APPOLO STUDY CENTRE CHENNAI

APPOLO STUDY CENTRE

GEOGRAPHY
TEST – 4 Part - 1

6th term – I	**Unit 1**	The Universe and Solar System
	Unit 2	Land and Oceans
6th term – II	**Unit – 1**	Resources
6TH TERM 3	**Unit 1**	Asia and Europe
7TH TERM 1	**Unit 1**	Interior of the Earth
	Unit 2	Land forms
	Unit 3	Population and Settlement
7TH TERM 2	**Unit 1**	Resources
	Unit 2	Tourism
8TH GEOGRAPHY	**Unit 1**	Rocks and Soil
	Unit 2	Weather and Climate
	Unit 3	Hydrologic Cycle
	Unit 4	Migration and Urbanisation
	Unit 5	Hazards
	Unit 6	**Industries**
9TH GEOGRAPHY	**Unit 1**	**Lithosphere – I Endogenetic Process**
	Unit 2	**Lithosphere – II Exogenetic Process**
	Unit 3	**Atmosphere**

	Unit 4	**Hydrosphere**
	Unit 5	**Biosphere**
	Unit 6	**Man and Environment**
	Unit 7	**Mapping Skills**
	Unit 8	**Disaster Management- Responding to Disasters**
10TH GEOGRAPHY	**Unit 1**	India – Location Relief and Ddrainage
	Unit 2	Climate and Natural Vegetation of India
	Unit 3	Components of Agriculture
	Unit 4	Resources and Industries
	Unit 5	India – Population, Transport, Communication and Trade
	Unit 6	Physical Geography of Tamil Nadu
	Unit 7	Human Geography of Tamil Nadu

6TH TERM – I
Geography
Unit 1 The Universe and Solar System

Pathway:

This lesson focuses on the universe and the members of the solar system. It also deals with the motions of the Earth and their resultant effects. It also talks about the four spheres of the Earth.

Teacher: Students, do you all know where you reside?
Students: Yes, teacher.
Teacher: (Points out a student) Iniya, do you know your address? Can you tell me your full address?
Iniya: Yes teacher. My address is Iniya, 24, Bharathiar street, Thirunagar, Madurai - 625 006.
Teacher: Good. Iniya, where is Thirunagar?
Iniya: Thirunagar is in Madurai.
Teacher: Children, tell me where Madurai is?
Students: It is in Tamil Nadu.
Teacher: Good. Where is Tamil Nadu?
Students: In India ...teacher.

Teacher: Now tell me where India is?

Students: India is in the continent of Asia, teacher.

Teacher: Excellent! Can anyone tell me where is the continent of Asia?

Students: Yes teacher. It is on the Earth.

Teacher: Ok children, tell me where the Earth is located.

Students: (Remain silent and after sometime they reply in chorus) No. We don't know.

Teacher: Now, let me explain. The Earth is the third planet in the Solar System. The solar system is in the galaxy. It is named as the Milky way Galaxy. There are millions of such galaxies in the Universe.

Iniya: Teacher, shall I say the address of our Earth?

Teacher: Address of our Earth? It's interesting Iniya. Tell us the address.

Iniya: Miss. Earth, No.3. Solar System, Milkyway Galaxy, Universe. (Everyone clapped and the teacher appreciates Iniya.)

Teacher: That was very good Iniya. Now let us know about the solar system, galaxy, the Universe and all other bodies in detail in this lesson.

Numerous stars and celestial bodies came into existence by a massive explosion called Big Bang. These celestial bodies together are called The Universe. It is also referred to as the Cosmos. The stars that you see are so far away that they appear to be small, but they are really huge in size.

The study of the Universe is called Cosmology. The termCosmos is derived from the Greek word 'Kosmos'.

1. Universe

The Universe is a vast expanse of space. Most astronomers believe that the Universe came into existence after the Big Bang explosion that tookplace about 15 billion years ago. The universe consists of billions of galaxies, stars, planets, comets, asteroids, meteoroids and natural satellites. These are collectively called as celestial bodies, which are located far away from each other. A Light year is the unit used to measure the distance between the celestial bodies.

A light-year is the distance traversed by light in a year at a velocity of 300,000 km per second. Sound travels at a speed of 330 m per second.

