SIN

2010

PHYSICS - I (Optional)

100043

Standard : Degree **Total Marks : 200**

Nature : Conventional **Duration : 3 Hours**

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any four*** *by selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective question.*

(iv) *Sign at the beginning indicates the different part of the question.*

(v) *Make suitable assumptions, wherever be necessary and state the same.*

(vi) *Number of optional questions up to the prescribed number in the order in which they have been solved will only assessed. Excess answers will not be assessed*

(vii) *Credit will be given orderly, concise and effective writing.*

(viii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

(ix) *For each slab of* ***10*** *and* ***15*** *marks, the examinee is expected to write answers in* ***125*** *and* ***200*** *words respectively.*

1. Answer ***any four*** of the following : (10 marks each 40 marks)

(a) Explain the concept of centre of mass of a system of particles. Derive the law of conservation of linear momentum for a system of particles. **10**

(b) Define Ultrasonic waves. How ultrasonic waves are produced with a piezo-electric oscillator ? **10**

(c) Explain with necessary theory the production of circularly polarized light. Derive an equation for a circle. **10**

(d) What is green-house effect? Explain the causes and consequences of green house effect. **10**

(e) With the help of a diagram, explain the structure of atmosphere and temperature variations in different atmospheric layers. **10**

SECTION - A

2. Answer the following sub-questions:-

(a) State and prove Kepler's laws of planetary motion. **15**

(b) Define Young's modulus and Bulk modulus. Derive an equation which gives the relation between Young's modulus, Bulk modulus and Rigidity modulus. **10**

(c) Define coefficient of viscosity. Derive Poiseuille's equation for flow of liquid through a capillary tube of uniform cross-section. State the assumptions made in it. **15**

P.T.O.

Marks

3. Answer the following sub-questions.
   (a) State Newton's law of gravitation. Derive an expression for gravitational potential and field at a point inside a hollow spherical shell. **15**
   (b) Define modulus of rigidity. A cylinder of radius 'a' and length '*l*' is clamped at one end and is twisted at other end. Derive an expression for the couple required per unit twist. **10**
   (c) Define and explain angle of contact. State the factors on which it depends. **15**

SECTION - B

4. Answer the following sub-questions.
   (a) State the fundamental postulates of special theory of relativity and deduce Lorentz transformations. **15**
   (b) Define transverse wave and longitudinal wave. Explain the propagation of transverse wave. **15**
   (c) Describe the variable density method for recording of sound. **10**

5. Answer the following sub-questions.
   (a) What is the time dialation in Special Theory of Relativity? A certain process requires 10^{-6} sec. to occur in an atom at rest in laboratory. How much time will this process require to an observer in the laboratory, when the atom is moving with a speed of 5×107 metres/sec. **15**
   (b) Define simple harmonic motion. Derive an equation for linear simple harmonic motion. Obtain its solution and expression for angular frequency. **15**
   (c) Define intensity of sound. Deduce an expression for the intensity of plane progressive simple harmonic sound wave travelling in still air. **10**

SECTION - C

6. Answer the following sub-questions.
   (a) Explain the Formation of Newton's rings in reflected light. Show that the radius of the n^{th} dark ring is directly proportional to the square roots of natural numbers. **10**
   (b) Describe the construction and working of Michelson's interferometer. Explain the formation of circular fringes in it. **10**
   (c) Explain the phenomenon of Fraunhofer diffraction due to a single slit. Draw the intensity distribution curve. **10**
   (d) Define and explain resolving power of a grating. A plane diffraction grating has a total number of 25000 lines ruled over it. Find the resolving power of the grating in the first order and the smallest wavelength difference that could be resolved in the region of 5000 A.U. For this order. **10**

Marks

7. Answer the following sub-questions :

(a) Explain the formation of interference Fringes in a wedge-shaped film experiment. Fringes of equal thickness are observed in a thin glass wedge of refractive index 1.52. The Fringe spacing is 1mm and wavelength of light is 5893 A. Calculate the angle of wedge in seconds of an arc. **10**

(b) Explain the principle of Fabry-Perot Interferometer. How this instrument is used to study the difference in wavelength between two lines due to isotope structure of an element. **10**

(c) Explain Rayeleigh's criterion for the resolving power of an optical instrument. Derive an expression for the resolving power of a microscope. **10**

(d) Explain the theory of a concave diffraction grating. **10**

SECTION - D

8. Answer the following sub-questions.

(a) State Van der Waal's equation of state. Obtain expressions for critical pressure and critical temperature. **10**

(b) Explain reversible and irreversible processes. State the requisite conditions of a reversible cycle? **10**

(c) Define and explain thermionic emission. Derive Richardson-Dushmann equation for thermionic emission. **20**

9. Answer the following sub-questions.

(a) Describe Onne's method to liquefy helium. **10**

(b) State and explain Carnot's theorem. A Carnot engine whose low temperature reservoir is at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased ? **10**

(c) Explain the Fermi - Dirac statistics. Derive the necessary equation which gives Fermi-Dirac distribution law. **20**

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