CBCS SCHEME

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18CV36

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Engineering Geology

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Using diagrams and explanation, describe the Internal Structure and Composition of Earth. **(10 Marks)**
b. Write the Physical properties, Chemical composition and uses of Feldspar group of Minerals. **(06 Marks)**
c. Differentiate between Rock Forming Mineral and Ore Mineral. **(04 Marks)**

OR

2 a. Discuss the relevance of Geology in Civil Engineering Profession. **(08 Marks)**
b. Using appropriate examples from the Mineral Kingdom, describe the physical properties of Minerals. **(08 Marks)**
c. Differentiate between Calcite and Magnetite. **(04 Marks)**

Module-2

3 a. Mention the Mineralogical composition texture, Origin and uses of
i) Granite ii) Sandstone iii) Marble iv) Shale. **(08 Marks)**
b. Explain any three types of Drainage patterns. **(06 Marks)**
c. With neat sketch, explain the Soil profile. **(06 Marks)**

OR

4 a. Give a detailed account of Structure of Sedimentary Rocks. **(08 Marks)**
b. Explain the types of Metamorphism. **(06 Marks)**
c. Explain the types of Physical Weathering. **(06 Marks)**

Module-3

5 a. Give a detailed classification of folds and their Engineering considerations. **(08 Marks)**
b. Differentiate between Horst and Graben. **(06 Marks)**
c. List the various Coastline Protection Structures. **(06 Marks)**

OR

6 a. Describe the different types of the joints and mention their Engineering considerations. **(08 Marks)**
b. Give the detailed account of types of Unconformities. **(06 Marks)**
c. Write short note on Rock Quality Designation. **(06 Marks)**

Module-4

7 a. Give an account of vertical distribution of groundwater. **(06 Marks)**
b. Write short note on Flood Control measures. **(06 Marks)**
c. Give the detailed account of types of Aquifers. **(08 Marks)**

OR

8 a. Give an account of the procedure for Seismic Refraction Survey method for Groundwater Exploration. **(10 Marks)**
b. Give a detailed account of methods of Artificial Groundwater recharge. **(10 Marks)**

Module-5

9 a. Write the causes and effects of Earthquakes. **(08 Marks)**
b. Write the short note on Seismic Zones of India. **(06 Marks)**
c. Write a Short note on Tsunami. **(06 Marks)**

OR

10 a. Explain the application and limitations of Remote Sensing Techniques. **(08 Marks)**
b. Explain the components of GIS. **(06 Marks)**
c. Enumerate the applications of Global Positioning System. **(06 Marks)**

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1.

Crust:

The earth's crust is the outermost layer of rocks. The crust is subdivided into 2 layers based on its composition and density.

- Continental crust
- Oceanic crust

Continental crust:

It consists of 0.374% of the earth's mass; depth average 35km and locally it varies 60 – 70kms. It is the outermost part of the earth composed mainly crystalline Felsic rocks. These are low density minerals composed mainly quartz (sio_2) and feldspars (granites, synites and andisites). The crust is the coldest part of our planet. Because cold rocks are deforms slowly, this layer can be easily travelled by primary (P) and secondary (S) waves at velocity 5.8 km/sec. It mainly composed of silicon and aluminium known as SIAL. Its density varies from 2.2 to 2.9 kg/ m^3

Oceanic crust:

It consists 0.099% of earth's mass; thickness or depth at which lies is 0 – 10kms. It is mainly composed of mafic rocks, it consists of silicon and magnesium known as SIMA. The majority of earth's crust was made through volcanic activity of the mid oceanic ridge system. A 40,000 km network of volcanoes generates new oceanic crust at the rate of 17 km^3 per year, covering the ocean floor with basalt. Eg. of accumulation of basalts are the Hawaii and Iceland's. P wave velocity is 6.4km.

The 'mohorovicic discontinuity', named after the Yugoslavian seismologist who discovered it, which separates the crust and the mantle and this boundary marks the variation in rock composition from crust to mantle. There is a marked difference in P wave velocity across the boundary from 6.5 km/s for the crust to 8 km/s for the mantle. Its density varies from 2.9 to 3.2 kg/ m^3 The continental crust regions are thicker and less dense where as oceanic regions are thinner and higher in density.

