

MODULE 1

SYSTEM OF EARTH

SYLLABUS

- Lithosphere- composition, rocks, soils;
- Atmosphere-layers, ozone layer, greenhouse effect,
- Weather, cyclones, atmospheric circulations,
- Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere.
- Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience.
- Disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs.

➤ **INTRODUCTION ABOUT VARIOUS SYSTEMS OF EARTH**

Everything under the earth is placed under 4 subsystems:

1) Lithosphere:

- The layer which contains rocks, soils and minerals.
- It is the outer layer of the earth
- Includes crust and mantle

2) Atmosphere:

- The layer which contains all the gases present on the earth.
- It contributes the climatic conditions.
- Based on temperature subdivided into
:troposphere,stratosphere,mesosphere,thermosphere,exosphere

3) Hydrosphere:

- The layer which contains all the water sources present on the earth.
- Contains surface and subsurface water sources
- Contributes climatic conditions.

4) Biosphere:

- The layer which contains all the living components present on the earth.
- Commonly known as ecosystem

➤ **ZONES OF EARTH**

Earth has 4 concentric zones:

1) Inner core

- Innermost zone
- Contains solid mass of iron
- Thickness—1216 km

2) Outer core:

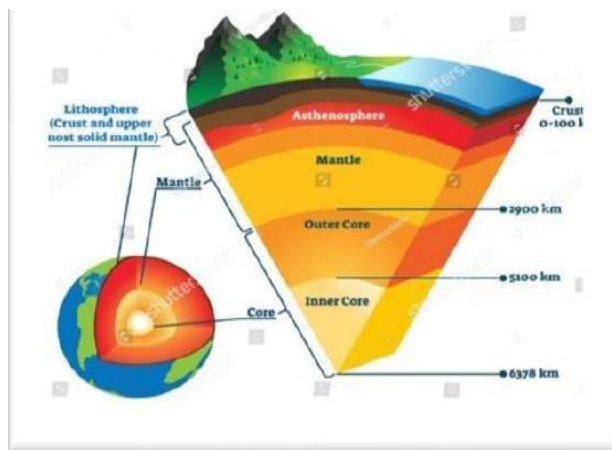
- Core which covers the inner core.
- Contains molten liquid of iron.
- Thickness—2270 km.

3) Mantle:

- Layer which covers the outer core.
- Contains various minerals.
- Thickness—2900 km

4) Crust:

- Outermost zone
- Exterior of the earth
- Thickness—5 km.



➤ **LITHOSPHERE**

- Outer layer of the earth, which contains soil, rocks and minerals.
- It includes crust and mantle part of the earth
- Lithosphere interacts with atmosphere, hydrosphere and biosphere. so they are known as pedosphere.

TYPES OF LITHOSPHERE

1) Oceanic lithosphere.

- **5-8** km thickness
- Composed of basalt

2) Continental lithosphere

- **30-40** km thickness

COMPOSITION OF LITHOSPHERE

- Lithosphere is composed of minerals, rocks and soil.

➤ **MINERALS:**

- Minerals are naturally occurring inorganic crystalline solids that have definite chemical composition.
- Minerals are composed of group of elements.
- Certain minerals are composed of single element. Eg:graphite diamond,made of carbon
- List of minerals found on earth's crust are:(CODE:OXY-SIAL-ICASO-POTAMAG)

<i>S.No.</i>	<i>Elements</i>	<i>Per cent</i>
1	Oxygen	46.6
2	Silicon	27.7
3	Aluminum	8.1
4	Iron	5.0
5	Calcium	3.6
6	Sodium	2.8
7	Potassium	2.6
8	Magnesium	2.1

➤ **ROCKS**

- Rocks are naturally occurring hard and consolidated inorganic materials, composed of one or a large number of minerals.
- Certain other materials, like coal and limestone are developed from plant and animal remains.
- there are mainly 3 types of rocks:

1) Igneous rocks 2) sedimentary rocks 3) metamorphic rocks

1) IGNEOUS ROCKS

- These rocks are formed by the solidification of magma or lava.
- They are composed of primary minerals, which are predominantly silicates.
- They sometimes overlap with sedimentary and metamorphic rocks.
- E.g.: Granite ,Basalt (CODE:GRABAS)

2) SEDIMENTARY ROCKS

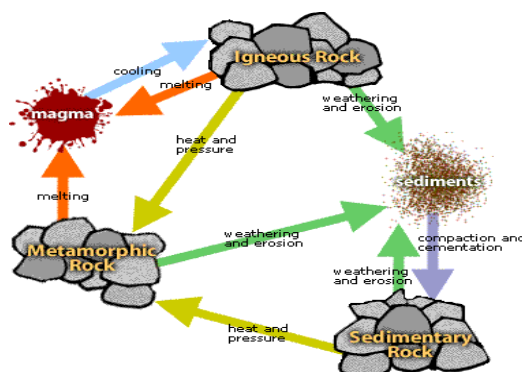
- These rocks are formed by the solidification of sediment deposits.
- They are composed of secondary minerals.
- In the oceanic beds, sedimentary rocks are formed by the precipitation and settlement of salts.
- In the landscape, sedimentary rocks are formed by the solidification of decomposed matter.
- E.g.: sandstone,shale,limestone (CODE:SASHAL)

3) METAMORPHIC ROCKS

- Rocks which are formed from the metamorphic changes occurred in pre-existing igneous and sedimentary rocks.
- Metamorphic changes are the changes in temperature and pressure.
- E.g.: marble, Quartzite. (CODE:MARQUAR)

➤ ROCK CYCLE

- It is the cyclical changes occur in igneous, sedimentary and metamorphic rocks.
- Due to weathering action, igneous rocks are disintegrated to sediments and they are consolidated to form sedimentary rocks.
- Due to excess heat and pressure the sedimentary rocks again converted into metamorphic rocks.
- Due to the action of magma and lava in metamorphic rocks, it again change to sedimentary rocks.



➤ **SOIL**

- Soil is the thin layer of material covering the earth's surface and is formed from the weathering of rocks.
- Weathering is the process of disintegration of rocks, to form soil.
- Soil mainly consist of mineral particles, organic materials, air, water and living organisms.
- Most plants get their nutrients from the soil and they are the main source of food for humans, animals and birds. Therefore, most living things on land depend on soil for their existence.

FUNCTIONS OF SOIL:

- Provides **mechanical support** to the plant.
- It has the property of porosity, i.e. ability to hold water.so that, soil is considered as the reservoir of water.
- Provides micro and macro nutrients and p.H for the growth of microorganisms, plants and animals.
- Prevents excessive leaching of nutrients.
- Contains bacteria that fix nitrogen and other elements; fungi, protozoa and other micro-organisms. These organisms' aids in the decomposition of organic matter.

