1.Define weathering and Explain factors influencing the physical and chemical weathering in detail.

Weathering a process that cause the disintegration of rocks, either to form new minerals that are stable on the surface of the Earth, or to break the rocks down into smaller particles. Weathering is the result of the interactions of air, water, and temperature on exposed rock surfaces and results the erosion on rock surface.

Physical weathering:

It is the process by which rocks are broken down into smaller pieces by external conditions. single block is broken gradually into numerous small irregular fragments and then into smaller fragments. Further it is classified into Block disintegration and Granular disintegration.

Block disintegration: This is because of regular arrangement of atoms in a rock, due to this individual blocks are obtain.

Granular disintegration: This is because of irregular arrangement of atoms in a rock, due to this small grains are obtain.

Thermal or heat effect: The effect of change of temperature on rocks is of considerable importance in arid and semiarid regions where difference between day- time and night time temperature is very high. Expansion on heating followed by contraction on cooling, repeated expansion and of the same rock body gradually breaks into smaller pieces due to stress developing by this process.

Frost action: It results due to freezing of water which are trapped in the cracks of the rocks widens and deepens the cracks, breaking off pieces and slabs.

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.

Hydrolysis: H^+ or OH^- replaces an ion in the mineral. Example

Leaching: Ions are removed by dissolution into water. In the example above, K^+ ionwas leached.

Oxidation: Since free oxygen (O_2) is more common near the Earth's surface, it may reactwith minerals to change the oxidation state of an ion. **Dehydration:** Removal of H_2O or OH^- ion from a mineral.

Complete Dissolution: The entire mineral is completely dissolved by the water.

2. What is drainage pattern? Explain different types of Drainage pattern

A Drainage pattern can be defined as a topographical features from which a stream gets runoff, through flow, and groundwater flow which can be divided by topographic barriers .

A geometric arrangement of streams in a region is known as a drainage pattern.

Types of Drainage patterns

1) Dendritic drainage pattern

A dendritic drainage pattern is the most common form and looks like the branching pattern of tree roots. It develops in regions underlain by homogeneous material. That is, the subsurface geology has a similar resistance to weathering so there is no apparent control over the direction the tributaries take. Tributaries joining larger streams at acute angle (less than 90 degrees).

Parallel drainage pattern

Parallel drainage patterns form where there is a pronounced slope to the surface. A parallel pattern also develops in regions of parallel, elongate landforms like outcropping resistant rock bands. Tributary streams tend to stretch out in a parallel-like fashion following the slope of the surface. A parallel pattern sometimes indicates the presence of a major fault that cuts across an area of steeply folded bedrock. All forms of transitions can occur between parallel, dendritic, and trellis patterns.

Trellis Drainage Pattern

Trellis drainage patterns look similar to their name, the common garden trellis. These drainage pattern typically develop where sedimentary rocks have been folded or tilted and then eroded to varying degrees depending on their strength . Tributaries join the main stream at nearly right angles.

Rectangular Drainage Pattern

The rectangular drainage pattern represents a region prominent parallel and perpendicular faults , repeated folds or a strong rectangular jointing pattern will display a rectangular drainage pattern.

Rectangular patterns develop in areas that have very little topography and a system of bedding planes , fractures or faults that forma rectangular net work.

Radial Drainage Pattern

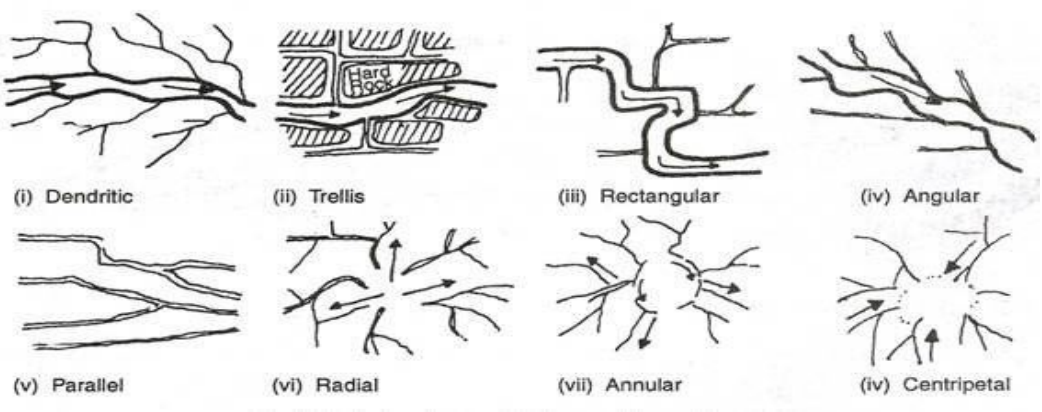
The radial drainage pattern develops around a central elevated point. This pattern is common to such conically shaped features as volcanoes. The tributary streams extend the head ward reaches upslope toward the top of the volcano.

