1. Ans. C.
In degrees of comparison Mr. X is taller than Mr. Y is apt.
Positive degree – tall
Comparative degree – taller
Superlative degree – tallest

2. Ans. B.
Felicitate means honor

3. Ans. C.
'rest is history' is an idiomatic expression which means 'rest is well known

4. Ans. C.
(9 inches) $^{1/2}$ = (0.25 yards) $^{1/2}$
Squaring on both sides
9 inches = 0.25 yards

5. Ans. B.
M efficiency = 2 [efficiency of S, E, and F]
Contribution of M in the project = x days × 6 hrs. ×2
Contribution of E in the project = 2x days × 12 hrs. ×1
Contribution of M: Contribution of E
x × 6 × 2 : 2x × 12 × 1
1 : 2

6. Ans. D.
From Venn diagram
$n(A)$ = no of persons reading books =13 +44 +12 +7 = 76
$n(B)$ = no of persons playing =15 + 44 + 7 +17 = 83
$n(A \cap B)$=51
$n(A \cup B) = n(A)+n(B)-n(A \cap B)$=76+83-51=108

7. Ans. A.
Until the colonial period means pre-colonial origin. Other options can't be inferred.

8. Ans. D.
If reflection is seen as

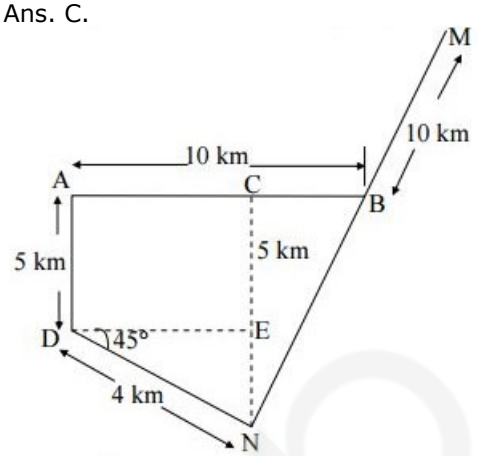
1:30

Actual Will Be

10:30

Thus, present time will be 10: 30 + 2:15 =12:45

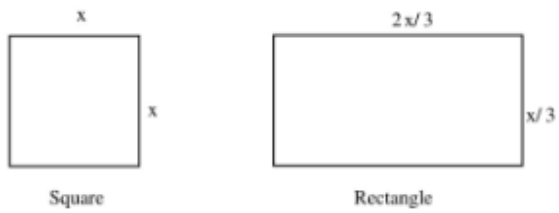
9. Ans. C.



$\cos 45^\circ = \frac{DE}{4}$
$DE = \cos 45^\circ \times 4$
$= 2.828$ km
$\sin 45^\circ = \frac{EN}{4}$
$EN = \sin 45^\circ \times 4 = 2.828$ km

$\sin 45^\circ = \frac{EN}{4}$
$EN = \sin 45^\circ \times 4 = 2.828$ km
$CN = NE + CE = 2.828 + 5$
$= 7.828$ km
$CB = AB - AC = 10 - 2.828$
$= 7.171$ km
$(NB)^2 = (NC)^2 + (BC)^2$
$= (7.828)^2 + (7.171)^2$
$\therefore NB = \sqrt{(7.828)^2 + (7.171)^2} = 10.616$ km
$\therefore NM = NB + BN = 10.616 + 10 = 20.61$ km

10. Ans. B.
Perimeter of rectangle
$= 2\left[\frac{x}{3}+\frac{2x}{3}\right] = 2x$
Perimeter of square = $340 - 2x$
Length of square = $\frac{340 - 2x}{4}$
Total area = $\left(\frac{340 - 2x}{4}\right)^2 + \frac{2}{9}x^2 = f(x)$
$f'(x) = \frac{4}{9}x - \frac{2x-340}{4} = 0$
$\Rightarrow \frac{4}{9}x = \frac{1}{4}(340 - 2x) \Rightarrow x = 90$
Length of square = $\frac{340 - 2x}{4} = 40mm$



11. Ans. B.
One of the Eigen values zero implies determinant of matrix is also zero.
From the matrix A, we can see that for determinant to be zero,
Row 1 and Row 3 can be made same.

