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(5th Semester)

PHYSICS

SEVENTH PAPER

(Classical Mechanics and Thermal Physics)

Full Marks : 55

Time : 2½ hours

(Pre-Revised)

(PART : B—DESCRIPTIVE)

(Marks : 35)

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

1. (a) What are Kepler's laws of planetary motion? 2
- (b) Deduce Kepler's laws of planetary motion from Newton's law. 5

Or

- (a) Using Lagrangian formulation, obtain the equation of motion of a simple pendulum and hence deduce the formula for its time period for small amplitude oscillations. 5
- (b) Show that for equilibrium of a system, the virtual work of applied forces is zero. 2

2. What is Brownian motion? Discuss Einstein's theory of translational Brownian motion. 1+6=7

Or

- (a) What is meant by 'mean free path' of a molecule of a gas? Derive an expression for mean free path. 1+4=5
- (b) Discuss the law of distribution of free path. 2

3. (a) Using Maxwell's thermodynamic relations, deduce (C_p C_v) relations for perfect and real gases. 5
- (b) Using Maxwell's relations, derive the first $T dS$ equation. 2

Or

- (a) What do you understand by the transport phenomena of gases? 2
- (b) Derive an expression for the coefficient of thermal conductivity. 5

4. (a) Explain the term 'phase space'. 2
- (b) Calculate the number of phase cells in the energy range O to E for a linear simple harmonic oscillator of mass m and frequency . 5

Or

Derive the condition of equilibrium between two systems in thermal contact and explain how it links with macroscopic physics. 7

5. (a) Using MB statistics, derive an expression for total internal energy and specific heat at constant volume of an ideal gas. 5
- (b) Discuss Bose-Einstein statistics. 2

Or

In quantum statistics, h is selected as a constant by nature', explain by using the case of particle in one-dimensional box. 7

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Subject Code : **V**/PHY (vii) (PR)

Booklet No. **A**

Date Stamp

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To be filled in by the Candidate

DEGREE 5th Semester
(Arts / Science / Commerce /
.....) Exam., **2016**

Subject

Paper

**To be filled in by the
Candidate**

DEGREE 5th 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)

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V/PHY (vii) (PR)

2 0 1 6

(5th Semester)

PHYSICS

SEVENTH PAPER

(Classical Mechanics and Thermal Physics)

(Pre-Revised)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

SECTION—I

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the
brackets provided : 1×5=5

1. A rigid body moving freely in space has degree of freedom

(a) 3 ()

(b) 6 ()

(c) 9 ()

(d) 4 ()

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(2)

2. The kinetic energy per unit volume of a perfect gas is equal to

(a) $\frac{2}{3}P$ ()

(b) $\frac{3}{2}P$ ()

(c) $\frac{P}{3}$ ()

(d) $\frac{1}{2}P$ ()

where P is pressure.

3. The variation of C_V with volume is zero for

(a) real gas ()

(b) ideal gas ()

(c) both real and ideal gases ()

(d) None of the above ()

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(3)

4. The value of probability of an event cannot be

(a) zero ()

(b) 1 ()

(c) $\frac{1}{2}$ ()

(d) negative ()

5. The particles obeying Maxwell-Boltzmann statistics are

(a) identical ()

(b) identical and indistinguishable ()

(c) distinguishable ()

(d) photons ()

(4)

SECTION—II

(Marks : 15)

Answer the following questions :

3×5=15

1. State and prove d'Alembert's principle.

(5)

- 2.** Deduce the average velocity of a gas molecule.

(6)

3. What do you mean by triple point?

(7)

4. Explain the principles of equal and a priori probabilities.

(8)

5. Explain Fermi-Dirac statistics.

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