CLASSIFICATION OF SOIL

Geologically soil is classified into 2 types:

1) Residual soil:

- Soil which resides near the parent rock
- Very less or no transportation.
- More fertile.

2) Transported soil

- Soil which transported away from the parent rock.
- During transportation, the soil mixed up and it is heterogeneous in nature.
- Classified into 6 types, based on the agents of transportation.
- 1. Colluvial soil – Transported by gravity.
- 2.Alluvial Soil –transported by water
- 3. Glacial soil- transported by ice.
- 4.Aeolian Soil-transported by wind
- 5.Volcanic Soil-transported by magma, lava

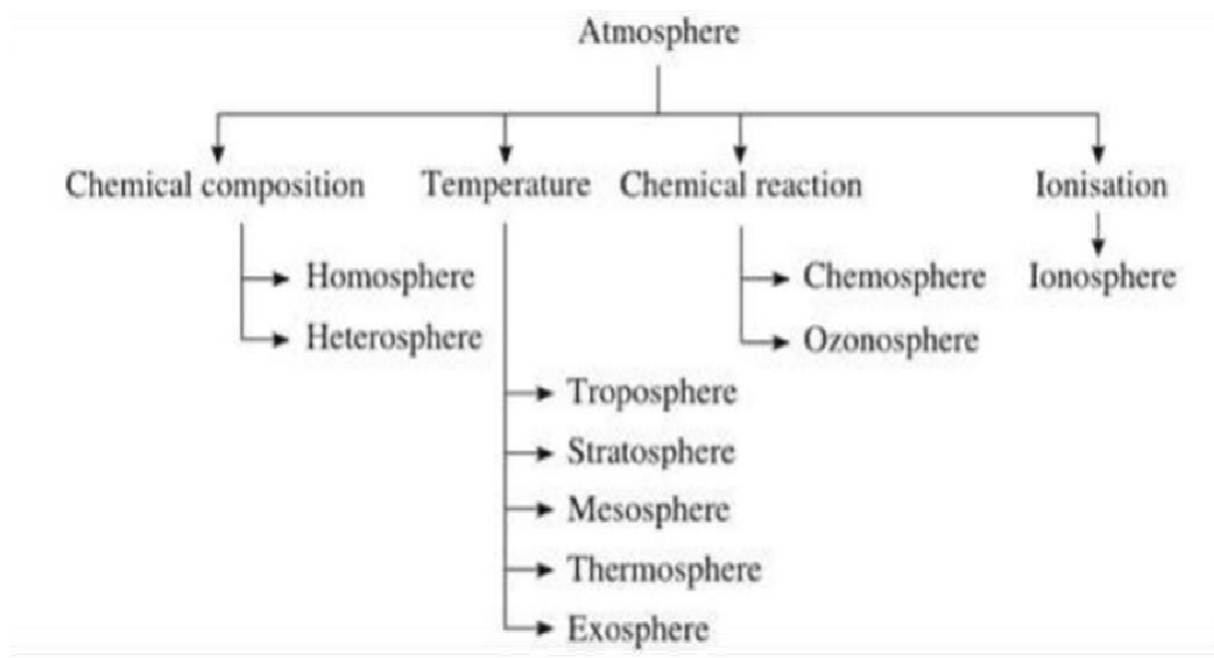
- 6. Lacustrine soil- transported by lakes.

➤ **ATMOSPHERE (UNIV QSTN-8 MARKS)**

- The layer which contains all the gases present on the earth.
- It is the layer of gases, which envelops the planet and held in place by the action of gravity by the planetary body.
- Chemical composition of atmosphere: the atmosphere contains mixture of gases composed of nitrogen, oxygen, carbon dioxide, water vapour and other non-reactive gases such as neon, Xenon etc...

➤ **LAYERS OF ATMOSPHERE**

The atmosphere is divided in to a number of concentric layers that extend from sea level to outer space. Atmosphere is classified in to various types as shown below:



➤ **Based on chemical composition atmosphere is divided in to two:**

1. HOMOSPHERE

- This layer is homogeneous in composition.
- Homosphere Extends to a distance of about 88Km from the surface of earth.

2. HETEROSPHERE

- The atmosphere lies above homosphere is heterosphere.
- The air composition is not uniform.

➤ **Based on temperature atmosphere is divided in to five:**

1.TROPOSPHERE

- Bottom dense part, closest to the ground
- Distance—20 km from the ground level.
- Clouds, storms and fog are found here.
- Temperature decreases to 6.4 degree Celsius/km,with height.
- This decrease in temperature with height is called lapse rate.
- Border of troposphere---tropopause.
- Temperature stops decreasing at tropopause.

2.STRATOSPHERE

- Clear layer above troposphere ,height of about 50 km from earth's surface.
- water vapors are absent .
- Ozone layer is found in this layer .
- Ozone absorbs and prevents the harmful ultraviolet radiations
- Border point- stratopause
- Temperature neither increases nor decreases with height.

3.MESOSPHERE

- Layer above stratosphere—85km height from earth's surface.
- starts from the edge of Stratopause
- Temperature at stratopause is 10 °c and falls to -75°C at mesosphere.
- Plays a crucial role in radio communication –ionization occur here.
- sunlight passing through this layer converts individual molecules to charged ions---D layer
- D-layer reflects radio waves transmitted from earth
- Border point—mesopause

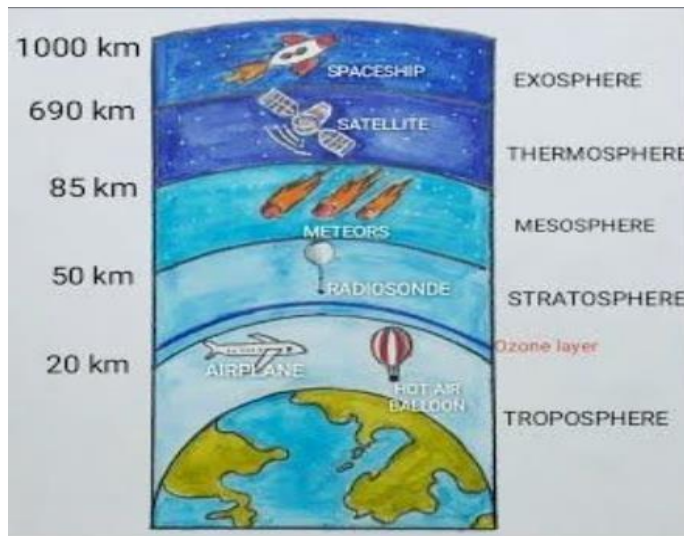
4.THERMOSPHERE

- Layer above mesosphere.
- 690km height from earth's surface.
- temperature increases to about 2000°C
- Ions are abundant in thermosphere
- Most of the approaching meteoroids burn up before reaching earth.

