Handouts

EDU515 Teaching of Geography

Lecture 1 (1 – 5)

Topic 1

Defining Geography -1

According to Greek philosophers, Geography is a subject of “the description of the Earth” “Geo” means the earth and “Graphy” means the description. Most people think that geographers are concerned with naming places, drawing maps and writing travel descriptions. Geography is a field of science dedicated to the study of the land, features, inhabitants, and the phenomena of the Earth. Geography is a spatial science with organized knowledge of the earth as the world of man. Spatial word is related to space.

Geography is the branch of science which deals with the study of earth and its physical and human environment with respect to its spatial and temporal variations. "To provide accurate, orderly, and rational description and interpretation of the variable character of the earth surface" explained by Richard Hartshorne, in 1959. The old definition of geography is “The purpose of geography is to provide "a view of the whole" earth by mapping the location of places” by Ptolemy explained in 150.

In the context of physical environment it deals with the entire physical and natural phenomenon. All the meteorological, geological and geomorphic processes are studied under this umbrella. While in the context of human environment, it deals with all the types of human activities i.e. population, migration, economic activities etc.

Spatial variation means, the difference in the magnitude of a same phenomenon at two different places i.e. degree of temperature and rainfall at two different places while temporal variation means the occurrence of a same phenomenon at same place but at different time. For example, difference in temperature of Lahore in 1960s and in 2000s.

Topic 2

Defining Geography -2

Geography can be defined

- Study of natural features of the Earth’s surface.
- Study of cultural feature of the Earth’s surface.
• Study of the Man - Environment interaction
• Study of natural features of the Earth’s surface
• Topography.
• Climate.
• Soil.
• Vegetation
• Study of cultural feature of the Earth’s surface.
  1. Human activities related to production like agriculture, mining, industry, etc.
  2. Human activities related to services like, transportation, trade, communication, etc.

  1. Activities related to production
     (Wheat production in Pakistan)
  2. Activities related to services
     (Trade through Panama Canal)

**Topic 3**

**Study of Man - Environment interaction**

Desert Environment: Deserts receiving less than 10 inches of annual rainfall

Study of Man – Environment Interaction

  1. Lithosphere
  2. Atmosphere
  3. Hydrosphere
  4. Biosphere
  5. Particular set of conditions as Mountain Environment
Topic 4

History of Geography

The introduction of Geography as a separate discipline and the developments of all the recent techniques in the field of Geography to enhance its worth is not the matter of nights. It takes a long time to develop. The History of Geography is too old as that of the mankind on the surface of earth. Different scholars of different ages contributed their services to develop the subject. Greeks are credited to be the father of Geography. The word Geography is derived from the Greek word “Geographia” means the study of Earth. Erastothene, a famous Greek Scholar, is considered as the father of Geography. He used the word “Geography” for the first time in the history. Later on, Romans, Arabs, Portuguese, Dutch, French and other European Geographers contributed their efforts. At present, Geography is not limited to the social sciences but is also taught as the natural science in different universities of the world.

Contributions of Greeks and Romans

Called father of geography; focused attention to the measurement and location of places.

- Plato, Aristotle, Eratosthenes, Ptolemy, Strabo.

Main contributions

1. Mathematical traditions
2. Deductive reasoning (from general to particular) by Plato
3. Inductive reasoning (particular to general) by Aristotle
4. Literary Traditions (Strabo)
5. Coined the word Geography
6. Tables of Latitudes and Longitudes, Map Projections
7. Topographical work

Father of Modern Geography

Alexander Von Humboldt, Karl Ritter, Friedrich Ratzel

1. Geography has become the major area of interest
2. Contributions in physical and human geography.
3. Field work
4. Produced several books

Richard Hartshorne

"To provide accurate, orderly, and rational description and interpretation of the variable characters of the earth surface."

**Topic 5**

**Recent advancements in Geography:**

Geography was a traditional subject in the beginning. A number of new avenues are introduced, which has increased the scope and sphere of application of this subject. A brief over view of these recent techniques is given below.

- Introduction of Geographic information system for the purpose of mapping and spatial analysis of a specific phenomenon.
- Introduction of Remote Sensing (RS) has increased the understanding of different objects which are out of the reach of man in past.
- Global Positioning System (GPS) is a recent advancement in the field of Geography. It ease the work of surveyor and Geographer to find out the specific location of an object or a phenomenon.
- Theodolite and Total Station (TS) has replaced the traditional system of surveying i.e. chain-table survey. The values are more accurate than before. TS is an effective advancement in the construction process as well.

**Significance of Geography:**

- It provides the knowledge about the entire physical and human phenomenon.
- It is difficult to get proper knowledge of natural and social sciences without the study of Geography as its dimensions in different fields are discussed.
- It provides the basic information about the historical discoveries and political systems and forms of Governments.
- The recent advancement like GIS, GPS and TS also playing a pivotal role in the modern developments.
- It is also essential to know about the climatic factors to develop the models to study the pattern of climate shift.

**Recent Advancements**

Tradition in Geography

- Spatial Tradition
• Regional Tradition
• Cultural-Environment Tradition
• Earth Science Tradition

Spatial Tradition
  1. Mapping (Boundaries, densities, etc.)
  2. Quantitative techniques as computerized mapping, Geography Information Systems
  3. Spatial patterns

Regional Tradition
  1. Description of regions
  2. World regional geography
  3. How regions are different from one another

Culture-Environment Tradition
  1. Human impact on nature
  2. Impact of nature on humans
  3. Natural hazards
  4. Cultural, political, and population geography

Earth Science Tradition
  1. Physical Geography
  2. The lithosphere, hydrosphere, atmosphere
  3. Earth-Sun interaction
  4. Offshoots are geology, mineralogy, glaciology, geomorphology, and meteorology.
  5. The study of the earth as humanities home.
Lecture 2 (6 – 7)

Topic 6

Nature of Geography

Geography has been concerned with

• The patterns of phenomena on the Earth’s surface
• How these patterns give character to the particular place.
• Explain how these features have come to be and what they are
• Examine how they influence the distribution of people and their activities
• Describe the different features of the Earth

Study the large part of the World as Pakistan and a part of a Country as Lahore.

Examine how they influence the distribution of people and their activities.

Topic 7

Scope of Geography

Following is the scope of Geography:

• Providing an accurate, orderly and rational description and interpretation of various features of the earth’s features
- An exact knowledge of the distribution of phenomena on the earth’s surface e.g:
  (Volcanic mountains)
  (Population distribution of Pakistan)

Physical environments are organized on the earth’s surface and how man distributed himself over the earth. Geographers are interested in understanding the character of the earth, continents, countries, regions or areas.

Branches of Geography:

Geography is a vast subject. In order to get complete understandings, it is divided into two major branches i.e. Physical Geography and Human Geography. These two disciplines are further divided into following branches.

Physical Geography:

It is the branch of Geography which deals with the study of physical environment. It is further discussed in following branches.

Climatology:

It is the branch of physical Geography which deals with the study of climate with respect to spatial and temporal variation. The phenomena of heat, moisture, winds etc are discussed in this branch of physical Geography.

Geology:

It is the branch of physical Geography which deals with the study of internal structure of earth all the phenomena which occur beneath the earth surface.
Geomorphology:

It is the branch of Geography which deals with the study of land forms on the surface of earth.

Biogeography:

It is branch of Geography which deals with the study of distribution pattern of plants and animals and relates them to environment, migration, evolution and extinction.

Coastal and marine Geography:

This branch of Geography examines the coastal process, marine resources and their human interface.

Environmental Geography:

This branch of Geography deals with the study of Environment.

Human Geography:

It is the branch of Geography which deals with the study of Human environment and human activities. It is further discussed into following branches.

Economic Geography:

It is the branch of human Geography which deals with the study of all the types of economic activities. It discusses the primary, secondary, tertiary, quaternary activities.

Population Geography:

It deals with all the types of population indicators like CBR, CDR, TFR, IMR etc and the population phenomenon like migration.

Settlement Geography:

It deals with the study of human settlement, its pattern, history and types of settlement.

Cultural Geography:

It deals with the study of human culture of different regions. It discusses about the language, traditions and customs of society.

Agricultural Geography:

It deals with the study of Agricultural pattern, methods and seeds to increase the production and to strengthen the living standard of human-beings.

Historical Geography:
It is the study of historical events with respect to time and space. It includes the study of different kingdoms, wars and revolutions.

**Lecture 3 (8 – 10)**

**Topic 8**

**Physical Geography**

Physical geography is concerned with the study of landforms, extent and nature of the oceans, the atmosphere, processes associated with weather and climate, soil, animals and vegetation.

