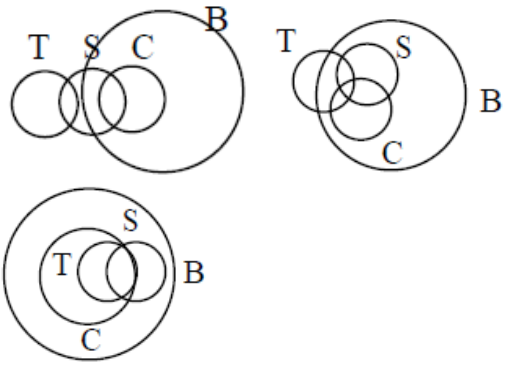
Solutions

General Aptitude

1. Ans. A.
Hurtful would be best option as person is complaining about her.

2. Ans. B.



3. Ans. B.
Given 40% of deaths on city roads are drunken driving

w.k.t in pie chart 100% →360° 1% →$\left(\frac{360}{100}\right)$ 40% → $\left(\frac{360}{100}\right)$ × 40 40% →144°

4. Ans. D.
Let H is house hold consumption and P is the other consumption.
Given
H×0.8+P×1.7 =(H+P)×0.75
Ratio is negative.

5. Ans. A.
Past Tense is used.

6. Ans. D.
Option D is correct according to the passage

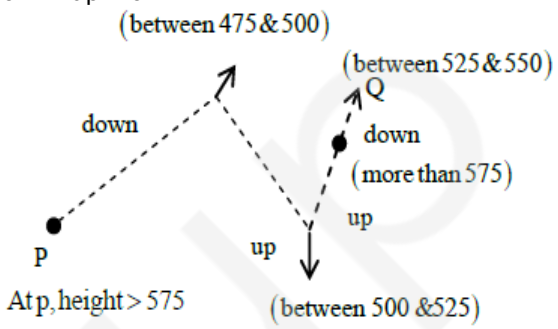
7. Ans. A.
No. of sub groups such that every sub group has at least one Indian

$$= \underbrace{3_{C_1}+3_{C_2}+3_{C_3}}_{Only\ indians} + \underbrace{3_{C_1}\times 3_{C_2}+3_{C_1}+3_{C_1}\times 3_{C_3}}_{One\ indian\ \&\ remaining\ chinese}$$

$$+\underbrace{3_{C_2}\times 3_{C_1}+3_{C_3}\times 3_{C_2}+3_{C_2}\times 3_{C_2}}_{2\ indian\ \&\ remaining\ chinese} + \underbrace{3_{C_3}\times 3_{C_1}+3_{C_3}\times 3_{C_2}+3_{C_3}\times 3_{C_3}}_{3\ indian\ \&\ remaining\ chinese}$$

=7+9+9+3+6+9+9+3+3+3+1=56.
Alternate method
Sub groups containing only Indians
= $3_{C_1}+3_{C_2}+3_{C_3}=3+3+1=7$
Subgroups containing one Indian and rest chinese
= $3_{C_1}\left[3_{C_1}+3_{C_2}+3_{C_3}\right]=3[3+3+1]=21$
Sub groups containing two Indian and remaining Chinese
$3_{C_2}\left[3_{C_1}+3_{C_2}+3_{C_3}\right]=21$
Sub groups containing three Indian and remaining Chinese
$3_{C_3}\left[3_{C_1}+3_{C_2}+3_{C_3}\right]=7$
∴Total no. of sub group = 7 + 21 + 21 + 7 = 56

8. Ans. C.
Down- up-Down



9. Ans. A.
Given speeds both car & Truck = 36 km/hour
They travel in 1 hr = 36 km = 36000 m.

∴ Maximum no. of vehicles than can use the bridge in I hour = $\frac{36000m}{50m}$ =720×2=1440 vehicles
Alternate method
Length of truck + gap required = 10+20 = 30m
Length of car + gap required = 5+15 = 20m
Alternative pairs of Truck and car needs 30+ 20 = 50 m.
Let 'n' be the number of repetition of (Truck + car) in 1 hour (3600 sec).
Given speed 36km /hr 10m /sec

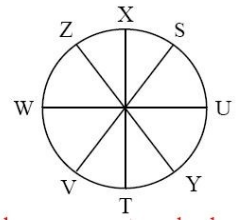
$$\frac{50m\times n}{3600\sec}=36km/hr$$

$$\Rightarrow \frac{50n}{3600}m/\sec=10m/\sec$$

$$\Rightarrow n=\frac{36000}{50}=720(Truck+car)$$

So, 720 Truck car passes 720 2 1440vehicles.

10. Ans. A.
Following circular seating arrangement can be drawn.



Only one such arrangement can be drawn.
The person on third to the left of V is X.

Electronics & Communications

1. Ans. C.

f_{clock} = 5MHz; T_{clock} = 0.2 × 10^{-6} sec

$T_{execution}$ = 1.4μs

No. of T-state required = $\frac{1.4}{0.2}$ = 7

2. Ans. A.

For an input-output relation if the present output depends on present and past input values then the given system is "Causal".