5.EXOSPHERE.

- Layer above thermosphere.

- Consists of only hydrogen and helium atoms
- 1000 km from earth's atmosphere.
- very high temperature due to solar radiation



➤ **Based on chemical reaction atmosphere is divided in to two:**

1.CHEMOSPHERE

- Region of the upper atmosphere.
- distance- 40 to 80 km
- Chemical processes driven by sunlight occurs here.
- The chemosphere overlaps the stratosphere and the mesosphere .

2. OZONOSPHERE

- Ozone layer is present
- Intense chemical reaction takes place with the help of oxygen.
- Ozone absorbs and prevents the harmful ultraviolet radiations

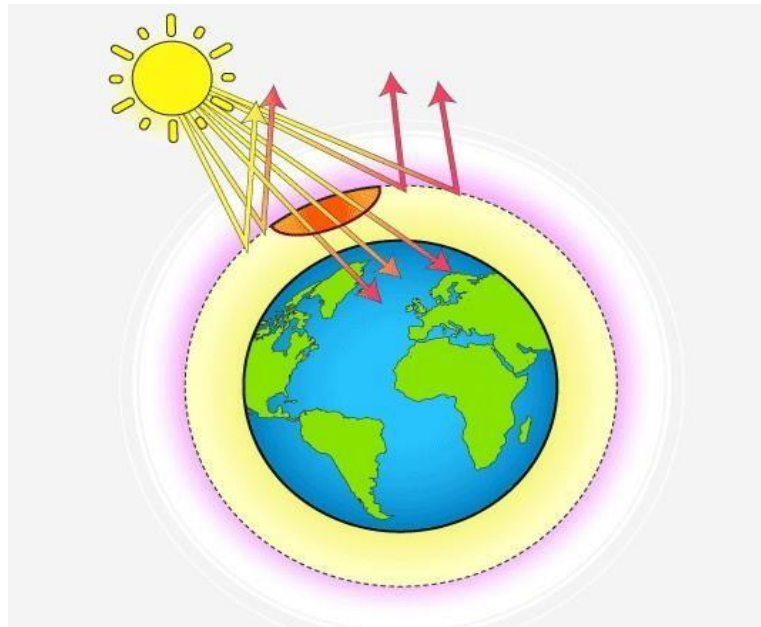
➤ **OZONE LAYER** (UNIV 3 MARKS)

- Ozone is a protective layer found in ozonosphere, which is in the stratosphere layer of atmosphere.
- Ozone absorbs and prevents the harmful ultraviolet radiations from reaching earth.
- Maximum concentration of ozone occurs at 22 km from the ground level.
- It has the potential to absorb 97-99% UV radiations from the sun, which can damage life on earth.

- If the ozone layer was absent, millions of people would develop skin disease and may have weakened the immune systems.
- **Formation/Mechanism of ozone layer**
- Oxygen molecule is photolysed by solar radiation, creating 2 oxygen radicals.
- $O_2 \xrightarrow{\text{photolysis}} 2O$
- Oxygen radicals react with molecular oxygen to produce ozone.
- $2O + O_2 \longrightarrow O_3$

OZONE LAYER DEPLETION (UNIV QSTN. -8 MARKS)

Ozone layer depletion is the gradual thinning of the earth's ozone layer in the upper atmosphere caused due to the release of chemical compounds containing gaseous bromine or chlorine from industries or other human activities."



- When CFC come in contact with ozone, chlorine splits ozone into individual molecules.
 - Here chlorine acts as a catalyst.
 - Chlorine breakdown the ozone and combine with free oxygen to create 2 oxygen molecule
 - $Cl + O_3 \longrightarrow ClO + O_2$
 - $ClO + O \longrightarrow Cl + O_2$
- **OZONE DEPLETING SUBSTANCES (ODS)**
- The substances which are responsible for the depletion of ozone layer is known as ozone depleting substances. (ODS)
 - E.g.: CFC, BFC, NO

Ozone depleting substances	Sources
Chlorofluorocarbons (CFCs)	Refrigerators, air-conditioners, solvents, dry-cleaning agents, etc.
Halons	Fire-extinguishers
Carbon tetrachloride	Fire extinguishers, solvents
Methyl chloroform	Adhesives, aerosols
Hydrofluorocarbons	fire extinguishers, air-conditioners, solvents

➤ **REASONS FOR OZONE DEPLETION:**

1) DEPLETION BY CFC AND BFC:

- Emitted by refrigerators and AC
- CFCS and BFCS are stable compounds in the atmosphere that have the property of living longer
- UV radiation split these as, Chlorine (Cl) and Bromine (Br) radicals.
- These radicals act as catalysts, and initiate breaking down of ozone molecules.
- Due action, Ozone concentration is decreasing at a drastic rate

2) DEPLETION BY NITRIC OXIDE (NO)

- Large quantities of nitrogen are emitted by aircrafts .
- One molecule of nitric oxide (NO) combines with ozone .
- oxidised to nitrogen dioxide and Oxygen
- NO₂ combines with another O₃ molecule to become NO₃ (Nitrate) and O₂ .
- This series of actions and reactions utilizes and depletes ozone.

3) DEPLETION BY NATURAL CAUSES

- The ozone layer has been found to be depleted by certain natural processes such as Sun-spots and stratospheric winds. But it does not cause more than 1-2% of the ozone layer depletion.
- The volcanic eruptions are also responsible for the depletion of the ozone layer.

➤ **PREVENTION OF OZONE LAYER DEPLETION**

1) Avoid Using ODS

- Reduce the use of ozone depleting substances.
- E.g.: avoid using malfunctioning A C and refrigerators, which emits more CFC and BFC

2) Use Eco-friendly Cleaning Products

- Most of the cleaning products have chlorine and bromine releasing chemicals that find a way into the atmosphere and affect the ozone layer.
- These should be substituted with natural products to protect the environment

3) Encourage Public transportation

- Use of private vehicles will emit more pollutants to the atmosphere, so public transportation should be promoted.

4) Use electric driven vehicles, in place of fuel driven vehicles

- Promote the use of EVs in place of vehicles run by petrol /diesel.
- Lead contained petrol will emit more pollutants.

5) Use of Nitrous Oxide should be prohibited

- The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer.
- People should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimized at the individual level as well.