**Branches of Physical Geography**

- Geomorphology is the study of the origin and development of landforms on the earth.
- Climatology is the scientific study of climate. It describes distribution and regional patterns of climate.
- Hydrology is the study of surface and underground water properties, phenomena, distribution, movement and utilization.
- Soil Geography is the study of the origin, development, characteristics and distribution of soils.
- Biogeography is the study of distribution of plants and animals on the earth’s surface.
- Plant geography is also called Phytogeography
- The study of animals is known as Zoogeography
- Oceanography is the study of extent and shape of ocean basins, the structure and relief of their floors, movements of sea water, its temperature and salinity. It also includes the study of organisms in the oceans.

**Topic 9**

**Branches of Human Geography**

Human geography deals with man and his activities. These human activities change the physical landscape and produce the cultural landscape.

- Cultural Landscape is composed of agriculture, cattle grazing, fishing, mining, settlements, manufacturing industries, and infrastructure (roads, electricity lines and telecommunication lines.)
- Population Geography concerned with the study of population density, distribution, migration, growth, and structure.
- Economic Geography is the study of resources, production related activities as agriculture (Wheat producing areas)
- Political geography concerned with the distribution of political regions and ideas of power and conflicts.
- Historical Geography deals with the study of places as they existed in the past including agriculture and other landscape evolution.

**Topic 10**

**Branches of Human Geography**

Man’s activities have an impact on environment

Environmental Geography

- Practical geography: Field work, i.e. field research, field study
- Cartography, the art or work of making maps or charts in lab
- Areal photography and remote sensing is used to take photographs of the earth’s resources or any land use from an aircraft or a satellite without making physical contact with the object
- Quantitative methods, dealing with statistical presentations, it is also called mathematical geography.
Lecture 4 (11 – 12)

Topic 11

Relation with Life Sciences

Relation with Natural Sciences:

Geography itself falls in both Social and Natural sciences but its sphere is more wide in the fields of natural sciences. A brief over-view is given below.

1. Geography and Environmental science.
2. Geography and Geology
3. Geography and Medical Sciences
4. Geography and pedology
5. Geography and Zoology (Zoo-Geography)
6. Geography and Hydrology
7. Geography and Space Sciences

The geography contains many branches which are related to the disciplines of life sciences.

   Link between Geography and related fields is very important.

   The methods and aims of the physical geographer and the natural scientist in studying the phenomena are same.

• As Physics has supporting fields with Climatology. The physical geographer needs some knowledge of Physics.

• As Botany has supporting fields with Phytogeography. Botanist needs some knowledge of geographical condition.

• Zoology also has a supporting field with Zoogeography.

• Similarly, most physical geographers concerned with geomorphology and biogeography require knowledge of geology and biology or ecology respectively.

Topic 12

Relation with Social Sciences

Human Environmental Sciences

There is desire to work toward some greater knowledge for some genuine understanding of the world.: 

As Political Science is linked with Political Geography
As Economics is linked with Economic Geography. Economic geography studies the distribution of resources but the problems of their exploitation from an economic point of view is related with economics.

- Population Geography requires knowledge of Demography (the statistical fields of populations).
- As Anthropology has a supporting field with Cultural Geography.
- As Sociology and Psychology linked with the Social Geography.
- As History linked with the Historical Geography.

**Relations with other subjects:**

Geography is a vast subject. It is considered as the mother of Knowledge. It is impossible to study other discipline of social and natural sciences without the understanding of Geography. It has links with all other subjects. A brief description of its relation with other discipline is given below.

**Relation with social sciences:**

A brief overview of its relation with other subjects is given below.

**Geography and Sociology:**

It is difficult to do the study of culture, ethnicity, language and customs of a region without proper knowledge of Geography and geographic feature of that area.

**Geography and History:**

It is impossible for a historian to reveal any historical event without of proper knowledge of physiography of that area.

**Geography and Archeology:**

It is very difficult for an Archeologist to discover any new site without the study of that region.

**Geography and Political Science:**

All the political systems and system of Governments also correlate with the physiography and even climate conditions of that area. As Aristotle said, “the people of tropics are aggressive in nature so there must be a system of Government which can control their behavior i.e. Dictatorship is suitable form of Government for them while the people of Polar Regions are calm by nature so Democracy will flourish there in effective manners”.

**Geography and Economics:**
It is all about the economic Geography.

Lecture 5 (13 – 15)

Topic 13

Importance of Geography in Education

Geography is studied in universities, colleges, secondary and primary schools. Its importance in education cannot be ignored. It is the understanding and communication of spatial information through maps, graphs, diagrams and other forms of illustrations.

It provides world knowledge, which helps people to make sense and well informed about the current events. Information increases in understanding different culture, within country and in the world, e.g; extent of biggest cultural groups in Pakistan. Environmental perception rises due to the awareness of use and misuse of the resources. Through studying physical and human resources on a variety of scales, we can learn a lot.
Geography helps in understanding the causes and impacts of hazards and disasters, as earthquakes, landslides, volcanicity, floods, droughts, cyclones, famines and diseases. Geography helps and enables people to acquire specific local knowledge about tourism, fishing, forestry, settlements, agriculture, etc. of their country.

**Topic 14**

**Importance of Geography in Development**

In Geography we not only develop maps but applying our skills in real life situation as studying phenomena in life as well as in the social sciences with fieldwork, statistical analysis, etc. The people make judgments on, political, social, economic and environmental issues; as in Pakistan which maintains its living standards by trading cotton products in World-wide markets.

Gives understanding of different communities makes students aware of people’s problems and developments. This promotes positive attitudes towards different cultures. Environmental perception enables people to identify the interrelationship between positive and negative processes as reduce, reuse and recycle.
Helps in developing the management and planning areas of the hazards and disasters, as earthquakes, landslides, floods, droughts, cyclones, and diseases. Geography helps in giving the specific local knowledge regarding the suitable areas for settlements, tourism, agriculture, industry, mining, infrastructure (roads, railways, ) development.

Topic 15

Importance of Geography in Knowledge

Major Land Masses or Continents
World Regions

Physical map of the world shows oceans, continents, islands, mountains, plains, deserts, etc.
Shows highland and lowland areas as some landforms are under agricultural activities and some are best for other human activities. Human or animal Habitats are generally controlled by climate. A penguin lives in the Antarctica. A camel lives in desert.
Lecture 6 (16 – 18)

Topic 16

Introducing Earth

Earth is the third major planet of the solar system. It is the planet which is inhabited by the human beings and all the other living organisms. People live on the surface of the earth in a physical environment that is extraordinary complex and extremely diverse. A large portion of the planet is covered by the water body that is 71% while the remaining is the part of land surface. Earth has diversity in its physiography and its atmospheric composition.

The earth is the third planet from the sun in the solar system orbiting between Venus and Mars at an average distance of 149.6 million km from the sun, and has one natural satellite, the moon. It has an equatorial diameter of 12,756 km, an average density 5.5 times that of water, and is believed to have formed about 4,600 million years ago. The earth, which is three-quarters covered by oceans and has a dense atmosphere of nitrogen and oxygen, is the only planet known to support life.

Earth also called the world and is the only planet which has life. The Earth was formed around 4.5 billion years ago. The earth passed through different phases of development. Some eras were under volcanism and some were under drought. Earth's biodiversity has evolved over hundreds of millions of years. It is currently home to 10-14 million species of life including over 7.2 billion humans. All depend on biosphere and natural resources. The Sun is the only source of energy (Heat and Light). The earth is surrounded by the atmosphere, a layer of some important gases important for the survival of life. Earth's human population is divided among about two hundred sovereign states.

Topic 17

The Shape of the Earth

It has been a long debate to express the shape of the earth between different scholars of different time. More than 2600 years ago, Greek scholars correctly reasoned that Earth have a spherical shape. About 2200 years ago, Eratosthenes the director of Greek library at Alexandria, calculated
the circumference of Earth by using trigonometric method. The Geographers and the mathematicians of later time believed that Eratosthenes did mistakes to calculate the circumference of the earth. Later on the Mathematicians of later ages gave their own point of view about the shape of the Earth. A few of them are briefly elucidated below.

Newton a famous mathematician challenged the spherical shape of the Earth and considered it like oval. A Scottish Mathematician, McLaren considered earth as a flat surface in in 1742. In 1834, Jacobs a Henry’s Scientist viewed that earth is an elliptical in shape which is close to the modern point of view about the shape of the earth. In 1885, Poincare flue an idea of pear shape of the earth. At present it is common view that earth is an elliptical by shape but infect this discussion is not to be ended yet.

The Earth is one of the fastest spinning body of the solar system so it shape is roughly spherical. The bulge at equator results from the rotation of the earth.