Galaxy

It is a huge cluster of stars which are held together by gravitational force. Most of the galaxies are scattered in space, but some remain in groups.The Milky Way Galaxy was formed about 5 billion years after the Big Bang explosion. Our solar system is a part of the Milky Way galaxy. Andromeda galaxy is the nearest to the Earth apart from the 'Magellanic Clouds' galaxy

2. The Solar System

The word 'solar' is derived from the Roman word 'sol', which means 'Sun God'. The solar system is believed to have formed about 4.5 billion years ago. The solar system is a gravitationally bound system which comprises of the Sun, the eight planets, dwarf planets, satellites, comets, asteroids and meteoroids.

The Sun

The Sun is at the centre of the solar system. Each member of the solar system revolves around the Sun. The Sun is sohuge that it accounts for 99.8 percent of the entire mass of the solar system. The Sun is made up of extremely hot gases like Hydrogen and Helium. The Sun is a star. It is self-luminous so it gives light on its own. The surface temperature of the Sun is about 6,000° C. It is the source of light and heat energy to the entire solar system. Sunlight takes about 8.3 minutes to reach the Earth.

1.3 million Earths fit inside the Sun. Imagine how big the Sun is.

GEO CONNECT: The ancient Tamils knew that the planets went around the Sun. For example, in Tamil literature Sirupanatruppadai, the line வாள் நிறவிசும்பின் கோள் மீன் சூழ்ந்த இளங்கதிர்ஞாயிறு mentions that the Sun is surrounded by planets.

Planets

The word planet means wanderer. There are eight planets in the solar system. They are Mercury, Venus, Earth, Mars, Jupiter, Saturn,Uranus and Neptune. All the planets rotate anti-clockwise (from west to east) on their own axes except Venus and Uranus. The elliptical path in which the planets move around the Sun is known as orbit. The eight planets revolve in their respective orbits because of the gravitational pull of the Sun. They do not move out of their paths or away from the solar system.

The four planets nearer to the Sun are called Inner or Terrestrial Planets (Mercury, Venus, Earth and Mars). The inner planets are comparatively smaller in size and are composed of rocks. The surface of inner planets has mountains, volcanoes and craters. The last four planets are called as Outer Planets or Jovian Planets (Jupiter, Saturn, Uranus, and Neptune). They are also called Gaseous Giants. An asteroid belt is found between Mars and Jupiter.

Mnemonic to remember the order of planets: My Very Educated Mother Just Showed Us Neptune.

Mercury (The Nearest Planet)

Mercury is the smallest and closest planet to the Sun. It is named after the Roman deity 'Mercury', themessenger to the Gods. It is an airless and waterless planet.It does not have an atmosphere and so experiences extremes of temperature. It has no natural satellites. Mercury can be viewed in the morning and evening with naked eye.

Venus (The Hottest Planet)

Venus is the second planet from the Sun. It is called Earth's twin, as it is almost the same size as the Earth. It has the longest rotation Venus period(243 days) among the planets in the Solar system. It rotates in the opposite direction to all other planets except Uranus. It has no natural satellites like Mercury. It is named after the Roman goddess of love and beauty. It is often visible in the mornings and the evenings and so it is frequently called as the Morning Star and the Evening Star. After the Moon, it is the brightest natural object in the night sky.

Earth (The Living Planet)

The Earth is the third planet from the Sun and the fifth largest planet in the solar system. It is called 'blue planet' or 'watery planet' because
three-fourth of the Earth is covered by water. The Earth is the only planet in the solar system which is not named after any Greek or Roman deity. It is the only planet known to support life. The polar diameter of the Earth is 12, 714 km and the equatorial diameter is 12, 756 km. The Earth revolves around the Sun at a speed of about 30 km per second. Life is possible on Earth because of the presence of land, air and water. The only natural satellite of the Earth is the Moon.

The distance between the Sun and the Earth is about 150 million

kilometre. A flight flying at a speed of 800 km per hour from the Earth would take 21 years to reach the Sun.

Mars (The Red Planet)

Mars is the fourth planet from the Sun and the second smallest planet in the solar system, after Mercury. It is named after the Roman Godof war. It appears red in colour due to the presence of iron oxide on its surface. So, it is often described as The Red Planet. It has a thin atmosphere. It also has polar icecaps like the Earth. Mars has two natural satellites namely Phobos and Deimos. Many orbiters and rovers have been launched to explore this planet.

On 24th September, 2014 Mangalyan (Mars Orbiter Mission - MOM), launched by the Indian Space Research Organization (ISRO), reached the orbit of Mars to analyze its atmosphere and topography. ISRO has now become the fourth space agency to reach Mars

after the Soviet Space programme, NASA and the European Space Agency.