➤ GREEN HOUSE EFFECT

- The greenhouse effect is the process that occurs when gases in Earth's atmosphere trap the Sun's heat.
- The gases which trap sun's heat is known as greenhouse gases.
- Eg: CO₂, methane

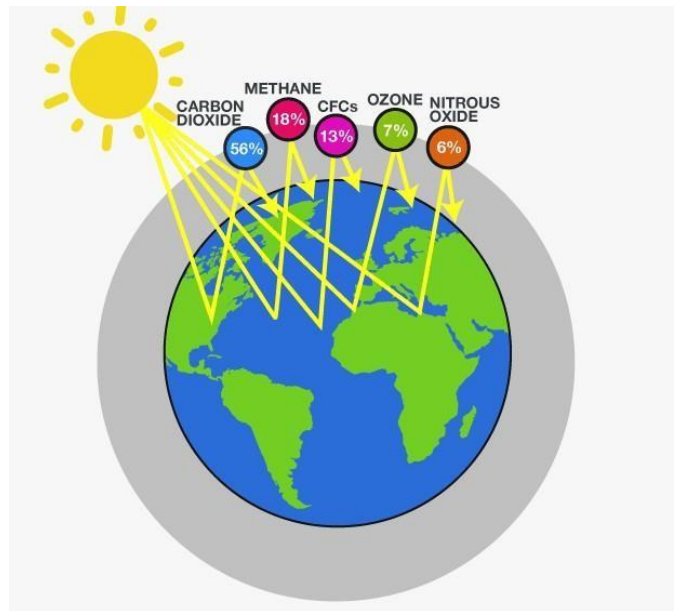
GREENHOUSE

- A house made of glass that can be used to grow plants.
- The sun's radiations warm the plants and the air inside the greenhouse.
- The heat trapped inside can't escape out and warms the greenhouse which is essential for the growth of the plants.

EFFECT OF GREEN HOUSE IN ATMOSPHERE

- During the day the sun heats up the earth's atmosphere.
- At night, when the earth cools down the heat is radiated back into the atmosphere. During this process, the heat is absorbed by the greenhouse gases in the earth's atmosphere.
- This is what makes the surface of the earth warmer that makes the survival of living beings on earth possible.

- However, due to the increased levels of greenhouse gases, the temperature of the earth has increased considerably. This has led to global warming



CAUSES OF GREENHOUSE EFFECT

The major causes of the greenhouse effect are:

☐ **Burning of Fossil Fuels**

Fossil fuels are an important part of our lives. They are widely used in transportation and to produce electricity. Burning of fossil fuels releases carbon dioxide. With the increase in population, the utilization of fossil fuels has increased. This has led to an increase in the release of greenhouse gases in the atmosphere.

☐ **Deforestation**

Plants and trees take in carbon dioxide and release oxygen. Due to the cutting of trees, there is a considerable increase in the greenhouse gases which increases the earth's temperature.

☐ **Farming**

Nitrous oxide used in fertilizers is one of the contributors to the greenhouse effect in the atmosphere.

☐ **Industrial Waste and Landfills**

The industries and factories produce harmful gases which are released in the atmosphere. Landfills also release carbon dioxide and methane that adds to the greenhouse gases

EFFECTS OF GREENHOUSE EFFECT

The main effects of increased greenhouse gases are:

1)Global warming

- It is the phenomenon of a gradual increase in the average temperature of the Earth's atmosphere.
- The main cause for this environmental issue is the increased volumes of greenhouse gases such as carbon dioxide and methane released by the burning of fossil fuels, emissions from the vehicles, industries and other human activities.

2)Smog and air pollution

- Smog is formed by the combination of smoke and fog. It can be caused both by natural means and man- made activities.
- In general, smog is generally formed by the accumulation of more greenhouse gases including nitrogen and sulfur oxides.
- The major contributors to the formation of smog are the automobile and industrial emissions, agricultural fires, natural forest fires and the reaction of these chemicals among themselves.

3)Acidification of water bodies

- Increase in the total amount of greenhouse gases in the air has turned most of the world's water bodies acidic.
- The greenhouse gases mix with the rainwater and fall as acid rain.
- This leads to the acidification of water bodies.
- Also, the rainwater carries the contaminants along with it and falls into the river, streams and lakes thereby causing their acidification.

➤ **WEATHER**

- **Weather** is the mix of events that happen each day in our atmosphere.
- It is the fluctuations occur in the atmosphere.
- Weather is different in different parts of the world and changes over minutes, hours, days and weeks.
- Most weather happens in the troposphere, the part of Earth's atmosphere that is closest to the ground.

Air Pressure and Weather

- The weather events happening in an area are controlled by changes in air pressure.
- Air pressure is caused by the weight of the huge numbers of air molecules that make up the atmosphere.
- When air pressure is high the skies are clear and blue. The high pressure causes air to flow down and fan out when it gets near the ground, preventing clouds from forming.
- When air pressure is low, air flows together and then upward where it converges, rising, cooling, and forming clouds.

Predicting weather

- Meteorologists develop local or regional weather forecasts including predictions for several days into the future.
- The best forecasts take into account the weather events that are happening over a broad region.
- Knowing where storms are now can help forecasters predict where storms will be tomorrow and the next day.
- Technology, such as weather satellites and Doppler radar, helps the process of looking over a large area, as does the network of weather observations.

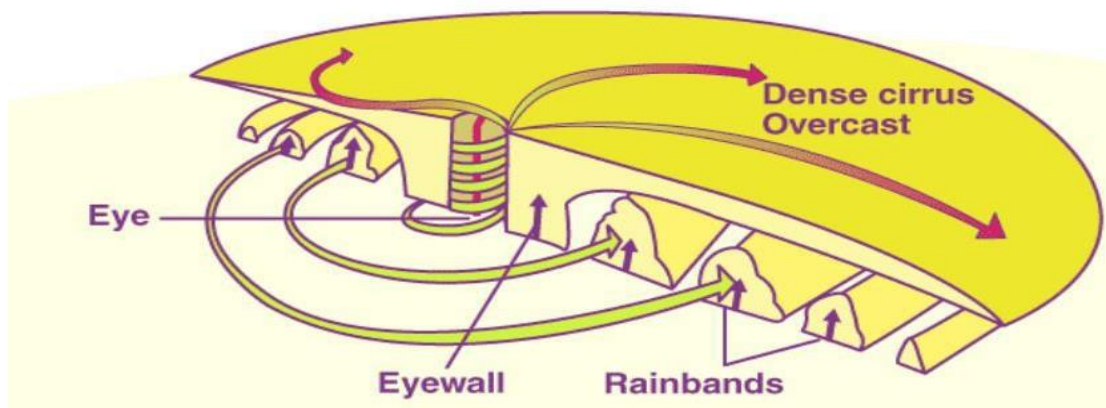
➤ **CYCLONES (IMP)**

- System of winds rotating inwards to an area of low pressure, in a coiled manner.
- Cyclone is derived from a Greek word *cyclos* which means coils of snake
- **Reason**: due to coriolis force, surface wind get spiralled towards the low pressure area.
- Cyclones are not present in equatorial regions because coriolis force is absent.

