

# DPP - Daily Practice Problems

Name :

Date :

Start Time :

End Time :

# PHYSICS

# 59

SYLLABUS : Communication Systems, Laser

Max. Marks : 120

Time : 60 min.

## GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deducted for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

**DIRECTIONS (Q.1-Q.21) :** There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** choice is correct.

**Q.1** In short wave communication which of the following frequencies will be reflected back by the ionospheric layer, having electron density  $10^{11}$  per  $m^3$ .

- (a) 2.84 MHz                      (b) 10.42 MHz  
(c) 12.24 MHz                      (d) 18.1 MHz

**Q.2** In an amplitude modulated wave for audio frequency of 500 cycle/second, the appropriate carrier frequency will be

- (a) 50 cycles/sec                      (b) 100 cycles/sec  
(c) 500 cycles/sec                      (d) 50, 000 cycles/sec

**Q.3** Range of frequencies allotted for commercial FM radio broadcast is

- (a) 88 to 108 MHz                      (b) 88 to 108 kHz  
(c) 8 to 88 MHz                      (d) 88 to 108 GHz

**Q.4** The process of superimposing signal frequency (*i.e.* audio wave) on the carrier wave is known as

- (a) Transmission                      (b) Reception  
(c) Modulation                      (d) Detection

**Q.5** The characteristic impedance of a coaxial cable is of the order of

- (a)  $50\Omega$                       (b)  $200\Omega$   
(c)  $270\Omega$                       (d) None of these

RESPONSE GRID

1. (a)(b)(c)(d)    2. (a)(b)(c)(d)    3. (a)(b)(c)(d)    4. (a)(b)(c)(d)    5. (a)(b)(c)(d)

Space for Rough Work

- Q.6** If  $\mu_1$  and  $\mu_2$  are the refractive indices of the materials of core and cladding of an optical fibre, then the loss of light due to its leakage can be minimised by having
- (a)  $\mu_1 > \mu_2$  (b)  $\mu_1 < \mu_2$   
 (c)  $\mu_1 = \mu_2$  (d) None of these
- Q.7** Maximum usable frequency (MUF) in  $F$ -region layer is  $x$ , when the critical frequency is 60 MHz and the angle of incidence is  $70^\circ$ . Then  $x$  is ( $\cos 70^\circ = 0.34$ )
- (a) 150 MHz (b) 170 MHz  
 (c) 175 MHz (d) 190 MHz
- Q.8** A laser is a coherent source because it contains
- (a) many wavelengths  
 (b) uncoordinated wave of a particular wavelength  
 (c) coordinated wave of many wavelengths  
 (d) coordinated waves of a particular wavelength
- Q.9** A laser beam is used for carrying out surgery because it
- (a) is highly monochromatic  
 (b) is highly coherent  
 (c) is highly directional  
 (d) can be sharply focussed
- Q.10** Laser beams are used to measure long distances because
- (a) they are monochromatic  
 (b) they are highly polarised  
 (c) they are coherent  
 (d) they have high degree of parallelism
- Q.11** An oscillator is producing FM waves of frequency 2 kHz with a variation of 10 kHz. What is the modulating index?
- (a) 0.20 (b) 5.0 (c) 0.67 (d) 1.5
- Q.12** If  $f_a$  and  $f_f$  represent the carrier wave frequencies for amplitude and frequency modulations respectively, then
- (a)  $f_a > f_f$  (b)  $f_a < f_f$   
 (c)  $f_a = f_f$  (d)  $f_a \geq f_f$
- Q.13** An antenna is a device
- (a) that converts electromagnetic energy into radio frequency signal  
 (b) that converts radio frequency signal into electromagnetic energy  
 (c) that converts guided electromagnetic waves into free space electromagnetic waves and vice-versa  
 (d) None of these
- Q.14** While tuning in a certain broadcast station with a receiver, we are actually
- (a) varying the local oscillator frequency  
 (b) varying the frequency of the radio signal to be picked up  
 (c) tuning the antenna  
 (d) None of these
- Q.15** In a communication system, noise is most likely to affect the signal
- (a) At the transmitter  
 (b) In the channel or in the transmission line  
 (c) In the information source  
 (d) At the receiver
- Q.16** In an FM system a 7 kHz signal modulates 108 MHz carrier so that frequency deviation is 50 kHz. The carrier swing is
- (a) 7.143 (b) 8  
 (c) 0.71 (d) 350
- Q.17** The phenomenon by which light travels in an optical fibres is
- (a) Reflection  
 (b) Refraction  
 (c) Total internal reflection  
 (d) Transmission
- Q.18** In frequency modulation
- (a) The amplitude of modulated wave varies as frequency of carrier wave  
 (b) The frequency of modulated wave varies as amplitude of modulating wave  
 (c) The amplitude of modulated wave varies as amplitude of carrier wave  
 (d) The frequency of modulated wave varies as frequency of modulating wave