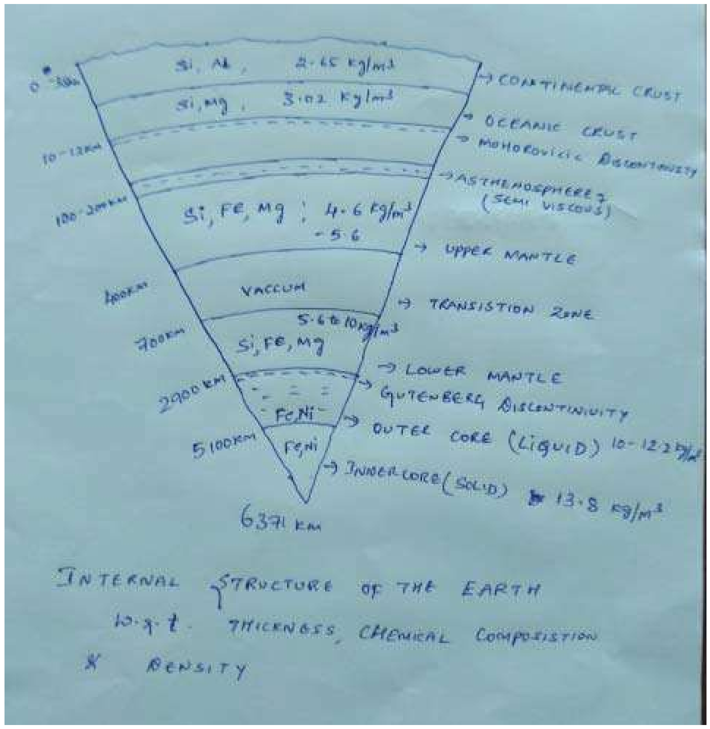
Mantle:

The second major internal region which extends from the base of the crust to the top of the core, forming the majority of the earth's volume..

The mantle region is the source of internal heat known as geothermal energy. This region is also the source energy for all major geodynamic processes like sea floor spreading, plate tectonics, orogeny (mountain building activity), major earthquakes and continental drift.

The mantle is subdivided into the following major categories based on seismic wave characteristics:

- Upper mantle
- Transition zone
- Lower mantle



Upper mantle:

10.3% of earth's mass; depth of 10 – 400km in oceanic crust and 35 – 400km in continental crust side. The upper mantle is mainly consists of ultramafic rocks like peridotite, pyroxenite, and dunnite etc. part of the upper mantle called **Asthenosphere** which is partly molten or semi solid in nature and is responsible for plate tectonism. It lies around 150 – 200km in upper mantle. Seismic velocities are not uniform in the mantle region as they vary with depth. This is because of the increasing density. There is a sudden increase in P wave velocity at a depth of 410km and is known as **410km discontinuity**. There is a decrease in the P wave velocity at depths of 100 – 200km which extends upto 300 to 400km and this decreases is due to partial melting of the material and the layer is called the **Asthenosphere**. This is responsible for the plate tectonics. Its density varies from 3.4 to 4.4 kg/ m^3

Transition zone:

7.5% of the earth mass; depth of 400 – 650km. This region is also called the mesosphere. Here it consists of mantle crust mass and is the source of basaltic magmas. It also contains calcium, aluminium and garnet, which is a complex aluminium bearing silicate mineral. There is a sudden increase in P wave velocity at a depth of 660km and this is called the **660km discontinuity**. Composition is same throughout the mantle zone, only velocity varies due to depth.

Lower mantle:

49.2% of the earth mass; depth of 650km – 2890km. The lower mantle contains 72.9% of the mantle-crust mass and is probably composed of silicon, magnesium and oxygen. It also contains some iron, calcium, and aluminium. Its density varies from 3.4 to 5.6 kg/ m^3

Core:

The inner most layer of the earth which got separated from mantle by Guttenberg – Weichert discontinuity. There is an increase in density from 5,500 kg/ m^3 to 9,900 kg/ m^3 across the boundary. It is again subdivided into two as the

- Outer core

- Inner core

Outer core:

30.8% of the earth's mass; depth of 2890km – 5150km. The outer core is a hot, electrically conductive liquid within which convective motion occurs. This conductive layer combines with the earth's rotation to create dynamo effect that maintains a system of electrical currents known as the earth's magnetic field. It also composed of sulphur and /or oxygen.

In the core mantle boundary there is a marked changes of seismic wave velocity. P wave velocity at the base of the mantle is about 13.7km/s. In the outer core it is 8km/s. Whereas shear wave or S wave drops from 7.3km/s to zero indicating that the outer portion of the core is fluid. Its density varies from 5.6 to 12.2 kg/ m^3

Inner core:

1.7% of the earth's mass, depth of 5150km – 6370km. The inner core is solid and unattached to the mantle, suspended in the molten outer core. It is belived to have solidified as a result of pressure freezing which happens to most liquids when temperature decreases or pressure increases. The innermost 1,200km of the core are solid, as indicated by increase in P wave velocity and non – zero S wave velocity and probably, composed of pure iron. In the high pressure at that depth, dense solids are favoured over less dense liquids. Its density varies from 12.2 to 13.1 kg/ m^3.

2.