FORMATION OF CYCLONE

- 1) Warm moist air rises upwards over the ocean, the air moves up and low pressure area is formed.
- 2) Low pressure area is filled with high pressure air from surroundings.

- 3) Again next batch cool air get warm and low pressure area is again formed.
- 4) Continuous cycle results in the formation of clouds.
- 5) When more clouds get formed,more water from the ocean get evaporates and storm is formed.
- 6) Due to coriolis force, storm system rotates faster and eye is formed in the center.
- 7) Eye of the storm is calm---air pressure is low



Categories of Cyclone

Cyclones are categorized on the basis of the strength of the winds. Below mentioned are the different categories starting from level 1. The wind speed and damage potential of each category cyclones have also been mentioned.

☐ **Category 1:**

Wind Speed 74-95 mph

Damage: Minimal

Surge surface: 4-5 feet

☐ **Category 2: Wind**

Speed 96-110 mph

Damage: Moderate

Surge Surface: 6-8 feet

☐ **Category 3: Wind Speed**

111-130 mphDamage:

Extensive

Surge surface: 9-12 feet

☐ **Category 4:** Wind

Speed 131-155 mph

Damage: Extreme

Surge surface: 13-18 feet

☐ **Category 5:** Wind

Speed >155 mph

Damage:

Catastrophic

Surge surface: 19+ feet

TYPES OF CYCLONE

1) TROPICAL CYCLONE

- Occurs in tropical oceans
- Hurricanes and typhoons are two types.

2) POLAR CYCLONE

- Also known as arctic hurricanes.
- Formed over arctic and Antarctic oceans.
- It takes place quickly, so forecasting is difficult.

3) MESO CYCLONES

- Formed along with strong thunderstorms.
- Known as vortex of air
- Air rises and rotates along vertical axis

4) EXTRA TROPICAL CYCLONES

- Also known as mid latitude cyclones.
- Winds are weaker
- Temperature gradient is sharper

DIFFERENCE BETWEEN CYCLONES AND ANTI CYCLONES

Cyclones	Anti cyclones
It is a low pressure system with surroundings of high pressure.	It is a high pressure system with surroundings of low pressure.
It blows anti clockwise in the Northern Hemisphere.	It blows clockwise in the Northern Hemisphere.
It blows clockwise in the Southern Hemisphere.	It blows anti clockwise in the Southern Hemisphere.
It is associated with cloudy skies, heavy rainfall with stormy winds.	It is associated with clear skies, mild winds and dry conditions.
It can cause great damage to lives and property if precautions are not taken.	The weather is settled and pleasant.

➤ **ATMOSPHERIC CIRCULATIONS**

- Atmospheric circulation is the large scale movement of air in which thermal energy is redistributed on the surface of earth.
- Earths atmospheric circulation varies from year to year
- It is linked with oceanic temperature and winds.

REASON FOR ATMOSPHERIC CIRCULATION:

- This is caused because sun heats the earth more at the equator than at the poles.
- It is controlled by three forces pressure gradient force, frictional force and coriolis force.
- When warm air rises from the equator, it starts moving towards the poles.
- Air moving from equator towards the pole does not travel in a straight line, and deflected because of the coriolis force.
- When the warm air get cools, it drops back to the ground and flows toward the equator and warm again.
- Now the warm air rises again and the pattern continues.

FORCES ACTING ON ATMOSPHERIC CIRCULATION:

Pressure Gradient Force

- The differences in atmospheric pressure produces a force.
- The rate of change of pressure with respect to distance is the pressure gradient.

Frictional Force

- The force which affects the speed of the wind.
- It is greatest at the surface and it is minimal over the sea level

Coriolis Force

- The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force
- It deflects the wind to the right direction in the northern hemisphere and to the left in the southern hemisphere.
- The deflection is more when the wind velocity is high.
- The Coriolis force is directly proportional to the angle of latitude.
- It is maximum at the poles and is absent at the equator.
- The Coriolis force acts perpendicular to the pressure gradient force.

➤ **INDIAN MONSOON (UNIV 3 MARKS)**

- The term monsoon has been derived from the Arabic word **mausin** meaning 'season'.
- Monsoons are seasonal winds which reverse their direction with the change of season.
- The monsoon is a double system of seasonal winds – They flow from sea to land during the summer and from land to sea during winter.
- Monsoon wind blows over all parts of the world- well developed in India and South East Asia

TYPES OF MONSOON

- Indian subcontinent has 2 types of monsoon

1) South-West Monsoon

2) North –East Monsoon.

SOUTH –WEST MONSOON:

- The south east trade winds originate from the southern hemisphere in the Indian ocean
- When these winds cross the equator, they get deflected by Coriolis force and become south west trade winds.

- These winds gather larger quantities of moisture, as they pass over Indian Ocean.
- As the S-W monsoon approaches the Indian peninsula they are diverted into 2:
1) The Arabian sea branch 2) The Bay of Bengal branch.
- When the moisture laden Arabian sea branch reaches the south western side of India, they are blocked by western ghats.
- When the mountain range blocks the wind, it gets cooled down and forms clouds.
- These clouds then result in precipitation.
- Kerala gets southwest monsoon during June every year.

NORTH –EAST MONSOON:

- Originates from landmass of north east regions of India.
- Relatively dry
- These winds pass over Bay of Bengal and gather moisture and cause rainfall over the parts of Odisha, Andhra Pradesh and Tamilnadu.
- Cyclone formation is common over Bay of Bengal during north east monsoon season
- Cyclones also bring heavy rainfall.

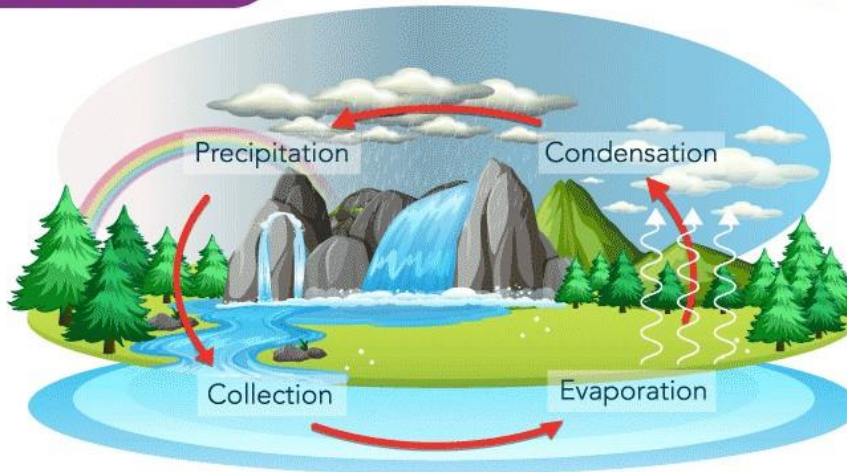
➤ **HYDROSPHERE**

- The layer which contains all the water sources present on the earth.
- It includes all the surface and subsurface water sources.
- It forms over 70% of earth's surface.
- Hydrosphere has direct influence on weather and climatic condition on the earth.