Centripetal Drainage Pattern

Centripetal or inland drainage pattern is opposite to the radial drainage pattern because it is characterized by the streams which converge at a point which is generally a depression or a basin , Found on sinkhole, craters and other basin like depressions.

Annular Drainage

Annular Drainage pattern is a pattern of concentric circles that are connected by shot radial stream segments



3.Explain the landforms formed by the action of river water

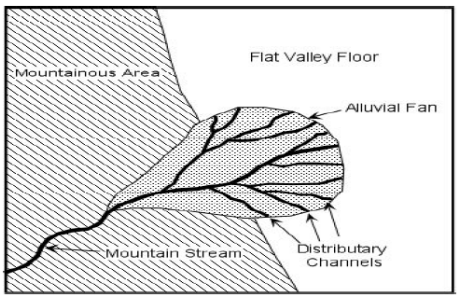
Potholes: These are bowl like cylindrical depression with the dimension of few inches to several feet formed due to Abrasion of softer rocks. Initially small depression forms and later the pebbles and gravels are caught in Eddis and thrown into a swirling / churning motion and causing deepening and widening of the holes.

Gorges and Canyons: A valley is a low land surrounded on sides by inclined hill slope sand mountains. Valley deepening occurs due to cutting down of river bed which depends on the velocity of streams GORGES are due to valley deepening and they are very deep and narrow valleys with very steep and high walls on either side. CANYONS are a specific type of gorge where the layers cut down by a river are essentially stratified and horizontal in altitudes.

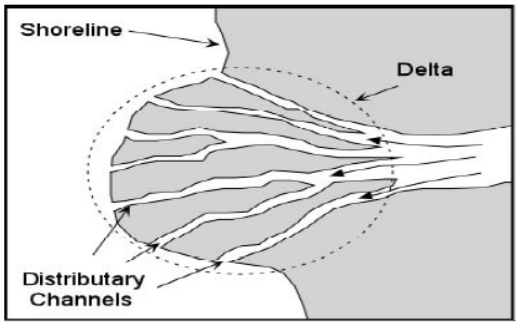
Waterfalls: -A step descent of a river at a particular point in its course, especially in mountainous regions is called a waterfall. Waterfalls range in size from a small descentor jump

called a rapid to a succession of rapids over a steep gradient called cascades to shear deep majestic vertical falls of hundreds of meters.

Alluvial Fans- When a steep mountain stream enters a flat valley, there is a sudden decrease in gradient and velocity. Sediment transported in the stream will suddenly become deposited along the valley walls in an alluvial fan. As the velocity of the mountain stream slows it becomes choked with sediment and breaks up into numerous distributary channels



Deltas – It is a region where stream or river enters to lake or ocean, there is a sudden decrease in velocity and the stream deposits its sediment in a deposit called a delta. As the velocity of a stream decreases on entering the delta, the stream becomes choked with sediment .