$$\Rightarrow \frac{-9 + x}{2} = -4$$

$$\Rightarrow x = 1$$

12. Ans. A.

$$let f(z) = u + iv$$

$$2z^3 + b|z|^3 = u + iv$$

$$\Rightarrow 2(x+iy)^3 + b(x^2+y^2)^{3/2} = u + iv$$

$$\Rightarrow 2(x^3 + 3x^2iy - 3xy^2 - iy^3)$$

$$+b(x^2+y^2)^{3/2} = u + iv$$

$$\Rightarrow u = 2(x^3 - 3xy^2) + b(x^2+y^2)^{3/2}$$

$$v = 6x^2y - 2y^3$$

$$\frac{\partial u}{\partial x} = 6x^2 - 6y^2 - 3bx(x^2+y^2)^{1/2}$$

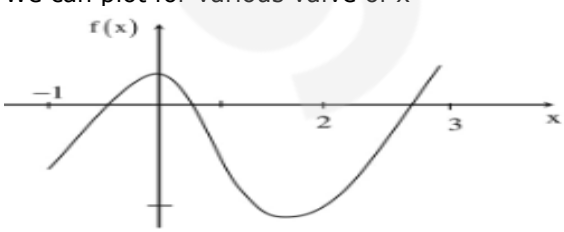
$$\frac{\partial v}{\partial x} = -12xy + 3by(x^2+y^2)^{1/2}$$

$$\frac{\partial u}{\partial x} = 12xy \frac{\partial v}{\partial x} = 6x^2 - 6y^2$$

$$f(z) is analytic \Rightarrow \frac{\partial u}{\partial x} = -\frac{\partial v}{\partial x}$$

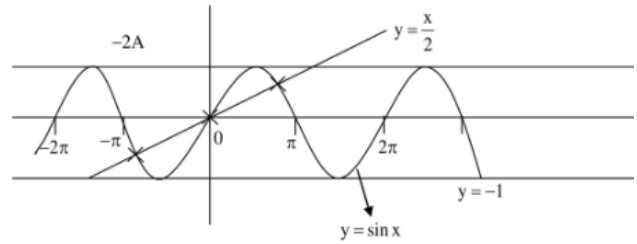
C-R equations hold for only b = 0

13. Ans. B.
We can plot for various valve of x



f(x) increases, decreases and again increases.

14. Ans. C.
let y=sin x, y = x/2 be two curves
The solutions of sin(x) = x/2 are intersected points of two curves y = sin x and y = x/2

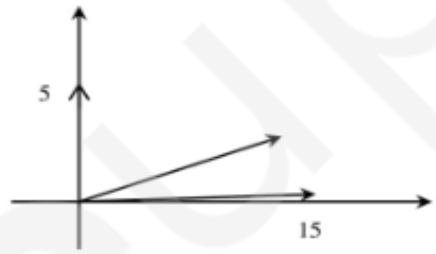


Therefore, three points they are intersecting.

15. Ans. A.

$$15\ cos(\omega t)x + 5\ sin(\omega t)y,$$

The minimum magnitude will be 5
At '5' magnitude angle is 90°.



16. Ans. B.
Under maximum power transfer condition, half of V_{th}, is dropped across R_{th} and remaining $-\frac{V_{th}}{2}$ dropped across load.

$\rightarrow$ So, we can say under MPT $\frac{V_s}{2}$ will appear on the load

so $I_L = \frac{V_s - \frac{V_s}{2}}{R} = \frac{V_s}{2R}$

17. Ans. D.
$\rightarrow$ At t = $\bar{0}$ switch in position 1 and since the capacitor is open circuited

$$V_c(\bar{0}) = \frac{2}{2+3}10 = 4V$$

$\rightarrow$ At t = infinity switch is in position 2 and since capacitor is open circuited

$$Vc(\infty) = (5)2 = 10V$$

$\rightarrow$ Time constant

$$t = R_{th}C = (4+2)0.1 = 0.6\ sec$$

$$\rightarrow \begin{aligned} V_c(t) &= V_c(\infty) + [V_c(0) - V_c(\infty)]e^{-t/\tau} \\ &= 10 + [4-10]e^{-t/0.6} = 10 - 6e^{-t/0.6} \end{aligned}$$

18. Ans. A.
At resonance,

$$\frac{|I_L|}{|I_R|} = \frac{QI_L}{I_m} = Q$$

$$For\ parallel\ circuits\ Q = R\sqrt{\frac{C}{L}} = 10\sqrt{\frac{10\times10^{-6}}{10\times10^{-3}}}$$