Jupiter (the Largest Planet)

Jupiter is the f fth planet from the Sun and the largest planet in the solar system. It is named after the king of the Roman gods. It is the third brightest objectin the night sky, after moon and Venus. It is the fastest spinning planet in the solar system. It is called a gas giant planet. Its atmosphere is made up of mostly Hydrogen and Helium like the Sun. It has the largest number of natural satellites. Io, Europa, Ganymede and Callisto are a few large satellites of Jupiter.

Saturn (The Ringed planet)

Saturn is the sixth planet from the Sun and the second largest planet in the solar system, after Jupiter. It is named after the Roman god of agriculture. Saturn has many rings around it. These rings are huge and are mostly made up of ice, rocks and dust particles.

Saturn has 62 natural satellites around it. Titan, Saturn's largest moon, is theonly satellite in the solar system that has clouds and dense atmosphere composed of nitrogen and methane. The specific gravity of Saturn is less than that of water.

Uranus (The Somersaulting planet)

Uranus is the seventh planet from the Sun. It was the first to be discovered with a telescope by the astronomer William Herschel in 1781. It appears green due to the presence of ethane. It is named after the Greek god of the sky. It rotates on its axis from east to west like Venus. Its axis is tilted so much that, it appears to orbit the Sun on its sides like a rolling ball. Uranus has 27 natural satellites, of which Titania is the largest.

Neptune (The coldest Planet)

Neptune is the eighth and the farthest planet from the Sun. There are strongwinds in this planet. It is named after the Roman god of sea. Neptune has 14 natural satellites, the largest being Triton. Because of its distance from the Sun, Neptune is oneof the coldest planets in the solar system. The striking blue and white features of Neptune help to distinguish it from Uranus.

The Dwarf Planets

Dwarf planets are small celestial bodies found beyond the planet Neptune. They are extremely cold and dark. They are almost spherical in shape, but unlike planets they can share their orbit with other dwarf planets. The five dwarf planets of the solar system are Pluto, Ceres, Eris, Makemake and Haumea.

The Moon - Earth's Satellite

Satellites are celestial objects, which revolve around the planets. The moon is the Earth's only satellite. It revolves around the Earth once
in every 27 days and 8 hours. It takes about the same time for it to complete one rotation around its axis. It has no atmosphere. The surface of the moon
is characterized by craters created by the impact of meteors. The distance between the moon and the Earth is about 3, 84,400 km. The size of the moon is one-quarter of the Earth. The Moon is the only celestial body where humans have landed.

Asteroids

Asteroids are small solid objects that move ISRO launched India's first ever Moon mission, Chandrayaan - 1 in 2008. Around the Sun. They are found as a belt between Mars and Jupiter. They are too small to be called as planets. They are also known as Planetoids or Minor Planets.

Comets

A comet is a celestial object made up of a head and a tail. The head of a comet consists of solid particles held together by ice and
the tail is made of gases. Halley's Comet is the most famous comet which comes close to the Earth every 76 years. It last appeared in 1986 and will next appear in 2061.

Meteors and Meteorites

A meteor is a stone like or metallic body. When entering into the Earth's atmosphere, most of them burn. As they often appear as streaks of light in the sky, they are also known as Shooting Stars. Meteors which strike the Earth's surface are called meteorites.

3. Motions of the Earth

Have you noticed the Sun in the morning, afternoon or evening? Is it in the same place throughout the day? No. It is seen in the east in the morning, overhead in the afternoon and in the west in the evening. Have you ever thought of the reason behind it? This is because of the constant moving of the Earth around the Sun. It seems that the Sun is moving, but it is not so. This is similar to what you experience when you are travelling in a bus or train. When you look out of the window, the trees, lamp posts and other objects seem to be moving, but actually it is you who are moving. To understand the motions of the Earth better, you need to be familiar with the shape and inclination of the Earth.

Shape and Inclination of the Earth

The Earth is spherical in shape. It rotates on its axis, which is an imaginary line that runs from the North Pole to the South Pole passing through the centre of the Earth. The Earth's axis is always tilted or inclined from the vertical by an angle of 23½°. It makes an angle of 66½° with the plane of the Earth's orbit.
The velocity of the Earth's rotation varies from 1670 km per hour at the equator to 845 km per hour at 60° N and S latitudes and zero at the poles.