Average diameter is 12,742 km, whereas

Equatorial diameter is 12,756 km and the

Polar diameter is 12,714 km.

The circumference or the distant around equator is 40,000 km.

- The spherical form of the earth is clearly visible in photographs of the earth taken from the satellites.

- If we observe a ship approaching land from the horizon, we see its smoke first and gradually more and more of the ship as it comes up over the horizon.

- Other planets are spherical, so we can assume that the earth is also spherical.

- When there is an eclipse of the moon the shadow of the earth on the moon is round. Only a sphere can cast a circular shadow.

- A person travelling around the world would return eventually to the same spot.
• The sun rises at different times over the surface of the earth. If the earth was flat the sun would rise at the same time over the entire surface.

**Topic 18**

**The Size of the Earth**

Our planet is just like of a grain in the Sahara desert when it is discussed in the context of whole universe. The diameter of our planet is about 13,000 km (7900 miles).

The mean radius of Earth is 3,959 miles (6,371 kilometers). However, Earth is not quite a sphere. The planet's rotation causes it to bulge at the equator. Earth's equatorial diameter is 7,926 miles (12,756 kilometers), but from pole to pole, the diameter is 7,900 miles (12,720 km) a difference of only 40 miles (64 km).

The total surface area of Earth is about 509 million square kms. About 71 percent is covered by water and 29 percent by land.
The radius of Earth is 6,371kms. However, the Earth's rotational speed is 1666 kms/hr which is 37 time more than the speed of the bullet causes bulge at the equator. Mount Everest is the highest top on Earth above sea level, at 29,028 feet. The lowest point on Earth is the Mariana Trench in the western Pacific Ocean. It’s depth is about 36,200 feet below sea level. Earth is the densest planet in the solar system because of its metallic core and rocky mantle. We could fit 1321 Earths inside of the Jupiter.

Lecture 7 (19 – 21)

Topic 19

Introducing Universe

All the matter and energy (Light and heat) that exists anywhere in space and time is called the Universe including planets, stars, galaxies and the contents of intergalactic space.

The universe expanded from an extremely dense and hot state and continues to expand today. It is gathered into about 100 billion galaxies. Most galaxies contain billions of stars and large clouds of gas and dust.

The size of the Universe is unknown; it may be infinite with a radius of about 46 billion light years. In 2010 astronomers estimated, observable Universe contains 300 billion stars.

The diameter of our galaxy Milky Way is 100,000 light-year, local group has about 5 million light years and the known universe has 20 billion light years astronomical distances.

A light year

A light-year is the distance when a beam of light travels with a speed of 300,000 km/sec and covered a distance of 9.446 trillion km in a year.

The light-year is most often used when expressing distances to stars and other distances on a galactic scale, the unit usually used in professional astrometry.
Topic 20

Galaxy and Milky Way

Galaxy:

It is the system of millions or billions of stars, together with gas and dust, held together by gravitational attraction.

Milky Way:

The Milky Way is the galaxy that contains our Solar System. Its name "milky" is derived from its appearance as a dim glowing band arching across the night sky whose individual stars cannot be distinguished by the naked eye.

There are probably more than 100 billion galaxies in the observable Universe. A galaxy range from ten million stars up to one trillion stars.

Most galaxies vary from about 10,000 to 200,000 light years in diameter, and are usually grouped in clusters of 20 to several thousands. The Clusters are grouped in Super clusters.

The Milky Way is our home galaxy, is roughly 100,000 light years in diameter, contains our Solar System. This galaxy has 100–400 billion of stars and planets as well.

Galaxy is an assemblage of stars, planets and other space material in a disc like shape. The diameter of a galaxy varies, distance between two neighboring galaxies is 3 million light-years.

Its name “milky” is derived from its appearance as a dim glowing band arching across the night sky, cannot distinguish individual stars.

The Solar System is located within the Milky Way, about 27,000 light-years away from the center of the galaxy. Stars and other material orbiting at approximately 220km/sec around the center of the galaxy.
Topic 21

The Sun as a star and its Planets

A solar system refers to a star and all the objects that travel in orbit around it. Our solar system consists of the sun - our star - eight planets and their natural satellites (such as our moon); dwarf planets; asteroids and comets.

The Solar System formed 4.6 billion years ago from the gravitational collapse of a giant interstellar molecular cloud. The vast majority of the system's mass is in the Sun, with most of the remaining mass contained in Jupiter. The four smaller inner planets, Mercury, Venus, Earth and Mars, are terrestrial planets, being primarily composed of rock and metal. The four outer planets are giant planets, being substantially more massive than the terrestrials. The two largest, Jupiter and Saturn, are gas giants, being composed mainly of hydrogen and helium; the two outermost planets, Uranus and Neptune, are ice giants, being composed largely of substances with relatively high melting points compared with hydrogen and helium, called ices, such as water, ammonia and methane. All planets have almost circular orbits that lie within a nearly flat disc called the ecliptic. Solar system is further discussed in the context of inner solar system and outer solar system.

The Solar system formed 4.6 billion years ago. The vast majority of the system's mass (99.98%) is in the Sun. All planets are revolving around the Sun and have almost circular orbits.

The Solar System comprises the Sun and its eight planets, that form the planetary system around it.

The inner planets Mercury, Venus, Earth and Mars are composed of rock, as silicates, iron or nickel, that remained solid in all conditions. These four inner planets have dense and rocky composition.

The outer planets are Jupiter, Saturn, Neptune and Uranus are composed mainly of gases, as hydrogen and helium.
The Sun is the major component and star of the Solar system. It has largest mass (332,900 Earth masses) and produce electromagnetic radiation.

The Solar System also contains billions of smaller objects, remnants of its early history. Asteroids are from a few hundred meters to several hundred kms across. Comets are icy frozen gases and rock particles.

**Inner solar system:**

The inner Solar System is the region comprising the terrestrial planets and the asteroid belt. Composed mainly of silicates and metals, the objects of the inner Solar System are relatively close to the Sun; the radius of this entire region is less than the distance between the orbits of Jupiter and Saturn. This region is also within the frost line, which is a little less than 5 AU (about 700 million km) from the Sun. This solar system consists upon the following planets which are also termed as inner planets.

1.1.1 **Mercury**

Mercury is the smallest and closest to the Sun of the eight planets in the Solar System, with an orbital period of about 88 Earth days. Seen from Earth, it appears to move around its orbit in about 116 days, which is much faster than any other planet in the Solar System. It has no known natural satellites. The planet is named after the Roman deity Mercury, the messenger to the gods.

Because it has almost no atmosphere to retain heat, Mercury's surface experiences the greatest temperature variation of the planets in the Solar System, ranging from 100 K (−173 °C; −280 °F) at night to 700 K (427 °C; 800 °F) during the day at some equatorial regions. The poles are constantly below 180 K (−93 °C; −136 °F).

1.1.2 **Venus**

1.1.3 **Earth**

1.1.4 **Mars**

Mars is the fourth planet from the Sun and the second smallest planet in the Solar System, after Mercury. Its Distance to Earth is 225,300,000km while its Radius is about 3,390 km and the distance from the sun is about 227,900,000 km and the Mass of the
planet is 639E21 kg (0.107 Earth mass). The Length of day at the surface of mercury is 1d 0h 40. It possess two moons named as Phobos, Deimos.

4.2 Outer solar System:

The outer region of the Solar System is home to the giant planets and their large moons. The centaurs and many short-period comets also orbit in this region. Due to their greater distance from the Sun, the solid objects in the outer Solar System contain a higher proportion of volatiles, such as water, ammonia, and methane than those of the inner Solar System because the lower temperatures allow these compounds to remain solid. The planet upon which it is comprised of is called outer planets. These planets are named below.

4.2.1 Jupiter

Jupiter is the fifth planet from the Sun and the largest planet in the Solar System. It is a giant planet with a mass one-thousandth that of the Sun, but is two and a half times that of all the other planets in the Solar System combined. A brief overview of its description is given below.

Radius: 69,911 km
Distance from Sun: 778,500,000 km
Mass: 1.898E27 kg (317.8 Earth mass)
Orbital period: 12 years
Gravity: 24.79 m/s²
Moons: Europa, Io, Ganymede, Callisto, Amalthea, Adrastea, more

4.2.2 Saturn

Saturn is the sixth planet from the Sun and the second largest in the Solar System, after Jupiter. It is a gas giant with an average radius about nine times that of Earth. A brief overview of the physical description is enlisted.

