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(1st Semester)

PHYSICS

FIRST PAPER

(Mechanics and Thermodynamics)

(Pre-revised)

Full Marks : 55

Time : 2½ hours

(PART : B—DESCRIPTIVE)

(*Marks* : 35)

The figures in the margin indicate full marks for the questions

1. *(a)* For a particle moving in a plane, find an expression for the radial and transverse components of velocity and acceleration. 4

(b) Show that a central force is conservative. 3

Or

(a) Show that the motion of centre of mass of a system of particles relative to an inertial frame of reference is same as that of a single particle of mass equal to the total mass of the system under the action of external force. 3

(b) Explain what you understand by Coriolis force. What is the action of Coriolis force on a body freely falling towards earth? 4

2. *(a)* Derive an expression for the moment of inertia of a spherical shell about its diameter. 5

(b) What physical quantities are conserved during elastic and inelastic collisions? 2

Or

(a) State the basic postulates of Einstein's special theory of relativity. Hence deduce Lorentz transformation equations. 1+4=5

(b) What would be the speed of a body so that its moving mass is twice its rest mass? 2

3. *(a)* Derive the expression for the moment of restoring couple in the case of a solid cylinder of length L when it is twisted through an angle radian at the free end. Compare this moment with that of a hollow cylinder of the same length, material and mass. 6

(b) Show that Poisson's ratio lies between -1 and $0 \cdot 5$. 1

Or

(a) Deduce Poiseuille's equation for the flow of liquid through a narrow horizontal tube. 5

(b) The excess pressure inside a soap bubble of radius 8 mm balances 2 mm column of oil of density $0 \cdot 8$ g/cm^3. Calculate the surface tension of the soap solution. 2

4. *(a)* What are the specific heats of an ideal gas? Find the relation between them. 1+4=5

(b) Density of hydrogen at NTP is $0 \cdot 000098$ g/cm^3. Find the r.m.s. velocity of hydrogen molecules at NTP. 2

Or

(a) Find the expression for pressure exerted by real gas. 5

(b) Define coefficient of thermal conductivity and find its dimension. 2

5. *(a)* What are the essential parts of Carnot's heat engine? Show that in Carnot's heat engine, during each cycle, the mechanical work obtained is numerically equal to the area of the Carnot's cycle. 1+4=5

(b) What are the limitations of first law of thermodynamics? 2

Or

(a) Derive the four Maxwell's thermodynamic relations. 5

(b) What are the four thermodynamic potentials? 2

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Subject Code : PHY/I/01 (PR)

Booklet No. A

Date Stamp ....

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To be filled in by the Candidate

DEGREE 1st Semester
(Arts / Science / Commerce / ....) Exam., **2017**

Subject ....

Paper ....

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, over-writing 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.**

To be filled in by the Candidate

DEGREE 1st Semester
(Arts / Science / Commerce / ....) Exam., **2017**

Roll No. ....

Regn. No. ....

Subject ....

Paper ....

Descriptive Type
Booklet No. B ....

Signature of Scrutiniser(s)

Signature of Examiner(s)

Signature of Invigilator(s)

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2 0 1 7

(1st Semester)

PHYSICS

FIRST PAPER

(Mechanics and Thermodynamics)

(Pre-revised)

(PART : A—OBJECTIVE)

(*Marks* : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 5)

Tick (✓) the correct answer in the brackets provided : 1×5=5

1. The areal velocity of a particle moving under the influence of central force is

(a) area swept out by radius vector per second ( )

(b) two times the area swept out by radius vector per second ( )

(c) a variable ( )

(d) half of the area swept out by radius ( )

2. If the moment of inertia of a disc about an axis through its centre and perpendicular to its plane is $\frac{MR^2}{2}$, then its moment of inertia about its diameter is

(a) $\frac{2MR^2}{3}$ ( )

(b) $\frac{2MR^2}{5}$ ( )

(c) $\frac{MR^2}{4}$ ( )

(d) $\frac{5MR^2}{4}$ ( )

3. The angle of contact between the liquid surface and solid surface varies from

(a) 0° to 90° ( )

(b) 0° to 360° ( )

(c) 0° to 180° ( )

(d) 90° to 180° ( )

4. The atomicity of diatomic gas is

(a) $\frac{5}{2}$ ( )

(b) $\frac{7}{5}$ ( )

(c) $\frac{5}{3}$ ( )

(d) $\frac{9}{7}$ ( )

5. If temperature of the sink of Carnot engine is absolute zero, then efficiency is

(a) 0% ( )

(b) 50% ( )

(c) 100% ( )

(d) undefined ( )

SECTION—B

(*Marks* : 15)

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

1. State and prove work-energy theorem.

2. Find the speed of a spacecraft whose clock runs 1 second slower for every hour when measured using a stationary clock on the earth.

3. What is the significance of Reynolds' number?

4. State and explain the law of equipartition of energy.

5. Explain the impossibility of attaining the absolute zero temperature.

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