

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [2015-18]

B.A./B.Sc. THIRD SEMESTER (July – December) 2016

Mid-Semester Examination, September 2016

Date : 17/09/2016

PHYSICS (General)

Time : 12 noon – 1 pm

Paper : III

Full Marks : 25

Group – A

(Answer any three questions)

1. a) A rocket is propagating in free space by ejecting gases at constant rate. Find the expression of velocity by assuming initial velocity was v_0 and initial mass was m_0 . Why the terminal velocity can't be increased beyond a certain limit? [3]
b) How multistage rockets can attain much more velocity than a single stage rocket? [2]
2. a) Earth is rotating with constant angular velocity $\omega = 7.3 \times 10^{-5}$ rad/sec. Before making any approximation, identify the different terms appear in the expression of the equation of motion of a particle on the Earth surface frame. [3]
b) Now, by making suitable approximation with proper explanation reduce the equation of motion of the particle near the Earth's surface. [2]
3. a) Write the equation of motion of a particle moving under central force. Show that total energy is a constant of motion for a particle moving under central force. [3]
b) Prove that if a planet is to revolve around the Sun in an elliptical path with the Sun at one of its focus, the central force necessarily varies inversely as the square of the distance of the planet from the Sun. [2]
4. a) State the law of conservation of angular momentum. Give one example of its application. [2]
b) A particle of mass 'm' moves in a circle of radius r at an angular speed ' ω ' about z-axis in a plane parallel to but a distance 'h' above x – y plane. Find the magnitude and direction of angular momentum. [3]
5. a) Show that the position of the centre of mass of a system of particles is quite independent of the frame of reference used. [3]
b) Prove that centre of mass of a uniform right angled triangular region is the centroid of the area. [2]

Group – B

(Answer any two questions)

6. a) How interference patterns are formed in a Newton's ring experiment? [2]
b) In a Newton's ring apparatus, the radius of curvature of the lower surface of convex lens is 10 meter. The Kth and (K+6)th dark ring are found to have radii 3 mm and 7 mm respectively. Find the wavelength of the light used. [3]
7. a) Write two differences in Fresnel and Fraunhofer class of diffraction. [2]
b) Find out the area of half period zone. [3]
8. How principal maxima and minima are formed in a single slit diffraction pattern. [5]