For the given relation,

$$y[n]=\begin{cases} n|x[n]| & \text{for } 0\le n\le 10 \\ x[n]-x[n-1] & \text{otherwise} \end{cases}$$

For n ranging from 0 to 10 present output depends on present input only.

At all other points present output depends on present and past input values.

Thus the system is "Causal".

Stability

If x[n] is bounded for the given finite range of n i.e. 0 < n 10 y[n] is also bounded.

Similarly x[n]–x [n–1] is also bounded at all other values of n

Thus, the system is "stable".

3. Ans. B.

y_1 = 1, y_2 = x, y_3 = x^2

Consider

$$\begin{vmatrix} y_1 & y_2 & y_3 \\ y'_1 & y'_2 & y'_3 \\ y''_1 & y''_2 & y''_3 \end{vmatrix} = \begin{vmatrix} 1 & x & x^2 \\ 0 & 1 & 2x \\ 0 & 0 & 2 \end{vmatrix} = 2\begin{vmatrix} 1 & x \\ 0 & 1 \end{vmatrix} = 2 \neq 0$$

$\Rightarrow$ y_1, y_2, y_3 are linearly independent $\forall$ x

4. Ans. C.

$$A=\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 1 & 2 & 3 & 4 \\ 4 & 5 & 1 & 2 & 3 \\ 3 & 4 & 5 & 1 & 2 \\ 2 & 3 & 4 & 5 & 1 \end{bmatrix}$$

For eigen values (λ), |A- λ I|=0

$$\Rightarrow \begin{bmatrix} 1-\lambda & 2 & 3 & 4 & 5 \\ 5 & 1-\lambda & 2 & 3 & 4 \\ 4 & 5 & 1-\lambda & 2 & 3 \\ 3 & 4 & 5 & 1-\lambda & 2 \\ 2 & 3 & 4 & 5 & 1-\lambda \end{bmatrix} = 0$$

$R_1 \to R_1 + R_2 + R_3 + R_4 + R_5$

$$\Rightarrow \begin{bmatrix} 15-\lambda & 15-\lambda & 15-\lambda & 15-\lambda & 15-\lambda \\ 5 & 1-\lambda & 2 & 3 & 4 \\ 4 & 5 & 1-\lambda & 2 & 3 \\ 3 & 4 & 5 & 1-\lambda & 2 \\ 2 & 3 & 4 & 5 & 1-\lambda \end{bmatrix} = 0$$

$$\Rightarrow (15-\lambda \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 5 & 1-\lambda & 2 & 3 & 4 \\ 4 & 5 & 1-\lambda & 2 & 3 \\ 3 & 4 & 5 & 1-\lambda & 2 \\ 2 & 3 & 4 & 5 & 1-\lambda \end{bmatrix} = 0$$

$\Rightarrow$ $15-\lambda$ =0

$\Rightarrow$ λ =15

5. Ans. A.

Given $\gamma = (0.1 + j40)m^{-1}$

Here $\alpha = 0.1\frac{\omega_P}{m}$

We know that,

$$1\frac{\omega_P}{m} = 8.686\frac{dB}{m} \Rightarrow 0.1\frac{\omega_P}{m} = 0.8686\frac{dB}{m}$$

6. Ans. A.

Silicon atoms act as P- type dopants in Arsenic sites and n- type dopants in Gallium sites.

7. Ans. C.

$$|M| = \begin{bmatrix} 5 & 10 & 10 \\ 1 & 0 & 2 \\ 3 & 6 & 6 \end{bmatrix} = 5(0-12) - 10(6-6) = -60-0+60=0$$

But a 2×2 minor, $\begin{bmatrix} 5 & 10 \\ 1 & 0 \end{bmatrix}$ =0-10=-10≠0

$\Rightarrow$ Rank = 2

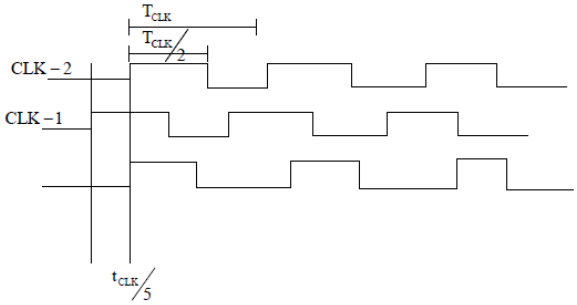
8. Ans. C.

As per the change carrier profile, base – to – emitter junction is reverse bias and base to collector junction is forward bias, so it works in Inverse active.

9. Ans. D.

Miller effect increase input capacitance, so that there will be decrease in gain in the high frequency cutoff frequency.

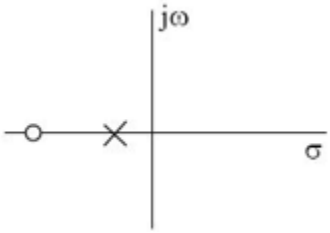
10. Ans. A.