Rotation

It is the spinning movement of the Earth on its axis. The Earth rotates from west to east (anticlockwise) and takes 23 hours 56 minutes and 4.09 seconds to
complete one rotation. The time taken by the Earth to complete one rotation is called a day. The rotation of the Earth causes day and night. As the Earth is spherical inshape, only one half of it is illuminated by the Sun at a time. The other half remains dark. The illuminated portion of the Earth experiences day, whereas the darkened part of the Earth experiences night. The line which divides the surface of the Earth into a lighted half and a dark half is called the Terminator Line.

The Midnight Sun is a natural phenomenon that occurs in the summer months in places north of the Arctic Circle or south of the Antarctic Circle, when the Sun remains overhead 24 hours a day.

Revolution

It is the movement of the Earth around the Sun on its elliptical path. The Earth takes 365 ¼ days for it to complete one revolution. It revolves around the Sun at aspeed of 30 km per second. For the sake of convenience, we take it as 365 days and call it a year. The remaining quarter day is added once in every four years in the month of February. That is why February has 29 days once in four years. It is called a Leap Year. The inclination of the Earth on its axis and its revolution around the Sun cause different seasons.

The Northern Hemisphere is inclined towards the Sun for six months from 21st March to 23rd September while the Southern Hemisphere is tilted away from the Sun.

From Sep 23rd to March 21st the southern hemisphere is inclined towards the Sun and the northern hemisphere faces away from the Sun. The changing position of the Earth in its orbit during revolution gives the impression that the Sun is continuouslymoving north and south of the equator. The equator faces the Sun directly on 21 March and 23 September. These two days are called Equinoxes, during which the day and night are equal throughout the Earth.

Perihelionis the Earth's closest position to the Sun. Aphelion is the farthest position of the

Earth from the Sun.

On 21st June, the Tropic of Cancer faces the Sun. This is known as Summer Solstice. It is the longest day in the Northern Hemisphere and longest night (shortest day) in the Southern Hemisphere. On 22nd December, the Tropic of Capricorn faces the Sun. It is called as Winter Solstice. It is the longest day in the Southern Hemisphere and longest night (shortest day) in the Northern Hemisphere.

4. Spheres of the Earth

The Earth is the most suitable planet to support life. It has three major components that we call as the realms of the Earth-lithosphere, hydrosphere and atmosphere. The three components along with suitable climate make life possible on Earth. All living things exist in a narrow zone called the biosphere. Now let us have a close look at each of the spheres.

Lithosphere

The word lithosphere is derived from the Greek word Lithos, which means rocky. The Lithosphere is the land on which we live. It is the solid outer layer of the Earth consisting of rocks and soils.

Hydrosphere

The word Hydro means water in Greek. The hydrosphere consists of water bodies such as oceans, seas, rivers, lakes, ice caps on mountains and water vapour in the atmosphere.

Atmosphere

The word Atmo means air in Greek. Atmosphere is the envelope of air that surrounds the Earth. Different types of gases make up the atmosphere. The major gases are Nitrogen (78%) and Oxygen (21%). The other gases like Carbon dioxide, Hydrogen, Helium, Argon, and Ozone are present in meager amounts.

Biosphere

The narrow belt of interaction among the lithosphere, the hydrosphere and the atmosphere, where life exists is known as Biosphere. Bio means life in Greek. It consists of distinct zones. Each zone has its own climate, plant and animal life. These zones are known as ecosystems.

The Gulf of Mannar Biosphere Reserve in the Indian Ocean covers an area of 10,500 sq.km in the ocean.

Wrap Up

- The Universe was formed 15 billion years after the Big Bang explosion
- Many galaxies are found in the Universe.
- Our solar system is a part of the Milky Way Galaxy.
- The Sun is so huge that it accounts for 99.8 percent of the entire mass of the solar system.
- All planets rotate anti-clockwise on their own axes except Venus and Uranus.
- Asteroids are found as a belt between Mars and Jupiter.
- The rotation of the Earth causes day and night.
- The revolution of the Earth causes seasons.
- Summer solstice is the longest day in the Northern Hemisphere.
- The presence of land, water and air along with suitable climate makes life possible on Earth.

Unit 2- Land and Oceans

Pathway

This lesson focuses on land and oceans found on the Earth. It deals with the classification of landforms - first, second and third order landforms.