Physical Properties- Feldspar group

Habit	crystalline, tabular, prismatic	crystalline, tabular, prismatic	crystalline, tabular, prismatic
Colour	Pale orange, Pale pink	White/ Dull white	Pale green
Streak	absent	absent	absent
Lustre	vitreous	vitreous	vitreous
Diaphaneity	transparent to translucent	transparent to translucent	transparent to translucent
Cleavage	Perfect, 3 sets – mutually bisects at 90°	Perfect, 2 sets –are mutually bisects at 90° and 3rd one around 86 – 89°	Perfect, 2 sets –are mutually bisects at 90° and 3rd one bisects obliquely
Fracture	uneven	uneven	uneven
Hardness	6, cant be scratchable by pen knife	6, cant be scratchable by pen knife	6, cant be scratchable by pen knife
Specific Gravity	Medium	Medium	Medium
Diagnostic Property	Habit, Colour, Cleavage	Habit, Colour, Cleavage	Habit, Colour, Cleavage
Occurance	Magmatic process Found as rock forming mineral in all the rock units	Magmatic process Found as rock forming mineral in all the rock units	Magmatic process Found as rock forming mineral in all the rock units
Chemical Composition	$KAlSi_3O_8$	$KAlSi_3O_8$	$NaAlSi_3O_8$, $CaAl_2Si_2O_8$
Uses	Paints, Ceramics, Gem Stone, Decorative Stone.	Paints, Ceramics, Gem Stone, Decorative Stone.	Paints, Ceramics, Gem Stone, Decorative Stone.
Name of the mineral	**Orthoclase Potash feldspar**	**microcline Potash feldspar**	**Plagioclase Soda feldspar**

3.
Minerals have been defined as naturally occurring homogenous substances, mostly inorganic, that are characterized by a definite chemical composition and a definite atomic structure.
Since rocks which make up the earth are simply natural aggregates of minerals, a study of minerals is of fundamental importance understands the elements of science of geology. The branch of geology dealing with the study of minerals is designated as Mineralogy.
Each mineral is generally characterized with a set of qualities some of which are always distinctive and differentiate it from other minerals. Some of these qualities or properties may be studied from the body of the minerals, its shape, color, shine, hardness etc.; these are termed physical properties. Some other qualities like the behavior towards light require extremely thin sheets or sections of the minerals and are best studied with the help of a microscope. These are termed optical or microscopic properties. A third group of properties involving.

Minerals are generally classified into two broad groups : i) Rock Forming minerals and Ore forming minerals. Rock Forming minerals are those which are found in Abundance in the rocks of the earth crust . Ore forming minerals are those which are of economic value and which do not occur in abundance in the rocks.

Minerals are broadly classified into many groups among them, few major groups are
1. Silicate group
2. Oxide group
3. Carbonate group
4. Sulphide group
5. Sulphate group
6. Hydroxide group

4.
Primary structures in sedimentary rocks
Primary structures are those which are formed at the time of deposition of sediments.
Important primary structures are –
1. Stratification and Lamination
2. Graded bedding
3. Current bedding
4. Ripple marks
5. Mud cracks
6. Others – Tracks and trails, Rain prints

1. **Stratification and Lamination:**
The sedimentary rocks are bedded in nature. A bed is called stratum and a number of beds are called Strata. A bed is a smallest rock unit generally homogeneous in composition, texture and colour. Each bed is bounded by a plane of separation both below and above. These are called Bedding planes. The different layers of beds may vary in grain size, mineral composition, colour, texture etc., depending upon the environment and formation. This feature is called stratification.
Sometimes there will be thin layers within the bed. Such paper thin bed is called a Lamina and the feature is called Lamination. Laminae are quite common in white Sandstone and Shale.

2. Graded Bedding:
In some beds at the bottom, there will be bigger particles and very fine particles at the top. There is a gradual decrease in the size of the particles from bottom to top. This phenomenon is called Graded bedding. Here individual layer is said to be graded with different particle size.

3. **Current Bedding or cross bedding:**
Generally, the sedimentary beds are parallel to one another. Some times the beds are deposited slightly inclined to the major bedding plane because of change in the velocity and direction of flow of stream. This structure is known as Current Bedding.

Ripple Marks:
This is a minor structure in sedimentary rocks formed due to mechanical origin. They are the undulations or wavy structure formed on the surface of loose sediments due to action of wind / wave in a shallow water body. It is also called wave marks. If the ripple marks are formed by stagnant water then the feature will be symmetrical and if they are formed by moving water then they are asymmetrical.

4. Mud Cracks:
These are common structural features of fine grained sedimentary rocks. The development of mud cracks is because of the drying of huge masses of fine grained sediments under sub-aerial condition. It is also called Sun cracks since they are formed due to the effect of solar heat.

