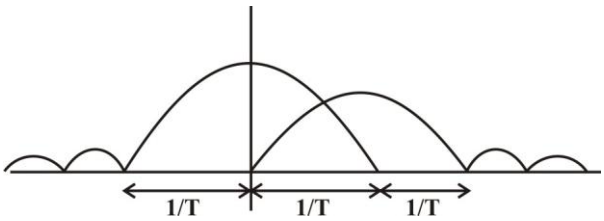
Communication Objective Solution

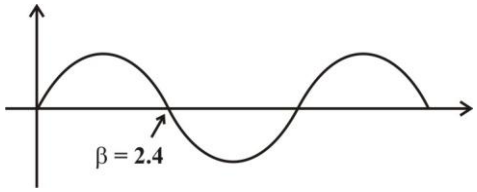
1. (C)



$$B/W = \frac{3}{T} = 3KHz$$

2. (A) $P_e = \frac{1}{4} \times 10^{-5} = 2.5 \times 10^{-6}$

3. (D) $P_c = \frac{A_c^{\,2}}{2} J_0^{\,2}(\beta)$



4. (C)

5. (D) $s(t) = \sqrt{\frac{2E_b}{T_b}} \left[\cos\left(2\pi f_c t + \frac{m\pi t}{T_b} \right) \right]$

6. (D) $\theta_i = 2\pi f_c t + k \int_{-\infty}^{t} m(t)\,dt$

$$\omega_i = \omega_c + km(t)$$

$$\Delta\omega = km(t)$$

$$\Delta f = \frac{k}{2\pi} m(t) \qquad \{\text{RMS value of Gaussian} = \sigma_x\}$$

$$(\Delta f)_{rms} = \frac{k}{2\pi} \times 2 = \frac{k}{\pi}$$

7. (B)

8. (D)

9. (A) $y_1(t) = m(t)\cos(2\pi f_c t)\cos(2\pi f_c t + \theta)$

$$= \frac{m(t)}{2}\left[\cos(4\pi f_c t + \theta) + \cos\theta\right]$$

$$0.9\frac{m(t)}{2} = \frac{m(t)}{2}\cos\theta$$

$$\theta = \cos^{-1}(0.9)$$

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10. (C) $y_1(t) = (A + m(t))^2 \cos^2 \omega_c t = \frac{(A^2 + m^2(t) + 2A\,m(t))}{2}(1 + \cos 2\omega_c t)$

$$= \frac{A^2}{2} + \frac{m^2(t)}{2} + A\,m(t) = A\,m(t) + \frac{m^2(t)}{2}$$

11. (A)

12. (B) $0.1 = \frac{\Delta}{20} \Rightarrow \Delta = 0.005V$

13. (A) Let $n(t) = n_I \cos \omega_c t - n_Q \sin \omega_c t$

Input of BPF is:

$$y_1(t) = CA_c \cos 2\pi f_c t\, m(t) + n_I \cos 2\pi f_c t - n_Q \sin 2\pi f_c t$$

$$= (CA_c m(t) + n_I)\cos 2\pi f_c t - n_Q \sin \omega_c t$$

$$ED :\rightarrow \sqrt{(CA_c m(t) + n_I)^2 + n_Q{}^2} = |CA_c m(t) + n_I|$$

14. (A) $\frac{(2+4+10)\times 2}{2} = 16\,KHz$

15. (D) $s(t) = 10\cos(\omega_c t + 5\sin 3000t + 10\sin 2000\pi t)$

$\omega_c = 2\pi \times 10^5\,Rad/sec$

$\omega_i = \omega_c + 5 \times 3000 \cos 3000t + 2 \times 10^4 \pi \cos 2000\pi t$

$|\Delta\omega|_{max} = 15000 + 2 \times 10^4 \pi \qquad \beta = \frac{15000 + 2 \times 10^4 \pi}{2\pi \times 1000} = 12.38$

16. (B) M-any FSK $\quad P = \frac{N}{2^{N+1}}$

M-any PSK $\quad P = \frac{\log_2 N}{2}$

for BFSK; $\quad P = \frac{2}{8} = 0.25$

for BPSK; $\quad P = \frac{1}{2} = 0.5$

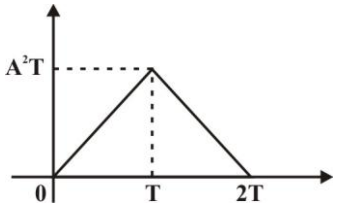
17. (C) For uniform quantization;

SNR for PCM $= L^2 = (256)^2$

$SNR = 10\log_{10}(256)^2 = 48$ dB.

