

Lecture : 09

B. Sc. (Hon.) Part-I

Paper - I

**Physics Course: Mechanics and
Properties of Matter**

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I. KEPLER'S LAWS

Kepler's three laws on planetary motion are as following:

1. All planets move in elliptical orbits with the Sun at one focus.
2. A line drawn from the Sun to any planet sweeps out equal areas in equal time intervals.
3. The square of the orbital period of any planet is proportional to the cube of the average distance from the planet to the Sun.

II. GRAVITATIONAL POTENTIAL

The change in the gravitational potential energy of a system is related to work done by the gravitational force. The gravitational potential energy of a system of particles is equal to negative of the work by the gravitational force as a particle is brought from infinity to its position in the presence of other particles of the system.

The gravitational potential represents the gravitational potential at a distance r from mass M is given by

$$U = - \int \frac{GM}{r}, \quad (1)$$

where G is the universal gravitational constant.

III. GRAVITATIONAL FIELD

The space around a body where the gravitational force exerted by it can be experienced by any other particle is known as the gravitational field of the body. The strength of this gravitational field is referred to as intensity, and it varies from point to point.

A. Field of a point mass

The gravitational field of a point mass is the force experienced by unit mass, means that the field at a distance r from a point mass M is

$$F = \frac{GM}{r^2}. \quad (2)$$