Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (First Year)

Subject: Geology

Paper Code: GEC 101

Paper Title: Fundamentals of Mineral Science

Unit: I

Module Name: Earth in the Solar system- origin, size, shape and age of the Earth - 2

Module No: 03

Name of the Presenter: Ms. Yogita Karkhanis

Notes:

Origin of Earth:

- The Earth and the other 7 planets and the Sun accreted at about the same time from a vast cloud of dust and gas (nebula).
- Nebular Concept
- The Earth formed about 4.6 Ga ago
- The Oldest rock dates 3.8 Ga

Shape of the Earth:

- The earth is not a perfect sphere.
- Besides differences in relief (uneven surface there is a slight bulge at the equator due to the rotation of the Earth.

- The angular velocity for matter at the equator is maximum and therefore the gravitational force is slightly less due to greater centripetal force.
- Towards the poles the angular momentum decreases and the inward gravitational pull is stronger.
- Towards the poles the angular momentum decreases and the inward gravitational pull is stronger.
- If the Earth were everywhere at sea level (smoothening out the topographic differences) its shape the Geoid (or figure of Earth) would closely approximate an ellipsoid of rotation with an equatorial axis longer than the polar axis by about 43 kms. This shape of the Earth is described as an OBLATE SPHEROID.
- It is slightly flatter at the poles.

Size of the Earth:

Earth – Oblate Spheroid… and Pear Shaped	
Mean Radius:	6,371 km
Equatorial Radius:	6,378.4 km
Polar Radius:	6,356.9 km
Equatorial Circumference:	40,077 km
Meridional (Longitude) Circumference:	40,009 km
Mean Circumference:	40,043 km

- The equatorial radius of the Earth is 21 kms longer that the polar radius. At the equator the radius is about 6378 kms and at the poles the radius is 6356 kms. The mean radius is 6371 kms.
- It has also been determined from the data derived from satellites that the radius from the centre to the North Pole is slightly longer than the radius to the South Pole.
- Therefore, the Earth is now sometimes described as pear shaped wherein the maximum bulge is slightly below the equator.

Surface Area:	510 Million Sq. km
Land Area:	149 Million Sq. km (29.2%)
Water Area:	361 Million Sq. km (70.8%)
Volume:	1.08 x 1012 km3
Mass:	5.97 x 1024 kg
Mean Density:	5.51 kg/m3
Equatorial Surface Gravity:	9.780 m/s2 (0.99 g)

- Mountain ranges and ocean basins along with local variations in density and gravity also add to the minor distortions of shape at the surface.

Earth's Four Spheres

- Geosphere/Lithosphere: Comprises the solid Earth and includes both Earth's surface and the various layers of the Earth's interior.
- Atmosphere: Gaseous envelope that surrounds the Earth and constitutes the transition between its surface and the vacuum of space

- Hydrosphere: Includes all water on Earth (including surface water and groundwater)
- Biosphere: The life zone of the Earth and includes all living organisms, and all organic matter that has not yet decomposed.

Lithosphere/Geosphere

- 94 % percent of the earth is composed of the elements oxygen and silicon (combined as the compound silica [silicon oxide: SiO_2]), iron and magnesium
- Interior of the earth is layered both chemically and mechanically.

Atmosphere

- The swirling clouds of the atmosphere represent the very thin blanket of air that covers our planet.
- It is not only the air we breathe, but protects us from harmful radiation from the sun.
- Consists of a mixture of gases composed primarily of nitrogen, oxygen, carbon dioxide, and water vapour

Hydrosphere

- The global ocean is the most prominent feature of our (blue) planet.
- The oceans cover ~71% of our planet and represent 97% of all the water on our planet.
- Range of surface temperatures and pressures of our planet permit water to exist in all three states: solid (ice), liquid (water), and gas (water vapour).

Biosphere

- Life evolved on earth during its early history by at least 3.5 billion years ago and the biosphere readily distinguishes our planet from all others in the solar system (as far as we know)
- includes all life on Earth - concentrated at the surface.
- Plants and animals don't only respond the their environment but also exercise a very strong control over the other parts of the planet.