m}$$

53.

$$\text{SmT} = \frac{r_2}{\sqrt{r_1^2 + (x_1 + x_2)^2}} = \frac{1}{\sqrt{1^2 + (3+3)^2}} = 0.1643$$

$$\text{Tem} = \left(\frac{3v^2}{c_v s}\right)\frac{1}{\left[\left(1 + \frac{1}{0.1643}\right)^3 + (3+3)^2\right]r_2} \times \left(\frac{r_2}{0.1643}\right)$$

$$= (12104)\frac{1}{14.16} = 854.8\text{ Nm}$$

$$\frac{\text{Test}}{\text{Tem}} = \frac{302.6}{854.8} = 0.354$$

54. $x(t) = 4 + 3e^{j2\pi t} + 3e^{-j2\pi t} + 5e^{j6\pi t} + 5e^{-j6\pi t}$

$x(t) = 4 + 6\cos 2\pi t + 10\cos 6\pi t$

$g(t) = 8 + 6\cos 2\pi t$

55. DC value of $y(t)$

$y(t) = H(w)\,\text{DC value of } g(t)$

$H(w) = \dfrac{1}{1 + j2\pi fRc}$

$RC = 1$

$\omega = 0$

$H(0) = 1$

$Y(t)|_{Dc} = 8$

60. $\text{S.I for 1 year} = \text{Rs. }(900 - 800) = \text{Rs.}100$

$\text{S.I for 4 years} = \text{Rs. }(100 \times 4) = \text{Rs.}400$

$\text{Principal} = \text{Rs.}400$

62. Suppose X will cost 40 paisa more than Y after 2 years, then

$(4.20 + 0.40Z) - (6.30 + 0.15Z) = 0.40$

$0.25Z = 0.40 + 2.10 \Rightarrow Z = 10$

$\text{Required year} = 2001 + 10 = 2011$

63. C's 1 day of work $= \dfrac{1}{3} - \left(\dfrac{1}{6} + \dfrac{1}{8}\right) = \dfrac{1}{24}$

A's wages : B's wages : C's wages $= \dfrac{1}{6} : \dfrac{1}{8} : \dfrac{1}{24} = 4:3:1$

C's share for 3 days $3 \times \dfrac{1}{24} \times 3200 = \text{Rs.}400$

64. Let the three integers be $x,\ x+2,\ x+4$

$3x = 2(x+4) + 3 \Rightarrow x = 11$

$\text{Third integer} = 11 + 4 = 15$

65. From the data it is not given that percentage of proteins in skin is 16%
Rather it is given that percentage entire human body is 16%
Therefore, we should not do 16% of 1/10