Radius: 58,232 km
Distance from Sun: 1,433,000,000 km
Mass: 568.3E24 kg (95.16 Earth mass)

Orbital period: 29 years

Length of day: 0d 10h 39m

Moons: Titan, Enceladus, Rhea, Iapetus, Dione, Mimas, Tethys, more

4.2.3 Uranus

4.2.4 Neptune

Stars:

These are the objects of the solar system which has their own light. The best example is Sun.

Planets:

These are the objects which have not their own light but rely upon the stars to be illuminated. There are about eight planes in our solar system. Our Earth is one of them. These planets revolve around the sun because sun is the center of the solar system.

Satellites or Moons:

These are the objects which revolve around the planets. Each planet has its own satellites which are also termed as moons of the planets.

Lecture 8 (22)

Topic 22

Earth’s Rotation

It is the process in which earth rotates around its own axis. It rotates from west to east on its axis. It requires about 24 hours to complete one cycle around its axis. It is rotating in anti-clock wise or counter clock wise direction. Sun always seems to appear in the east and set in the west because of spin of earth towards east ward direction. This phenomenon of rotation of earth controls the alternation of day and night. Rotation has several striking effects on the physical characteristics of the earth’s surface. These physical characteristics includes the coriolis effect, increase and decrease of the force of gravity of earth, moon and sun and most important is the time of illusion and darkness on the surface of earth.
The Earth has two movements

It is the movement of the solid Earth around its own axis at inclined angle (23.5 degree).

The Earth rotates once in about 24 hours with respect to the sun.

**Earth’s Revolution**

It is the phenomenon in which earth completes its circle around the sun. Earth revolution takes 365 days, 5 hours, 48 minutes and 46 seconds or 365.24 days. This is also known as tropical year or solar year. The path followed by Earth in its journey around the sun is not a true circle but is an ellipse. Due to this elliptical orbit, the Earth-Sun distance is not constant. It varies from 147,166,480 KM at the perihelion position, perihelion is a combination of two Greek words, Peri- means closest and hellion stands for sun, to 152,171,500 km at aphelion. Aphelion stands for the farthest distance from the sun.

This phenomenon of revolution of Earth controls the phenomenon of seasonal variation. During the month May, June and July Northern hemisphere enjoys summer season and the southern hemisphere enjoys winter season and the opposite is true during the months of December, January and February.

Throughout the year, as our small blue planet orbits the Sun and experience changing seasons. The warm Spring, hot Summer, Autumn, Finally, comes cold, wet, and dry, Winter.
The Earth revolves around the Sun once every 365.24 mean solar days. The Earth orbits the Sun at a speed of 108,000 km/h.

Lecture 9 (23)

Topic 23

Latitudes and Longitudes

Geographic Grid:

The complete understanding of the physical features on the surface of earth is very illusive until the grid system is not fully understood. This system of grid system consists upon two types of lines which intersects each other at right angle. These lines are termed as longitude and latitude lines.

Equator:

It is the imaginary line which divides the globe into Northern and Southern Hemisphere.

Prime-Meridian:
It is the line perpendicular to the equator which divides the globe into Easter and Western hemisphere.

**Latitude:**

It is the angular distance from the equator. While the line joining these angular distances are termed as latitude. Latitudes run parallel to the equator line. It is expressed in the term of degrees, minutes and seconds. There are seven latitudes in the Geographic Grid System (GGS) are of primary importance. These seven latitudes are:

1. Equator, 0 degree
2. Tropic of cancer, 23.5 degree North
3. Tropic of Capricorn, 23.5 degree South
4. Arctic circle, 66.5 degree North
5. Antarctic Circle, 66.5 degree South
6. North Pole, 90 degree North
7. South pole, 90 degree south

**Longitude:**

It is the angular distance from the prime-meridian while the line joining these points is called longitudes. These are also expressed in the term of degrees, minutes and seconds. These are also termed as time zones. Global Positioning System (GPS) is the most recent technology in the field of Geography to identify or calculate the exact location by longitude and latitude of a desired object.
Remember that the lines of Latitudes are parallel with each other, while the lines of Longitudes meet at the poles.

These lines help us to locate where we are or where any particular place is located.
Lecture 10 (24)

Topic 24

Longitudes and Time

The Earth takes 24 hours to rotate once and making a circle or moves 360 degrees.

So one degree is covered in 4 minutes.

The earth will pass through 15 degrees of longitudes in one hour.

A time zone is a region that has a uniform standard time for legal, commercial, and social purposes. Before clocks were invented, people marked the time of day with solar time.
Greenwich Mean Time (GMT) was established in 1675 when the Royal Observatory was built. Time zones are based on Greenwich Mean Time (GMT) the mean solar time at longitude 0° (the Prime Meridian).

All time zones are specified from GMT, passing through the Royal Observatory in Greenwich, London. Countries now legally define their standard time to GMT.
Longitude and time:

Longitudes are also termed as time zones. If there is difference of one degree between two places by longitude then there will be difference of 4 minutes by time. There will be a difference of 1 hour between the times of two places then there will be the difference of 15 degree by longitude. It means that, earth takes 4 minutes to rotate about 1 degree around its axis.

Lecture 11 (25 – 33)

Topic 25

MAPS AND RELIEF - Introducing Map

Definition:

Map is the representation of Earth’s surface as a whole or some part of it on the plan surface along with the title, scale, legend, North arrow and conventional signs.

History of Maps:

Maps are not the invention of recent period of time. There is a long history behind the development of maps. The earliest maps were pictorial in nature and present the idea in rough sketch without consideration of the primary elements. About 3000 years ago, Egyptian prepared the first map which only shows the demarcation of boundaries of one owner. The basic purpose of those maps were to generate revenue. Infect, those were not maps in real sense but were just pictures or sketches.

The credit of modern cartographic inventions goes to the Greek Geographers, i.e. Ptolemy, Aristotle and Erastothene. The first accurate map in the history of cartography was prepared by Ptolemy, which is presented in his book “Geographia”. This book contained a world map along with other 26 small maps. At his world map, Asia and Europe are extended over 180* but according to the modern calculations these two continents cover about 130* while the length of Mediterranean was shown about 62* but in real sense it is about 42*. Besides of these chief faults, the Ptolemy’s map is considered as the foundation for the modern cartographic inventions.
Romans were the next, who contributed in the field of cartography. Unlike of the Greeks, Roman paid little attentions to the mathematical Geography. The recognition of Earth as spheroid with its poles, Equator and Tropics, Division of Earth into climatic zones, development of system of graticules and the formation of first projection were the contribution of Romans in the field of cartography.

During the period of Arabs, a number of improvements were made in the previously developed maps. They followed the Greek’s method and prepare the first accurate map showing the Islamic World.

In the 15th century the recovery of Ptolemy’s “Geographia” is considered as the renaissance in the field of cartography. During this century, The Italians, Spanish, Dutch, Portuguese and German cartographers perfected the art of map making.

In 16th century, the introduction of map printing press of Amsterdam opened the door of employment for the cartographers and proved to be a mild stone in the history of cartography.

In 18th century, England became the foremost maritime power in Europe and London became the center of the cartographic developments. During this century another improvement was done by conducting the first national survey in France by C.F Cassini. Whose work was continued by his son at the eve of French revolution.in 19th century, more attentions were given to the cartography. Rich and colorful symbols were used instead of “Black & White” for the first time in the history of maps. The introduction of airplane photography in the 20th century opened a new dimension in the topographical surveying. All the advanced countries of the world have made extensive use of airplane topographic surveying. Recently, USA has collected various types of images through LANDSAT-1 tom produce extensive and accurate world map.

A map is a symbolic depiction, which highlights relationship between elements of objects, regions and themes.

Cartography is an art of map making and the practice of crafting the physical and man-made features of the Earth. The skilled person is called a cartographer.
Maps are not the invention of modern age. The earliest maps were generally pictorial, roughly sketched and inaccurate.
World map (2004)

Areal Photography
A large scale map shows a small area, with great detail. A map depicting a large area, such as country, is considered a small scale map and shows more territory, but less detailed.

**Topic 26**

**Introducing Maps 2**

**Elements of Maps:**

These are basically the fundamental organs of maps. If any of them is absent then the map will be no more than that of the rough sketch. Following are the major elements of map.

1. Title
2. Scale
3. Legend
4. N-Arrow
5. Conventional signs.

**Map and symbols:**
The main purpose of map is to communicate data and information to the users. The symbols are considered as the language of map. There are three types of symbols which provide the information about the different features on map.

1. **Point symbol:**
   These are used to represent the specific location of objects.

2. **Line symbol:**
   These are used to represent the roads and railway lines on the maps.

3. **Area Symbols:**
   These represent the marshy areas, residential areas, forests, water body etc.

**Shape of features on map:**

Different physical or human features are presented on map by different shape. These may be rectangle, square or line. The rectangle may be used to represent building and triangle may present mine while line may be used to present the roads.