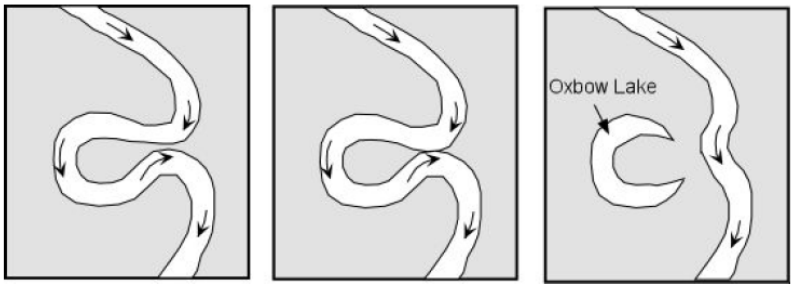


Meanders and oxbow lakes: Meanders refers to the bends or longitudinal courses of the rivers. When a river is sluggishly flowing in the plains, it has very little energy to remove the obstructions. Its course gets deviated / deflected due to slight irregularities. As a result, the river develops prominent beds which may furthers well into big loop.

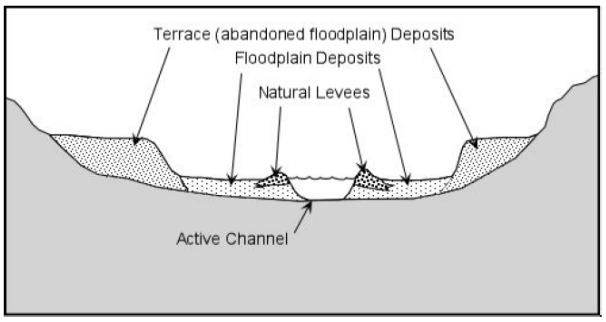
Erosion will take place on the outer parts of the meander bends where the velocity of the stream is highest. Sediment deposition will occur along the inner meander bends where the velocity is low. Such deposition of sediment results in exposed bars, called point bars.

Oxbow lake

When curvature of the meander loops in accentured due to lateral erosion , the meander loops become almost circular and the two ends of meander loops come closer, consequently , the same course and meander loops are abandoned to form Ox Bow lake.



Stream terraces. Stream terraces are step like benches that occur above the stream bed and floodplain. They are cut into bedrock or are remnants of older river sediments that have since been eroded. Terraces form in response to flooding or changes in base level.



4.Explain the criteria's for selecting the rocks as a 1. Foundation material 2. Railway ballast

Igneous Rock These Rocks are formed from an originally hot molten material through the process of cooling and crystallization. Silica is the dominant constituent of the Igneous rock.

Many of igneous rocks are extensively used as materials for construction . Due to very high crushing strength Granites, Syenites and Dolerite are used most of construction works , Basalt and other dark colored igneous rock are useful for foundation and as road stones.

Igneous rocks are typically impervious ,hard and strong form very strong foundations for dams and reservoir .

Sedimentary rocks are types of rock that are formed by the deposition and subsequent cementation of that material at the Earth's surface and within bodies of water.

Sedimentary rock are used in the cement, sand , gravel and to make concrete.

Selection of Rock as a Foundation material

- Rock foundations are always preferred in terms of stability and durability.
- Even the weakest rock is better in strength and reliability compared to good soils.
- Rocks such as limestone, granite, sandstone, shale have a high bearing capacity which are extensively used for foundation
- The durability, strength and other factors depend on the type of the rock s its texture and structure and mineral composition .

On the basis of the above factors we can recommend igneous rocks of plutonic origin and also basalt of volcanic origin, these rocks formed from magma and lava by the processes crystallization to form a rigid mass with out any outside material matrix which is present in sedimentary rocks, similarly the magma during its cooling develops a interlocking of crystals which makes very hard compact with high load bearing capacity.

Selection of Rock as a Railway Ballast

- Railway Ballast is the foundation of railway track and provide just below the sleepers. The loads from the wheels of trains ultimately come on the ballast through rails and sleepers.
- The stone to be used as railway ballast should be hard, tough nonporous and should not decompose when exposed to air and light. Rocks like granite, quartzite, Gneiss, basalt forms the excellent ballast materials.

5. What are folds? Explain five different types of folds with neat diagram.

An undulation is obtained in rock strata produced by compressive forces in plastic strata similar to buckling of an overload column is known as Folds.

Anticline: A simple up fold in which older beds lie inside and the limbs dip away from each other equally or unequally like the sides of a gable roof of a house. When the limbs dip equally the fold is called a symmetrical anticline when dip unequally, it is called asymmetrical anticline.