$$= 0.316$$

19. Ans. B.

$$Z_{matrix}\begin{bmatrix} Z_a + Z_c & Z_c \\ Z_c & Z_b + Z_c \end{bmatrix}$$

$$Z_b + Z_c = 3 + 2j\omega$$

$$Z_c = j\omega$$

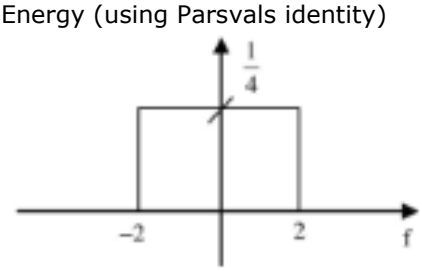
$$\Rightarrow Z_b = 3 + j\omega$$

$$\Rightarrow R_b = 3$$

20. Ans. C.

$$x(t) = \frac{\sin(4\pi t)}{(4\pi + 1)} \overset{F.T}{\leftrightarrow}$$

Energy (using Parsvals identity)



$$\Rightarrow \int_{-2}^{2}\left(\frac{1}{4}\right)^2 df = 0.25$$

21. Ans. D.

Ebers-Moll model of a BJT is valid in active, saturation and cut-off modes.

22. Ans. D.

$$R_{on} = \frac{1}{k_n(V_{GS} - V_t)}$$

$$k_n = \mu_n c_{ox}.\frac{W}{L}$$

$$so, R_{on} = \frac{L}{\mu_n c_{ox}.L[V_{GS} - V_t]}$$

23. Ans. A.

Diode is the OFF state

$$I_2 = \frac{8}{8k} = 0.25mA$$

24. Ans. A.

$$I_1 = I_x e^{\frac{V_{BE}}{V_T}} = Ise25m\ ,$$

$$1m = I_s e^{\frac{0.7}{25nn}}, V_t = 25m$$

$$I_S = 6.914 \times 10^{-16}$$

$$1_2 = I_s e^{\frac{0.7 - I_2R_2}{25mv}}$$

$$\frac{0.7 - I_2R_2}{25mv} = 25.69\ 25m$$

$$I_2R_2 = 0.057$$

$$R_2 = 575.6\Omega$$

25. Ans. A.

The parasitic capacitances are in PF and the coupling and bypass capacitors are in μF. Therefore, for the mid frequency band, parasitic capacitance act like open circuits and coupling and bypass capacitances act like short circuits.

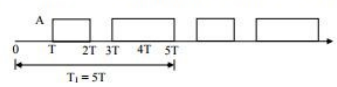
26. Ans. C.

Width of PMOS transistors should be halved. while width of NMOS transistors should not be changed, because NMOS transistors are in parallel. If anyone transistor ON, output goes to LOW.

27. Ans. D.

C/k	Q_1	Q_2	Q_3	Q_4	Q_5	$Y = Q_3 + Q_5$
0	0	1	0	1	0	0
1	0	0	1	0	1	1
2	1	0	0	1	0	0
3	0	1	0	0	1	1
4	1	0	1	0	0	1
5	0	1	0	1	0	0

The waveform at OR gate output, Y is [A = +5V]



Average power

$$P = \frac{V_{Ao}^2}{R} = \frac{1}{R}\left[\lim_{T_1\to\infty}\frac{1}{T_1}\int_0^{T_1} y^2(t)\,dt\right]$$

$$P = \frac{1}{RT_1}\left[\int_T^{2T} A^2dt + \int_{3T}^{5T} A^2dt\right] = \frac{A^2}{RT_1}[(2T - T) + (5T - 3T)] = \frac{A^2.3T}{R(5T)} = \frac{5^2.3}{10\times5} = 1.5\,mw$$

28. Ans. A.

A	B	C_{in}	C_{out}
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

$\Rightarrow I_0(A=0, B=0)=0$

$I_1(A_0=0, B=1)=C_{in}$

$I_2(A_0=1,\ B=0)=C_{in}$

$I_3(A_0=1,\ B=1)=1$

29. Ans. B.

$$G\ (s)=\frac{s-2}{(s+1)(s+3)}=\frac{-3}{2(s+3)}+\frac{5}{2}\frac{1}{s+3}$$

$$\frac{dy(t)}{dx}=g(t)=\frac{-3}{2}e^{-t}+\frac{5}{2}e^{-3t}$$

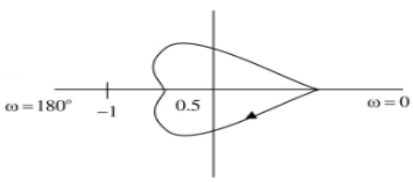
$$\left.\frac{dy(t)}{dx}\right|_{t=0^{-1}}=\frac{5}{2}-\frac{3}{2}=1$$