**Size of Different Features on Map:**

These are used to indicate the degree of importance of any feature. For example, large circle may represent a city and small circle may represent a town.

**Color and Texture:**

Different color scheme is also used to emphasis over different features. For example, red color may indicate an urban or built area while green color may elucidate the Agricultural area.

**Landsat Satellite System**
SPOT Satellite Program
Topic 27

Types of Map

The map may be defined as the representation of the earth’s pattern as a whole or part of it with conventional signs, drawn to a scale and projection. The framework of the map is based on the way how the graticule, i.e., the longitudinal and latitudinal network is prepared. This depends on the position of the area on the earth’s surface and type of map.
The amount of information to be represented on the map depends on:

i. Map Projection

ii. Conventional signs

iii. Methods of map-making

iv. Scale

**Types of Maps on the basis of Scale:**

Scale is the most essential element of map. Maps are usually drawn to show different detail on large or small scale. The details that are to be shown on it may be varied, if scale is varied. On the basis of scale, map can be categorized into two types.

1. **Small scale maps.**
These maps cover large area to shown but provides small information. The ambiguity may exist due to cover of large area. These are not fit for more detailed and accurate information.

Examples of small scale maps are, wall maps and chorographical or Atlas maps.

2. **Large scale maps:**
   These maps cover small area and provide more detailed information. For example, Cadastral maps and topographical maps.

Types of Maps on the basis of Purpose:

On the basis of purpose, these maps can be discussed in two types.

**Physical Maps:**

These maps are also termed as natural maps. These maps indicate the physical or natural phenomenon. These are further subdivided in to following types of maps.

1. Astronomical maps
2. Orographical maps
3. Geological maps
4. Climatic Maps
5. Soil Maps
6. Natural vegetation maps

**Cultural Maps:**

These maps represent the human environment or man-made phenomenon. This type includes the following maps.

1. Economic maps
2. Political maps
3. Military maps
4. Historical maps
5. Social maps
6. Land utilization maps
The need for map projections arises from the fact that an ordinary globe is rendered useless for a small country. It is not possible to make a globe on a very large scale.

**Topic 28**

**Types of Map**

Map projection varies with size and location of different areas on the earth’s surface.

**Basic Types of Map Projections**

- Cylindrical
- Azimuthal
- Conic
Azimuthal Projection

Gnomonic  Stereographic  Orthographic
Azimuthal projections
Elevation and Relief:

The term elevation is used to represent the height of land surface above a fixed plane or sea level. This height is measured in feet. That fixed plane is termed as datum,
from where further measurements are made. If the value is in negative then it will be termed as depression, if the value is positive then the it will be called elevation. While the term relief is used in synthetic sense. It indicated the variation in the nature of land surface. It shows the relative heights of highlands and lowlands which are termed as hills, knolls, spurs, valleys etc.

**Methods of Representation:**
Different methods are used to represent the elevation and relief. These methods are, Pictorial methods, Mathematical methods, and the combination of previous two.

**Pictorial Methods:**
This method is aimed to provide the true visual picture of terrain. These are further discussed in following methods.

1. **Hachures:**
   It is the method of representing the relief by means of sets of finally drawn disconnected lines which indicate the direction to which water would flow from highland to lowland.

2. **Hill shading**
   In vertical illumination, source of light is held at vertically above the place which varies according to the slope. Steeper slope will reflect the darker shading but relatively flat area will show the lighter shading. While in the oblique illumination, source of light is supposed to be beyond the N-W corner of the map. So, the slope which faces to the N-W will be lighted while facing S-E will be darker.

**Mathematical Methods:**
This method is discussed in following ways.

1. **Spot Height:**
   These provide the actual height of places above sea level which are fixed by the surveyors. These are shown on maps by dots followed by the number giving heights above sea level in feet or meters.

2. **Bench Mark:**
   These are bench marks places on buildings which indicate the height above sea level. On map these are shown by BM.
3. **Trignometrical stations:**

These are points on the surface of earth which were used as stations for triangulation survey. These are indicated on maps by small triangles.

4. **Contours:**

These are the imaginary lines of the ground joining the adjacent places at the same height above sea level.

**Combination of Previous Methods:**

The modern relief maps use several methods in combination. A brief description is given below.

1. Contours and Hachures
2. Contours, Hachures and Spot-Heights
3. Contours, form lines and spot Heights
4. Contours and Hill Shading
5. Contours and Layer Tints.

**Topic 29**

**Maps and Relief**

Conical Projection
Conical Projection (Bonne’s)

Cylindrical Projection
Topic 30

Types of Map

Conventional signs.
On maps the conventional signs have made it possible to compress maximum of information in the minimum of space without losing their importance.

Weather Symbols
Total Sky Cover

- No clouds
- Less than one-tenth or one-tenth
- Two-tenths or three-tenths
- Four-tenths
- Five-tenths
- Six-tenths
- Seven-tenths or eight-tenths
- Nine-tenths
- Completely overcast
- Sky obscured

Cultural Symbols
Methods of Map making
Topic 31

Types of Map

For understanding things maps can be classify into different categories.

1) Scale     2) Purpose
The maps are usually drawn to show different detail on a large or small scale.
According to Scale.

(a) Cadastral:

large scale map, are drawn to register the ownership of property by demarcating the boundaries of fields and buildings.

(b) Topographical map:

large scale maps based on precise surveys. They show general surface features in detail both natural landscapes and cultural landscapes.
(c) **Wall Maps:**

Small scale maps used in the classroom. The world as a whole or in hemisphere is represented on the wall maps. These are prepared for continents or countries large or small according to need.

(d) **Atlas Maps:**

Very Small scale maps give a more or less highly generalized picture regarding the physical, climatic and economic conditions of different regions of the earth.

**Topic 32**

**Types of Map**

According to purpose:

Based on the content of the map, both natural features and man-made features evolved over different areas.

**Astronomical maps:**

Showing heavenly features known as astronomical map.

**Orographic maps:**

The maps depicting surface forms are also called relief maps. The level of land, its slope and drainage.
Geological maps:

The detail of rocks and mineral composition of the regions are marked on geological maps.

Soil Maps: These maps showing the various types of soils covering the area.

Weather maps:

The maps showing the average condition of weather elements over a shorter period ranges from daily, monthly to seasonal weather conditions.
Climatic maps:

When averages of weather conditions over long period say 30 years or more are charted out on maps, they are defined as climatic maps.
Cultural maps:

The maps showing the cultural patterns over the surface of the earth.
Military maps:

These maps record strategic points, routes and battle plans.
Topic 33

Types of Map

Political maps: shows Boundaries between different political states or units.

Social maps:

Social organizations-tribes and races, their languages, religion are depicted on maps.
Communication maps:

These maps show only the means of communication as roads, railway, airways, etc.

Economic maps:

The distribution of important agricultural, mineral and industrial products with important centers.

Distributional maps:

These maps show characteristic features of a certain area, items may be natural like temperature, flora and fauna or it may be cultural, showing population.

Choropleth maps:

Different shading by horizontal, vertical and slanting lines may be adopted to show different densities of population and other data.
Historical maps:

Past events are symbolized on these maps.
Topic 34

Determination of Directions

The four cardinal directions or cardinal points are the directions of north, east, south, and west, commonly denoted by N, E, S, W.
Intermediate points between the four cardinal directions form the inter cardinal, or ordinal directions are Northeast (NE), Southeast (SE), Southwest (SW), Northwest (NW).
Further, the intermediate direction of every set of inter cardinal and cardinal direction is called a secondary-inter cardinal direction, like the NNE, ENE.

**Magnetic Compass**

![Magnetic Compass Image]

**Topic 35**

**Representation of relief features**

The term elevation means the height of the land surface above a fixed plane. The height is measured in feet or in any other unit.

The term relief is used in a systematic sense, it indicates the variation in the nature of the land surface. It shows the heights of highlands and lowlands.
Methods:

1. Mathematical

2. Pictorial

Giving a more or less true visual picture of the elevation and relief.
Mathematical method: Contouring is the standard method of representing relief are imaginary lines of the ground joining places of same height above sea level. These lines are fixed by accurate surveys.

The contour interval of a contour map is the difference in elevation between successive contour lines.
Spot Heights give the actual height of places above sea level, fixed by surveys. They show a height value.
Topic 36

Representation of relief features

Bench Marks: These are marks placed on buildings, or on other places, indicating the height above sea level, determined by actual surveys.

