

Roll No.

Total Pages : 4

235102

December, 2019

B.Sc. (Hons.) Physics- I SEMESTER

Mechanics (BPH-102)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART - A

1. (a) Define elastic potential energy. Give its expression.
[CO-1] (1.5)
- (b) What are the features of central force motion?
[CO-3] (1.5)
- (c) State Kepler's laws. [CO-3] (1.5)
- (d) A particle vibrates with SHM of amplitude 0.06 m and time period 31.4 s. Calculate its maximum velocity.
[CO-3] (1.5)

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- (e) What is impulse? State its units. [CO-1] (1.5)
- (f) Define moment of inertia. What is its physical significance? [CO-2] (1.5)
- (g) Do photons have mass? If no, then how photons have momentum? [CO-4] (1.5)
- (h) What is Hooke's law? What do you mean by elastic limit? [CO-2] (1.5)
- (i) What is laboratory and centre of mass frame of reference? [CO-4] (1.5)
- (j) What do you understand by Coriolis force? Write its few applications. [CO-4] (1.5)

PART - B

2. (a) Establish the following relation for a rocket

$$V_f = V_{rel} \log_e (M_o/M_f).$$
 [CO-1] (10)
- (b) A phonograph for turntable rotates at 33.3 revolutions per minute. What is the frequency of revolution, angular velocity and period of motion? [CO-1] (5)
3. (a) What is meant by conservative force? Show that for a conservative force field, a scalar function $U(r)$ can be defined as $F(r) = -\nabla U(r)$. Also show that $\nabla \times F(r) = 0$. [CO-1] (7)

- (b) Show that in perfectly inelastic collision in laboratory system there is always loss in kinetic energy. [CO-1] (8)

4. What is driven harmonic oscillator? Set up a differential equation of motion for such a oscillator. Discuss the transient and steady state terms in complete solution. Discuss the condition of resonance. [CO-3] (15)
5. (a) Calculate the radius of gyration of a solid sphere rotating about a diameter, if its radius is 5.0 cm. [CO-2] (5)
- (b) Derive the expression for the moment of inertia of a hollow sphere about a diameter. [CO-2] (10)
6. (a) State the postulates of special theory of relativity and hence deduce the Lorentz transformations. [CO-4] (10)
- (b) Find the speed that a proton must be given if its mass is to be twice its rest mass 1.67×10^{-27} kg. [CO-4] (5)

7. (a) How can a two body problem can be reduced to one body problem for central force motion? Also write the concept of reduced mass. [CO-3] (10)
- (b) Show variation of gravitational potential and field due to a spherical shell graphically. [CO-2] (5)
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