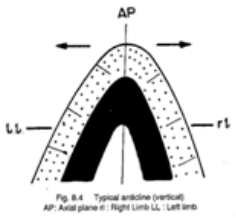
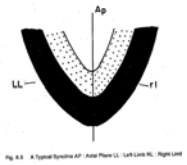


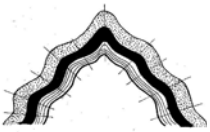
Fig. 8.4 Typical anticline (vertical)
AP: Axial plane rl : Right Limb LL : Left limb

Syncline: a Simple down fold in which younger beds lie inside and the limbs dip towards each other. When the limb dip equally the fold is called symmetrical synclines, when dip unequally an asymmetrical syncline.



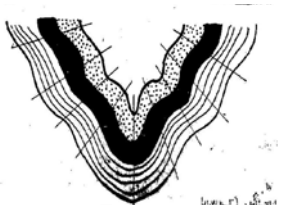
Anticlorium

A large Anticline with secondary folds smaller size developed on it



Synclorium

A large Syncline with secondary folds smaller size developed on it



Folds are classified depending on the position of axial plane as below

Symmetrical Folds:

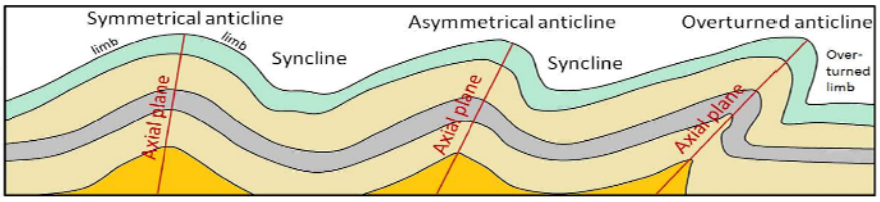
When the axial plane divides a fold into two equal halves in such a way that one half is the mirror image, then the fold is called as symmetrical fold.

Asymmetrical Folds :

When the axial plane divides a fold not of the in such a way that not having same magnitude (Inclined), asymmetrical folds are formed.

Overturned Folds :

Both limbs dip in same direction but one limb will be beyond vertical . The beds dip in the same direction on both sides of the axial plane because one of those limbs being rotated through an angle of at least 90º

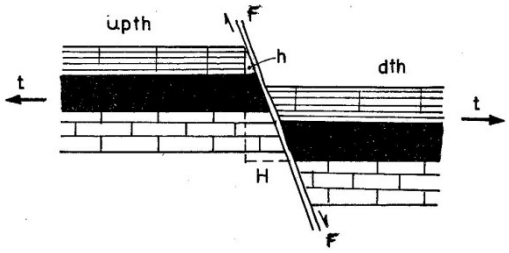


6.What are faults? Explain five different types of faults with neat diagram.

A fault is a fracture or fracture zone in rocks along which there has been displacement of the two sides relative to one another parallel to the fracture. A fault is defined as a displacement of rock strata, due to relative movement of adjacent blocks has taken place.

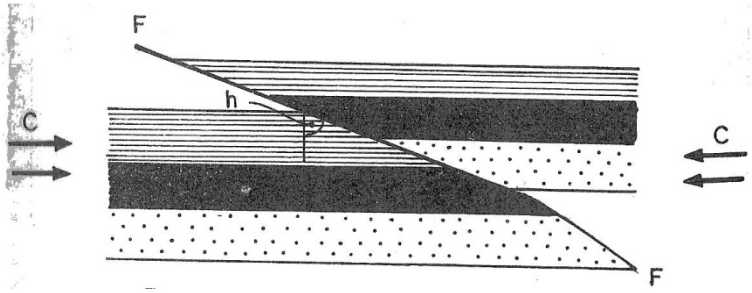
A fault is a rupture deformation produced either by tensional or compressive forces.

Normal Fault: A normal fault is a high angle dip-slip fault in which the fault plane is inclined steeply with hade10 deg -20 deg or less. The vertical component of the movement ie the throw is generally large. The hanging wall moves downwards relative to the foot wall and caused by extensional tectonic forces. This kind of faulting will cause the faulted section of rock to lengthen.



