QUESTION 1:

What causes earthquakes? If the Richter magnitude reaches at 8 or above what will be the consequences? Differentiate primary and secondary waves?

Earthquakes occur when the ground is subjected to so much force that it fractures or breaks. Scientists can explain how most earthquakes are caused using simplified theories of the Earth's structure.
Most of what we know about the interior of the Earth comes from the study of seismic waves from earthquakes. Seismic waves from large earthquakes pass throughout the Earth.

**Magnitude Reaches at 8 or above:**
The region of the united states is part of integral national economy. Undoubtedly the economic effects of a major earthquake (taken to be in the order of magnitude 8 to 8.5 on the richter scale) will not be limited to the impacted region alone Hence, there will be ripple effects. To see how the rest of country will be affected by a major earthquake in the long-run, imagine an artificial economy which is completely diversified in the sense that every household in the country of everything. In this factitious world.

**Difference Between Primary Waves and Secondary Waves:
Primary waves:**
Primary waves travel faster, move in a push-pull pattern, travel through solids, liquids and gases, and cause less damage due to their smaller size.

**Secondary Waves:**Secondary waves travel slower, move in an up-and-down pattern, travel only through solids, and cause more damage due to their greater size.

## Wave Speeds

## P waves travel faster than S waves, and are the first waves recorded by a seismograph in the event of a disturbance. P waves travel at speeds between 1 and 14 km per second, while S waves travel significantly slower, between 1 and 8 km per second. The S waves are the second wave to reach a seismic station measuring a disturbance. The difference in arrival times helps geologists determine the location of the earthquake.

## Type of Wave

Primary waves are made up of compression waves, also known as push-pull waves. The individual waves, therefore, push against one another, causing a constant parallel, straight motion. S waves are transverse waves, which means they vibrate up and down, perpendicular to the motion of the wave as they travel. In an S wave, particles travel up and down and the wave moves forward, like the image of a sine wave.

## Travel Capability

Because of their wave movement, P waves travel through any kind of material, whether it is a solid, liquid or gas. On the other hand, S waves only move through solids and are stopped by liquids and gases. For this reason, S waves are sometimes referred to as shear waves because they are unable to alter the volume of the material that they pass through. This also accounts why fewer S waves are recorded than P waves. Geologist used this difference to determine that the Earth's outer core is liquid, and continue to use this difference to map the internal structure of the Earth.

## Wave Sizes

S waves are generally larger than P waves, causing much of the damage in an earthquake. Since the particles in an S wave move up and down, they move the earth around them with greater force, shaking the surface of the Earth. P waves, though easier to record, are significantly smaller and do not cause as much damage because they compress particles in only one direction.

QUESTION 2:
Describe the role of geology in selection of sites for dams and reservoirs?

Ans:

Geological investigation for selecting and locating dam sites is one of the most significant studies which should be carried out in different scales and stages before deciding the best location for a dam. Therefore, an adequate assessment of site geologic and geotechnical conditions is one of the most significant aspects of a dam safety evaluation. Evaluation of the safety of a new dam requires, among other things, that its site, abutments, foundation and reservoir have been adequately examined, explored, and investigated so that the geological conditions are fully understood as much as possible.

The geological investigations should include four main topics;

* The geology of the dam site including the foundation for the dam itself and the sites for other structures such as spillway, diversion tunnel and outlet works. To check whether the dam foundation has sufficient strength and durability to support the type of dam proposed, whether the foundation is watertight, especially, when karstified rocks occur in the site and in deeper horizons bellow the foundations.
* The geology of the area to be occupied by the reservoir once the dam is completed. Whether the storage area is watertight or are there areas of cavernous limestone and/or gypsum which might lead to the dam not retaining water.
* Stability of the slopes in the dam site and reservoir area whether landslides into the reservoir are possible which might cause a wave of water to be pushed over the top of the dam.
* Finding sources of the construction materials which will be needed to build the dam in nearby areas of the dam site including all required types like: aggregates of different types and sizes, filling materials in the core and both surfaces (if the dam is of earth-fill type).

**QUESTION 3:**

What are the different types of mass wasting? Also explain the protective measures of landslides?

