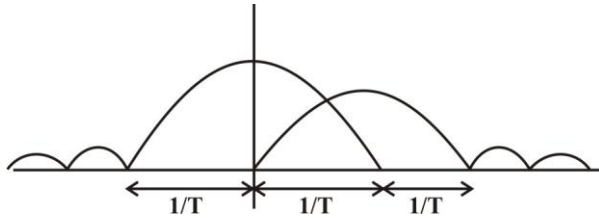


Communication Objective Solution

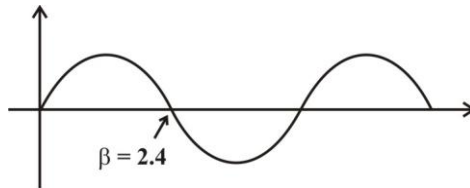
1. (C)



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

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

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

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

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

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

7. (B)

8. (D)

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

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

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

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

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

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

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) $\frac{(2+4+10) \times 2}{2} = 16 \text{ KHz}$

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

$$\omega_c = 2\pi \times 10^5 \text{ Rad/sec}$$

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

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

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

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

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

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

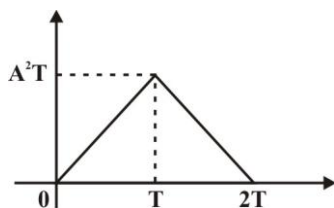
17. (C) For uniform quantization;

$$\text{SNR for PCM} = L^2 = (256)^2$$

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

18. (D)

19. (C)



$$A^2T = 3 \times 3 \times 2 = 18$$

$$T = 2$$

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

21. (C)

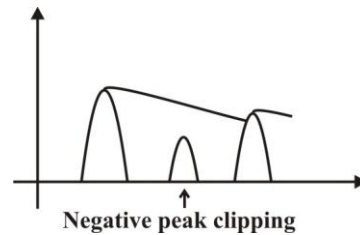
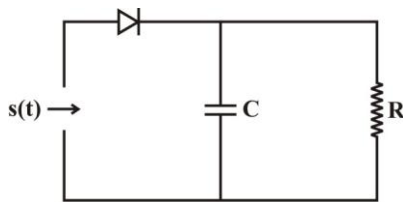
22. (A) $f_i(t) = f_c + K_f m(t) = 10^6 + 4000 \times 5 = 1002$

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

$$(240 + n)8000 = 2.048 \times 10^6 \quad n = 16$$

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

$$\text{Total signal} = (\cos(2\pi \times 10t) + \cos(2\pi \times 10.1t))$$

$$= \cos(2\pi \times 10t) + \cos(2\pi \times 10t) \cos(0.1t) - \sin(2\pi \times 10t) \sin(0.1t)$$

$$= \cos(2\pi \times 10t) [1 + \cos 0.1t] - \sin(2\pi \times 10t) \sin(0.1t)$$

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

$$\phi = kt$$

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

30. (A) $8(7 \times 20 + 1) = 8(141) = 1128$ 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 \times 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) $P_e = \frac{1}{2} \text{erfc} \sqrt{\frac{E_b}{N_0} \cos^2 \phi}$

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

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

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 Bits = $12 \times 512 \times 3 = 18432$

40. (C) $(f_2 - f_1) = \frac{h}{T_b}$

For orthogonal FSK;

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

41. (D) $f_m = 3.2 \text{ KHz}$ $f_s > 6.4 \text{ KHz}$
 Bits = 6 Bit rate = $6 \times 6.4 = 38.4 > 36 \text{ kbps}$.
 \therefore Not correct.

42. (C) Frame alignment word = 8 bits
 Bits per frame = $24 \times 8 + 8 = 200$
 $\text{bps} = 200 \times 8 \times 10^3 = 1.6 \text{ Mbps}$.

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

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

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

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

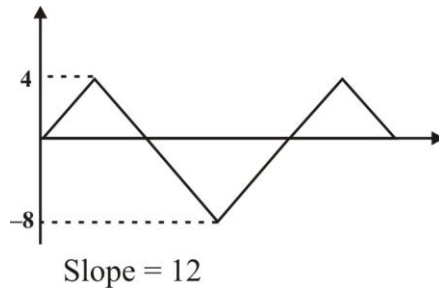
$$10^{-3} = \frac{1}{2} \text{erfc} \sqrt{\frac{E_b}{N_0}} \quad \text{—BPSK}$$

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

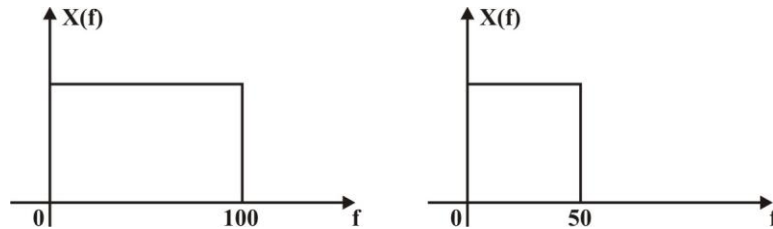
$$\text{Non coherent ASK: } P_e = \frac{1}{2} \exp\left(-\frac{E_b}{2N_0}\right)$$

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

47. (B)



48. (B)



Multiplication in frequency domain.

$$\therefore z(t) \rightarrow f = 50 \text{ KHz}$$

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

50. (B) 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) $NA \times BW = \text{Const}$

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)
$$\frac{\Delta t}{z} = \frac{n_1}{c} \left(\frac{\Delta}{1-\Delta} \right) = \frac{1.5}{3 \times 10^8} \left(\frac{1/3}{2/3} \right) = 2.5 \text{ ns/m.}$$

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

$$y_1(t) = A_c^2 (1 + k_a m(t))^2 \cos^2 \omega_c t$$

$$= A_c^2 (1 + k_a^2 m^2(t) + 2k_a m(t)) (1)$$

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

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

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

$$k_a = 1 \text{ (For maximum value)}$$



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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.