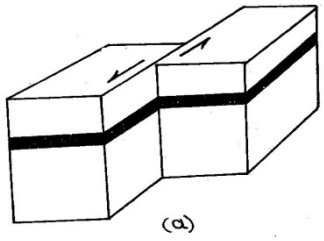
Reverse Fault: A reverse fault is a low –angle dip-slip fault in which the fault plane is inclined less steeply towards the up throw side i.e the hade is pointing towards the up throw side and the hanging wall has moved up relative to the foot wall and caused by compressional tectonic forces. This kind of faulting will cause the faulted section of rock to Shorten.

Reverse faults are produced by severe compressive forces and the fault planes commonly area gently dipping with large hade over 45 deg.. Reverse fault may be small, local or regional.

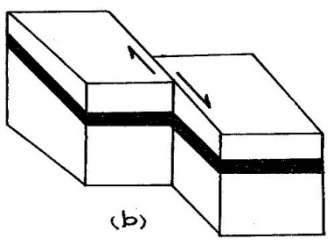


Lateral Fault: - A lateral fault is a strike slip fault i.e in which the dislocation is essentially horizontal in the direction of the strike of the fault plane without any dip-slip component. Lateral faults are also called faults, transverse, transcurrent or wrench faults. The fault plane is vertical of near vertical.

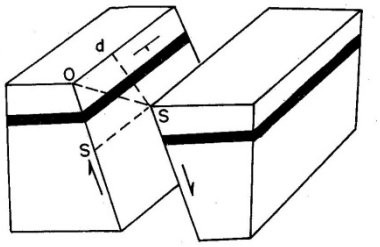
(a). Left-lateral or Sinistral Fault: - in which the left block appears to have moved towards the observer.



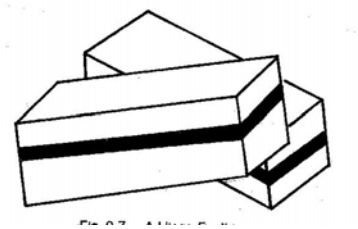
(b). Right-Lateral or Dextral Fault: - in which the right side block appears to have moved towards the observer.



(c). Diagonal-slip Fault: - This is an oblique –slip fault in which the dislocation is diagonal i.e at an angle to the directions of true-dip and strike of the fault plane, up or down both dip-slip and strike-slip components.



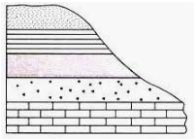
(d). Hinge-Fault: - A fault with an angular or rotational displacement in which the wall rocks of one side have rotated along an axis normal to the fault plane with respect to the rocks of the other wall.



7.What are unconformities? Explain the different types of unconformities with neat diagram.

Unconformities

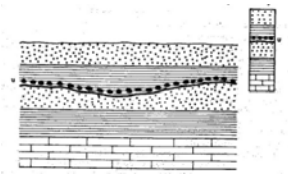
When stratified rock formations are deposited regularly and continuously one above the other without any disturbance or break in the succession presenting a series of parallel beds, the sequence is called conformable beds or series and the structure is called conformity.



Unconformity is of three kinds.

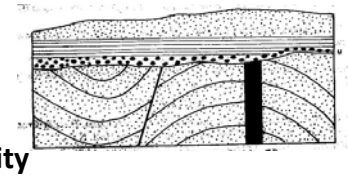
Parallel Unconformity or Disconformity

An erosion surface with an uneven relief between two parallel (conformable) series. When the underlying (older) and overlying (younger) sedimentary rock strata are parallel and the contact plane is an erosional surface is called Disconformity



Angular Unconformity

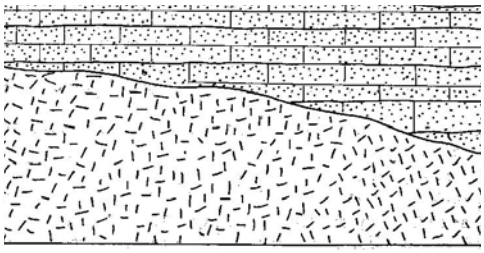
An unconformity in which a younger parallel series deposited on an erosion surface of a lower deformed (tilted, folded and or faulted) older series with an angular discordance. When the underlying (older) rocks and overlying (younger) rock strata show some angle w.r.t one another is know as Angular unconformity



Non-Conformity

An unconformity between two series of rock of different origins like an upper younger stratified formation and an older non-stratified or massive igneous or metamorphic rock.