18. (D)

19. (C)



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$A^2T = 3\times3\times2 = 18$ T = 2

20. (D) $\theta(t) = \omega_c t + K_p m(t) = \omega_c t + \frac{\pi}{2}$

21. (C)

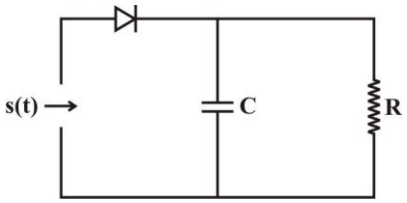
22. (A) $f_i(t) = f_c + K_f m(t) = 10^6 + 4000\times5 = 1002$

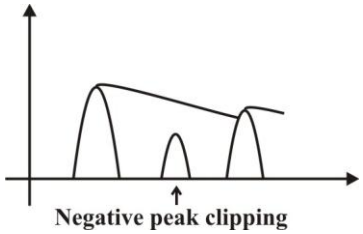
23. (B) $MUR = \frac{C}{2PRF}$

24. (D) By seeing equation of angle modulated one can't decide whether it is PM or FM

25. (C)

26. (B) Due to high value of time constant small peaks are missed out.





27. (C)

28. (B) Frames per sec = 8000

Frames per bit = $30 \times 8 = 240$ bits/frame

$(240+n)8000 = 2.048\times10^6$ n = 16

29. (D) (frequency detectors: differentiates the phase)

Total signal $= \left(\cos(2\pi\times10t) + \cos(2\pi\times10.1t)\right)$

$= \cos(2\pi\times10t) + \cos(2\pi\times10t)\cos(0.1t) - \sin(2\pi\times10t)\sin(0.1t)$

$= \cos(2\pi\times10t)[1+\cos0.1t] - \sin(2\pi\times10t)\sin(0.1t)$

$\phi = \tan^{-1}\tan kt$

$\phi = kt$

$y(t) = \frac{d\phi}{dt} = k = \text{constant}$

30. (A) $8(7\times20+1) = 8(141) = 1128$ kbps

31. (C) Foster seeley > ratio detector > balanced > simple $\rightarrow$ linearity order

32. (A) In simple slope, one tuned circuit Rest has 2.

33. (A) Bit Rate = Rand Rate × No. of bits

$8000 = 1000\times n$

n = 8

$L = 2^8 = 256$

34. (A) If Local oscillator is used then it should have frequency of 400 KHz

35. (B) $P_e = \frac{1}{2}\text{erf}_c\sqrt{\frac{E_b}{N_0}\cos^2\phi}$

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$$= Q\sqrt{\frac{2E_b}{N_0}\cos^2\phi} \qquad \cos\phi = \frac{1}{\sqrt{2}} \qquad \cos\phi = 45^o$$

$$= Q\sqrt{\frac{2E_b}{2N_0}} = Q\sqrt{\frac{E_b}{N_0}}$$

36. (C)

	μ law	A law
I level	24	30
II level	96	120
III level	672	480

37. (B) M.I of FM may be less than 1

38. (C)

39. (B) No. of bits = 3 $\qquad$ Bits $= 12\times512\times3 = 18432$

40. (C) $\left(f_2 - f_1\right) = \dfrac{h}{T_b}$

For orthogonal FSK;

$$10\,\text{KHz} = \frac{1}{2T_b} \qquad T_b = 50\mu\,\text{sec}$$

41. (D) $f_m = 3.2\text{KHz} \qquad f_s > 6.4\,\text{KHz}$

Bits = 6 $\qquad$ Bit rate = $6\times6.4 = 38.4 > 36\,\text{kbps}.$

$\therefore$ $\qquad$ Not correct.

42. (C) Frame alignment word = 8 bits

Bits per frame $= 24\times8+8 = 200$

$$\text{bps} = 200\times8\times10^3 = 1.6\ \text{Mbps}.$$

43. (C) $\text{B/W} = 2\max\left(1,\ 2\right) = 4\ \text{KHz}$

44. (C) when ever modulating signal crosses zero.