5. Other :
Some of the very minor structures observed in sedimentary rocks are 'Tracks and Trails, Rain Prints. The movement of organisms on the surface of loose sediments develops a marking or impression and is called 'tracks and trails'. On the other hand 'Rain prints' are formed on the top surface of loose sediments due to impact of 'drops' of rainwater.

Metasomatism:
Sometimes fluids present around the rock comes in contact with the minerals at high temperature producing many changes in composition, and structure. This process of rock/mineral alteration by the agency of solution is called metasomatism.

Kinds of metamorphism:
Depending upon the factors responsible for metamorphism, different kinds of metamorphism are noticed and they are

1. Thermal metamorphism
2. Dynamic metamorphism
3. Dynamo -thermal metamorphism

1. Thermal metamorphism:
Here, temperature is the dominant factor and pressure and fluid are the sub-ordinate factors. When the thermal metamorphismoccurs in the immediate contact of igneous intrusions, it is called contact metamorphism and when it occurs on a regional scale at depth it is called Plutonic metamorphism. As a result of thermal metamorphism, recrystallization of original minerals takes place.

Ex: Limestone Marble, Sandstone Quartzite

Dynamic metamorphism:

This type of metamorphism takes place in the rock by means of direct pressure / stress which is a dominant which leads to new structures. It is also called Cataclastic / kinetic metamorphism and the rock undergo mechanical breaking down and they may be crushed into smaller ones by pressure.

Ex. Shale Slate

Dynamothermal metamorphism:

It is a kind of metamorphism where temperature and pressure are the dominant factors which operates upon pre-existing rocks. The metamorphism may be regional / local scale and it is called **Regional metamorphism**. Here, temperature promotes recrystallization as in the case of thermal metamorphism and the original mineral grains re-arrange into new minerals. Direct pressure / stress leads into the formation of new structures. Thus, the minerals developed under direct pressure are usually flat, tabular, flaky in nature.

Ex. Granite Gneiss Granulite

Chemical weathering:

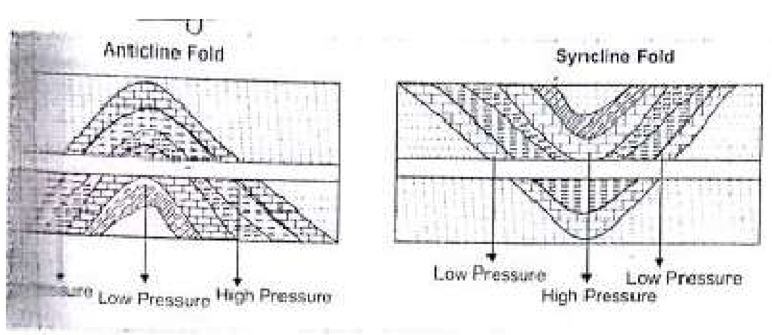
It is a process where chemical alteration or decomposition of rocks and minerals takes due to rain, water, and other atmospheric agents. Chemical weathering weakens the bonds in rocks and makes them more vulnerable to decomposition and erosion.

4

Effects of Structural Features:

Folds signify beds and curvatures and a lot of strain energy stored in the rocks. Their influence on design and construction of tunnels is important . Folding of rocks introduces considerable variation and uncertainty in a sequence of rocks, so that entirely unexpected rocks might be encountered along any given direction. This situation becomes especially serious when folding is not recognized properly in preliminary or detailed surveys due either to its being localized or to misinterpretation.

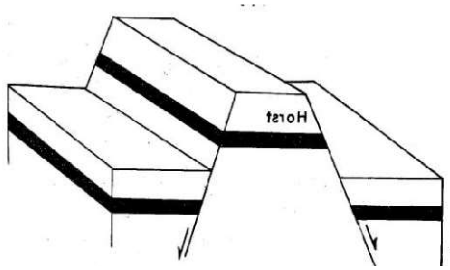
Folding of rock introduces peculiar rock pressures. In anticline folds, loads of rocks at the crest are transferred by arch action to a great extent on to the limbs, which may be highly strained,

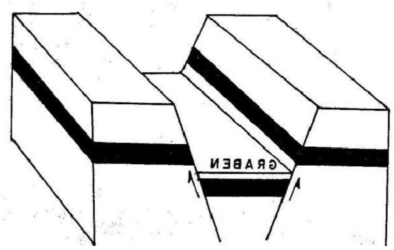


A. Anticlinal – low pressure in middle region B.Synclinal- high pressure

Horst Fault: A fault system consisting of a pair of normal faults whose fault planes are inclined away from each other with a common up throw side in between. The up throw side of a ridge fault system forms a conspicuous inverted wedge shaped ridge parallel to the fault planes, generally long compared to its width called **ridge or a horst.**

Graben Fault: A fault system consisting of a pair of normal faults whose fault planes are inclined towards each other with a common down throw side in between. The down throw side of a troughs fault system forms a long trench or depression parallel to the fault planes, general long compared to its width called **fault basin or graben of a rift valley.**





Coastlines and their engineering considerations

Coastline definition is a line that forms the boundary between the land and the ocean or a lake

Coastal erosion is the wearing away of land and the removal of beach or dune sediments by Currents and Waves, Swash and Backwash of waves, Tides and Tidal Currents, Rip Currents,
Long Shore drift, Hurricanes and Tsunami, Abrasion & Attrition, Corrosion (Salutation).