On maps these are indicated by the letters B. M. followed by the height in feet or meters above sea level. Form lines resembles contours, but represent no actual elevations, sketched from visual observation or from unreliable map sources, to show collectively the configuration of the terrain.
Trigonometrical Stations: These are points on the surface of the earth which were used as stations for triangulation survey.
Trigonometrical Stations are indicated on map by triangle followed by the height above sea level.

**Topic 37**

**Representation of relief features**

**Pictorial methods:** These aim at giving a more or less true visual picture of the elevation and relief features.

Hachures is a method of representing the relief by means of sets of finely-drawn disconnected lines which indicate the direction of water flow. It does not show the absolute height.

**Hill Shading:** In this method steeper the slope the darker the shade. Relatively flat area like plateau, plain, valley bottom have lighter shading.
A digital terrain model is a topographic model of the bare earth or relief features or a 3D representation of a terrain's surface.

Shaded relief today can be created digitally, using a digital elevation model (DEM) as its basis.
The Digital Elevation Model may be converted to shaded relief using software such as Photoshop GIS or ArcMap's Spatial Analyst extension.

**Topic 38**

**Geographical fieldwork**

Surveying is the art of making measurements of the natural and man-made features on the earth’s surface. The information or data that we get from the surveys are presented either graphically or numerically. Surveying is divided into geodetic and plane surveying. In geodetic surveying large areas of the earth’s surface are involved, and the curvature of the earth must be taken into account. In plane surveying relatively small areas are under consideration, and it is taken that the earth’s surface is flat or horizontal plane.
Branches of Surveying

Surveys are often classified by:

**Topographic surveys:**

These produce maps and plans of the natural and man-made features.

**Engineering Surveys:**

These include all the surveys work required before, during and after any engineering works.

**Cadastral Surveys:**

These are undertaken to produce plans of property boundaries for legal purposes. In many countries the registration of ownership of land is based on these plans.

**Topic 39**

**Field Work in Human Environment:**

This type of field work is proceeded to monitor a specific phenomenon related to the human activities. These are conducted either by personal observation, questionnaire based surveys;
interviews are conducted by the respondents and the residents of that particular area which is under the influence of the monitored phenomenon. The investigated phenomenon by employing this type of field survey may include the human activities, economic activities, CBR, CDR, TFR, IMR, population inflow or outflow, Fertility rate, life expectancy, literacy rate, employment rate etc. These surveys play a significant role in the process of policy making and to minimize the personal suffering. These are generally supervised by the state responding institutions. These are descriptive in nature. Surveyors are key contributor in order to take some productive measure to reduce the grievances of the victims.

**Geographical fieldwork**

The recent techniques are used in geography especially in field surveys for the representation of various data, and in mapping.

**River Fieldwork**

Flooding Investigating the causes and impacts of river flooding. River processes Investigating downstream changes in channel, investigating meanders or flood plain

**Coastal Field work**

Coastal processes Investigating, land forms and sediment analysis.

**Coastal management**

Investigating methods, perceptions and impacts

**Urban Field work**

Urban inequalities Exclusion and unequal spaces, disability.

Urban rebranding Strategies and managing urban rebranding.

**Rural Fieldwork**

Functions rural characteristics, Multi-village studies of settlement hierarchies.

Change Counter-urbanization and other recent change.
Ice Field work

Glacial and fluvio-glacial processes and landforms

Ecology fieldwork

Sand Dunes, and other features

Topic 40

Recent Techniques in Geography 3

Statistical Techniques

Statistical techniques are used in geography for the interpretation of numerical information or facts and figures as population statistics or education statistics. Geographers, like many other scientists both in social and physical domains are facing with an information explosion. One of the most powerful uses of statistics technique is in helping the geographer to decide relationship between two sets of sample data.

The major use of statistics is in helping us to make predictions, or postdictions (past time).
Statistical Techniques in Data Presentation:

After the conducting of field survey the next more significant part is its presentation. The collected data may be presented either in the form of maps or charts. If the data is presented by using the maps then it will be the spatial presentation of data and if it is presented in the form of charts, pie-charts, line graphs, bar-graphs, tables etc. These statistical techniques are used to perform different temporal or spatial analysis about a specific phenomenon. These techniques are more useful in to perform the analysis about the data collected from the human-environment. Data is also presented by using the color scheme.

Statistical interpolation:

Interpolation is the process in which the unknown values are speculated on the basis of collected data. This may be either statistical interpolation or spatial interpolation.

Statistical interpolation is the use of a set of observations of a state variable to supplement a set of estimated values of that variable. More specifically, it can be a way of constraining an NWP model, by combining the output of that model with actual observational data to achieve a more realistic result. In practice, the output from a model will be on a regular grid, whereas observations will come from irregularly-positioned stations. In this case, what we are trying to
achieve through statistical interpolation is a combination of the two datasets in such a way that the overall variance of the result is minimized.

For example, if the calculated values are like 1,2,3,4,6,7,9 then what would the missing values. So in order to investigate these values statistical interpolation is used. On the basis of this technique of interpolation the missing values will be 5 and 8.

**Topic 41**

**Recent Techniques in Geography 4**

**Geographical Information System**

Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. GIS can enhance weather systems on surface maps, as air masses, fronts, and surface observations. Thus, weather information could be provided to public. A Geographic Information System allows users to visualize multiple layers of geographic data in order to reveal relationships, patterns, and trends.

GIS can be utilized to map, analyze, and answer real-world questions. It stores information in multiple layers, each layer pertaining to a certain type of data. GIS was used to construct this computerized 3-D model of the Iron Age in central Jordan. The model is actually a digital representation. GIS store geospatial data in digital form, enhance the characterization of earth
surfaces, facilitates the understanding of landform structure and other geomorphological phenomena.

**Geographic Information System:**

A geographic information system (GIS) is a computer based system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. The GIS is sometimes used for geographical information science or geospatial information studies to refer to the academic discipline or career of working with geographic information and is a large domain within the broader academic discipline of Geo-informatics. What goes beyond a GIS is a spatial data infrastructure, a concept that has no such restrictive boundaries.

In a general sense, the term describes any information system that integrates stores, edits, analyzes, shares, and displays geographic information. GIS applications are tools that allow users to create interactive queries, analyze spatial information, edit data in maps, and present the results of all these operations. Geographic information science is the science underlying geographic concepts, applications, and systems.

GIS is a broad term that can refer to a number of different technologies, processes, and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insurance, telecommunications, and business. For that reason, GIS and location intelligence applications can be the foundation for many location-enabled services that rely on analysis and visualization.

GIS can relate unrelated information by using location as the key index variable. Locations or extents in the Earth space–time may be recorded as dates/times of occurrence, and x, y, and z coordinates representing, longitude, latitude, and elevation, respectively. All Earth-based spatial–temporal location and extent references should, ideally, be relatable to one another and ultimately to a "real" physical location or extent. This key characteristic of GIS has begun to open new avenues of scientific inquiry. There is a vast range of application of the GIS; almost it covers all the aspects of applications. It is broader technology which possesses influence upon all the types of activities. Its range of application begins from the interior of the earth to the space.

**Applications of GIS:**

A brief description of GIS application is enlisted.
Uses of GIS range from indigenous people, communities, research institutions, environmental scientists, health organizations, land use planners, businesses, and government agencies at all levels.

Uses range from information storage; spatial pattern identification; visual presentation of spatial relationships; remote sensing - all sometimes made available through internet web interfaces, involving large numbers of users, data collectors, specialists and/or community participants.

Some examples include:

- Historical geographic information systems
- GIS and Hydrology
- Remote sensing applications
- Traditional knowledge GIs
- Public Participation GIS
- Road networking
- Wastewater and storm water systems
- Waste management
- Crime mapping

Topic 42

Recent Techniques in Geography 5

Remote Sensing
Remote sensing refers to gathering information from great distances and over broad areas, usually through instruments mounted on aircraft or orbiting spacecraft. The instruments mounted on remote sensors measures electromagnetic radiations coming from the Earth’s surface and atmosphere as received at spacecraft plate form. All the natural and man-made features are capable of reflecting, transmitting, absorbing, and emitting electromagnetic radiation.
Remote Sensing is an exciting and expanding field within physical geography.

**Topic 43**

**Recent Techniques in Geography 6**

**Remote Sensing**
Orbiting Earth Satellites which carry remote sensing systems, is become a major branch of geographic research. They can image and monitor large geographic areas or the entire Earth.
LEO and GEO orbit elevations

- LEO: about 850km up
- GEO: about 36,000km high
Medium Earth Satellites are smaller to LEO satellites in functionality. They have a larger coverage area than LEO satellites.

**Remote Sensing:**

It is the technology in which the information can be collected about any object on the surface or in the space without having any physical contact with that object is called remote sensing or RS.

