

(i) Printed Pages : 3

Roll No.

(ii) Questions : 7. Sub. Code :

1	1	7	1	8
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Exam. Code :

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**Bachelor of Science (FYUP) 1st Semester
(2124)**

PHYSICS

Paper : Mechanics PHYDSC1

Time Allowed : Three Hours]

[Maximum Marks : 60

Note :— (1) Attempt **FIVE** questions in all, selecting **TWO** from each from Unit-I and Unit-II.

(2) Unit-III is compulsory.

(3) Use of Non-programmable Scientific Calculator is allowed.

UNIT—I

1. (a) What is Cartesian and spherical polar coordinate system ? Find the expression for velocity and acceleration in spherical polar coordinate system. 7
- (b) Define solid angle. Derive an expression for it. Also show that the value of solid angle subtended by sphere at its center is 4π Steradian. 5
2. (a) Show that the rotational invariance leads to law of conservation of angular momentum. 8

- (b) Neutron with mass 1.67×10^{-27} Kg moving with velocity 10^7 m/s collides with a deuteron at rest and sticks to it. Calculate the velocity of the combination. (Given, mass of Deuteron is 3.34×10^{-27} Kg). 4
3. (a) State and prove Kepler's laws of planetary motion. 8
- (b) Show that for elastic collisions in lab frame of reference $\phi + \alpha = 90^\circ$. 4

UNIT—II

4. (a) Obtain an expression for Moment of Inertia tensor and hence define Principal and Product Moment of Inertia. 8
- (b) Consider two frames S and S' such that S' is moving with velocity $\vec{v} = 3\hat{i} + 4\hat{j} + 6\hat{k}$ ms⁻¹ relative to S. If origins of two frames coincide initially and coordinates of any point after 3 sec are (6, 7, 8) meter in S, then find coordinates of same point from S'. 4
5. (a) What is Coriolis force ? Show that Coriolis and centrifugal forces are consequences of rotating frame of reference. 9
- (b) Show that displacement is invariant under Galilean transformation. 3
6. (a) State fundamental postulates of special theory of relativity. Obtain Lorentz transformation equation for two inertial frames moving with respect to each other. 9

- (b) A young lady decides on her birthday to appear thin to her husband. How fast does she need to move with respect to her stationary husband to appear thinner by a factor of 50% ?

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UNIT—III

7. Attempt any **SIX** parts. Each part carries **2** marks :

- (a) Define potential energy and kinetic energy.
- (b) Define conservation law of linear and angular momentum.
- (c) What is the value of net internal forces in rigid body ? Justify your answer.
- (d) Define fictitious forces.
- (e) What is the difference between central and non-central forces ?
- (f) What are inertial and non inertial frames of reference ?
- (g) What are elastic and inelastic scattering ?
- (h) Define length contraction.

$6 \times 2 = 12$