

2016

( 2nd Semester )

PHYSICS

SECOND PAPER

( Oscillations, Acoustics and Optics )

[ 2014–2015 Batch (Revised) ]

Full Marks : 55

Time : 2½ hours

( PART : B—DESCRIPTIVE )

( Marks : 35 )

*The figures in the margin indicate full marks for the questions*

1. Obtain the differential equation of simple harmonic motion and hence obtain the solution. 2+5=7

Or

Let two masses  $m_1$  and  $m_2$  be connected by a spring of spring constant  $k$ . One of the masses is fixed to a rigid support and the other mass is displaced through a distance  $x$

and is released. Show that the motion of the spring is simple harmonic, and hence obtain the frequency and time period of the motion. Give the physical meaning of force constant. What is its unit? 5+1+1=7

2. Show that in forced vibration, the resultant amplitude is given by

$$A = \frac{f}{\sqrt{(p^2 - p^2)^2 + 4b^2 p^2}}$$

where  $b$  is damping coefficient,  $p$  is external angular frequency,  $f$  is external force per unit mass,  $p$  is natural angular frequency. 7

Or

What do you mean by ultrasonic wave? Discuss the method of production of ultrasonic wave by using piezoelectric generator. Write down two applications of ultrasonic wave. 1+4+2=7

3. Deduce the condition for achromatism of two thin lenses separated by small distance  $d$ . 7

Or

What are cardinal points? Explain them in brief. Show that the distance between two nodal points is equal to the distance between two principal points. 1+2+4=7

( 3 )

4. What is Fresnel's biprism? Show that in Fresnel's biprism, fringe width is given by  $\frac{D}{2d}$ , where  $2d$  is the separation between two virtual sources and  $D$  is the distance between the source and the screen. 1+6=7

Or

Write down the construction and working of Michelson interferometer. How is it used to determine wavelength of light? 5+2=7

5. Answer the following questions : 1+2+1+3=7

- (a) What do you mean by double refraction?
- (b) What are O-ray and E-ray in reference to double refraction?
- (c) What is phase retardation plate?
- (d) Discuss half-wave plate and quarter-wave plate mentioning their uses.

Or

- (a) What is optical activity? Define dextro- and laevorotatory. Write down Biot's laws of rotatory polarization. 1+1+3=5

( 4 )

- (b) A tube of 20 cm length containing sugar solution is placed between crossed Nicols and illuminated with light of wavelength 6000 angstrom. If the optical rotation produced is  $13^\circ$  and the specific rotation is  $65^\circ$ , determine the strength of the solution. 2

\*\*\*

Subject Code : PHY/II/02 (R)

Booklet No. **A**

[Empty dashed box]

Date Stamp .....

**To be filled in by the Candidate**

DEGREE 2nd Semester  
(Arts / Science / Commerce /  
..... ) Exam., **2016**  
Subject .....  
Paper .....

.....

[Empty dashed box]

**To be filled in by the Candidate**

DEGREE 2nd Semester  
(Arts / Science / Commerce /  
..... ) Exam., **2016**

Roll No. ....

Regn. No. ....

Subject .....

Paper .....

Descriptive Type

Booklet No. B .....

**INSTRUCTIONS TO CANDIDATES**

1. The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.
2. This paper should be ANSWERED FIRST and submitted within 45 minutes of the commencement of the Examination.
3. While answering the questions of this booklet, any cutting, erasing, overwriting or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.

Signature of  
Scrutiniser(s)

Signature of  
Examiner(s)

Signature of  
Invigilator(s)

**PHY/II/02 (R)**

**2 0 1 6**  
( 2nd Semester )

**PHYSICS**

SECOND PAPER

**( Oscillations, Acoustics and Optics )**

[ 2014–2015 Batch (Revised) ]

( PART : A—OBJECTIVE )

( Marks : 20 )

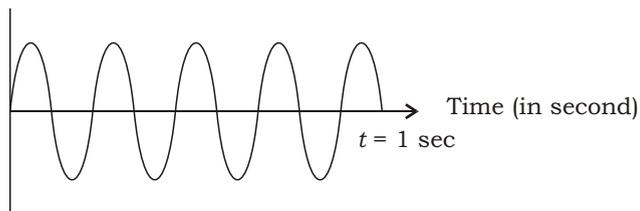
*The figures in the margin indicate full marks for the questions*

SECTION—I

( Marks : 5 )

Tick (✓) the correct answer in the brackets provided :  $1 \times 5 = 5$

1. From the given figure of a wave, the frequency is



- (a) 2 Hz      (    )  
(b) 4.5 Hz    (    )  
(c) 2.5 Hz    (    )  
(d) 2.25 Hz    (    )

/226

( 2 )

2. When two or more notes are sounded simultaneously, the combined note producing a pleasing effect on the ear is called

(a) harmony ( )

(b) melody ( )

(c) noise ( )

(d) interval ( )

3. The basic reason for chromatic aberration of a lens is

(a) different wavelengths of light have different refractive indices ( )

(b) different wavelengths of light have the same refractive indices ( )

(c) different wavelengths of light have different colours ( )

(d) different wavelengths of light have the same colours ( )

PHY/II/02 (R)/226

( 3 )

4. In Young's Double Slit Experiment (YDSE), if the separation between the two slits is reduced to half, then for a constant wavelength and the constant distance between the slits and the screen

(a) the fringe width will increase by a factor of  $\sqrt{2}$   
( )

(b) the fringe width will increase by a factor of 2  
( )

(c) the fringe width will decrease by a factor of  $\sqrt{2}$   
( )

(d) the fringe width will decrease by a factor of 2  
( )

5. An unpolarized wave is incident on a material (from vacuum) with angle of incidence  $60^\circ$ , the reflected wave is found to be plane polarized. The refractive index of the material is

(a) 1.33 ( )

(b) 1.9 ( )

(c) 1.73 ( )

(d) 1 ( )

PHY/II/02 (R)/226

( 4 )

SECTION—II

( Marks : 15 )

Write very short answers to the following questions : 3×5=15

1. Displacement of a particle is given by  $x = x_0 \sin \omega t$ .  
Show that it performs simple harmonic motion.

PHY/II/02 (R)/226

( 5 )

2. What is the difference between free vibration and damped vibration? Write the differential equation for each one.

( 6 )

3. An equilateral prism  $P$  with mean refractive index 1.6 is combined with another equilateral prism  $Q$  with mean refractive index 1.5 such that there is no dispersion. Refractive index for violet and red lights for prism  $P$  are 1.62 and 1.58 respectively, whereas for prism  $Q$  1.51 and 1.49 respectively. Calculate the dispersive power of prism  $P$ .

( 7 )

4. The ratio of maximum to minimum intensities of two interfering light waves is 25. What is the ratio of the intensities of the two individual waves involved?

( 8 )

5. What is polarization? Why is only electric field considered, not the magnetic field of light in case of polarization?

\*\*\*

G16—650/226

PHY/II/02 (R)