

**2007**  
**PHYSICS - I (Optional)**

100059

**Standard : Degree****Total Marks : 200****Nature : Conventional****Duration : 3 Hours****Note :**

- (i) Answers must be written in **English** only.
- (ii) **Question No. 1 is Compulsory.** Of the remaining questions, attempt **any four** 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 upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.
- (vii) Credit will be given for 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) :**

- (a) Define angular momentum of a partical. Show that time rate of change of Angular Momentum of a partical is equal to the torque acting on it. **10**
- (b) What are ultrasonic waves ? Explain a method of production of ultrasonic wave by use of piezo-electric effect. Calculate the fundamental frequency of ultrasonic waves produced by quartz crystal of thickness ( $l$ ) = 0.5 mm. **10**  
(Given : Young's Modulus of quartz ( $Y$ ) =  $8 \times 10^{11}$  dyne/cm<sup>2</sup> and the density ( $\rho$ ) = 2.65 gm/cm<sup>3</sup>).
- (c) What do you understand by the term Polarization of light ? Describe the process of production of linearly polarized light by refraction. **10**
- (d) What do you mean by Atmospheric Pollution ? Explain. Describe Green-house effect. **10**
- (e) What do you know about stratospheric ozone depletion ? Discuss its causes. **10**

**P.T.O.**

## SECTION - A

## 2. Answer the following sub-questions :

- (a) Define gravitational potential. Explain ? Derive an expression for gravitational potential due to spherical body at a point out side the shell. 15
- (b) What is torsional pendulum ? Derive an expression for periodic time of the torsional pendulum. 10
- (c) State Bernoulli's theorem and deduce Bernoulli's equation. 15

## 3. Answer the following sub-questions :

- (a) State Newton's Laws of Motions. Newton's First law is simply a special case of Newton's second law of Motion. Explain ? Discuss the limitations of Newton's law of Motions. 15
- (b) Explain the term Elasticity with suitable example. State and explain Hook's Law. 10
- (c) Define surface Tension. State its SI unit and give its dimensions. A drop of water of 0.0005 meter radius is split into 1000 tiny drops of equal radii. Find mechanical work done. 15  
(Given : Surface Tension of water =  $75 \times 10^{-3}$  N/m).

## SECTION - B

## 4. Answer the following sub-questions :

- (a) Derive the relativistic length contraction using Lorentz transformation. A meter stick is projected into space and its length appears to be contracted to 50 cm. What is the velocity with which the stick is projected ? 15
- (b) The differential equation for damp natural Oscillation is  $\frac{d^2x}{dt^2} + 2b\frac{dx}{dt} + w^2x = 0$ , 15  
obtain the general solution for damp motion.
- (c) Explain in detail the principle and working of reproduction of sound on a CD. 10

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5. *Answer the following sub-questions :*

- (a) Explain construction and working of Michelson-Morley experiment, and discuss its negative result. 15
- (b) Define displacement resonance in Forced Oscillation. State the condition for displacement resonance and derive the expression for resonance frequency. 15
- (c) Explain in detail the principle and working of recording of sound on a cine film. 10

### SECTION - C

6. *Answer the following sub-questions :*

- (a) Explain the experimental arrangement of Newton's ring and obtain the condition for bright and dark rings. 10
- (b) Discuss the principle of Fabri-Perot interferometer and state its uses. 10
- (c) Distinguish between Fresnel and Frannhofer type diffraction. Explain Fresnell's half-period zones. 10
- (d) Give the theory of concave grating. 10

7. *Answer the following sub-questions :*

- (a) What is interference of light ? Discuss the necessary conditions for interference of light. 10
- (b) Draw a neat diagram of Twyann - Green Interferrometer and explain its working. 10
- (c) What do you understand by the resolving power of an optical Instruments ? Explain Rayleigh criterian for resolution. 10
- (d) Explain and derive an expression for resolving power of Prism. 10

P.T.O.

## SECTION - D

8. *Answer the following sub-questions :*

- (a) What are the assumptions of Kinetic theory of gasses ? State and prove Law of Equipartition of Energy. 10
- (b) Describe Carnot's reversible cycle and derive an expression for its efficiency. 10
- (c) Explain Bose-Einstein condensation. Maxwell's - Boltzmann distribution as a limiting case of Bose - Einstein and Fermi - Dirac Distributions. Explain ? 20

9. *Answer the following sub-questions :*

- (a) Using the law of Equipartition of Energy prove that, 10
- (i) for mono atomic gas,  $\gamma$  (gamma) = 1.66 and
- (ii) for diatomic gas,  $\gamma$  (gamma) = 1.4
- (b) Calculate the change in entropy when 10 gm of ice at 0 °C. melts to form water at the same temperature. 10
- (Given : Specific latent heat of ice = 80 cal/gm.)
- (c) Discuss experimental verifications of Maxwell's distribution of Molecular speeds. 20
- Calculate the RMS velocity of H<sub>2</sub> at 27 °C.
- (Given : Boltzmann constant (k) =  $1.38 \times 10^{-23}$  J/deg, and mass of Hydrogen Molecule =  $3.34 \times 10^{-27}$  kg.)

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