Total No. of printed pages = 4

3 (Sem-1) PHY M2 (BU)

2018

PHYSICS

(Major)

Paper : 1·2

Full Marks – 60

Time – Three hours

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

[MECHANICS]

1. Answer the following questions : 1×5=5

   (a) What is the basic property of inertial frame of reference ?

   (b) Distinguish between elastic and in-elastic collision.

   (c) Mention one example of conservative force.

   (d) Write down the condition at which the flow of liquid will be turbulent.

(e) Write any two factors on which coriolis force depends.

2. (a) What are Galilean transformation ? State and prove Galilean invariance. 1+4=5

(b) What is a Geo-stationary satellite ? Calculate the height of the orbit above the surface of the earth in which a satellite, when placed, become stationary (radius of earth = 6400 km, g = 9·8 m/sec^2). 2+3=5

3. Answer any *five* questions : 2×5=10

(a) Show that the law of conservation of linear momentum is invariant in Galilean transformation.

(b) Prove that angular momentum remain constant under the central force.

(c) In case of an one dimensional elastic collision, prove that the relative velocity before and after collision remain constant.

(d) Calculate the moment of inertia of a solid circular cylinder of radius 20 cm and length 10 cm about its own axis. Density of the material is 3·14 gm/cc.

(e) The masses and positions of two particles are 6kg $(6\mathbf{i} + 7\mathbf{j})$ and 2kg $(2\mathbf{i} + 11\mathbf{j} - 8\mathbf{k})$. Find the position of centre of mass.

(f) Show that the direction of the acceleration and force are opposite to the direction of motion of the vibrating particle in Simple Harmonic Motion.

4. Answer any *three* questions : 5×3=15

(a) Derive the expression for the gravitational potential at a point outside of a solid sphere. 5

(b) What is damped vibration ? Obtain the differential equation of motion for a damped harmonic oscillator. 1+4=5

(c) Show that the coriolis force is nothing but the consequence of rotation of frame of reference. 5

(d) Establish the relation

$$\eta = \frac{Y}{2(1+\sigma)}$$

Where η is modulus of rigidity, Y is Young's modulus and σ is Poisson's ratio. 5

5. Answer any *two* questions : $10 \times 2 = 20$

(a) (i) Express conservative force as a negative gradient of potential energy. 5

(ii) The length of a copper wire increases by 0·5 cm when it is loaded with a weight of 5 kg. Calculate work done in stretching the wire. 5

(b) Define reduce mass. With proper diagram, reduce two body problems to one body problem and then obtain equation of motion for equivalent one body problem for two masses. 2+8=10

(c) (i) Prove that the length of an object measured in a frame of reference moving with respect to an observer is smaller than the length of the same object as observed in stationary frame. 5

(ii) On the basis of Lorentz transformation discuss the variation of time with velocity according to special theory of relativity. 5