Coastal Land Forms

- Headlands and Bay Mouth Bars.
- Barrier islands and Barrier Reef.
- Sand Spits.
- Cliffs, Crack or Inlet.
- Caves and Arches.
- Stack and Stump.
- Wave Cut Platform
- Tombolos

Prevention Methods

Coastal erosion occurs when the waves that lap at the coast slowly wear away at the shoreline. As these waves wash over the shore, they carry sand and sediment with them and redistribute it to the ocean floor or to other areas. Coastal erosion prevention methods are as fallows

1. Structural Measures.

- Sea walls.
- Groins.
- Jetties.
- Bulkheads
- Revetments.

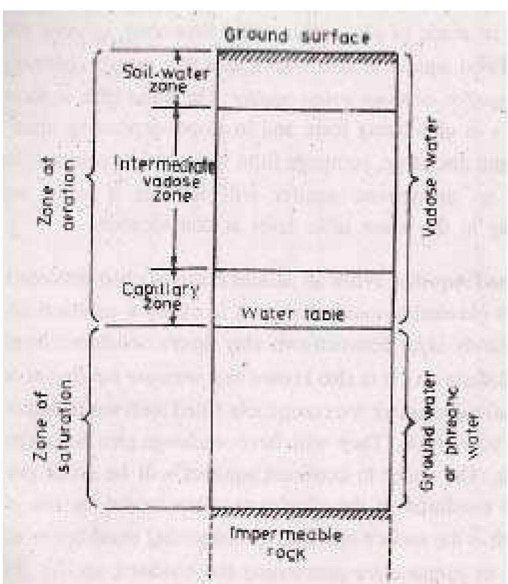
2. Non-Structural Measures

 Building sand dunes and growing vegetation around them.
 Artificial beach nourishment
 Coastal Dunes

3. Bio Shield Methods
• Mangroves
• Coral reefs
• Sea grass
• Sea weeds
• Animal habitats
• Marine parks
• Marine sanctuaries

In general the term groundwater or subsurface water refers to the water that occurs below the surface of earth. The main source of groundwater is infiltration. The infiltrated water after meeting the soil moisture deficiency percolates deeply and becomes groundwater. The subsurface is considered into two zones.

- Zone of saturation
- Zone of aeration



ZONE OF SATURATION: -
This zone, also known, as groundwater zone is the space in which all the pores of the soil are filled with water. The water table forms its upper limit and marks a free surface.
ZONE OF AERATION: -
In this zone the soil pores are only partially saturated with water. The space between the land surface and the water table marks the extent of this zone. Further the zone of aeration has three sub zones:

- Soil water zone,
- Capillary fringe
- Intermediate zone

Soil water zone: -
This lies close to the ground surface in the major root band of the vegetation from which the water is lost to the atmosphere by evapotranspiration. The lithological character of the belt is most important from the groundwater point of view, as this is the zone, which largely controls the infiltration of rainwater.
Capillary fringe: -
The belt overlying the water table in which water is drawn up from the zone of saturation and held against the force of gravity. The water is held by capillary fringe is determined by the texture of the rock pore space above the zone of saturation. The capillary rise in sediments ranging from clay to coarse sand varies roughly as follows. The capillary fringe moves up and down depending on the fluctuation of the water table.
Intermediate zone: -
The intermediate zone, as the name indicates lies between capillary fringe and the belt of soil moisture. In areas where the water table lies close to the land surface.
All earth materials, from soil to rocks have pore spaces. Although these pores are completely saturated with water below the water table from the groundwater utilization aspect only such material through which water moves easily and hence can be extracted with these are significant. On this basis the saturated formations are classified into four categories.
Aquifer, Aquitard , Aquiclude, Aquifuge

FLOOD AND ITS CONTROL
Flood is overflow of excess water that submerges land and inflow of tide onto land.
Floods can form where there is no stream, as for example when abnormally heavy precipitation falls on flat terrain at such a rate that the soil cannot absorb the water or the water cannot run off as fast as it falls.
Floods are caused not only by rain but also by human interference to the surface of the earth. Farming, deforestation, and urbanization increase the runoff from rains; thus storms that previously would have caused no flooding today inundate vast areas.
Some of the major causes are:

- Heavy rainfall
- Heavy siltation of the river bed reduces the water carrying capacity of the rivers/stream.
- Blockage in the drains lead to flooding of the area.
- Landslides blocking the flow of the stream.
- In areas prone to cyclone, strong winds accompanied by heavy down pour along with storm surge leads to flooding

Prevention methods for effective Control of Flood

- **Mapping of the flood prone areas**

Historical records give the indication of the flood inundation areas and the period of occurrence and the extent of the coverage. Warning can be issued looking into the earlier marked heights of the water levels in case of potential threat. In the coastal areas the tide levels and the land characteristics will determine the submergence areas. Flood hazard mapping will give the proper indication of water flow during floods.

