

TEST

JEE Mains PYQs Communication system (Physics Master Academy)

QUESTIONS

SECTIONS

1. Section A - 25 Questions

Section 1 : Section A - 25 Questions

SECTION INSTRUCTIONS

This section contains 25 MCQs. +4 for every correct answer, -1 for every incorrect answer.

1 A carrier wave with amplitude of 250V is amplitude modulated by a sinusoidal base band signal of amplitude 150V, The ratio of minimum amplitude to maximum amplitude for the amplitude modulated wave is  $50:x$ , then value of  $x$  is \_\_\_

- 50
- 100
- 150
- 200

Correct: +4 · Incorrect: -1

2 A bandwidth of 6 MHz is available for AM transmission. If the maximum audio signal frequency used for modulating the carrier wave is not to exceed 6kHz. The number of stations that can be broadcasted within this band simultaneously without interfering with each other will be \_\_\_

- 100
- 50
- 500
- 250

Correct: +4 · Incorrect: -1

3 A transmitting antenna has a height of 320m and that of receiving antenna is 2000 m. The maximum distance between them for satisfactory communication in line of sight mode is 'd'. The value of 'd' is \_\_\_ km.

221

224

215

220

Correct: +4 · Incorrect: -1

4 An antenna is mounted on a 400m tall building. What will be the wavelength of signal that can be radiated effectively by the transmission tower upto a range of 44km?

37.8m

605m

75.6m

302m

Correct: +4 · Incorrect: -1

5 An amplitude modulated wave is represented by  $C_m(t) = 10(1 + 0.2\cos 12560t) \sin(111 \times 10^4 t)$  volts. The modulating frequency in KHz will be \_\_\_\_

1

2

3

4

Correct: +4 · Incorrect: -1

6 The maximum amplitude for an amplitude modulated wave is found to be 12V while the minimum amplitude is found to be 3V. The modulation index is  $0.6x$  where x is \_\_\_\_

1

2

3

4

Correct: +4 · Incorrect: -1

7 In amplitude modulation, the message signal  $V_m(t) = 10 \sin(2\pi \times 10^5 t)$  volts and carrier signal  $V_c(t) = 20 \sin(2\pi \times 10^7 t)$  volts. The modulated signal now contains the message signal with lower side band and upper side band frequency, therefore the bandwidth of modulated signal is  $\alpha$  kHz. The value of  $\alpha$  is \_\_\_\_

- 2000 kHz
- 50 kHz
- 100 kHz
- 0

Correct: +4 · Incorrect: -1

8 What should be the height of transmitting stations and the population covered if the television telecast is to cover a radius of 150km? The average population density around the tower is  $2000/\text{km}^2$  and the value of  $R_e = 6.5 \times 10^6 \text{m}$ .

- Height = 1731m; Population covered =  $1413 \times 10^5$
- Height = 1241m; Population covered =  $7 \times 10^5$
- Height = 1600m; Population covered =  $2 \times 10^5$
- Height = 1800m; Population covered =  $1413 \times 10^5$

Correct: +4 · Incorrect: -1

9 A carrier signal  $C(t) = 25 \sin(2.512 \times 10^{10} t)$  is amplitude modulated by a message signal  $m(t) = 5 \sin(1.57 \times 10^8 t)$  and transmitted through an antenna. What will be the bandwidth of the modulated signal?

- 50 MHz
- 2.01 GHz
- 1987.5 MHz
- 8 GHz

Correct: +4 · Incorrect: -1

10 A 25m long antenna is mounted on an antenna tower. The height of the antenna tower is 75m. The wavelength (in meter) of the signal transmitted by this antenna would be

- 400
- 100

300

200

Correct: +4 · Incorrect: -1

11 If a message signal of frequency ' $f_m$ ' is amplitude modulated with a carrier signal of frequency ' $f_c$ ' and radiated through an antenna, the wavelength of the corresponding signal in air is

$\frac{c}{f_c}$

$\frac{c}{f_m}$

$\frac{c}{f_c + f_m}$

$\frac{c}{f_c - f_m}$

Correct: +4 · Incorrect: -1

12 An audio signal  $v_m = 20 \sin 2\pi(1500t)$  amplitude modulates a carrier  $v_c = 80 \sin 2\pi(100,000t)$ . The value of percent modulation is \_\_\_\_

20

23

22

25

Correct: +4 · Incorrect: -1

13 In an amplitude modulator circuit, the carrier wave is given by  $C(t) = 4 \sin (20000 \pi t)$  while modulating signal is given by  $m(t) = 2 \sin (2000 \pi t)$ . The values of modulation index and lower side band frequency are

0.5 and 10 kHz

0.4 and 10 kHz

0.3 and 9 kHz

0.5 and 9 kHz

Correct: +4 · Incorrect: -1

14 A message signal of frequency 100 MHz and peak voltage 100V is used to execute amplitude modulation on a carrier wave of frequency 300 GHz and peak voltage 400V. The modulation index and difference between the two side band frequencies are