30. Ans. A.

$$G(j\omega)=\frac{1-j\omega}{4+2j\omega}$$

$$\omega=0, |Gj\omega|=0.25, \angle G(j\omega)=0$$

$$\omega=\phi\infty, |G(j\omega)|=0.5, \angle G(j\omega)=-180^o$$



N= 0

31. Ans. A.
The minimum average code word length is also equal to Entropy of source.

$$H(s)=\frac{1}{2}log_2 2\ +\frac{1}{4}\ log_2 4$$

$$+\frac{1}{8}\ log_2 8\ +\frac{1}{8}\ log_2 8\ =\ 1.75\ bits$$

32. Ans. B.
Data rate = r_b= 64 kbps
M = 4

Minimum bandwidth = $\frac{1}{2T}=16\ KHZ$

$$T=T_b.log_2{}^{M}=\frac{1}{64\times10^3}.\ 2-\frac{1}{32\times10^3}$$

33. Ans. A.
Force due to B on q is

$$F=q(V\times B)=q[V_xV_n](-y)$$

$\Rightarrow$ Helical motion in z-direction.

34. Ans. D.

Option A.: The polarization is linear Option B.: $V_g=\frac{C}{V_P}$

Option C.: $V_p=\frac{\omega}{\beta}$

Option D.: It is not possible to find the intrinsic impedance of the medium. So, it is not possible to find power flux.

35. Ans. B.

$$\theta_i=sin^{-1}\sqrt{n_2^2-n_1^2}=sin^{-1}\sqrt{(1.5)^2-(1.4)^2}$$

$$=\ 32.58$$

36. Ans. A.

$\frac{dy}{dx}=-3y+2,\quad y(0)=1$

If $|1-3h|<1$ then solution of differential equation is stable

$\Rightarrow -1<1<-3h<1$

$\Rightarrow -2<-3h<0$

$\Rightarrow 0<3h<2$

$\Rightarrow 0<h<\frac{2}{3}$

$\therefore$ If $0<h<0.66$ then we get stable

37. Ans. B.
By Green's theorem

$$\oint Mdx+Ndy=\iint_R\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$$

$$\oint\left(xy^2dx+x^2ydy\right)=\iint_R(2xy-2xy)dxdy=0$$

38. Ans. A.

$$P\{x+y\le1\}$$

$$=P\{x\le1-y\}$$

$$=\int_0^1\int_0^{1-x}f_{xy}(x,y)dxdy$$

$$=\int_0^1\left\{\int_0^{1-x}(x,y)dx\right\}dy$$

Solving we get

$$P\{x+y\le1\}=1/3=0.333$$

39. Ans. C.
Solving for determinant
ab = 10
Solving for trace (Sum of diagonal elements)

$a+b=7$

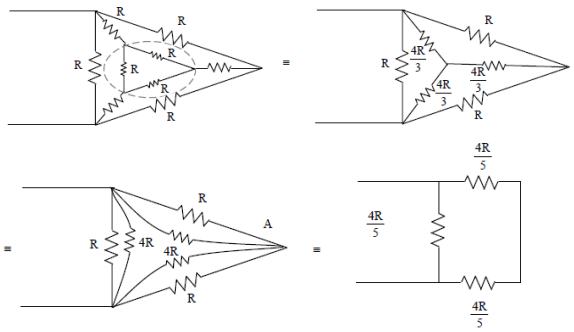
$\Rightarrow a=5,\ b=2$

or

$a=2,\ b=5$

$\Rightarrow |a-b|=3$

40. Ans. D.
Let assume all resistance as R, then by using start-delta transformation



$$\Rightarrow R_{ab}=\frac{4R}{5}\parallel\frac{8R}{5}=\frac{32R^2}{12R}=\frac{8R}{15}\ as R=1\Omega$$

$$R_{ab}=\frac{8}{15}\Omega$$

41. Ans. A.
Let current through
$R_1=I.$

$$\Rightarrow I+0.04V_x=\frac{V_x}{5}$$

$$\Rightarrow I=\frac{V_x}{5}-\frac{V_x}{25}=\frac{4V_x}{25}$$

Applying KVL,

$$60=\frac{4V_x}{25}\times 5+8\times\frac{V_x}{5}$$

$$60=\frac{12V_x}{5}\Rightarrow V_x=25$$

Thus, current through $R_L=\frac{25}{5}=5amps$

42. Ans. A.

Given $H(s)=\frac{2s+6}{s^2+6s+8}$

So,

$z=e^{-sT}s,=6 given f_s=2, J_T=0.5$

$$H(s)=\frac{2s}{(s+4)(s+2)}$$

$$H(s)=\frac{1}{s+2}+\frac{1}{s+4}$$

$$H(z)=\frac{1}{1-e^{-2T_s}z^{-1}}+\frac{1}{1-e^{-4T_s}z^{-1}}$$

$$=\frac{1}{1-e^{-1}z^{-1}}+\frac{1}{1-e^{-2}z^{-1}}$$

$$=\frac{[1-e^{-2}z^{-1}]+1-e^{-1}z^{-1}}{1-z^{-1}[e^{-1}+e^{-2}]+e^{-3}z^{-2}}$$