$\Rightarrow$ Dutyde of o/p = $\dfrac{\dfrac{T_{CLK}}{2}-\dfrac{T_{CLK}}{5}}{T_{CLK}}\times 100 = 30\%$

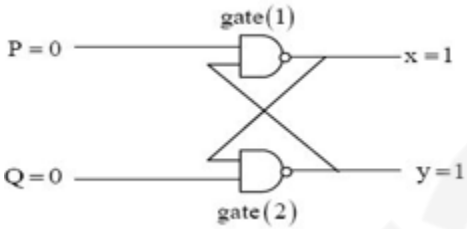
11. Ans. A.

In phase lag compensator pole is near to jω- axis,



12. Ans. B.

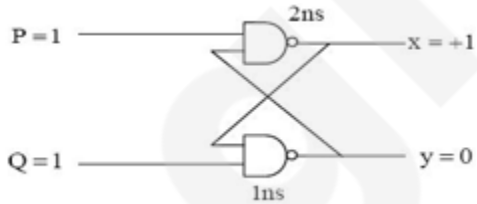
Unequal propagation delay



Case I :

Gate 1 →2ns

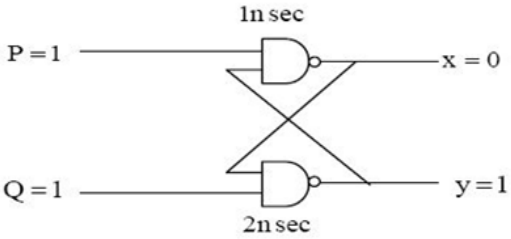
Gate 2 →1ns



Case II :

Gate 1→1nsec

Gate 2 → 2nsec



∴ Either x = 1, y = 0 or x = 0, y =1

13. Ans. A.

Required probability

$= 6\left(\frac{1}{6}\times\frac{1}{6}\times\frac{1}{6}\right) = \frac{1}{36} = 0.028$

14. Ans. A.

If x(t) = -x(-t) the given periodic signal is odd symmetric. For an odd symmetric signal a_n for all n

If $x(t) = -x\left(t-\frac{\pi}{\omega_0}\right)$ $\because$ $\frac{\pi}{\omega_0} = \frac{T_0}{2}$ where T_0 is fundamental period then the given condition satisfies half-wave symmetry.

For half-wave, symmetrical signal all coefficients a_n and b_n are zero for even value of n.

15. Ans. A.

$G(s) = \dfrac{(s+1)}{s^p(s+2)(s+3)}$

If p=1, e_{ss} (for ramp input) = 6

$k_v = \frac{1}{6}$

p=1 , e_{ss} (for ramp input) = 0

$k_p = \infty$, $e_{ss} = \dfrac{1}{1+k_p} = 0$

16. Ans. D.

$V_{bi} = V_T \ln\left(\frac{N_1}{N_2}\right)$

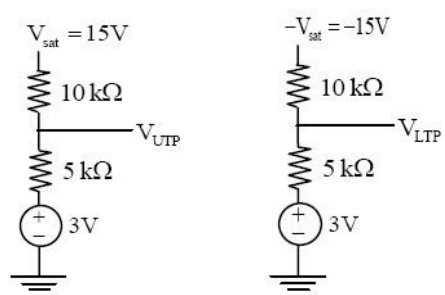
$= 0.25\ln\left(\frac{10^{18}}{10^{15}}\right) = 0.173V.$

17. Ans. B.

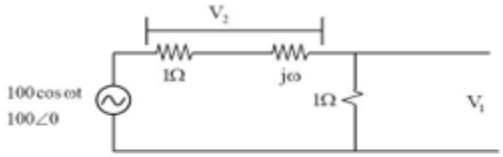
$V_{sat} = 15V$, $-V_{sat} = -15V$

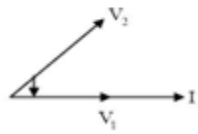
$V_{UTP} = \dfrac{(15-3)\times 5}{15}+3 = \dfrac{12}{3}+3 = 7V$

$V_{LTP} = \dfrac{(-15-3)\times 5}{15}+3 = \dfrac{-18}{3}+3 = -6+3 = -3V$



18. Ans. A.





$$V_1 = \left(\frac{1}{2+j\omega}\right)\times 1\omega\angle 0$$

$$V_1 = \frac{100}{\sqrt{4+\omega^2}}\angle -\tan^{-1}\frac{\omega}{2}$$

$$V_2 = \frac{1+j\omega}{2+j\omega}100\angle 0$$

$$V_2 = \left(\frac{\sqrt{1+\omega^2}}{\sqrt{4+\omega^2}}\right)\times 1\omega\angle -\tan^{-1}\frac{\omega}{2}+\tan^{-1}\omega$$

$$V_2 - V_1 = \frac{\pi}{4}$$

$$-\tan^{-1}\frac{\omega}{2}+\tan^{-1}\omega+\tan^{-1}\frac{\omega}{2}=\frac{\pi}{4}$$

$$\omega = \tan\frac{\pi}{4} = 1 \text{ rad/sec}$$

19. Ans. B.
For ISI free pulse, If P(t) is having spectrum P(f)

Then $\sum_{k=\infty}^{\infty} P(f-kR_S)$ = constant

R_S = 2 KSpa
Thin condition is met by pulse given in option B.

