RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

FIRST YEAR [BATCH 2018-21] B.A./B.Sc. SECOND SEMESTER (January – June) 2019 Mid-Semester Examination, March 2019

Date : 27/03/2019

PHYSICS (General) Paper : II

Time : 11 am – 12 noon

Answer <u>any five</u> questions taking at least <u>one from each group</u>

<u>Group – A</u>

- 1. a) What do you mean by center of mass for a system of particles? Write down the equation of motion for this system of particles.
 - b) A water molecule consists of an oxygen atom with two hydrogen atoms bound to it. The angle, between the two bonds is 106° . If the bonds are 0.1 nm long, where is the center of mass of the molecule? ($1nm = 10^{-9}m$)



2. a) Show that the moment of inertia of a uniform disc of radius *a* and mass M about an axis passing through its center and perpendicular to the disc is $\frac{1}{2}$ Ma².

- b) Find an expression for the rotational kinetic energy of a rigid body.
- c) Consider an oxygen molecules(O₂) rotating in the xy plane with angular speed 4.6×10^{12} rad/s about the z axis. The axis passes through the center of the molecule , perpendicular to tis length. The mass of each oxygen atom is 2.66×10^{-26} kg, and at room temperature the average separation between the two atom is $d = 1.21 \times 10^{-10}$ m. Calculate the moment of inertia and rotational kinetic energy of the molecule about the z-axis. [1+1]
- 3. a) Define central force.
 - b) For a particle moving in a central force show that
 - (i) the orbit of a particle must be a plane curve.
 - (ii) the angular momentum of the particle is conserved.
 - (iii) the particle sweeps equal areas in equal times.
- 4. A vibrating system is resisted by a force proportional to the first power of velocity. Show that the amplitude of damped vibrations decays exponentially with time when the damping factor is very high compared to the natural frequency.
- 5. What is simple harmonic motion? A particle of mass m is attached to the midpoint of a vertical light string stretched between two rigid supports under a constant tension. Find the time period of small horizontal oscillation.

[5]

[1+4]

[1+1+1]

Full Marks : 25

[5×5]

[1+1]

[3]

[2]

[1]

[2]

<u>Group – B</u>

6.	a)	How bright and dark rings are formed in Newton's ring arrangement.	[3]
	b)	How do you get bright ring at centre in Newton's ring arrangement.	[2]
7.	a)	What is zone plate?	[2]
	b)	In a Newton's ring apparatus, the radius of curvature of the lower surface of the convex lens is 10 metre. The K^{th} and $(K+6)^{th}$ dark rings are found to have radii 3 mm and 7 mm respectively. Find	
		the wavelength of the light used.	[3]
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