**RESPONSE  
GRID**

6. (a)(b)(c)(d) 7. (a)(b)(c)(d) 8. (a)(b)(c)(d) 9. (a)(b)(c)(d) 10. (a)(b)(c)(d)  
 11. (a)(b)(c)(d) 12. (a)(b)(c)(d) 13. (a)(b)(c)(d) 14. (a)(b)(c)(d) 15. (a)(b)(c)(d)  
 16. (a)(b)(c)(d) 17. (a)(b)(c)(d) 18. (a)(b)(c)(d)

Space for Rough Work

**Q.19** Audio signal cannot be transmitted because

- The signal has more noise
- The signal cannot be amplified for distance communication
- The transmitting antenna length is very small to design
- The transmitting antenna length is very large and impracticable

**Q.20** For sky wave propagation of a 10 MHz signal, what should be the minimum electron density in ionosphere

- $\sim 1.2 \times 10^{12} \text{ m}^{-3}$
- $\sim 10^6 \text{ m}^{-3}$
- $\sim 10^{14} \text{ m}^{-3}$
- $\sim 10^{22} \text{ m}^{-3}$

**Q.21** What should be the maximum acceptance angle at the aircore interface of an optical fibre if  $n_1$  and  $n_2$  are the refractive indices of the core and the cladding, respectively

- $\sin^{-1}(n_2/n_1)$
- $\sin^{-1}\sqrt{n_1^2 - n_2^2}$
- $\left[ \tan^{-1} \frac{n_2}{n_1} \right]$
- $\left[ \tan^{-1} \frac{n_1}{n_2} \right]$

**DIRECTIONS (Q.22-Q.24) :** In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

**Codes :**

- 1, 2 and 3 are correct
- 1 and 2 are correct
- 2 and 4 are correct
- 1 and 3 are correct

**Q.22** In which of the following remote sensing technique is used?

- Forest density
- Pollution
- Wetland mapping
- Medical treatment

**Q.23** What type of modulation is not employed in India for radio transmission?

- A mixture of both frequency and pulse modulation.
- Pulse modulation
- Frequency modulation
- Amplitude modulation

**Q.24** Which of the following are the characteristics of Laser beams?

- They are monochromatic
- They are coherent
- They have high degree of parallelism
- They are not monochromatic

**DIRECTIONS (Q.25-Q.27) :** Read the passage given below and answer the questions that follows :

The electron density of a layer of ionosphere at a height 150 km from the earth's surface is  $9 \times 10^9$  per  $\text{m}^3$ . For the sky transmission from this layer up to a range of 250 km,

**Q.25** The critical frequency of the layer is

- 2 Hz
- 2.7 Hz
- 2.78 kHz
- 2.7 MHz

**Q.26** Maximum usable frequency is

- 3.17 Hz
- $3.17 \times 10^6$  Hz
- $3.17 \times 10^3$  Hz
- $3.17 \times 10^{10}$  Hz

**Q.27** Angle of incidence of this layer is

- $0^\circ$
- $\sec^{-1}(1.51)$
- $\sec^{-1}(1.17)$
- $37^\circ$

**RESPONSE  
GRID**

19. (a)(b)(c)(d)    20. (a)(b)(c)(d)    21. (a)(b)(c)(d)    22. (a)(b)(c)(d)    23. (a)(b)(c)(d)  
24. (a)(b)(c)(d)    25. (a)(b)(c)(d)    26. (a)(b)(c)(d)    27. (a)(b)(c)(d)

Space for Rough Work

**DIRECTIONS (Qs. 28-Q.30) :** Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

- (a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.  
 (b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.  
 (c) Statement -1 is False, Statement-2 is True.  
 (d) Statement -1 is True, Statement-2 is False.

**Q.28 Statement-1 :** Television signals are not received through sky-wave propagation.

**Statement-2 :** The ionosphere reflects electromagnetic waves of frequencies greater than a certain critical frequency.

**Q.29 Statement-1 :** The electromagnetic waves of shorter wavelength can travel longer distances on earth's surface than those of longer wavelengths.