20. Ans. A.

$$G(s) = \frac{1}{S^{q-p}}\left[\frac{1+b_1S^{-1}+---+b_pS^{-p}}{1+q_1S^{-1}+---+a_pS^{-q}}\right]$$

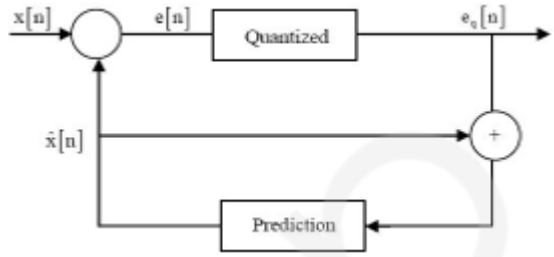
If $S^{q-p} = S^3$, when p=0 and q=3, then
It has -60dB/dec at ω=∞

21. Ans. C.
A good trans conductance amplifier should have high input and output resistance.

22. Ans. A.
For two independent random variable
I (X; Y) H (X) = H (X/Y)
H(X/Y)= H(X) for independent X and Y
$\Rightarrow$ I (X; Y)= 0

23. Ans. D.
If a system is non-causal then a pole on right half of the s-plane can give BIBO stable system. But for a causal system to be BIBO all poles must lie on left half of the complex plane.

24. Ans. D.



DPCM Block diagram
e_q [n] is quantized e[n]
e[n]is difference of message signal sample with its prediction.

25. Ans. C.

$$C = B\log_2\left[1+\frac{S}{N_0B}\right]$$

Where $S = \frac{P_tG_tA_{er}}{4\pi r^2}$

$$= \frac{P_tA_{er}A_et}{\lambda^2(r^2)} = p_t\frac{4A_{er}.A_et}{4.\lambda^2(r^2)}$$

$$= \frac{P_t.A_{er}.A_et}{A^2r^2} = S$$

Channel capacity remain same.

26. Ans. A.
Let f(x) = x^3+x-1 f'(x) = $3x^2+1$
Given X_0 =1
By Newton Raphson method.
1st iteration ,

$$x_1 = x_0 - \frac{f(\mathbf{x_0})}{f'(\mathbf{x_0})} = 1 - \frac{f(1)}{f'(1)} = 1 - \frac{1}{4} = \frac{3}{4} = 0.75$$

2nd iteration. $X_2 = x_1 - \frac{f(\mathbf{x}_1)}{f'(\mathbf{x}_1)} = 0.75 - \frac{f(0.75)}{f'(0.75)} - \frac{0.17}{2.69}$

=0.69

27. Ans. B.
$u_0(t)$ =5cos(2000πt)
F_0=10kHz
$U_1(t)$=5cos(22000πt)
f_1=11kHz
For $u_0(t)$ and $U_1(t)$ to be orthogonal, it is necessary that

$$f_1 - f_0 = \frac{n}{2T}\ ;\ (11-10)\times 10^3 = \frac{1}{2T}$$

$$\Rightarrow T = \frac{1}{2\times 10^3} = 0.5 \text{ m sec}$$

28. Ans. A.

$A_v = \left[\frac{V_0}{V_1}\right] = \frac{R_c}{r_e}$

$r_e = \frac{V_T}{I_E}$

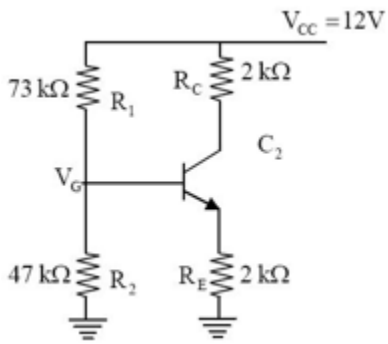
$V_G = \frac{12\times 47}{120}$ = 4.7 V

$V_G = V_{EE} + I_E R_E$

$IE = \frac{4.7-0.7}{2\times 10^3}$ = 2mA

$r_e = \frac{25}{2}$ =12.5Ω

$A_V = \frac{R_c \| R_L}{r_e} = \frac{2\times 10^3 \| 8\times 10^3}{12.5} = 128$



29. Ans. A.

$V_1 = \left(\frac{4+j3}{4+j3+5-12j}\right)\times 100\angle 0 \Rightarrow$

$V_1 = \left(\frac{4+j3}{9+9j}\right)\times 100\angle 0$

$V_2 = \left(\frac{5-12j}{4+j3+5-12j}\right)\times 100\angle 0 \Rightarrow \left(\frac{5-12j}{9+9j}\right)\times 100\angle 0$