$$=\frac{2-z^{-1}[e^{-1}+e^{-2}]}{1-z^{-1}[e^{-1}+e^{-2}]+e^{-3}z^{-2}}$$

$$=\frac{2z^2-z(e^{-1}+e^{-2})}{z^2-z[e^{-1}+e^{-2}]+e^{-3}}$$

$So, k=0.0497$

43. Ans. A.
Given, $x[1]=[3,2,3,4]$
We can directly find the DFT of given sequence
$x_1[n]=\{3,0,0,2,0,0,3,0,0,4,0,0\}$
$X_1(k)=[12,2j,0,-2j,12,2j,0,-2j,12,2j,0,-2j]$DFT repeats itself
$X_1(8)=12$
$X_1(11)=-2j$

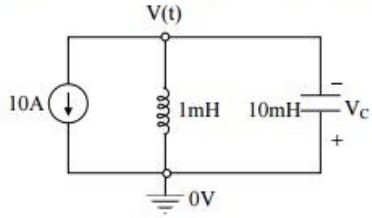
$$\Rightarrow\frac{|X_1(8)|}{|X_1(11)|}=6$$

44. Ans. A.

$i_L(0^-) = \frac{10}{1} = 10A = i_L(0^+)$

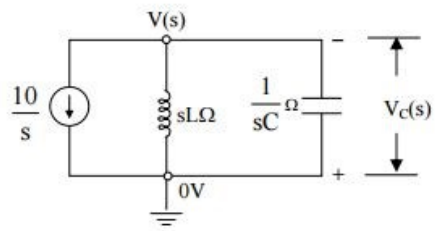
$v_c(0^-) = 0v = v_c(0^+)$

For diode, $R_r = \infty\Omega$ and $R_f = 0\Omega$(given)



For $t \geq 0$

Transform the above network in Laplace domain



$$\text{Nodal} \Rightarrow \frac{10}{5} + \frac{v(s)}{sL} + \frac{v(s)}{\frac{1}{sc}} = 0$$

$$\Rightarrow v(s) = \frac{-10L}{s^2LC+1}$$

$$= v(s) = -10L.\frac{1}{\sqrt{LC}}.\frac{\frac{1}{\sqrt{LC}}}{s^2 + \frac{1}{LC}}$$

$$= -10\sqrt{\frac{L}{C}}.\frac{\omega_n}{s^2+\omega_n^2}\Bigg| \text{where}\,\omega_n^2 = \frac{1}{LC}$$

$$\Rightarrow v(t) = -10\sqrt{\frac{L}{C}}\sin\omega_n t \quad \text{for}\, 0 \leq t \leq \infty$$

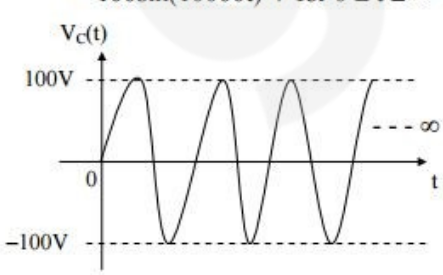
Where $\omega_n = \frac{1}{\sqrt{LC}}$ rad/sec

$$\Rightarrow v(t) = -100\sin 10^4 t \quad \text{for}\, 0 \leq t \leq \infty$$

By KVL $\Rightarrow v(t) + v_c(t) = 0$

$\Rightarrow v_c(t) = -v(t)$

$= 100\sin(10000t)$ V for $0 \leq t \leq \infty$



So, $v_c = 100\angle -90v$

$\Rightarrow |v_c| = 100v$

45. Ans. B.

$Q_{inv} = k(V_{GS} - V_t),\ V_{GS} > V_t$

$|Q_{inv}| = qN_i$

$qN_i = k(V_{GS} - V_t)$

Given

Case (i)

$q(2\times10^{11}cm^{-2}) = k(0.8 - V_t)$

Case (ii)