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on site observation. Remote sensing is a sub-field of geography. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth (both on the surface, and in the atmosphere and oceans) by means of propagated signals (e.g. electromagnetic radiation). It may be split into active remote sensing (when a signal is first emitted from aircraft or satellites) or passive (e.g. sunlight) when information is merely recorded.

**Applications of remote sensing data:**

Remote Sensing has its applications in all the walks of life. A brief overview is described below:
- Conventional radar is mostly associated with aerial traffic control, early warning, and certain large scale meteorological data. Doppler radar is used by local law enforcements’ monitoring of speed limits and in enhanced meteorological collection such as wind speed and direction within weather systems in addition to precipitation location and intensity. Other types of active collection include plasmas in the ionosphere. Interferometry is used to produce precise digital elevation models of large scale terrain.

- Laser and radar altimeters on satellites have provided a wide range of data. By measuring the bulges of water caused by gravity, they map features on the seafloor to a resolution of a mile or so. By measuring the height and wavelength of ocean waves, the altimeters measure wind speeds and direction, and surface ocean currents and directions.

- Ultrasound (acoustic) and radar tide gauges measure sea level, tides and wave direction in coastal and offshore tide gauges.

- Light detection and ranging (LIDAR) is well known in examples of weapon ranging, laser illuminated homing of projectiles. LIDAR is used to detect and measure the concentration of various chemicals in the atmosphere, while airborne LIDAR can be used to measure heights of objects and features on the ground more accurately than with radar technology. Vegetation remote sensing is a principal application of LIDAR.

- Radiometers and photometers are the most common instrument in use, collecting reflected and emitted radiation in a wide range of frequencies. The most common are visible and infrared sensors, followed by microwave, gamma ray and rarely, ultraviolet. They may also be used to detect the emission spectra of various chemicals, providing data on chemical concentrations in the atmosphere.

- Stereographic pairs of aerial photographs have often been used to make topographic maps by imagery and terrain analysts in traffic ability and highway departments for potential routes, in addition to modeling terrestrial habitat features.
Global Positioning System

The Global Positioning System (GPS) is a satellite-based system that can be used to locate positions anywhere on the earth. The Global Positioning System (GPS) provides critical capabilities to military, civil, and commercial users around the world.
Pakistan is set to become the fifth Asian country to use China’s domestic satellite navigation system.

**Global Positioning System:**

The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

If we discuss about the structure of GPS, it consists upon three primary segments i.e. Space segment, user segment and controlled segment.

**Applications of GPS:**

A brief overview of the application of GPS is outlined below.

- Astronomy: both positional and clock synchronization data is used in astrometry and celestial calculations. It is also used in amateur astronomy using small telescopes to professional’s observatories, for example, while finding extra solar planets.
- Automated vehicle: applying location and routes for cars and trucks to function without a human driver.
- Cartography: both civilian and military cartographers use GPS extensively.
- Disaster relief/emergency services: depend upon GPS for location and timing capabilities.
- GPS-equipped radiosondes and dropsondes: measure and calculate the atmospheric pressure, wind speed and direction up to 27 km from the Earth's surface.
- Radio occultation for weather and atmospheric science applications.
- Fleet tracking: the use of GPS technology to identify, locate and maintain contact reports with one or more fleet vehicles in real-time.
Recent Techniques in Geography:

The fields of Geography are not only limited to the old and traditional methods and techniques. A number of new developments are made in the field of Geography which placed Geography in the field of Sciences. These recent techniques not only facilitate the Geographers but also facilitate the common people at equal pace. The sphere of the application of these techniques is not only limited to the physical environment but also play an active role in the human environment as well. In the physical environment these techniques are used to monitor or investigate the physical or natural phenomenon happening in the natural environment while in the human environment these techniques are used to monitor the human activities in a specific region. These techniques are used to develop the different models to monitor the climatic pattern and climate shift while these recent techniques also play a mild stone in order to formulate the policies to tackle the situation. These recent techniques include the modern tools of surveying and the recent technologies like Geographic Information System (GIS), Remote Sensing (RS), and Global Positioning System (GPS) etc. these techniques along with the brief description are elucidated below.

Geographical Field Work:

Geography is not the knowledge of myth or speculations but infect it deals with the systematic study and the personal observation of the surveyor or researchers. The researchers conducted under the discipline of Geography mainly of primary nature. So, in order to pursue the field work the researchers have to rely upon the effective techniques which provide him the accurate data.

Geographical field work means the personal observation about a specific phenomenon either that is physical in nature or human by nature after outgoing of the surveyor from the busy routine work. This field work may be either in temporal prospective or spatial prospective about a phenomenon.

The Geographical field work is described in two fundamental dimensions.

1. Field work in physical environment
2. Field work in Human environment

Field Work in Physical Environment:
This type of field work mainly relates with the monitoring of physical environment or the natural phenomenon occulting in space. These are conducted to monitor the temperature, rainfall pattern, moisture, wind speed etc. these phenomenon are monitored by employing different tools like Thermo-meter, Reengage, Annometer etc. This type of field work is purely scientific by nature. It is done for the purpose of developing a climatic model or interpolate about the upcoming weather conditions. This type of surveys are also conducted to explore the hidden natural reserves and geological by nature.
Lithosphere

The planet Earth is the only livable place for the human being. It consists upon different spheres which play a vital role in the prosperity of human-beings. These sphere influence in all the walks of life i.e., from breathing to food and shelter. All the necessities of human-existence primarily depend upon these spheres. These are basically the blessings of Almighty to our planet, which has increased its significance than its counterparts. These range from the bare soil to the large water bodies and from the water bodies to the atmosphere. The planet Earth is the only livable place for the human being. It consists upon different spheres which play a vital role in the prosperity of human-being. These sphere influence in all the walks of life i.e., from breathing to food and shelter. All the necessities of human-existence primarily depend upon these spheres. These are basically the blessings of Almighty to our planet, which has increased its significance than its counterparts. These range from the bare soil to the large water bodies and from the water bodies to the atmosphere. These are four in numbers i.e. Lithosphere, Hydro-sphere, Atmosphere and Bio-sphere. All of them are briefly described below.

1. Lithosphere
2. Atmosphere
3. Hydrosphere
4. Biosphere

Lithosphere:

It is the outer most portion of earth surface. It is the place where we live and do all our activities to grow food and to build houses for our existence. A lithosphere (Ancient Greek: lithose for "rocky", and σφαῖρα [sphaira] for "sphere") is the rigid outermost shell of terrestrial surface that is defined by its rigid mechanical properties. On Earth, it comprises the crust and the portion of the upper mantle that behaves elastically on time scales
of thousands of years or greater. The outermost shell of a rocky planet, the crust, is defined on the basis of its chemistry and mineralogy.

There are two types of the Lithosphere on the basis of the chemical properties of the soil surface i.e. oceanic lithosphere and continental lithosphere.

- Oceanic lithosphere is associated with oceanic crust and exists in the ocean basins. Its mean density is about 2.9 grams per cubic centimeter.
- Continental lithosphere is associated with continental crust and its mean density is about 2.7 grams per cubic centimeter.

Importance of lithosphere in the Environment:

Lithosphere is the solid outer part of the earth. It is the place where we live and also play a significant role in the environment. These are outlined below.

- Suitable to live
- Agriculture and the growing of crops is possible
- Play a vital role in the prosperity of man
- Low temperature as compared to the other layers of Earth
- Rich in natural resources which are exposed at the time of volcanic eruption.
- It controls the stability of Earth crust

Environmental Problems of Lithosphere:

Besides of the positive role, there are also some environmental problems of lithosphere are.

- Soil degradation, erosion and pollution
- Deforestation
- Landslides and earthquakes
- Loss of agricultural land for nonagricultural purposes
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The four great spheres, systems realms are:

Lithosphere

Atmosphere

Hydrosphere

Biosphere

These spheres have distinction with unique components and properties.

The outer most solid layer of the Earth, or Lithosphere, provides the platform for activities of the most of life. Lithosphere is an ancient Greek word means *lithos* for "rocky sphere is the rigid, outer most shell of the planet, and can be identified on the basis of its mechanical properties. On Earth, it comprises the crust and the portion of the upper mantle. The land forms contain features- as mountains, hills, and plains provide varied habitats for plants, animals, and humans.
The solid rock of the lithosphere bears a shallow layer of the soil in which the nutrients elements become available to organisms. The surface of the lithosphere is eroded into landforms.