$\left[\frac{V_1}{V_2}\right] = \left[\frac{5-12j}{4+j3}\right] = \frac{\sqrt{5^2+12^2}}{\sqrt{4^2+3^2}} = \frac{13}{5} = 2.6$

30. Ans. D.

$\frac{dy}{dx} = (x+y-1)^2$ ------- (1)

Put x+y-1 = t

$\Rightarrow 1+\frac{dy}{dx} = \frac{dt}{dx}$

$\Rightarrow 1+\frac{dy}{dx} = \frac{dt}{dx}$ -1

From (1), $\frac{dt}{dx}$ -1 = t^2

$\Rightarrow \frac{dt}{dx} = 1+t^2$

$\Rightarrow \int \frac{1}{1+t^2}dt = \int dx$

$\Rightarrow \tan^{-1}(t) = x+C$

$\Rightarrow \tan^{-1}(x+y-1) = x+C$

31. Ans. A.

G(s)= $\frac{K(s^2+2s+2)}{(s^2-3s+2)}$

C.E = 1 + G (s) = s^2 - 3s + 2 + ks^2 + 2ks + 2k=0

= s^2 (1 + k) + s (2k – s) + 2k + 2 = 0

If closed loop system to be stable all coefficients to positive k >-1

$k>-1 \cap k>1.5 \cap k>-1$

So, k >1.5

32. Ans. A.

The straight line joining A(0, 2, 1) and B(4, 1, -1) is

$\frac{x-0}{4-0} = \frac{y-2}{1-2} = \frac{z-1}{-1-1}$

$\Rightarrow \frac{x}{4} = \frac{y-2}{-1} = \frac{z-1}{-2} = t$ (say)

$\Rightarrow$ x = 4t, y = 2 - t, z = 1 - 2t

$\Rightarrow$dx = 4dt, dy=-dt, dz=-2dt

$\Rightarrow$For x = 0 $\Rightarrow$ t = 0

$\Rightarrow$For x = 4 $\Rightarrow$ t =1

I= $\int_C (2zdx+2ydy+2xdz)$

$= \int_{t-0}^{1} 2(1-2t)4dt + 2(2-t)(-dt) + 2(4t)(-2dt)$

$= \int_{t-0}^{1} (-30t+4)dt = \frac{-30t^2}{2} + 4t$

33. Ans. A.

C= $\frac{\in A}{W}$

C∝ $\frac{1}{w}$ and W ∝ $\frac{1}{\sqrt{doping}}$

C∝ $\sqrt{doping}$

$\frac{C_2}{C_1} = \sqrt{\frac{(doping)_2}{(doping)_1}} = \sqrt{\frac{10^{16}}{10^{14}}} = \sqrt{100}$ = 10

34. Ans. A.
For circular polarization, the phase difference between E_x & E_y is π/ 2
The phase difference for linear polarization should be π
$\Rightarrow$So the wave must travel a minimum distance such that the extra phase difference of π/ 2 must occur.

$\beta_y l_{min} - \beta_x l_{min} = \frac{\pi}{2}$

$\Rightarrow$ l_{min}

$$\frac{\omega}{c}\left[n_y - n_x\right] = \pi/2 \Rightarrow \frac{2\pi l_{min}}{\lambda_0}\left[n_y - n_x\right] = \pi/2$$

$\Rightarrow$ l_{min} =

$$\frac{\lambda_0}{4\left[n_y - n_x\right]} = \frac{1.5\times10^{-6}}{4[0.0001]} = \frac{1.5}{4}\times10^{-2}$$

$$= 0.375\times10^{-2} m = 0.375 cm$$

35. Ans. A.
Given
x[n]={1,2,1}; h[0]=1
h[n]={1,a,b}

	1	2	1
1	1	2	1
a	a	2a	a
b	b	2b	b

Y[n]={1,2+a,2a+b+1,2b+a,b}
It is given that y[1] =3
∴ 2+a=3 $\Rightarrow$ a=1
Similarly 2a+b+1=4 $\Rightarrow$ b=3-2(1)=1
b=1
∴y[3]=2(1)+1=3
Y[4]=b=1
∴10y[3]+y[4]=30+1=31

36. Ans. C.
F(s) = $s^4 + s^2 + 1 = 0$
Let take s^2 =t
t^2 +t+1=0

t= $\frac{-1\pm i\sqrt{3}}{2}$

Where t= s^2 = $\frac{-1\pm i\sqrt{3}}{2}$

$$s^2 = \frac{-1+i\sqrt{3}}{2} = e^{\frac{j2\pi}{3}} \Rightarrow s^2 = \frac{-1-i\sqrt{3}}{2} = e^{\frac{-j2\pi}{3}}$$

S= $\pm e^{\frac{j2\pi}{6}}$ and s= $\pm e^{\frac{-j2\pi}{6}}$
Hence two roots contain RHS and two roots contain LHS plane.

