# Physicsaholics

**DPP – 5 (Semiconductor)**

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/63

Video Solution on YouTube:- https://youtu.be/NH9dQzdNb2Y

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Q 1. If a carrier wave of 1000 kHz is used to carry the signal, the length of transmitting antenna will be equal to –
(a) 3 m
(b) 30 m
(c) 300 m
(d) 3000 m

Q 2. If the maximum and minimum voltage of an AM wave are $V_{max}$ and $V_{min}$ respectively then modulation factor –
(a) $m = \frac{V_{max}}{V_{max}+V_{min}}$ (b) $m = \frac{V_{min}}{V_{max}+V_{min}}$
(c) $m = \frac{V_{max}+V_{min}}{V_{max}-V_{min}}$ (d) $m = \frac{V_{max}-V_{min}}{V_{max}+V_{min}}$

Q 3. Fraction of total power carried by side bands is given by –
(a) $\frac{P_S}{P_T} = m^2$ (b) $\frac{P_S}{P_T} = \frac{1}{m^2}$
(c) $\frac{P_S}{P_T} = \frac{2+m^2}{m^2}$ (d) $\frac{P_S}{P_T} = \frac{m^2}{2+m^2}$

Q 4. For a carrier frequency of 100 kHz and a modulating frequency of 5 kHz what is the width of AM transmission -
(a) 5 kHz
(b) 10 kHz
(c) 20 kHz
(d) 200 KHz

Q 5. A radar has a power of 1 kW and is operating at a frequency of 10 GHz. It is located on a mountain top of height 500 m. The maximum distance upto which it can detect object located on the surface of the earth (Radius of earth = 6.4 × 10 6 m) is
(a) 16 km
(b) 40 km
(c) 64 km
(d) 80 km

Q 6. **Statement I:** sky wave cannot be observed on moon.
**Statement II:** Atmosphere of variable refractive index is required for propagation of sky wave.

(a) Statement-1 is true, Statement-2 is true; Statement-2 is the correct explanation of Statement-1.
(b) Statement-1 is true, Statement-2 is true; Statement-2 is not correct explanation of Statement-1.
(c) Statement-1 is false, Statement-2 is true.
(d) Statement-1 is true, Statement-2 is false.

Q 7. In an amplitude modulated wave for audio frequency of 500 cycles/second, the appropriate carrier frequency will be
(a) 50 cycle/sec
(b) 100 cycle/sec
(c) 500 cycle/sec
(d) 50000 cycle/sec

Q 8. The velocity of electromagnetic waves in a nonmagnetic dielectric modium $\epsilon_r = 4$ is
(a) $3 \times 10^8$ m/s
(b) $1.5 \times 10^8$ m/s
(c) $6 \times 10^8$ m/s
(d) $7.5 \times 10^8$ m/s

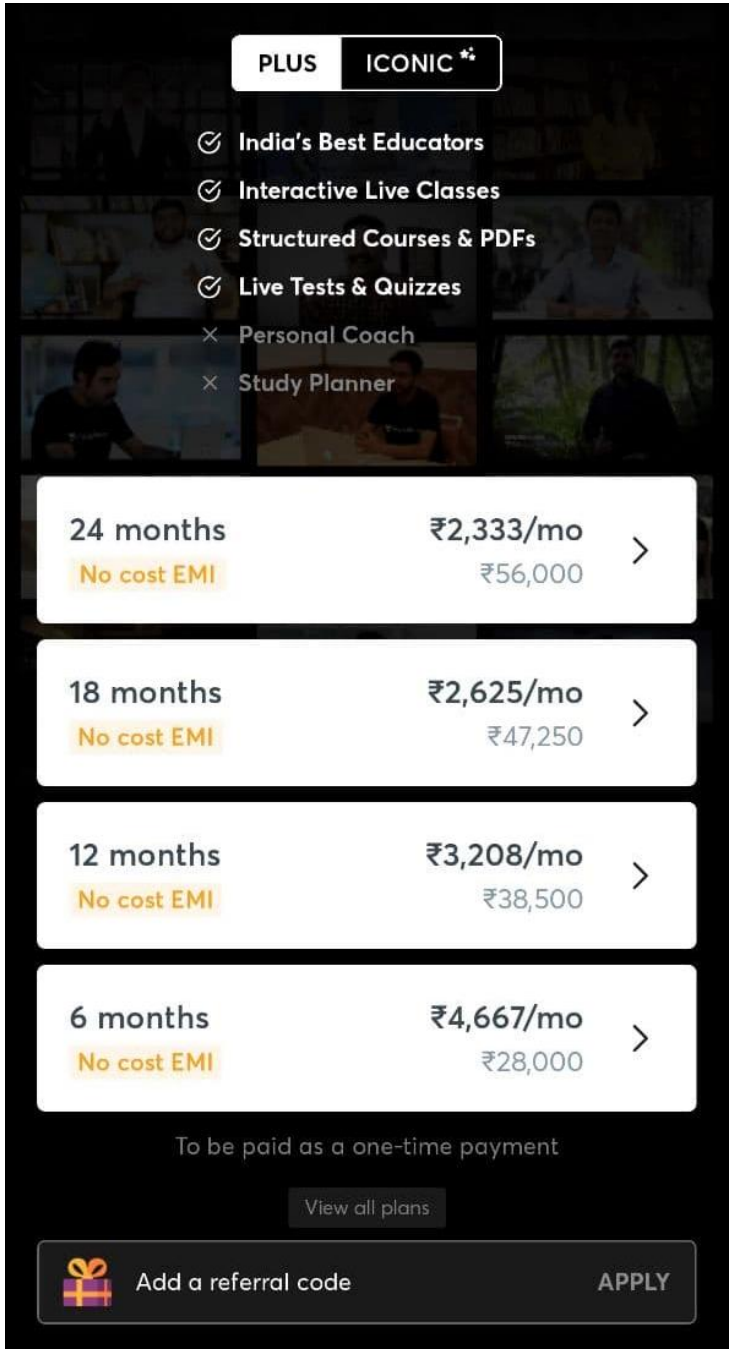
Q 9. The TV transmission tower in Delhi has a height of 240 m. The distance up to which the broadcast can be received, (taking the radius of earth to be $6.4 \times 10^6$ m) is –
(a) 100 km
(b) 60 km
(c) 55 km
(d) 50 km