$q(4\times10^{11}cm^{-2}) = k(1.3 - V_t)$

$2 = \frac{1.3 - V_t}{0.8 - V_t}$

$1.6 - 2V_t = 1.3 - V_t$

$V_t = 0.3$

$So,\ k = \frac{2\times10^{11}}{0.5}\times1.6\times10^{11}$

$So,\ 1.6\times10^{11}\times N_i = 4\times10^{11}\times1.6\times10^{-19}(1.5)$

$N_i = 6\times10^{11}cm^{-2}$

46. Ans. C.

If the depletion region is not making any change it means $N_D \times V_{BR}$ = constant

47. Ans. A.

$$\frac{dE}{dx} = \frac{qN_D}{\varepsilon} \Rightarrow \frac{50\times10^3}{L} = \frac{1.6\times10-19\times10^{17}}{8.854\times10^{-14}\ \times11.7}$$

$$L = \frac{50\times10^3\times8.854\ \times10^{-14}\times11.7}{1.6\ \times10^{-2}}$$

$$= 32.372\times10^{-9}m$$

48. Ans. A.

From given conditions $V_{DS} \leq V_{GS} - V_t$, So transistor is linear

$$I_D = k_n\left[(V_{GS} - V_t)V_{DS} - \frac{V_{DS}^{\ 2}}{2}\right]$$

$$\frac{\partial I_D}{\partial V_{GS}} = k_n.V_{DS}$$

$$k = \frac{0.5\times10^6}{50\times10^{-3}} = \frac{1}{100}\times10^{-3}\times10^{-5}A/v^2$$

$$So,\ \frac{\partial I_D}{\partial V_{GS}} = k_n(V_{GS} - V_t)$$

$$8\times10^{-6} = 10^{-5}[2 - V_t]$$

$$V_t = 2 - 0.8 = 1.2V$$

49. Ans. A.

Peak -to-peak ripple voltage

$$V_{rpp} = \frac{I_L}{f_c} = \frac{I_L T}{C} = \frac{1\times1\times10^{-3}}{475\times10^{-6}} = 2.1 volt$$

50. Ans. A.
For t < 0 switch is closed

$$V_{(-)} = 10V$$

$$V_{(+)} = \frac{1}{1+4}(-5) = -1V$$

For $t \geq 0$ the capacitor charges through $10k\Omega$ the switching will occur. When $V_{(-)} < -1$ volt equivalently, the switching will occur. When V_c becomes slightly more than 11V

$$V_c(t) = 20e^{\frac{-t}{RC}}$$

$$t_1 = 20e^{\frac{-t}{RC}}$$

$$t_1 = RC\ In\left(\frac{20}{9}\right) = (1)\ In\ \left(\frac{20}{9}\right)$$

$$\boxed{t_1 = 0.789\ sec}$$

51. Ans. A.
The gain of the practical op-amp

$$\frac{V_{out}}{V_{in}} = \frac{\left(1+\frac{R_f}{R_1}\right)}{\left[1+\frac{\left(1+\frac{R_f}{R_1}\right)}{A_{02}}\right]}$$

$$\left(1+\frac{R_f}{R_1}\right) = 16, A_{02} = 100$$

$$V_{out} = \left[\frac{1+\frac{R_f}{R_1}}{1+\frac{\left(1+\frac{R_f}{R_1}\right)}{A_{02}}}\right][V_{in} + V_{ios}]$$

$$= \frac{16}{1+\frac{16}{100}}[25+5]$$

$$= 413.79mV$$

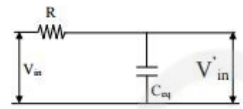
52. Ans. A.
Address varying from 1000 H to 2FFFH
i.e.
0001 0000 0000 0000 H
.
.
.
0010 1111 1111 1111 H

$$\overline{CS} = (\overline{A_{14}}\,\overline{A_{15}}.\overline{A_{13}}A_{12} + \overline{A_{14}}\,\overline{A_{15}}.\overline{A_{12}}A_{13})$$

$$= A_{14} + A_{15} + (A_{13}.A_{12} + \overline{A_{13}}.A_{12})$$

53. Ans. A.

$$V_{in}^1 = \frac{V_{in}}{RC_{eq}}T$$



V_{in}^1 has to settle down within $\frac{1}{2}$ LSB of full scale value.

i.e $\frac{509}{510}V_{in} = \frac{V_{in}.T}{75\times(255\times8\times10^{-12})} \Rightarrow T = (75\times255\times8\times10^{-2})\times\frac{509}{510}$

$T \approx 0.15\ \mu sec$

Thus sample period $T_s \geq T$

$T_s \geq 0.15$ m sec

$f_s, max = \frac{1}{Ts_{,min}} = \frac{1}{0.15\times10^{-6}}$ Hz ≈ 6 Megasamples

54. Ans. C.
From the state diagram we can derive the state table. It is given that the binary inputs are XYZ so if in any transition some value of input is missing, it should be considered as don't care combination.