37. Ans. A.
$v_d = \mu_n \in$

$\mu_n = \frac{v_d}{\varepsilon} = \frac{10^7}{5\times10^7} 20 \frac{cm^2}{V-\sec}$

E=
$\frac{V}{d} = \frac{5}{1\times10^{-4}} v/cm$

$J_{drift} = nqv_d = nq\mu_n \in$

J_{drift} = nqv_a= $nq\mu_n\varepsilon$ = 10^{16} $\times1.6\times10^{-19}\times20\times10^4$ =1.6 KA/c m^2

38. Ans. A.
$V_G = \frac{8\times5}{5}$ =5V

V_{GS} = V_G- $I_D R_s$=5-10^3 I_D

$I_D = \frac{1}{2}\ \mu_n C_{ox}\left(\frac{W}{L}\right)\ (V_{GS-}V_T)^2$

$I_D = \frac{1}{2}\times1\times10^{-3}\ (V_{GS-}V_T)^2$

$I_D = \frac{1}{2}\times10^{-3}\left[5-10^3 I_D - 1\right]^2 = \frac{10^{-3}}{2}\ \left[4-10^{-3} I_D\right]^2$

$I_D = \frac{10^{-3}}{2}\left[16+10^6 I_D^2 - 8\times10^3\right]$

$0.5\times10^{-3}\ I_D^2$-5I_D-8×10^{-3} =0
I_D=8mA,2mA
I_D must be least value
So I_D =2mA

39. Ans. A.
Since DC components in same in S_x (f) and S_y(f)
$\Rightarrow E[x(t)] = E[y(t)]$

$E\left(x^2(t)\right)$ = Area under

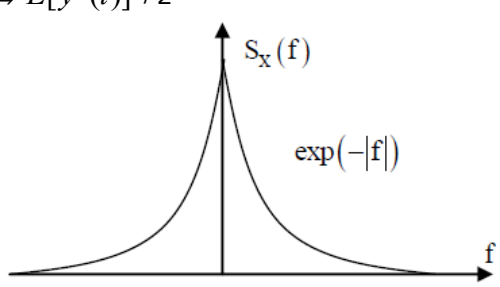
$S_x(f)$ = $\int_{-\infty}^{\infty} e^{-|f|}df = 2\int_{-\infty}^{\infty} e^{-f|}df = 2$

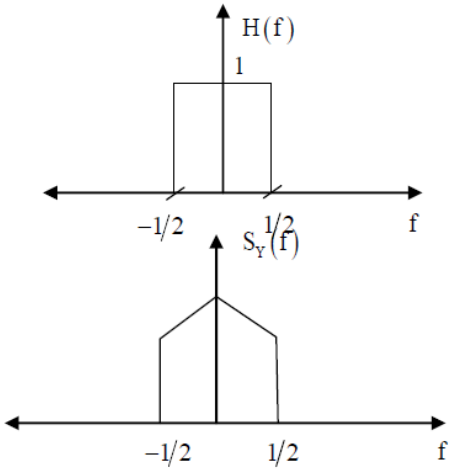
$E\left(y^2(t)\right)$ = Area under

$S_y(f) = \int_{-0}^{\frac{1}{2}} e^{-f}df = 2\int_{-\infty}^{\infty} e^{-f}df = 2\frac{e^{-f}}{-1}|= 2[1-e^{-\frac{1}{2}}]$

$\Rightarrow E[x^2(t)] \neq E[y^2(t)]$

$\Rightarrow E[y^2(t)] \neq 2$





40. Ans. A.

$\Delta P=\Delta n=$ $G_{Lo}\left(1-\frac{\frac{L}{2}}{L}\right)$ $\tau_p=G_{Lo}\times$ $\tau_p=10^{17}\times\frac{1}{2}$ $\times10^{-4}=\frac{1}{2}\times$ $10^{13}/cm^3$

$|J_{p1}$ diff$|$ $=qD_p$

$$\frac{dp}{dx}=1.6\times10^{-19}\times100\times\frac{\frac{1}{2}\times10^{13}}{\frac{0.1\times10^{-4}}{2}}=16A/cm^2$$

41. Ans. B.

$$G(s)=\frac{K}{(s^2+2s+2)(s+2)}$$

C.E $=s^3+s^2+76s+4+k=0$

If system to stable

24>k+4∩K+4>0

k>-4∩k<20

(i) Stable condition -4<k+20

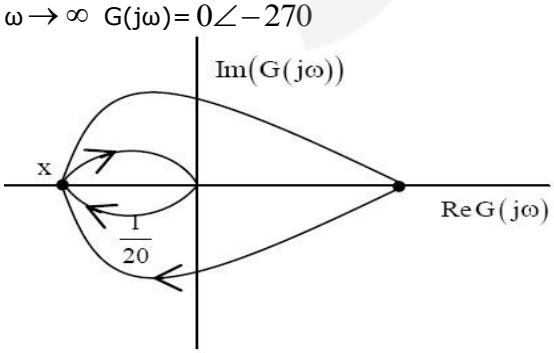
Means If k =10 system stable

k =100 system unstable

Or G(jω)= $\angle\tan^{-1}\left(\frac{\omega}{2}\right)-\tan^{-1}\left(\frac{2\omega}{2-\omega^2}\right)$

