HINTS & SOLUTIONS

EXERCISE - 1

Single Choice

1. B **2.** B **3.** B **4.** C

5. $h = \lambda = \frac{c}{\nu} = 3\times10^8/10^6 = 300\ m$

6. Three types of modulation are amplitude, frequency and phase modulation.

7. A **8.** C

9. To avoid corruption of transmitted signal.

10. D

11. $C_m(t) = (A_c + A_m \sin \omega_m t) \sin \omega_c t$

$= A_c \sin \omega_c t + \frac{\mu A_c}{2} \cos(\omega_c - \omega_m)t$

$- \frac{\mu A_c}{2} \cos(\omega_c + \omega_m)t$

12. $P_c = \frac{E^2_{rms}}{R} = \frac{E_c^2}{2R}$

13. D **14.** C **15.** C **16.** C

17. $\Delta\omega = 2\omega_m = 2\times5 = 10$ kHz.

18. A

19. Repeaters add on energy to received signals and retransmit them.

20. B **21.** C **22.** A **23.** A **24.** D **25.** C
26. D **27.** D **28.** D **29.** D **30.** A **31.** A

32. Due to Hifi communication system distortion is minimized.

33. A **34.** A **35.** A **36.** C

37. Side band frequencies are $\omega_c \pm \Delta\omega = (1000 \pm 0.8)$ kHz i.e. 1000.8 kHz, 999.2 kHz

38. $f_c = 100\, f_m = 100\times500 = 50000$ cps.

39. B

40. Polarization is only for transverse waves.

41. $v = \frac{c}{\epsilon_r} = \frac{3\times10^8}{4} = 7.5\times10^7$ m/s

42. A **43.** B **44.** C **45.** D

EXERCISE - 2

Part # I : Multiple Choice

1. D **2.** B **3.** D **4.** C **5.** C **6.** C
7. A **8.** C **9.** C **10.** D

11. $d = \sqrt{2Rh} = \sqrt{2\times6.4\times10^6\times240} = 55$ km

12. D **13.** A **14.** D **15.** D **16.** B

17. $N = \sigma\pi d^2$

$50\times10^5 = \sigma\times\frac{22}{7}\times2\times6.4\times10^6\times150$

$\sigma = 828.6\ km^{-2}$

18. C

19. Amplifier is not energy transformer it just increases the energy level.

20. C **21.** B **22.** C **23.** A **24.** C

25. Energy flux at point of focus $= \frac{10^{12}}{10^{-4}} = 10^{16}$

26. $\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{10^{-9}\times10\times10^{-6}}}$

$\Rightarrow \nu = 10^7\times0.1592 = 1592$ kHz.

27. B **28.** D **29.** $d = \sqrt{2Rh}$ **30.** D **31.** C
32. A **33.** D **34.** C **35.** A **36.** D **37.** A
38. C **39.** D **40.** C **41.** B **42.** D **43.** D

44. $m = \frac{\Delta f}{f_c} = \frac{10}{2} = 5$

45. C **46.** D **47.** D

Part # II : Assertion & Reason

1. A **2.** D **3.** A **4.** A **5.** D **6.** C
7. A

EXERCISE - 3

Part # I : AIEEE/JEE-MAIN

1. 3

2. 4

3. Low frequencies cannot be transmitted to long distances. Therefore, they are super imposed on a high frequency carrier signal by a process known as modulation.
Speed of electro–magnetic waves will not change due to modulation. So time lag between transmission and reception of the information signale.

4. $r = R + h \cong R$

$x = \sqrt{(R+h)^2 - R^2}$

$= \sqrt{h^2 + 2hR}$

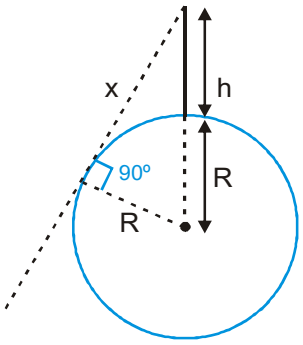
$x^2 = 25000 + 2.500\,6.4\,100000$

$= 25000 + (64 \times 100000000)$

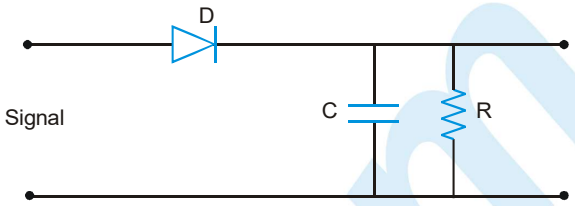
$= 10^4 (640025)$

$x^2 \cong 10^4.640000$

$x = 8 \times 10^4\ m = 80\ km.$



5.



$\tau = RC = 100 \times 10^3 \times 250 \times 10^{-12}\ sec$

$= 2.5 \times 10^7 \times 10^{-12}\ sec$

$= 2.5 \times 10^{-5}\ sec$

The higher frequency which can be detected with tolerable distortion is

$$f = \frac{1}{2\pi m_a RC} = \frac{1}{2\pi \times 0.6 \times 2.5 \times 10^{-5}} Hz$$

$$= \frac{100 \times 10^4}{25 \times 1.2\pi} Hz$$

$$= \frac{4}{1.2\pi} \times 10^{-4}\ Hz$$

$= 10.61\ KHz$

This condition is obtained by applying the condition that rate of decay of capacitor voltage must be equal or less then the rate of decay modulated singnal voltage for proper detection of mdoulated signal.