Present State	X	Y	Z	Next State
A	0	0	0	B
A	1	0	X	C
A	0	X	1	A
A	X	1	X	A
B	X	0	0	A
B	X	1	X	B
B	X	0	1	C
C	X	X	0	C
C	X	1	1	B
C	1	X	1	A

Conclusion
Let us consider the two row of present state A, what it means is

$$\left.\begin{array}{lll} 0 & X & 1 \longrightarrow A \\ 0 & 0 & 1 \longrightarrow A \\ 0 & 1 & 1 \longrightarrow A \\ X & 1 & X \longrightarrow A \\ 0 & 1 & 0 \longrightarrow A \\ 0 & 1 & 1 \longrightarrow A \\ 1 & 1 & 0 \longrightarrow A \\ 1 & 1 & 1 \longrightarrow A \end{array}\right\} \text{So, no ambiguity as each distinct state are differentiable clearly}$$

Similar way if we check all row, let in present state C case

(a) $X \quad X \quad 0 \rightarrow C$

$0 \quad 0 \quad 0 \rightarrow V$

$0 \quad 1 \quad 0 \rightarrow V$

$1 \quad 0 \quad 0 \rightarrow V$

$1 \quad 1 \quad 0 \rightarrow V$

$$\left.\begin{array}{lll} X & 1 & 1 \longrightarrow B \\ 0 & 1 & 1 \longrightarrow B \\ 1 & 1 & 1 \longrightarrow B \end{array}\right\} \text{This shows inconsistency because if input XYZ =111 thennext state could be A or B}$$

b. $1 \quad X \quad 1 \rightarrow A$

c. $1 \quad 0 \quad 1 \rightarrow A$

$1 \quad 1 \quad 1 \rightarrow A$

So, transition from state C is ambiguous

55. Ans. B.
Minimum setting time and no overshoot implies case of critical damping.
At critical damping $\zeta = 1$.

$$H(s) = \frac{k}{(s^2 + 2s + k)}$$

$$\omega_n = \sqrt{k}$$

$$2\zeta\omega_k = 2 \Rightarrow 2.1 \times \sqrt{k} = 2 \Rightarrow k = 1$$

56. Ans. C.
The given condition implied marginal stability. One alternative way without going for gain margin, phase margin concepts is find k value for marginal stability using reflection.

$$C.E: -S^3 + 11s^2 + 6s + 6k = 0$$

$$\begin{array}{c|cc} S^3 & 1 & 6 \\ S^2 & 11 & 6+k \\ S^1 & \dfrac{60-k}{11} & \\ S^0 & 6+k & \end{array}$$

For marginal stability odd order row of S should be zero. i.e.,

$$\frac{60-k}{11} = 0 \Rightarrow k = 60$$

57. Ans. A.
Since it is the phase plot given we can't use the slope concept as these are nonlinear curves. So we can take any phase angle of at a given frequency as reference and can obtain P_1
$\rightarrow$ Phase of transfer function

$$\phi(\omega) = -\tan^{-1}\left(\frac{\omega}{0.1}\right) - \tan^{-1}\left(\frac{\omega}{10}\right) - \tan^{-1}\left(\frac{\omega}{P_1}\right) \rightarrow \text{Form}$$

the plot at $\omega = 0.1, \phi = -45^o$

$$-45^o = -\left[\tan^{-1}\frac{0.1}{0.1} + \tan^{-1}\frac{0.1}{10} + \tan^{-1}\frac{0.1}{P^1}\right]$$

Solving for P, we get $P_1 = 1$.

58. Ans. A.
The Auto correlation function is

$$R_b(\tau) = \left\{\begin{array}{ll} 1+k^2 & \tau = 0 \\ k & \tau = \pm 3 \\ 0 & \text{otherwise} \end{array}\right\}$$

Power spectral density
$S_b(f) = 1 + k^2 + 2k\cos(2\pi f 3T)$

Null will occur at $f = \frac{1}{3T}$

So at $f = \frac{1}{3T} \Rightarrow S_b(f) = 1 + k^2 + 2k\cos 2\pi\left(\frac{1}{3T}\right) \times 3T = 0$