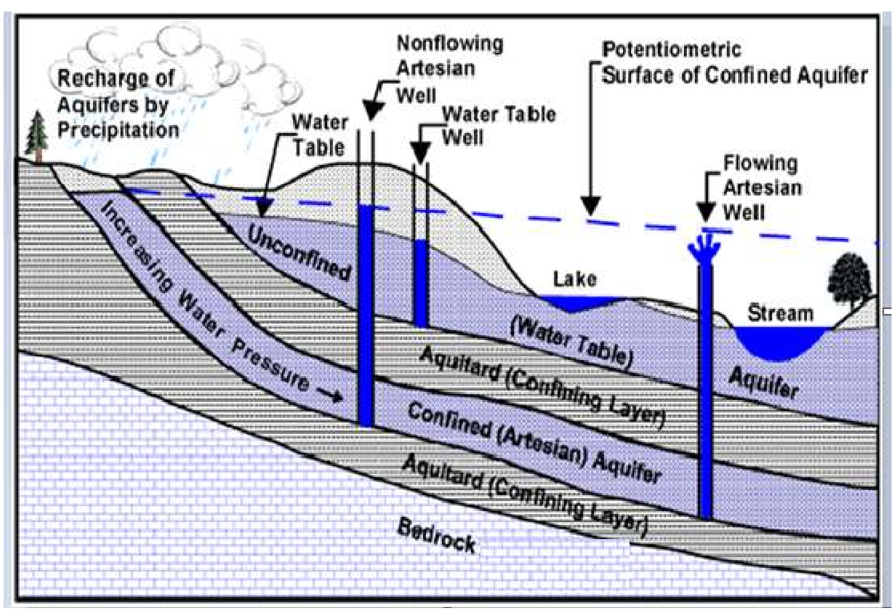
- **Land use control**

In areas where people already have built their settlements, measures should be taken to relocate to better sites so as to reduce vulnerability.
No major development should be permitted in the areas which are subjected to high flooding. Important facilities like hospitals, schools should be built in safe areas.
In urban areas, water holding areas can be created like ponds, lakes or low-lying areas.

- **Construction of engineered structures**

Construction of Engineering structures like Embankments , Dams & reservoirs, Channel improvement ,Drainage improvement , Diversion of flood rivers to withstand flood forces and seepage.
The buildings should be constructed on an elevated area. If necessary build on stilts or platform.

AQUIFER
Groundwater is an important natural resource. The precipitation infiltrates into the ground and travels down until it reaches the impervious stratum where it is stored as groundwater. It is stored in the pores present in the geological formations such as soil, rock, sand, etc.
1. Aquifer
An aquifer is a saturated formation of the earth. It not only stores the water but also yields it in adequate quantity. Aquifers are highly permeable formations and hence they are considered as main sources of groundwater applications. Unconsolidated deposits of sand and gravel are examples of an aquifer.



Aquifers are classified into two types based on their occurrence which are as follows :

- **Unconfined aquifer**
- **Confined Aquifer**

Unconfined aquifer

An unconfined aquifer is an aquifer which has free water surface – which means the water table exists for this type of aquifer. This is also called as water table aquifer or free aquifer or phreatic aquifer. Unconfined aquifers are recharged by the infiltration of precipitation from the ground surface**.**

Unconfined aquifers are those into which water seeps from the ground surface directly above the aquifer.

Confined Aquifer

A confined aquifer is an aquifer confined between two impermeable beds such as aquifuge, aquiclude, etc. The water in the confined aquifer will be under greater pressure which is greater than atmospheric pressure. Hence, the water level shown by piezometer is always higher than the top level of the confined aquifer. The recharge of confined aquifer occurs at a place where it exposes to the ground surface.

2. Aquitard

An aquitard is also a saturated formation. It permits the water through it but does not yield water in sufficient quantity as much as aquifer does. It is because of their partly permeable nature. But however, if there is an aquifer under the aquitard then the water from aquitard may seep into the aquifer. **Sandy clay** is an example of an aquitard. Here, the clay particles block the voids present in the sand and make it partly permeable.