**Statement-2 :** Shorter the wavelength, the larger is the velocity of wave propagation.

**Q.30 Statement-1 :** A dish antenna is highly directional.

**Statement-2 :** This is because a dipole antenna is omni directional.

**RESPONSE GRID**

28. (a) (b) (c) (d)    29. (a) (b) (c) (d)    30. (a) (b) (c) (d)

**DAILY PRACTICE PROBLEM SHEET 59 - PHYSICS**

Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	30	Qualifying Score	50
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work



## DAILY PRACTICE PROBLEMS

## PHYSICS SOLUTIONS

# 59

1. (a) By using  $f_c = 9(N_{\max})^{1/2} \Rightarrow f_c = 2.84 \text{ MHz}$
2. (d) Carrier frequency > audio frequency
3. (a) A maximum frequency deviation of 75 kHz is permitted for commercial FM broadcast stations in the 88 to 108 MHz VHF band.
4. (c) Carrier + signal  $\rightarrow$  modulation.
5. (c)  $270 \Omega$
6. (a)  $\mu_1 > \mu_2$
7. (c)  $MUF = \frac{f_c}{\cos \theta} = \frac{60}{\cos 70^\circ} = 175 \text{ MHz}$
8. (d) coordinated waves of a particular wavelength
9. (d) Surgery needs sharply focused beam of light and laser can be sharply focused.
10. (d) Laser beams are perfectly parallel. So that they are very narrow and can travel a long distance without spreading. This is the feature of laser while they are monochromatic and coherent, these are characteristics only.
11. (b) The formula for modulating index is given by
 
$$m_f = \frac{\delta}{v_m} = \frac{\text{Frequency variation}}{\text{Modulating frequency}} = \frac{10 \times 10^3}{2 \times 10^3} = 5$$
12. (b)  $f_a < f_f$
13. (c) An antenna is a metallic structure used to radiate or receive EM waves.
14. (a) Varying the local oscillator frequency
15. (b) In the channel or in the transmission line
16. (a) Carrier swing =  $\frac{\text{Frequency deviation}}{\text{Modulating frequency}} = \frac{50}{7} = 7.143$
17. (c) In optical fibre, light travels inside it, due to total internal reflection.
18. (b) The process of changing the frequency of a carrier wave (modulated wave) in accordance with the audio frequency signal (modulating wave) is known as frequency modulation (FM).
19. (d) Following are the problems which are faced while transmitting audio signals directly.
  - (i) These signals are relatively of short range.
  - (ii) If every body started transmitting these low frequency signals directly, mutual interference will render all of them ineffective.
  - (iii) Size of antenna required for their efficient radiation would be larger *i.e.* about 75 km.
20. (a) The critical frequency of a sky wave for reflection from a layer of atmosphere is given by  $f_c = 9(N_{\max})^{1/2}$ 

$$\Rightarrow 10 \times 10^6 = 9(N_{\max})^{1/2}$$

$$\Rightarrow N_{\max} = \left( \frac{10 \times 10^6}{9} \right)^2 = 1.2 \times 10^{12} \text{ m}^{-3}$$
21. (b) Core of acceptance angle  $\theta = \sin^{-1} \sqrt{n_1^2 - n_2^2}$
22. (a) Remote sensing is the technique to collect information about an object in respect of its size, colour, nature, location, temperature etc without physically touching it. There are some areas or location which are inaccessible. So to explore sensing is used. Remote sensing is done through a satellite.
23. (b)
24. (a) Laser beams are perfectly parallel. They are monochromatic and coherent. These are characteristics only.
25. (d)  $f_c = 9\sqrt{N_m} = 9 \times \sqrt{9 \times 10^{10}}$ 

$$= 2.7 \times 10^6 \text{ Hz} = 2.7 \text{ MHz}$$
26. (b)  $f = f_c \sqrt{1 + \frac{D^2}{4h^2}} = 2.7 \times 10^6 \times \sqrt{1 + \frac{(250 \times 10^3)^2}{4 \times (150 \times 10^3)^2}}$ 

$$= 3.17 \times 10^6 \text{ Hz}$$
27. (c)  $f = f_c = \sec \phi_i$ 

$$\sec \phi_i = \frac{f}{f_c} = \frac{3.17 \times 10^6}{2.7 \times 10^6} = 1.174$$

$$\phi_i = \sec^{-1}(1.174) = 31.6^\circ$$
28. (d) TV signals (frequency greater than 30 MHz) cannot be propagated through sky wave propagation. Above critical frequency, an electromagnetic wave penetrates the ionosphere and is not reflected by it.
29. (d) The electromagnetic waves of shorter wavelength do not suffer much diffraction from the obstacles of earth's atmosphere so they can travel long distance. Also, shorter the wavelength, shorter is the velocity of wave propagation.
30. (b) A dish antenna is a directional antenna because it can transmit or signals in all direction.