$\Rightarrow 1 + k^2 + 2k = 0$
$\Rightarrow (k+1)^2 = 0$
$\Rightarrow k = -1$

59. Ans. A.
Transmission Bandwidth = 1500 Hz.

$$B_T = R_s(1+\alpha)$$

$$R_s = \frac{4800}{\log_2 M}, M = 16$$

$$\Rightarrow R_s = 1200 \; symbols/sec$$

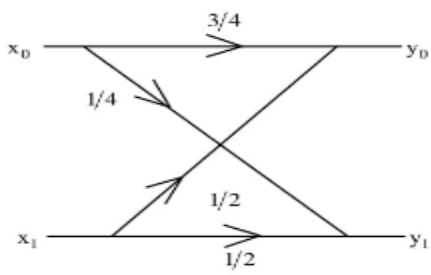
$$1500 = 1200[1+\alpha] \Rightarrow \alpha = 1.25 - 1 = 0.25$$

60. Ans. B.
$x(t) = 3V(t)$ -8,

$$R_x(t) = E\left[x(t)\times(t+\tau)\right]$$
$$= E\left(3v(t)-8\right)\left(3\,v(t+\tau)-8\right)]$$
$$= E\left[(9\,v(t)\;v(t+\tau)-24\,v(t)-24\,v(t+\tau)+64\right]$$
$$= 9\,R_v(\tau)-48\,E[v[t]+\;64$$
$$P_x\;(\tau)_{\tau=0} = Power\ in\ X(t) = 9R_v(0)+64$$
$$= 36+64 = 100w$$

61. Ans. B.
Given Binary communication channel Information content in receiving y it in given that x_o is transmitted is

$$H(y/x_0) = P(y_0/x_0)\log_2\frac{1}{P(y_0/x_0)}$$
$$+P[y_1/x_0]\log_2\frac{1}{P(y_1/x_0)}$$
$$= \frac{3}{4}\log_2\frac{4}{3}+\frac{1}{4}\log_2 4 = 0.811$$

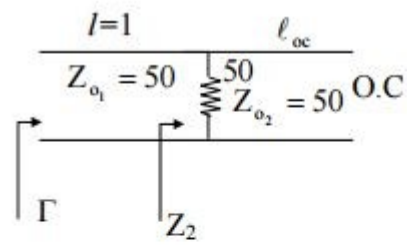


62. Ans. A.
If capacitor is electrically isolated then charge is same
We know $C_1d_1 = C_2d_2$ and $\frac{C_1}{V_2} = \frac{C_2}{V_2}$
If `d' is doubled then C will be C/2 and V will be 2V
Given

$$E = \frac{1}{2}CV_2 \Rightarrow E_{new} = \frac{1}{2}.\frac{C}{2}\times(2V)^2$$
$$= 2\times\frac{1}{2}CV^2 = 2E$$

63. Ans. A.
According to question correct answer would be A

64. Ans. A.



$Z_L = 50\ //\ -j\ 50\cot\beta\,\ell_{o_c}$

$|\Gamma| = \left|\frac{Z_2 - Z_{01}}{Z_2 + Z_0}\right| = 0$ only when $Z_L = Z_{o_1}$

$50\ //\ -j\ 50\cot\beta\, l_{oc} = 50$

This satisfied only when $-j\ 50\cot\beta\, l_{oc} = \infty$

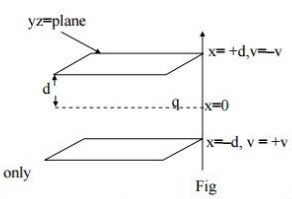
i.e., $\beta\, l_{oc} = m\pi$

$$\frac{2\pi}{\lambda}\ell_{oc} = m\pi$$
$$\ell_{oc} = \frac{m\lambda}{2}$$
$$\ell_{oc} = \frac{mv}{2f}$$
$$= \frac{m\times 2\times 10^8}{2\times f\times 10^9}\quad [\because f \text{ in GHZ, Here } f = 0,1,2,3..\text{ GHZ}]$$
$$\ell_{oc} = \frac{m}{10f}$$

f = 1GHz (Here f= 1 GHz m = 1 for minimum length l_{oc})

$$\ell_{oc} = \frac{m}{10}$$
$$\ell_{oc} = \frac{1}{10}\ [\text{for } m = 1]$$
$$L_{oc} = 0.1$$

65. Ans. C.



When there is no external field,
Change at rest having potential energy only
P.E = qv
By an application of an external field, change carries acquire some kinetic energy, with velocity V.

$qv = ½\,mv^2$

$$V = \sqrt{\frac{2eV}{m}}$$

Time taken to reach x = d plate is known as g tr 'Gap tramit' time

$$t_g = \frac{d}{v} = \frac{d}{\sqrt{\frac{2eV}{m}}}$$
$$\therefore\ t_d \alpha \frac{d}{\sqrt{V}}$$

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