

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

FIRST YEAR [BATCH 2017-20]

B.A./B.Sc. SECOND SEMESTER (January – June) 2018

Mid-Semester Examination, March 2018

Date : 16/03/2018

PHYSICS (General)

Time : 11 am – 12 noon

Paper : II

Full Marks : 25

Answer any five questions taking at least one from each group

[5×5]

Group – A

1. a) Define torque and angular momentum. Deduce a relationship between them. [3]
b) A particle of mass 'm' moves along a space curve defined by $\vec{r} = a \cos \omega t \hat{i} + b \sin \omega t \hat{j}$. Find (i) the torque and (ii) the angular momentum about the origin. [2]
2. a) Show that the center of mass of a rod of mass 'M' and length 'L' lies midway between its ends, assuming the rod has a uniform mass per unit length. [2]
b) Show the total linear momentum of a system of particles about the center of mass is zero. [2]
c) What are the advantages of using center of mass frame over the laboratory frame. [1]
3. a) State and prove the parallel axis theorem of moment of inertia. [1+3]
b) Using parallel axis theorem determine the moment of inertia of a uniform rigid rod of mass 'M' and length 'L' about an axis perpendicular to the rod and passing through one end of the rod. Note that the moment of inertia of the rod about an axis perpendicular to the rod and passing through the centre of mass is $I_{CM} = \frac{1}{12} ML^2$. [1]
4. a) Write down the equation of motion of a particle of mass 'm' subject to a restoring force proportional to displacement and frictional force proportional to its velocity. [1]
b) Solve the equation and show when the motion will be oscillatory. [4]
5. a) Define Simple Harmonic Motion. [1]
b) Some liquid is taken in a U-tube of uniform cross section. If liquid in one arm of the tube be pressed and released, show that it executes SHM. Find the time period of oscillation. [Neglect damping] [4]

Group – B

6. How interference pattern occurs in Newton's ring experiment? [5]
7. How zone plate behaves like a convex lens. [5]

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