3. Aquiclude

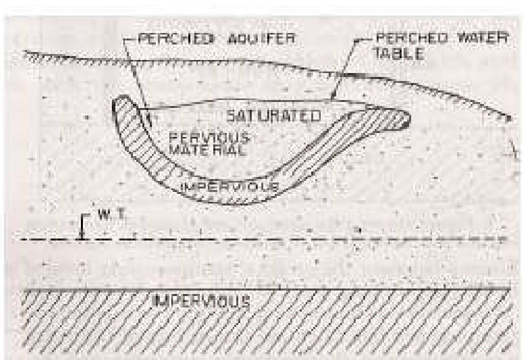
An aquiclude is a geological formation which is impermeable to the flow of water. It contains a large amount of water in it but it does not permit water through it and also does not yield water. It is because of its high porosity. **Clay** is an example of aquiclude.

4. Aquifuge

An aquifuge is an impermeable geological formation which is neither porous nor permeable – which means it cannot store water in it and at the same time it cannot permit water through it. Compact rock is an example of aquifuge.

Perched Aquifers: -

Perched aquifer is a special case, which is sometimes found to occur within an unconfined aquifer. A perched aquifer is separated from another water-bearing stratum by an impermeable layer. Since this type of aquifer occurs above the regional (original) water table, in the unsaturated zone, the aquifer is called a perched aquifer.



5.

REMOTE SENSING

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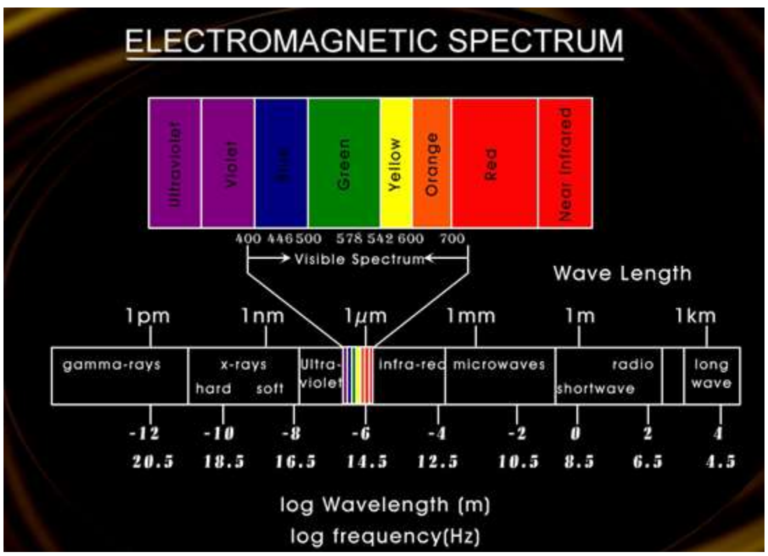
According to India's National Remote Sensing Agency- —**Remote Sensing is the technique of acquiring information about objects on the earth's surface without physically coming into contact with them.**

The art, science, and technology of obtaining reliable information about physical objects and the environment, through the process of recording, measuring and interpreting imagery and digital representations of energy patterns derived from non-contact sensor systems

Principles of remote sensing

1. Detection and discrimination of objects or surface features means detecting and recording of radiant energy reflected or emitted by objects or surface.
2. Different objects return different amount of energy in different bands of the electromagnetic spectrum, incident upon it.
3. Depend upon the property of material (physical, structural, and chemical), surface roughness, angle of incidence, intensity, and wavelength of radiant energy.



Stages/ Process/Principle in remote sensing

1. Energy Source or Illumination (A)
2. Radiation and the Atmosphere (B)
3. Interaction with the Target (C)
4. Recording of Energy by the Sensor (D)
5. Transmission, Reception, and Processing (E)
6. Interpretation and Analysis (F)
7. Application (G)

1. Energy Source or Illumination (A)

The first requirement for remote sensing is to have an energy source to illuminate the target (unless the sensed energy is being emitted by the target). This energy is in the form of electromagnetic radiation.

2. Energy Interactions with Atmosphere As the energy travels in the form of Electromagnetic radiation from its source to the target, it will come in contact with and interact with the atmosphere it passes through.

3. Interaction with the Target (C)

Radiation that is not absorbed or scattered in the atmosphere can reach and interact with the Earth's surface.

4. Recording of Energy by the Sensor (D)

After the energy has been scattered by, or emitted from the target, we require a sensor (remote - not in contact with the target) to collect and record the electromagnetic radiation.

Transmission, Reception, and Processing

The energy recorded by the sensor has to be transmitted, often in electronic form, to a receiving and processing station where the data are processed into an image (hardcopy and/or digital).

6. Interpretation and Analysis (F)

The processed image is interpreted, visually and/or digitally or electronically, to extract information about the target which was illuminated.