- 4;  $1 \times 10^8$  Hz
- 4;  $2 \times 10^8$  Hz
- 0.25;  $2 \times 10^8$  Hz
- 0.25;  $1 \times 10^{-8}$  T

Correct: +4 · Incorrect: -1

15 The physical sizes of the transmitter and receiver antenna in a communication system are

- independent of both carrier and modulation frequency
- inversely proportional to carrier frequency
- inversely proportional to modulation frequency
- proportional to carrier frequency

Correct: +4 · Incorrect: -1

16 The wavelength of the carrier waves in a modern optical fiber communication network is close to

- 2400 nm
- 1500 nm
- 600 nm
- 900 nm

Correct: +4 · Incorrect: -1

17 In a line of sight radio communication a distance of about 50km is kept between the transmitting and receiving antenna. If the height of the receiving antenna is 70m, then the minimum height of the transmitting antenna should be (Radius of the earth =  $6.4 \times 10^6$ m)

- 20m
- 51m
- 32m
- 40m

18 A 100V carrier is made to vary between 160V and 40V by a modulating signal. What is the modulation index?

- 0.3
- 0.5
- 0.6
- 0.4

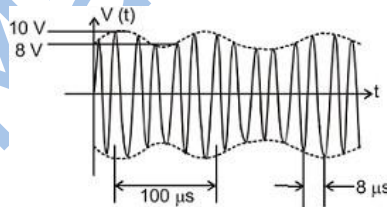
Correct: +4 · Incorrect: -1

19 To double the covering range of a TV transmission tower, its height should be multiplied by

- $\frac{1}{\sqrt{2}}$
- 2
- 4
- $\sqrt{2}$

Correct: +4 · Incorrect: -1

20 An amplitude modulated signal is plotted below:



Which one of the following best describes the above signal?

- $(9 + \sin(2.5\pi \times 10^5 t)) \sin(2\pi \times 10^4 t)V$
- $(1 + 9 \sin(2\pi \times 10^4 t)) \sin(2.5\pi \times 10^5 t)V$
- $(9 + \sin(2\pi \times 10^4 t)) \sin(2.5\pi \times 10^5 t)V$
- $(9 + \sin(4\pi \times 10^4 t)) \sin(5\pi \times 10^5 t)V$

Correct: +4 · Incorrect: -1

21 A TV transmission tower has a height of 140m and the height of the receiving antenna is 40m. What is the maximum distance upto which signals can be broadcasted from this tower in LOS (Line of sight) mode? (Given radius of earth =  $6.4 \times 10^6 m$ )

- 65km
- 48km
- 80km
- 40km

Correct: +4 · Incorrect: -1

**22** A telephonic communication service is working at carrier frequency of 10GHz. Only 10% of it is utilized for transmission. How many telephonic channels can be transmitted simultaneously if each channel requires a bandwidth of 5 kHz?

- $2 \times 10^3$
- $2 \times 10^4$
- $2 \times 10^5$
- $2 \times 10^6$

Correct: +4 · Incorrect: -1

**23** A carrier wave of peak voltage 14V is used for transmitting a message signal. The peak voltage of modulating signal given to achieve a modulation index of 80% will be

- 11.2V
- 7V
- 22.4V
- 28V

Correct: +4 · Incorrect: -1

**24** The number of amplitude broadcast stations that can be accommodated in a 300 kHz band width for the highest modulating frequency 15 kHz will be

- 20
- 10
- 8
- 15

25 A signal is to be transmitted through a wave of wavelength  $\lambda$ , using a linear antenna. The length  $l$  of the antenna and effective power radiated  $P_{\text{eff}}$  will be given respectively as: (K is a constant of proportionality)

$\lambda, P_{\text{eff}} = K \left( \frac{1}{\lambda} \right)^2$

$\frac{\lambda}{8}, P_{\text{eff}} = K \left( \frac{1}{\lambda} \right)$

$\frac{\lambda}{16}, P_{\text{eff}} = K \left( \frac{1}{\lambda} \right)^3$

$\frac{\lambda}{5}, P_{\text{eff}} = K \left( \frac{1}{\lambda} \right)^{1/2}$

Correct: +4 · Incorrect: -1



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ANSWERS

SECTIONS

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1 200

2 500

3 224

4 605m

5 2

6 1

7 2000 kHz

8 Height = 1731m; Population covered =  $1413 \times 10^5$

9 50 MHz

10 100

11  $\frac{c}{f_c}$

12 25

13 0.5 and 9 kHz

14 0.25;  $2 \times 10^8$  Hz

15 inversely proportional to carrier frequency

16 1500 nm

17 32m

18 0.6

19 4

20  $(9 + \sin(2\pi \times 10^4 t) \sin(2.5\pi \times 10^5 t))V$

21 65km

22  $2 \times 10^5$

23 11.2V

24 10

25  $\lambda, P_{eff} = K \left( \frac{1}{\lambda} \right)^2$

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