45. (C) Q noise is not linked with channel noise.

46. (A) $10^{-3} = \dfrac{1}{2}\text{erfc}\sqrt{\dfrac{0.5E_b}{N_0}}$ —BFSK

$$10^{-3} = \frac{1}{2}\text{erfc}\sqrt{\frac{E_b}{N_0}} \quad \text{—BPSK}$$

$$10^{-3} = \frac{1}{2}\text{erfc}\sqrt{\frac{0.25E_b}{N_0}} \quad \text{—ASK}$$

Non coherent ASK: $P_e = \dfrac{1}{2}\exp\left(-\dfrac{E_b}{2N_0}\right)$

16-ary PSK: $P_e = 2\text{erfc}\sqrt{\dfrac{E_b}{N_0}}$

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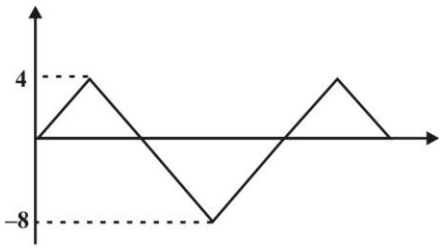
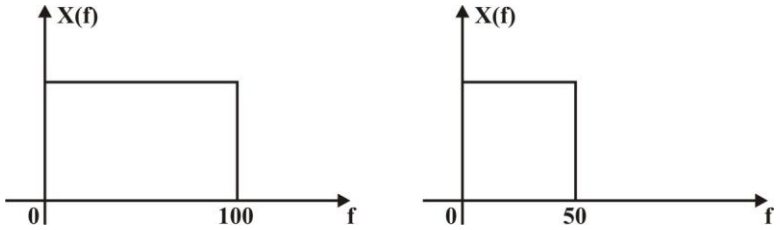
47. (B)



Slope = 12

48. (B)



Multiplication in frequency domain.

$\therefore \quad z(t) \rightarrow f = 50\,KHz$

49. (D) Clark's orbit $\rightarrow$ Geostationary.

50. (B) $\text{Energy} = \frac{5^2}{2} \times 10^{-4} = 1.25$

Peak to peak = 2.5 mV.

51. (D) LEO satellite doesn't provide 24 hours time period.

52. (C) It does not remain stationary but comes on same point within 24 hours.

53. (A) It occurs only in single mode fiber.

54. (B) $NA \times BW = Const$

55. (B) They are used for long distance with less loss.

56. (C) The point on the earth below satellite is known as Sub satellite point.

57. (A) $\frac{\Delta t}{z} = \frac{n_1}{c}\left(\frac{\Delta}{1-\Delta}\right) = \frac{1.5}{3\times10^8}\left(\frac{1/3}{2/3}\right) = 2.5\,ns/m.$

58. (B) $s(t) = A_c\left(1 + k_a m(t)\right)\cos\omega_c t$

$$y_1(t) = A_c^{\,2}\left(1 + k_a m(t)\right)^2 \cos^2\omega_c t$$

$$= A_c^{\,2}\left(1 + k_a^{\,2} m^2(t) + 2k_a m(t)\right)(1)$$

$$= A_c^{\,2} + \frac{A_c^{\,2} k_a^{\,2}}{2}\left(1 + \cos 2\omega_m t\right) + 2k_a \cos\omega_m t$$

$$y_1(t) = \frac{A_c^{\,2}}{2} + \frac{A_c^{\,2} k_a^{\,2}}{2} + 2A_c^{\,2} k_a \cos\omega_m t + \frac{A_c^{\,2} k_a^{\,2}}{2}\cos 2\omega_m t$$

$$H.D. = \frac{A_c^{\,2} k_a^{\,2}}{2 \times A_c^{\,2} k_a \times 2} = \frac{k_a}{4}$$

$k_a = 1$ (For maximum value)

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Maximum H.D. = 25%

59. (B) Image Channel selectivity of SHR is determined by Pre selector and RF amplifier.

60. (D) if probability is same then entropy will be maximum and when one of the probability is Decreased then Entropy will be decreased.

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