Q 10. A diode detector is used to detect an amplitude modulated wave of 60% modulation by using a condenser of capacity 250 pico farad in parallel with a load resistance 100 kilo ohm. Find the maximum modulated frequency which could be detected by it
(a) 10.62 MHz
(b) 10.62 kHz
(c) 5.31 MHz
(d) 5.31 kHz

Q 11. Sinusoidal carrier voltage of frequency 1.5 MHz and amplitude 50 V is amplitude modulated by sinusiodal voltage of frequency 10 kHz producing 50% modulation. The lower and upper side-band frequencies in kHz are
(a) 1490, 1510
(b) 1510, 1490
(c) $\frac{1}{1490}, \frac{1}{1510}$
(d) $\frac{1}{1510}, \frac{1}{1490}$

# Answer Key

| | | | | |
|---|---|---|---|---|
| **Q.1) c** | **Q.2) d** | **Q.3) d** | **Q.4) b** | **Q.5) d** |
| **Q.6) a** | **Q.7) d** | **Q.8) b** | **Q.9) c** | **Q.10) b** |
| **Q.11) a** | | | | |

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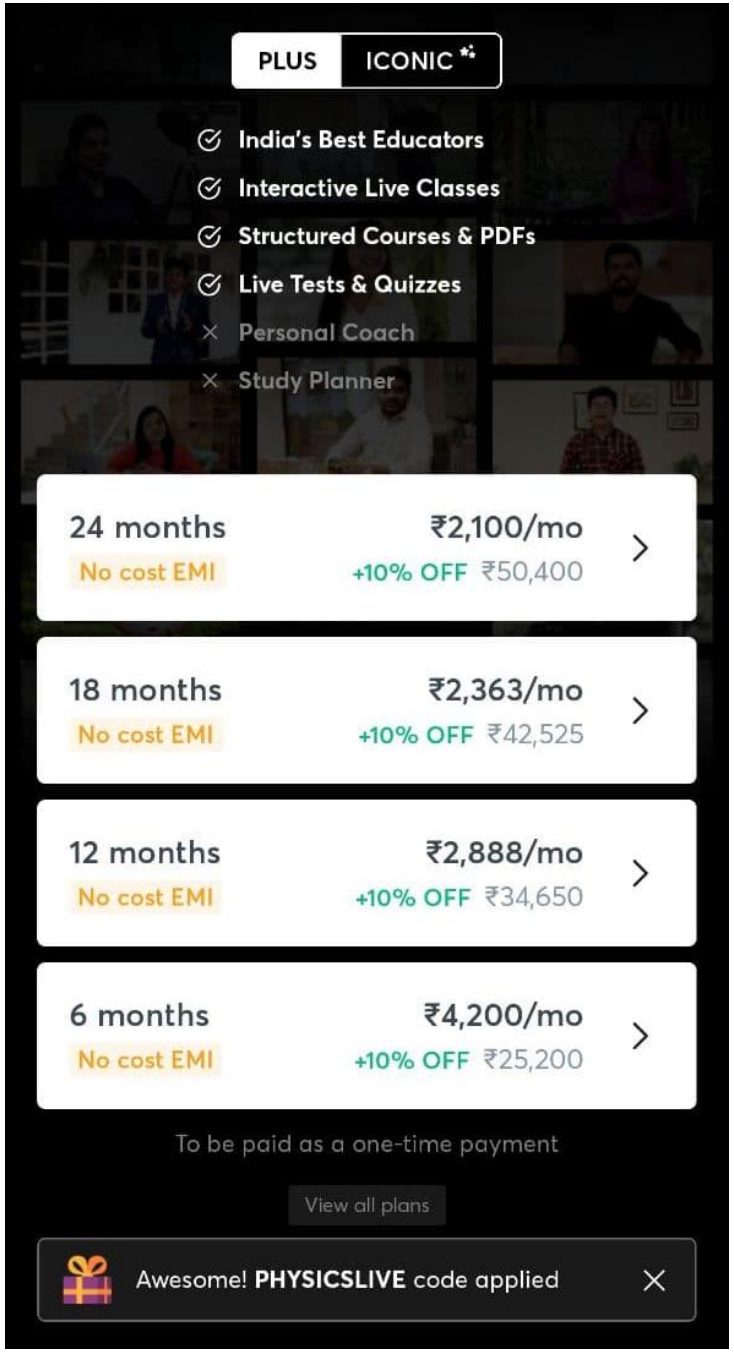