If $\omega\to0$ G(jω)= $\frac{k}{4}<0$

$\omega\to\infty$ G(jω)= $0\angle-270$



So If k =10 touching point= 0.5

If k =100 touching point =5

N= P-Z, Here P=0

N=-Z

If closed loop system to be stable, then $\Rightarrow$ z=0,N=0,

So, k=0 is stable system

42. Ans. A.

$I_B=\frac{(2-0.7)}{12\times10^3}=0.108mA$

$I_C=\frac{(5-0.2)}{4.8\times10^3}=1mA$

$\beta=\frac{I_c}{I_B}=\frac{1}{0.108}=9.259$

$\alpha=\frac{\beta}{1+\beta}=\frac{9.259}{1+9.259}=0.903$

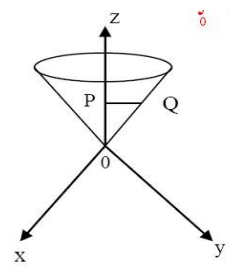
43. Ans. A.

PQ = $\sqrt{x^2+y^2}$ is the radius of variable circle at some Z.

$\Rightarrow pQ^2=x^2+y^2=z^3$ (Given)

∴ Volume of region revolved around z-axis =

$$\int_0^1\pi(PQ)^2dz=\int_0^1\pi z^3dz=\pi\frac{z^4}{4}\Big|_0^1=\frac{\pi}{4}=0.79$$



44. Ans. C.

Given the direction of propagation is

$\hat{a}_x-\hat{a}_y$

The orientation of $\bar{E}$ field is $\hat{a}_x+\hat{a}_y+j2\hat{a}_z$

The dot product between above two is =1-1+0=0

$\Rightarrow$ It is a plane wave

We observed that

$\bar{P}=\hat{a}_x-\hat{a}_y,\hat{a}_x+\hat{a}_y and j2\hat{a}_z$ are normal to each other. So electric field can be resolved into two normal component along $\hat{a}_x+\hat{a}_y$ and j2 $\hat{a}_x$

The magnitude are $\sqrt{2}$ and 2 and θ = $\frac{\pi}{2}$

So elliptical polarization.

45. Ans. D.
In given diagram

Prsent State	D_A	D_B	X_{in}	X_{in}	X_{in}=0 Next State		X_{in}=1 Next State	
					θ_A^+	θ_B^+	θ_A^+	θ_B^+
00	0	1	0	1	0	1	0	1
01	1	1	0	1	1	1	1	1
11	0	1	0	1	0	1	0	0
01	1	1	0	1	1	1	0	1

When X_{in}=0 2 State
When X_{in}= 1 3 State

46. Ans. B.
Fourier series coefficient a_k is unaffected by scaling operating. Thus (I) is true and (II) is false. T= 1sec for x(t) and if it compressed by '3' then the resultant period T= $\frac{1}{3}$

∴ Fundamental frequency = $\frac{2\pi}{T_1}$ =6π rad/sec.

Thus (III) is correct.

47. Ans. A.

CLK	A $D_{in}=A\oplus B$	B $A\to B$	C $B\to C$	D $C\to D$	
0	1	1	0	1	→ initial state
1	0	1	1	0	
2	0	0	1	1	
3	1	0	0	1	
4	0	1	0	0	
5	0	0	1	0	
6	0	0	0	1	
7	1	0	0	0	
8	1	1	0	0	
9	1	1	1	0	
10	1	1	1	1	→ Final state

10 clock pulse required.

48. Ans. C.
We have series of f(x) around x=0 is f(x)=

$$f(0)+xf'(0)+\frac{x^2}{2!}f''(0)+\frac{x^3}{3!}f''''(0)$$

(upto powers of „x" less than or equal to „3")
Given

f(x) = $e^{x+x^2} \Rightarrow f(0)=1$

$$f'(x)=e^{x+x^2}(1+2x)\Rightarrow f'(0)=1$$

$$f''(x)=e^{x+x^2}(1+2x)+2e^{x+x^2} \Rightarrow f''(0)=3$$

$$f'''(x)=e^{x+x^2}(1+2x)^3+e^{x+x^2}4(1+2x)+2(1+2x)e^{x+x^2}$$

$$\Rightarrow f'''(0)=7$$

∴ f(x)= e^{x+x^2}

= 1+x.1+$\frac{x^2}{2!}(3)+\frac{x^3}{3!}(7)=1+x+\frac{3}{2}x^2+\frac{7}{6}x^3$

49. Ans. B.
MVI A, 33H A ← 33H
MVI B, 78H B ← 78H
ADD B B ← ABH
CMA A ← 54H
ANI 32H A ← 10H
A → 0011 0011 A → 1010 1011
B → 0111 1000 B → 0101 0100