WATER CYCLE

- The water cycle transfers water from one state to another.
- It consists of four stages:
 - EVAPORATION: sun's heat evaporates water from surface sources.
 - CONDENSATION: evaporated water cools down and forms clouds.
 - PRECIPITATION: the clouds then precipitate to form rain.
 - COLLECTION: rain water is then collected in surface and subsurface sources.
- The whole process is repeated in a cyclic manner.

WATER CYCLE



IMPORTANCE OF HYDROSPHERE:

- Helps to maintain hydrological cycle.
- Plays vital role in earth's climate.
- Helps in the process of water transportation.

➤ OCEANS

- Ocean is the body of salt water, which covers 70% of earth's atmosphere.
- It is the principal component of earth's hydrosphere and acts as a huge heat reservoir.
- It influences climate and weather patterns.
- The salinity of ocean is due to dissolved materials (mainly salts) contained in it.
- Mean salinity of ocean is 34.7g/kg, lowest value of salinity is 33 g/kg and highest value is 36 g/kg
- Dominant salt in ocean –NaCl
- Salt is spread to the atmosphere when wind blows sprays the sea water.

TYPES OF OCEANS:

- 1) Atlantic Ocean
- 2) Pacific Ocean
- 3) Indian Ocean
- 4) Arctic Ocean
- 5) Antarctic Ocean.

IMPORTANCE OF OCEANS:

A) Oceans as Moderator of climate:

- Water in oceans moves in regular patterns due to activity of winds.
- These movement of water is called ocean circulation or ocean currents.
- Current arise due to the interplay of wind and water.
- Current plays a significant role in heating up the globe and climate
- When water moves from deeper part to warmer part, heat is carried with it and spread to atmosphere.
- This heat transfer plays an important role in moderating the climate.

B) Oceans as Heat Reservoir:

- Oceans play a role of heat reservoir, by moderating extreme temperature.
- Water in upper portion of ocean store higher heat than entire atmosphere.
- During spring and summer seasons, oceans are cooler than nearby lands.
- During winter, oceans are warmer than land masses.
- Due to the temperature difference in sea and land, heat energy is transfer from land to water and vice versa

C) Ocean as Carbon Reservoir:

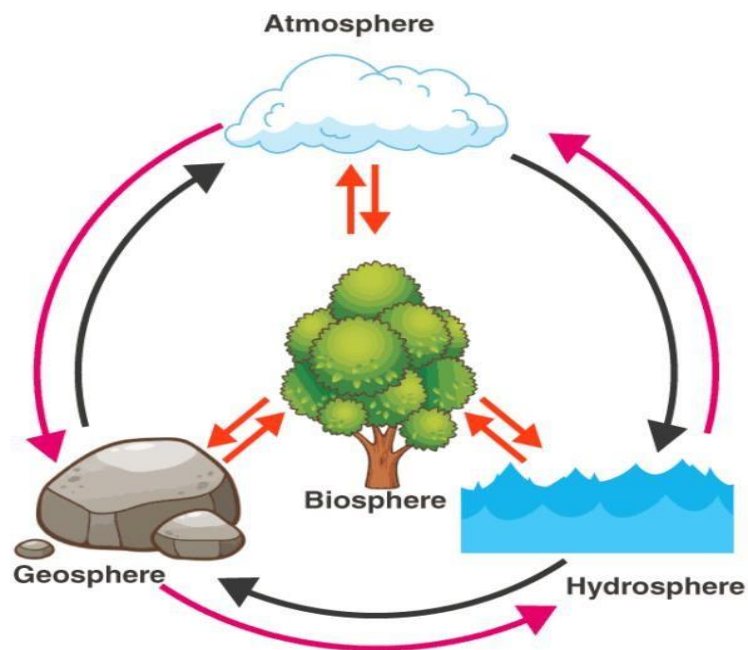
- Oceans are largest carbon reservoir on earth
- It gives of large amounts of carbon into the atmosphere.
- Through certain biological and chemical exchange process ,it plays an important role in carbon cycle

➤ **INLAND WATER BODIES:**

- Fresh water constitute the basis for life on land
- On land water is found in all 3 states:
a) Solid b) Liquid c) Gas
- In solid form, water is found as glacial ice, ice caps and ground ice
- In liquid form, water is found in lakes, rivers and streams and also as groundwater and soil moisture.
- In gaseous form, the fresh water of earth is interchanged between surface of earth and atmosphere through evaporation and precipitation.

➤ **BIOSPHERE:**

- Biosphere is a thin envelop that encircles most of the earth, and supports life. It is the global sphere in which the biota interacts with lithosphere, atmosphere and hydrosphere.
- It is totally dependent on, and involves complex interactions between the atmosphere, hydrosphere, and lithosphere.
- Biosphere is the spherical terrestrial layer that comprises of the lower part of the atmosphere, the seas and the upper layers of the soil wherein living organisms exist naturally.
- All forms of life including human beings dwell in biosphere. The health of the biosphere is determined by the availability of oxygen, moisture, temperature, air pressure and soil.



□ Biosphere is a giant ecosystem that consists of two major ecosystems:

□ (a) Terrestrial ecosystem

□ b) Aquatic ecosystem

a) Terrestrial ecosystem

- ▮ The terrestrial ecosystem consists of plants, animals, microorganisms their dependencies and interdependencies with the non-living items around it on the land.
- ▮ A terrestrial ecosystem is made up of either natural ecosystem or artificial/man-made ecosystem
- ▮ Ecosystem ,which is made naturally is called natural ecosystem eg:Forest
- ▮ Ecosystem ,which is made artificially is called manmade ecosystem eg:zoo

b) Aquatic Ecosystem

- ▮ Aquatic ecosystem consists of marine and fresh water ecosystem. While seas and oceans form the marine ecosystem; the rivers, pond, lakes, and wetlands form fresh water ecosystem. Aquatic ecosystems provide human beings with a wide range of services.
- ▮ Some of the services include the availability of water for day to day uses, foods like fish and crustaceans, breaking down: of chemical and organic wastes, recreation, etc. The aquatic ecosystem provides the human beings with a wealth of natural resources.

➤ DEFINITION AND KEY TERMS IN DISASTER MANAGEMENT (IMP)

1) DISASTER:

A sudden occurrence of an accident that causes huge loss of life and property is called as a disaster. It is also called as a calamity.

