SEMESTER 1ST

STUDY METERIAL

MODULE 1 : ORIGIN OF THE UNIVERSE, SOLAR SYSTEM AND EARTH'S EVOLUTION

SUBJECT -GEOGRAPHY

Tidal Hypothesis

The Tidal Hypothesis was proposed by **T. C. Chamberlin and F. R. Moulton in 1905** to explain the origin of the Solar System. According to this hypothesis, the formation of the planets was the result of gravitational or tidal forces generated by a close encounter between the Sun and a passing star. This theory is also known as the **Planetesimal Hypothesis**, as it emphasizes the role of small solid bodies in planet formation.

According to the hypothesis, during the early stage of the Solar System, the Sun existed as an isolated mass of hot gaseous matter in space. At that time, a massive star passed very close to the Sun. The strong gravitational attraction of this passing star produced intense tidal forces on the Sun, causing long streams or tongues of incandescent gaseous material to be pulled out from its surface. This ejected matter was stretched into space due to the combined gravitational effects of the Sun and the passing star.

As time progressed, the ejected gaseous matter gradually cooled and condensed to form numerous small solid bodies known as **planetesimals**. These planetesimals moved around the Sun in elliptical orbits and, through mutual collision and gravitational attraction, gradually coalesced to form larger bodies. Eventually, these larger bodies developed into the planets, satellites, and other minor members of the Solar System, including the Earth.

The Tidal Hypothesis has certain merits. It successfully introduced the concept of planetesimals, which later became significant in explaining planetary accretion processes. The theory also highlighted the importance of gravitational forces in shaping celestial bodies and contributed to the advancement of astronomical thought during the early twentieth century.

However, the hypothesis has been widely criticized on scientific grounds. The probability of a star passing sufficiently close to the Sun is extremely low. Moreover, the hot gaseous material pulled from the Sun would disperse rapidly instead of condensing into solid bodies. The theory also fails to satisfactorily explain the angular momentum and orbital characteristics of the planets. Due to these limitations, the Tidal Hypothesis is no longer accepted by modern scientists.

In conclusion, although the Tidal Hypothesis is not considered valid today, it played an important role in the historical development of theories concerning the origin of the Solar System. It laid the foundation for later and more refined models by introducing the idea of planetary formation through the accumulation of smaller bodies.

STUDY METERIAL- 2

MODUL 3: DYNAMIC EARTH

Plate Tectonics

The theory of **Plate Tectonics** is one of the most important concepts in physical geography and geology. It explains the large-scale movements of the Earth's lithosphere and provides a scientific basis for understanding the distribution of continents and oceans, earthquakes, volcanoes, mountain building, and ocean floor features. The modern theory of plate tectonics was developed during the **1960s**, building upon earlier ideas such as **Alfred Wegener's Continental Drift Theory**.

According to the theory, the Earth's outer rigid layer, known as the **lithosphere**, is broken into several large and small fragments called **tectonic plates**. These plates include major plates such as the **Pacific Plate, Eurasian Plate, African Plate, Indo-Australian Plate, North American Plate, South American Plate, and Antarctic Plate**. The lithospheric plates float and move slowly over the semi-molten and ductile layer beneath them called the **asthenosphere**. Plate movement is driven mainly by forces such as **mantle convection currents, ridge push, and slab pull**.

The movement of tectonic plates occurs at a very slow rate, usually a few centimeters per year, but over geological time this movement produces significant changes on the Earth's surface. Based on the nature of their movement, plate boundaries are classified into three main types: **divergent, convergent, and transform boundaries**. At divergent boundaries, plates move away from each other, leading to the formation of mid-oceanic ridges and new oceanic crust. At convergent boundaries, plates move towards each other, resulting in subduction zones, deep-sea trenches, fold mountains, and volcanic activity. At transform boundaries, plates slide past each other horizontally, causing earthquakes without creating or destroying crust.

The theory of plate tectonics successfully explains the global distribution of earthquakes and volcanoes, the formation of fold mountains such as the Himalayas, the origin of ocean basins, and the presence of similar fossils and rock formations on different continents. It is widely accepted as a unifying theory in Earth sciences.

In conclusion, plate tectonics provides a comprehensive framework for understanding the dynamic nature of the Earth's surface. It explains how internal forces shape the planet and helps in predicting geological hazards. Due to its explanatory power and scientific evidence, plate tectonics is regarded as a fundamental theory in modern geography and geology.