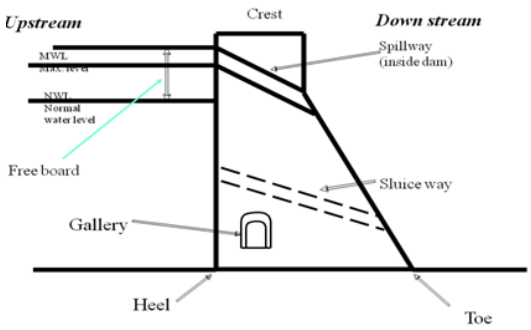
When the underlying rocks are Igneous or Metamorphic (i.e. unstratified) and the overlying younger rocks are sedimentary (stratified) is know as Non-conformity.



8. Define Dam. Explain the role of Dip and Strike in the stability of a dam construction with neat diagram.

A dam may be defined as a solid barrier constructed at a suitable location across a river valley. The principle uses are to provide stream regulation and storage for communities or industrial water supply, power, irrigation, flood control, water traffic. A dam that serves more than one such purpose is known as multipurpose dam.

Schematic cross section of dam



Dip and Strike plays a very important role in the stability of a Dam Structure

Dip and strike conditions in the nature at the site of dams may be:

1. Dams on Upstream dipping beds
2. Dams on Horizontal beds
3. Dams on Downstream dipping beds

i) Dams on Upstream dipping beds

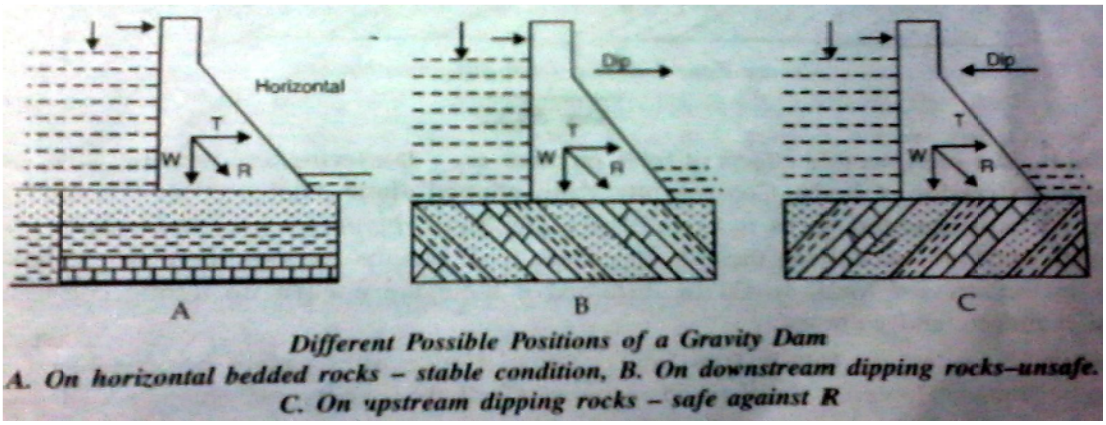
In this condition , gently upstream dipping layers offers best resistance – the force in the dam which is the most stable condition

ii) Dams on Horizontal beds

Horizontal bedded rocks in the foundation provide stable condition to the dam.

iii) Dams on Downstream dipping beds

In this situation the force (due to weight of the dam and thrust of the impounded water) is always down stream. The most unfavourable strike direction in which the beds strike parallel to the axis of the dam and DIP in downstream direction must avoided



Different Possible Positions of a Gravity Dam
A. On horizontal bedded rocks – stable condition, B. On downstream dipping rocks–unsafe.
C. On upstream dipping rocks – safe against R

T=Trust of water in Reservoir, R=Resultant force, W= Weight of the dam)

Fig. A : on Horizontal bedded rock- Stable condition

Fig. B: on downstream dipping rocks- unsafe, The condition is worse, there is a great chance of seepage of much of water form to reservoir

Fig. C :on Upstream dipping rocks –Safe condition