▮ Types of Disasters

- **1. Natural Disaster:** A disaster caused by natural factors called as a natural disaster e.g., earthquake, flood, cyclone etc.
- **2. Man-made disaster:** A disaster caused due to the human activities e.g: wars, fire accidents, industrial accidents etc.

2)HAZARDS:

- A hazard can be defined as a potentially damaging physical event, social and economic disruption or environmental degradation.

- ▶ Typical examples of hazards can be absence of rain (leading to drought) or the abundance thereof (leading to floods).
- ▶ Chemical manufacturing plants near settlements and incorrect agricultural techniques, can also be seen as hazards which could lead to possible disasters.
- ▶ Hazards are the reason behind a disaster

DIFFERENCE BETWEEN DISASTER AND HAZARD (3 MARK)

Hazard	Disaster
Hazard is an event that has potential for causing injury/ loss of life or damage to property/environment.	Disaster is an event that occurs suddenly/unexpectedly in most cases and disrupts the normal course of life in affected area.
Hazards can lead to disasters.	A disaster is the result of a hazard but at the same time is also a hazardous event.
Hazards come with warnings.	Ignoring warnings can lead to disaster.
Hazards may be inevitable.	Disasters can be prevented.
Hazard occurs at less populated area.	Disaster occurs at overpopulated area.

3) EXPOSURE

- It is the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.
- Exposure changes over time and from place to place.
- As more people and assets are exposed, risk in these areas becomes more concentrated.
- If global exposure continues to trend upwards, it may increase disaster risk to dangerous levels.

4) VULNERABILITY

- Vulnerability is the inability to resist a hazard or to respond when a disaster has occurred.
- For example, people who live on plains are more vulnerable to floods than people who live higher up.

- Vulnerability depends on several factors, such as people's age and state of health, local environmental and sanitary conditions, as well as on the quality and state of local buildings and their location with respect to any hazards.

5) RISK

- Measure of expected losses due to a hazard, occurring in a given area over a specific time period.
- It considers the probability of harmful consequences, or expected losses resulting from a hazard.

- $$\text{Risk} = \text{Probability of Hazard} \times \text{Degree of Vulnerability}.$$

6) RISK ASSESSMENT

- Process of identifying the potential hazards and analyse what could happen, if a hazard occurs.
- Disaster risk assessments include:
 - the identification of hazards;
 - a review of the technical characteristics of hazards such as their location, intensity, frequency and probability;
 - the analysis of exposure and vulnerability, including the physical, social, health, environmental and economic dimensions;
 - Evaluation and results.

7) RISK MAPPING

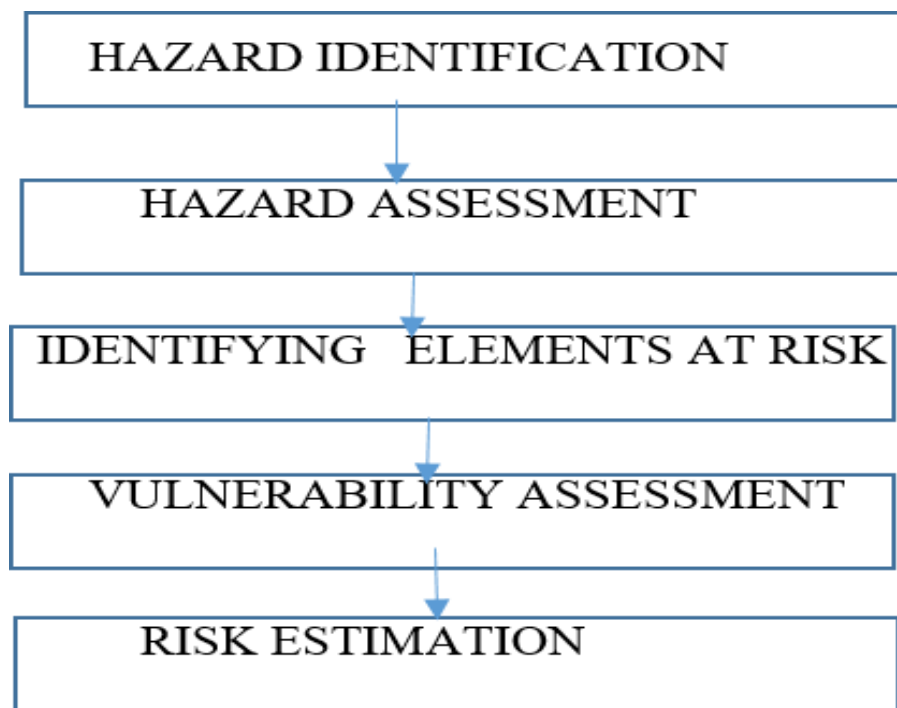
- Risk mapping is a process of analyzing the hazard, vulnerability and capacity through a scientific methodology.
- It is based on the risk assessment.
- There are 2 main components:

1) Risk Analysis.

2) Risk Evaluation:

1) Risk Analysis:

- The use of available information to estimate the risk caused by the hazard to individuals, population.
- It contains the following steps:



2) Risk Evaluation

- This is the stage at which values and judgements are entered for the decision making process.
- It includes all the results of risk associated with social, economic and environmental.

RELATIONSHIP BETWEEN HAZARD VULNERABILITY AND DISASTER

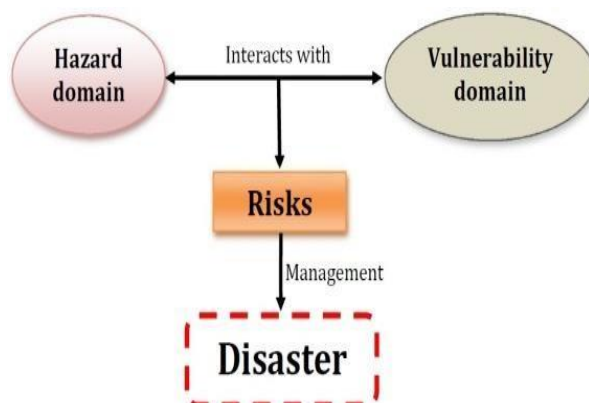


Figure 1.3.1: Conceptual relationships between hazard, vulnerability, risk and disaster

8) RISK REDUCTION

- All the structural and non-structural measures for reducing disaster
- It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them.
- It includes 2 measures:

1) Structural measures:

- Use of engineering solution to avoid disaster.
- Eg:construction of floodwall to reduce flood

2) Non-structural measures:

- It includes awareness and education.
- Expert people in disaster management will take awareness class among the people in vulnerable areas.

9) DISASTER RISK MANAGEMENT

- Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses.