1010 1011

0101 0100
0011 0010

0001 0000

50. Ans. A.
Under dc condition inductor acts as short all

∴ $I_{total}=\frac{15}{1}=15A$

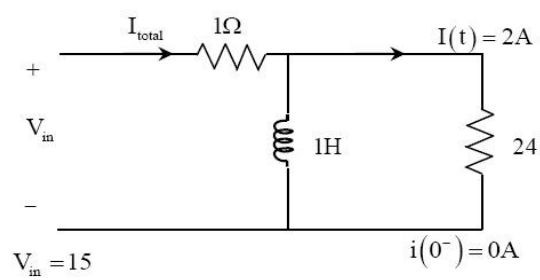
$$i(t)=(i(0^{-1})-i(\infty)e^{-\frac{t}{2}}+i(\infty)\ i(0^-)=i(0^+)=0A$$

$$i(t)=(0-15)e^{-\frac{3}{2}t}+15$$

I_{total}=

$$\frac{I_{total}}{3}=\frac{15}{3}(1-e^{-\frac{3}{2}t})$$

2=5$\left(1-e^{-\frac{3}{2}t}\right)$ ⇒ t=0.34sec



51. Ans. A.
The null occurs along axis of the antenna which is θ=90°, ∅=45°

52. Ans. A.
Given Amplifier is using –ve feed back

$$A_f=\frac{A_0}{1+A_0\beta}$$

$$\beta=\frac{1}{80};A_0=10^5$$

$$A_f = \frac{10^5}{1+10^5/8} = 79.93$$

$$f_{cut} = 8Hz \times (1 + A_0\beta) = 10008Hz$$

$$A_f(\omega) = \frac{A_f}{\sqrt{1+(f/f_{cut})^2}}$$

$$= \frac{79.93}{\sqrt{1+\left(\frac{15\times10^3}{10008}\right)^2}}$$

=44.3

53. Ans. A.

It is given that,

H[0]= $\frac{1}{3}; h[1] = \frac{1}{3}; h[2] = \frac{1}{3}$ &

H[n]=0 for n<0 and n>2.

∴ h[n]=h[0]δ[n]+h[1]δ[n-1]+h[2]δ[n-2]

$$= \frac{1}{3}[\delta[n] + \delta[n-1] + \delta[n-2]]$$

Apply DTFT on both sides,

∴ H(ω) = $\frac{1}{3}[1 + e^{-j\omega} + e^{-2j\omega}]$

Given that H(ω_0) =0 & 0< ω_0.<π

$$\Rightarrow H(\omega_0) = 0 \,\&\, 0 < \omega_0 < \pi$$

$$\Rightarrow H(\omega_0) = \frac{1}{3}\left[1 + e^{\frac{-3j\omega_0}{2}}\left(e^{\frac{-j\omega_0}{2}} + e^{\frac{j\omega_0}{2}}\right)\right] = 0$$

∴1+2 $e^{-3j\omega_0}$ cos $\frac{\omega_0}{2} = 0$

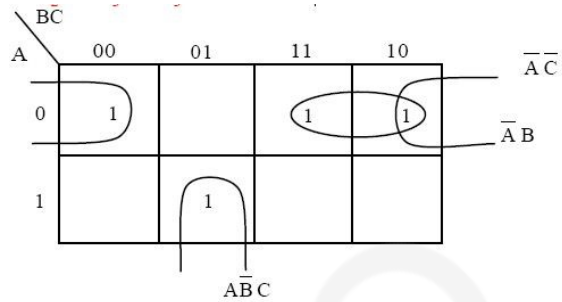
Consider |H ω_0 | $\Rightarrow$ cos $\frac{\omega_0}{2} = \frac{1}{2}$

$$\therefore \omega_0 = \frac{2\pi}{3}$$

ω_0 =2.094

54. Ans. B.

$$F = M_0 + M_1 + M_2 + M_3 + M_5 \rightarrow \min term$$



55. Ans. A.

Given: (t)= $\begin{cases} \frac{2\sin(300\pi t)}{\pi t} & t \neq 0 \\ 600 & t = 0 \end{cases}$

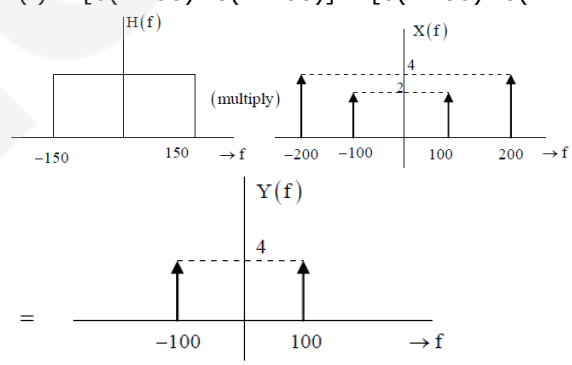
Thus h(t) =600sin c(300t)

∴H(f) = 2rect$\left(\frac{f}{300}\right)$

Given x(t) =4cos200πt+800cos400πt

In f-domain

X(f)=2[δ(f-100)+δ(f+100)]+4[δ(f-200)+δ(f+200)]



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