Geographic Information System (GIS)

GIS stands for Geographical Information System. It is defined as an integrated tool, capable of mapping, analyzing, manipulating and storing geographical data in order to provide solutions to real world problems and help in planning for the future.

A geographic information system‖ (GIS) is a computer-based tool that allows you to create, manipulate, analyze, store and display information based on its location. GIS makes it possible to integrate different kinds of geographic information, such as digital maps, aerial photographs, satellite images and global positioning system data (GPS), along with associated tabular database information (e.g., attributes or characteristics about geographic features).

Components of a GIS

Hardware: It consists of the equipment‘s and support devices that are required to capture, store process and visualize the geographic information. These include computer with hard disk, digitizers, scanners, printers and plotters etc.

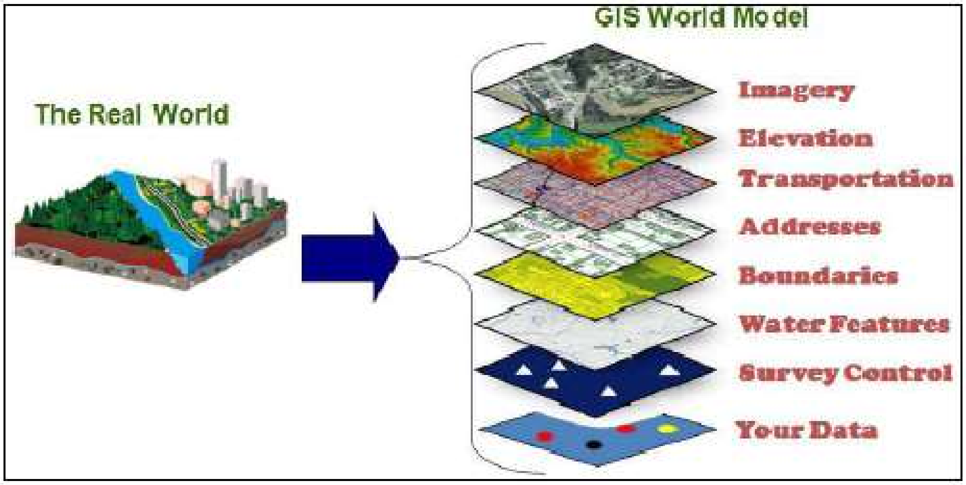
Software: Software is at the heart of a GIS system. The GIS software must have the basic capabilities of data input, storage, transformation, analysis and providing desired outputs.

The interfaces could be different for different software‘s. The GIS software‘s being used today belongs to either of the category –proprietary or open source. ArcGIS by ESRI is the widely used proprietary GIS software. Others in the same category are MapInfo, Microstation, Geomedia etc. The development of open source GIS has provided us with freely available QGIS, GIS GRASS, Map Window GIS etc.,

Data: The data is captured or collected from various sources (such as maps, field observations, photography, satellite imagery etc) and is processed for analysis and presentation.

Procedures: These include the methods or ways by which data has to be input in the system, retrieved, processed, transformed and presented.

People: This component of GIS includes all those individuals (such as programmer, database manager, GIS researcher etc.) who are making the GIS work, and also the individuals who are at the user end using the GIS services, applications and tools. Geographic information (i.e.., land information, spatial information) is information that can be associated with a place name, a street address, section/township, a zip code, or coordinates of latitude and longitude.



Global Positioning System (GPS)

The GPS is a satellite based navigation and surveying system for determination of precise position and time in post processing mode. It was developed by U.S Department of Defence (DOD) which revolutionized the field of modern surveying, navigation and mapping. GPS was considered as a ranging system from known positions on land, sea, air and space and an essential input for GIS. It is having a 24 hr service in all weather conditions. It can analyze upto 24 satellite orbiting at an altitude of 20,200 km.

The system was replaced by NAVSTAR GPS (Navigation satellite timing and ranging GPS), launched in 1972 by US defense mapping agency.

GPS, which stands for Global Positioning System, is the only system today able to show the exact location on the Earth's surface anytime, in any weather and anywhere.

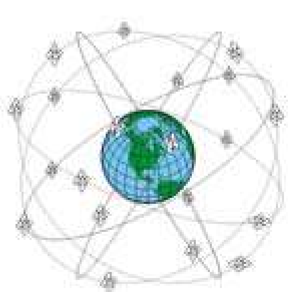
The three parts of GPS are:

1. Satellites
2. Receivers
3. Software

Three Segments of the GPS

1. Space Segment

Space Segment has 24 GPS space vehicles (SVs).Satellites orbit the earth in 12 hrs. 6 orbital planes inclined at 55 degrees with the equator. This constellation provides 5 to 8 SVs from any point on the earth.



GPS

- 6 Orbital planes
- 24 Satellites + Spare
- 55^0 Inclination Angle
- Altitude 20,200km