10) CAPACITY

- Refers to all the strengths, attributes and resources available within a community, organization or society to manage and reduce disaster risks and strengthen resilience.
- It is the ability to rescue from a disaster.
- It is important to emphasize people's capacity to anticipate, resist and recover from disasters, rather than simply focusing on the vulnerability that limits them.
- Like vulnerability, capacity depends on social, economic, political, psychological, environmental and physical assets.
- The starting point for capacity development is the existing knowledge, strengths, attributes and resources individuals, organizations or society has.
- Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.

- **Capacity development** is the process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals
- **Types of capacity:** 1) Physical Capacity 2) Socio-Economic capacity

11) RESILIENCE

- Ability of individuals, communities, organisations and states to adapt to and recover from hazards, shocks or stresses without compromising long-term prospects for development.
- It is opposite to vulnerability.
- Resilience is a term shared by many disciplines (e.g. psychology, engineering and ecology) and has been used in disaster studies since the 1970s.
- Resilience also emphasizes the importance of not only effectively managing change but also improving well-being in the face of multiple risks and shocks.
- There are different types of resilience that we need to develop in order to support ourselves during challenging times. These include **physical resilience, mental resilience, emotional resilience and social resilience**.

12) EARLY WARNING SYSTEM

- EWS is a socio-technical system designed to generate and circulate meaningful warning information in a timely manner to take a proactive response to a hazardous threat in order to avoid disaster or reduce its impacts.
- It is an integrated communication systems to help communities prepare for hazardous climate-related events.
- A successful EWS saves lives and jobs, land and infrastructures and supports long-term sustainability.
- Early warning systems will assist public officials and administrators in their planning, saving money in the long run and protecting economies.

TYPES OF EARLY WARNING SYSTEM

- 1) Signal early warning system
- 2) Social early warning system
- 3) Formal early warning system

13) DISASTER PREPAREDNESS

- It consists of the knowledge and capacities of institutions, communities and individuals to effectively respond and recover from the impacts due to a hazard.
- Preparedness action is carried out within the context of disaster risk management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response to sustained recovery.
- Preparedness is based on a sound analysis of disaster risks and with early warning systems, and includes activities such as contingency planning, the stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises.
- The related term “readiness” describes the ability to quickly and appropriately respond when required.

14) DISASTER PREVENTION

- Disaster Prevention is the elimination or reduction of the occurrence of natural hazard event, or their adverse impacts.
- Examples of disaster prevention actions include flood protection embankments.
- It is defined as those activities taken to prevent a natural phenomenon or potential hazard from having harmful effects on either people or economic assets.
- Delayed actions drain the economy and the resources for emergency response within a region. For developing nations, prevention is perhaps the most critical components in managing disasters.
- Prevention planning is based on two issues: hazard identification (identifying the actual threats facing a community) and vulnerability assessment (evaluating the risk and capacity of a community to handle the consequences of the disaster).
- Disaster prevention refers to measures taken to eliminate the root causes that make people vulnerable to disaster.

15) DISASTER MITIGATION:

- It refers to a set of measures to reduce or neutralise the impact of natural hazards by reducing social, functional, or physical vulnerability.
- Primary mitigation refers to reducing the resistance of the hazard and reducing

vulnerability.

- Secondary mitigation refers to reducing the effects of the hazard (preparedness).
- Mitigation includes recognizing that disasters will occur; attempts are made to reduce the harmful effects of a disaster, and to limit their impact on human suffering and economic assets.

16) DISASTER RESPONSE

- Disaster response (relief) is the provision of assistance or intervention through the emergency services during or immediately after a crisis in order to save lives, reduce further impacts on health and public safety and to meet the basic subsistence needs of affected populations.

17) DAMAGE ASSESSMENT

- Damage Assessment is the process for determining the nature and extent of the loss, suffering, and/or harm to the community resulting from a natural, accidental or human-caused disaster.
- Damages are normally classified as:
- **Severe:** The target facility or object cannot be used for its intended purpose. Complete reconstruction is required.
- **Moderate:** The target facility or object cannot be used effectively for its intended purpose unless major repairs are made.
- **Light:** The target facility or object can be used for intended purpose but minor repairs would be necessary.

18) CRISIS COUNSELLING

- Process of eliminating the emotional and psychological disturbances of people, affected by a disaster
- It can be carried out by psycho educational counselling classes.
- It is a crucial part of recovery and reconstruction.
- It enables people to take right decisions.

NEEDS OF CRISIS COUNSELLING

1) Providing support and guidance

- The purpose of crisis counselling is to decrease emotional pain, provide emotional support, make sure that the person in crisis is safe, and help develop a plan for coping with the situation. Sometimes it also involves connecting a person to other community or health services that can provide long-term support.

2) Crisis counselling can be linked to health education.

- It is used to increase knowledge of how to avoid or cooperate with a crisis in the future. It can also be used to change people's attitudes and beliefs about people in crisis, and to provide people with information about help available in their community.

3) Crisis counselling is related to health promotion.

- Skills, information, and support services gained through crisis counselling can also help a person or a group of people to improve their health and quality of life. Crisis counselling can also be tied to health promotion through the development of health-related public policy and supportive environments.

4) A valuable tool for public health

- It is relatively low-cost and simple to provide, and it is flexible and easy to learn. A wide variety of health professionals, including doctors, nurses, psychologists, and social workers, can be taught to help people through the application of crisis counselling techniques.

5) New technologies--Internet based crisis counselling.

- By using these resources people can sometimes get the help they need without using more expensive health care services, and they can often take advantage of twenty-four-hour crisis services.

6) Used by any professionals.

- People working in public places such as stores and airline terminals are also learning how to do crisis counselling in order to deal with unhappy or violent customers.

Some Characteristics of Effective Crisis Counsellors

Effective crisis counsellors should possess characteristics such as:

- ❖ *Self-Awareness*: knows him/her self and empathise with clients without becoming personally involved or emotional when people who have gone through personal experiences come to them.
- ❖ *Non-judgemental*: willing to listen all through to the client without casting judgement on those in crisis.
- ❖ *Non-Reactive*: does not react to client's outbursts or threats but be completely supportive when client shows strong emotions.
- ❖ *High Tolerance*: remain calm when placed in tense and stressful situations
- ❖ *Specific Training*: receive specific skills and techniques in crisis counselling that are quite different from normal counselling.

19) NEEDS ASSESSMENT

- Needs assessment is a process of estimating the financial, technical, and human resources needed to implement the agreed-upon programmes of recovery, reconstruction, and risk management.
 - The Post-Disaster Needs Assessment (PDNA) is an internationally accepted methodology for determining the physical damages, economic losses, and costs of meeting recovery needs after a natural disaster through a government-led process.
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