Ans:

Types of mass wasting include Creep, slides, flows, topples, and falls, each with its own characteristic features, and taking place over timescales from seconds to hundreds of years. Mass wasting occurs on both terrestrial and submarine slopes, and has been observed on Earth, Mars, Venus, and Jupiter's moon.
When the gravitational force acting on a slope exceeds its resisting force, slope failure (mass wasting) occurs. The slope material's strength and cohesion and the amount of internal friction within the material help maintain the slope's stability and are known collectively as the slope's shear strength. The steepest angle that a cohesionless slope can maintain without losing its stability is known as its angle of repose. When a slope made of loose material possesses this angle, its shear strength counterbalances the force of gravity acting upon it.

Mass wasting may occur at a very slow rate, particularly in areas that are very dry or those areas that receive sufficient rainfall such that vegetation has stabilized the surface. It may also occur at very high speed, such as in rockslides or landslides, with disastrous consequences, both immediate and delayed, *e.g.*, resulting from the formation of landslides dams. Factors that change the potential of mass wasting include: change in slope angle, weakening of material by weathering, increased water content; changes in vegetation cover, and overloading.

**QUESTION 4:**

Differentiate fault, joint and fold?

1. What do the normal faults cause to the crust of the Earth?
2. Folds develop in which type of rock?
3. What is the effect of faulting on outcrop?
4. Where should a site for a civil engineering project be located? a) On faulted zone
b) on folded strata c) On a joint d) Must be avoided to possible extent to be built on all three.

**FOLD**:

Permanent wavelike deformation in layered rock or sediment.
**FAULT**:

A fracture in bedrock along which rocks on one side have moved relative to the other side.
**JOINT**:
A fracture on a rock without noticeable movement.

**(A) Normal Fault Cause to Crust on the Earth:**Faults are cracks in the earth's crust along which there is movement. These can be massive (the boundaries between the tectonic plates themselves) or very small. If tension builds up along a fault and then is suddenly released, the result is an earthquake.

**(B) Folds Develop in Rock:**
Most fold mountains are composed primarily of sedimentary rock and metamorphic rock formed under high pressure and relatively low temperatures. Many fold mountains are also formed where an underlying layer of ductile minerals, such as salt, is present. Fold mountains are the most common type of mountain in the world.

**(C ) Effects of faulting on Outcrop:**In dip faults which occur parallel to the dip of the outcrop, the most prominent effect observed after faulting and erosion of the upthrown block is a horizontal shift between the two parts of the outcrop.

**(D) Site for Civil Engineering Project:**On A fold strata but also possible on all scenarios.

**QUESTION 5:**

**Describe tunneling on the basis of geology? Also determine geological investigation for tunnels?**

**Ans:**

**Tunneling on the basis of Geology:**A tunnel is an underground passageway, dug through the surrounding soil/ earth/ rock and enclosed except for entrance and exit, commonly at each end. A pipeline is not a tunnel, though some recent tunnels have used immersed tube construction techniques rather than traditional tunnel boring methods.

**Geological Investigation for Tunnel:**

1. Geotechnical investigations are critical for proper planning of a tunnel.
2. Selection of the alignment, cross section, and construction methods is influenced by the geological and geotechnical conditions, as well as the site constraints. Good knowledge of the expected geological conditions is essential. Tunnel alignment is sometimes changed based on the results of the geotechnical to minimize construction cost or to reduce risks.
3. The type of the ground encountered along the alignment would affect the selection of the tunnel type and its method of construction.
4. Study of the impact of geological features on the tunnel alignment in the presence of active or inactive faults. During the planning phase, avoid crossing a fault zone. If it is un avoidable then proper measures for crossing it should be implemented. Presence of faults or potentially liquefiable materials would be of concern during the planning process.
5. Geotechnical issues such as the soil or rock properties, the ground water regime, the ground cover over the tunnel should be analysed. The investigation should address not just the soil and rock properties, but also their anticipated behaviors during excavation.
6. The investigation should also address groundwater. For example, in soft ground SEM tunneling, the stability of the excavated face is greatly dependent on control of the groundwater. Dewatering, pre-draining, grouting, or freezing are often used to stabilize the excavation.
7. Analysing the ground behavior during tunneling will affect potential settlements on the surface. Measures to minimize settlements by using suitable tunneling methods or by preconditioning the ground to improve its characteristics would be required.
8. Risk assessment is an important factor in selecting a tunnel alignment. Construction risks. Sensitive existing structures. Very Hard spots (rock, for example) beneath parts of a tunnel.