

(i) Printed Pages : 3 Roll No.

(ii) Questions : 7 Sub. Code :

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Exam. Code :

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**Bachelor of Science (FYUP) 1st Semester
(2125)**

PHYSICS

Paper : Mechanics PHYDSC1

Time Allowed : Three Hours] [Maximum Marks : 60

Note :— (i) Attempt **five** questions in all, selecting **two** questions each from Unit I and II. Unit III is compulsory.

(ii) Use of non-programmable calculator is allowed.

UNIT—I

1. (a) Determine the turning points in the trajectory of a particle moving under a central force. Also discuss the relation of shape of trajectory with total energy.
(b) A satellite is moving in a nearly circular orbit around the earth. Show that the air friction will increase the velocity of satellite. 9,3
2. (a) Define spherical polar coordinates. Derive an expression for volume element in this system.
(b) The polar coordinates of a point are $(r, \theta, \varphi) = (8, 30^\circ, 45^\circ)$. Find the Cartesian coordinates of the same point. 8,4

3. (a) State homogeneity of flow of time. Prove that the law of conservation of energy is a consequence of homogeneity of time.
- (b) Briefly discuss the various forces in nature. 8,4

UNIT—II

4. (a) Derive an expression for relativistic variation of mass with velocity.
- (b) A spaceship is 50 m long on the ground. When it is in flight, its length appears to be 49 m to an observer on the ground. Find the speed of the spaceship. 8,4
5. Describe Michelson-Morley experiment. What conclusions do you draw from it? 12
6. (a) What is meant by Galilean transformation and Galilean invariance? Show that the laws of conservation of momentum and energy are invariant under Galilean transformations.
- (b) What are inertial and non-inertial frames of reference? Explain with examples. 9,3

UNIT—III

7. Attempt any **six** parts :
- (a) What do you mean by time dilation?
- (b) Two photons are moving towards each other. What is their relative velocity?

- (c) How will you say that Galilean transformations are the special case of Lorentz transformations?
- (d) What is relativistic Doppler effect?
- (e) What is the limit of radial distance, zenith angle and azimuthal angle in spherical polar coordinates?
- (f) State Kepler's third law.
- (g) What is solid angle? What are its units?
- (h) What are conservative and non-conservative forces?

2×6=12