# Written Solution

## DPP- 5, Semiconductor - Communication Systems

**By Physicsaholics Team**

Sol 1)

$$f = 1000\ KHz = 10^6\ Hz$$

$$\lambda = \frac{v}{f} = \frac{3\times10^8}{10^6} = 300\ meter$$

$$\Rightarrow l \simeq \lambda = 300m$$



Ans (c)

Sol 2) In Amplitude modulated wave

$V_{max} = V_c + V_m$ , $V_{min} = V_c - V_m$

Amplitude modulation factor

$$m = \frac{V_m}{V_c} = \frac{V_{max} - V_{min}}{V_{max} + V_{min}}$$



Ans (d)

Sol 3)

$$\text{Total Power of side bands} = \frac{m^2 E_c^2}{4R}$$

$$\text{Total Power of AM waves} = \frac{E_c^2}{2R}\left(1+\frac{m^2}{2}\right)$$

$$\text{fraction} = \frac{\frac{m^2 E_c^2}{4R}}{\frac{E_c^2}{2R}\left(1+\frac{m^2}{2}\right)}$$

$$= \frac{m^2}{2+m^2}$$

Ans (a)

Sol 4)

Width of F.M. transmission

$= 2f_m = 10\ KHz.$



Ans (b)

Sol 5)

$$\text{Range} = \sqrt{2Rh}$$

$$= \sqrt{2 \times 6.4 \times 10^6 \times 500}$$

$$= \sqrt{64 \times 10^8}$$

$$= 8 \times 10^4 \text{ m}$$

$$= 80 \text{ Km}$$

Ans(d)

Sol 6)

for propagation of surface wave and sky wave atmosphere is required & moon does not have atmosphere.



Ans(a)

Sol 7)

Carrier frequency >> modulating wave frequency



Ans (d)

Sol 8)

for medium $\epsilon_r = 4$, $\mu_r = 1$

$$\text{Refractive index} = \sqrt{\mu_r \epsilon_r} = 2$$

$$\text{Velocity of light in medium} = \frac{c}{\mu} = \frac{3 \times 10^8}{2} = 1.5 \times 10^8 \text{ m/sec}$$

Ans(b)

Sol 9)

$$\text{Range} = \sqrt{2RE}$$

$$= \sqrt{\frac{2 \times 6.4 \times 10^6 \times 240}{48 \times 64 \times 10^6}}$$

$$= 2\sqrt{3} \times 10^3 \text{ m}$$

$$= 5.5 \text{ Km}$$

Ans (c)

Sol 10)

$$f_{max} = \frac{1}{2\pi \beta R C}$$

$$= \frac{1}{2\pi \cdot 6 \times 100k \times 250 \times 10^{-12}}$$

$$= \frac{1000000 \times 10^6}{1.2\pi \times 25 \times 10^3 \times 10^3}$$

$$= \frac{40}{1.2\pi} \times 10^3 \text{ Hz}$$

$$= 10.62 \text{ K Hz}$$

Ans (b)

Sol 11) $f_c = 1.5\ MHz = 1500\ KHz$

lower side band frequency

$= f_c - f_m = 1500\ KHz - 10\ KHz = 1490\ KHz$

upper side band frequency

$= f_c + f_m = (1500 + 10)\ KHz = 1510\ KHz$

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