**Topic 46**

**Spheres of the Earth 02**

**Atmosphere**

The Atmosphere of Earth is a layer of gases surrounding the planet Earth that is retained by earth's gravity. The atmosphere absorbs ultraviolet solar radiation, warming the surface through greenhouse effect, and reducing temperature extremes between day and night (the diurnal temperature variation).
The earth is the only planet where atmosphere is suitable for life. So the life sustainability is due to atmospheric condition.
Atmosphere:

It is the mixture of different gasses in the Earth’s Environment. Without of the atmosphere the life is impossible on the planet because it provides the essential elements like, air, water, temperature, insolation etc. It is a layer of gases surrounding a planet or other material body of sufficient mass that is held in place by the gravity of the body. An atmosphere is more likely to be retained if the gravity is high and the atmosphere's temperature is low.

The atmosphere of Earth is mostly composed of nitrogen. It also contains oxygen used by most organisms for respiration and carbon dioxide used by plants, algae and cyanobacteria for photosynthesis. It protects living organisms from genetic damage by solar ultraviolet radiation, solar wind and cosmic rays.

The atmospheric composition on Earth is largely governed by the by-products of the life that it sustains. Dry air from atmosphere contains 78.08% nitrogen, 20.95% oxygen, 0.93% argon, 0.038% carbon dioxide, and traces of hydrogen, helium, and other "noble" gases (by volume), but generally a variable amount of water vapor is also present, on average about 1% at sea level.

**Layers of the Atmosphere:**

There are four major layers of Atmosphere i.e. Troposphere, Stratosphere, Mesosphere, Thermosphere.

Troposphere:

This is the lowest atmospheric layer and is about seven miles (11 km) thick. Most clouds and weather are found in the troposphere. The troposphere is thinner at the poles (averaging about 8km thick) and thicker at the equator (averaging about 16km thick). The temperature decreases with altitude.

Stratosphere:

The stratosphere is found from about 7 to 30 miles (11-48 kilometers) above the Earth’s surface. In this region of the atmosphere is the ozone layer, which absorbs most of the
harmful ultraviolet radiation from the Sun. The temperature increases slightly with altitude in the stratosphere. The highest temperature in this region is about 32 degrees Fahrenheit or 0 degrees Celsius.

Mesosphere:

The mesosphere is above the stratosphere. Here the atmosphere is very rarefied, that is, thin, and the temperature is decreasing with altitude, about –130 Fahrenheit (-90 Celsius) at top.

Thermosphere:

The thermosphere starts at about 55 kilometers. The temperature is quite hot; here temperature is not measured using a thermometer, but by looking at the motion and speed of the rarefied gases in this region, which are very energetic but would not affect a thermometer. Temperatures in this region may be as high as thousands of degrees.

Exosphere:

The exosphere is the region beyond the thermosphere.

Importance of Atmosphere:

This sphere of physical environment of earth surface is equally important for the environment in following respects.

From the perspective of the planetary geologist, the atmosphere is an evolutionary agent essential to the morphology of planet. The wind transports dust and other particles which erodes the relief and leaves deposits (eolian processes). Frost and precipitations, which depend on the composition, also influence the relief. Climate changes can influence a planet's geological history. Conversely, studying surface of Earth leads to an understanding of the atmosphere and climate of a planet — both its present state and its past.
For a meteorologist, the composition of the atmosphere determines the climate and its variations. For a biologist, the composition is closely dependent on the appearance of the life and its evolution.

**Topic 47**

**Spheres of the Earth 03**

**Hydrosphere**

The hydrosphere includes the oceans, seas, lakes, ponds, rivers and streams. The hydrosphere covers about 71% of the surface of the Earth and is the home for many plants and animals. There are 1386 million cubic kms of water on Earth. This includes water in liquid and frozen forms, groundwater, glaciers, oceans, lakes and streams. Saltwater accounts for 97.5% of this amount. Approximately 75% of the Earth's surface, an area of some 361 million square kilometers, is covered by ocean. Freshwater accounts for only 2.5%. Of this fresh water 68.9% is in the form of ice and permanent, snow cover in the Arctic, the Antarctic, and in the mountainous regions. 30% exists as fresh ground waters. Only 0.3% of the total amount of fresh waters is easily accessible. It is found in lakes, reservoirs and river systems. Freshwater accounts for only 2.5%. Of this fresh water 68.9% is in the form of ice and permanent, snow cover in the Arctic, the Antarctic, and in the mountainous regions. 30% exists as fresh ground waters. Only 0.3% of the total amount of fresh waters is easily accessible. It is found in lakes, reservoirs and river systems.
The average salinity of the Earth's oceans is about 35 grams of salt per kilogram of sea water (3.5%).

Hydrosphere:

It is the portion of water surface over the surface of Earth. It covers about 71% of the total area over the planet. It considers all the water resources like, Atmospheric water resources, surface water resources and ground water resources. It also includes the frozen and the liquefied state of water. It is the most pervasive and least well defined of the four spheres of Earth’s physical environment.

Components of Hydrosphere:

The major ingredients of hydrosphere are.

Surface water resources: these water resources include oceans, rivers, lakes, swamps etc. Atmospheric water resources: these water resources consist upon the precipitation, humidity, thunderstorms, rainfall etc. it may be in the form of drizzles, water droplets or in snow form.
Ground water resources: these are the more purified and the safe water reserves. These resources include aquifer and ground water table etc.

**Importance of Hydrosphere:**

Water is life. Human existence on the planet earth is impossible without the sufficient quality and quantity of water. Hydrosphere overlaps all other three spheres of Earth’s physical environment. For example, liquid water, ice and even water vapors occur in the soil and rocks of the lithosphere. Water vapors and cloud particles composed of liquid water and ice are the important constituent of the lower portion of the earth’s atmosphere. In the biosphere, water is critical component of every living organism of biosphere. Life is impossible without water and every living thing primarily depends upon the efficient quantity of water. It is necessary for plant kingdom and animal kingdom, the two major kingdom classifications of living organisms. Indeed, the total mass of every living thing is more than half water, the proportion ranging from about 60% for some animals, for some animals is about 95% and the human body consists upon about 97% of water. Some other importance of the hydrosphere for human-being is pinned point below.

1. It provides water for drinking.
2. Water is also required for irrigation in rainfall deficit areas.
3. Hydrosphere plays an important role in maintaining the global water cycle and bringing precipitation through the process of water cycle.
4. Aquatic bodies play a great role in our ecosystem by supporting several aquatic floral n faunal lives.
5. It acts as a global pollution sink, and dissolves several pollutants which are present in the atmosphere.

**Topic 48**

**Spheres of the Earth 04**

**Biosphere**

The Biosphere comprises of all living organisms of the earth. Life-forms on the earth utilize the gases of the atmosphere, the water of the hydrosphere, and the nutrients of the lithosphere. Most
of the biosphere is contained in the shallow surface zone called the life layer. It includes the surface of the lands and the upper 100m or so of the ocean. On land, the life layer is the zone of interactions among the biosphere, lithosphere, and atmosphere, with the hydrosphere represented by rain, snow, still water in the ponds and lakes, and running water in rivers.

In the ocean, the life layer is the zone of interactions among the hydrosphere, biosphere, and atmosphere, with the lithosphere represented by nutrients dissolved in the upper layer of seawater.

Biosphere:

The biosphere includes everything living on Earth, including humans, animals, plants, and insects. In other words, the biosphere is everything that is alive on the Earth. It simply means anywhere organisms are found on Earth. Currently the biosphere has a biomass (or amount of living things) at around 1900 rigatonis of carbon. It is not certain exactly how thick the biosphere is, though scientists predict that it is somewhere around 12,500 meters. The biosphere extends to the upper areas of the atmosphere, including birds and insects.

Zones of Biosphere:

Zones of Biosphere are divided into following three zones.

(i) Core Zone:
In core or natural zone human activity is not allowed. This area is legally protected and undisturbed ecosystem.

(ii) Buffer zone:
It is the immediate surrounding area of core zone is buffer zone. Here limited human activities live like research, education and research strategy is permitted.

Manipulation zone:
Manipulation or transition zone is the outermost or peripheral area of biosphere reserve. With the cooperation of reserve management and local people several human activities like settlements, cropping, recreation, and forestry are carried out without disturbing the environment.

Importance of Biosphere Reserve:
Some more important aspects of importance of Biosphere reserves are given below.

1. Conservation:
Biosphere reserves conserve genetic resources, species, ecosystems and landscapes without uprooting inhabitants. Rather the traditional life style and traditional resources of the local people are maintained.

2. Development:
Sustainable economic, cultural, social and ecological developments are ensured.

3. Restoration:
Biosphere reserve helps to rebuild any damage caused to ecosystems and habitats.
4. Education and Research:
Biosphere reserve provides a lot of scientific information for specific scientific studies and research. Exchange of information on restoration, conservation and development of biosphere can be made at national and international levels.