The teacher enters the classroom with giant-sized envelopes. The students are enthusiastic to know the content of the envelopes. Teacher asks the children to sit in groups and explains the activity. Each group is given an envelope which contains seven jig-saws and a chart paper. The teacher asks them to paste the jig-saws (continents) close to each other leaving no gap between them. Teacher asks them to colour the remaining places in blue.

A group pastes the continents and comes first with the chart without any gaps inbetween the continents. The teacher then puts the chart on the board and the children applaud.

"What kind of picture is this? Once I have seen one like this in the atlas, " saysYazhini."You are right. This is Pangea, the Super Continent, and the Sea around is Panthalasa. It was 200 million years ago, when these landmasses moved away from each other to gain the present position as continents and oceans." says the teacher.

"What makes it to move madam?" asks Nila. "Nothing other than the internal heat of the Earth," says the teacher and continues, "this lesson deals about the continents and oceans in detail"

The Earth is covered by water which occupies 71 percent and land that occupies 29 percent of the Earth's surface. The surface of the Earth is not even, because it has lofty mountains, deep oceans and other landforms. These landforms can be classified as

1. First order landforms

Continents and oceans are grouped as frst order landforms. The vast land masses on Earth are called Continents and huge water bodies are called Oceans. There are seven continents. They are Asia, Africa, North America, South America, Antarctica, Europe and Australia. Asia is the largest continent, whereas Australia is the smallest one.

GEO CONNECT:

Land classification - Sangam period

1. Kurinji - Mountain and its environs
2. Mullai - Forest and its surroundings
3. Marutham - Agricultural land and its adjoining areas.

4. Neithal- Sea and its environs

5. Palai - Desert region

Apart from continents, there are five oceans located on the Earth's surface. They are the Pacific, Atlantic, Indian, Southern and Arctic Ocean. Among these oceans, the Pacific Ocean is the largest and the Arctic Ocean is the smallest.

Isthmus : A narrow strip of land which connects two large landmasses or

separates two large waterbodies.

2. Second order landforms

The second order landforms are categorised as mountains, plateaus and plains.

Mountains

A landform that rises 600 metre above its surroundings and has steep slopes is called a mountain. Mountains arefound in isolationor in groups. If the mountains extend for a larger area continuously, it is called a mountain range. These ranges stretch for hundreds or thousands of kilometre. The Himalayas of Asia, the Rocky Mountains of North America andthe Andes of South America are such examples. The Andes mountain in South America is the longest mountain range (7,000 km) in the world. The highest point of a mountain is known as peak. Mt. Everest is the highest peak (8,848 m) in the world. Which country is Mt. Everest located in?

Mountains are the sources of rivers. They provide shelter to flora and fauna. Here, tourism is an important activity. During summer, people go to mountain regions to enjoy the pleasing cool weather. Udhagamandalam, Kodaikanal, Kolli hills, Yercaud and Yelagiri are some of the hill stations found in Tamil Nadu.

Plateaus

Plateaus are the elevated portions of the Earth that have fat surfaces bounded by steep slopes. The elevation of plateaus may be a few hundred metre or several thousand metre. Tibetan Plateau is the highest plateau in the world. So, it is called as the 'Roof of the world'. The fat topped part of the plateau is called Tableland. The plateaus are generally rich in minerals. The Chotanagpur Plateau is one of the mineral rich plateaus in India. Therefore, mining is one of the major activities of the people living here. The Deccan Plateau in peninsular India is of volcanic origin.

Plains

Plains are a fat and relatively low-lying lands. Plains are usually less than 200 metre above sea level. Sometimes they may be rolling or undulating. Most plains are formed by rivers and their tributaries and distributaries. These plains are used extensively for agriculture due to the availability of water and fertile soil. Theyare most suitable for human inhabitation. Hence, they are the highly populated regions of the world. The oldest civilisations like the Mesopotamian and the Indus civilisations developed in river plains. The Indo-Gangetic plain in North India is one of the largest plains in the world. The plains formed by river Cauvery and Vaigai are important plains found in Tamil Nadu. Coastal plains are the low lying lands adjacent to oceans and seas.

Dharmapuri Plateau, Coimbatore Plateau and Madurai Plateau are found in Tamil Nadu.

The plains have been the cradle of civilisations from the earliest times.

For example: the Indus in India, the Nile valley in Egypt are some of the early civilisations which developed and flourished.

3. Third order landforms

Third order landforms are formed on mountains, plateaus and plains mainly by erosional and depositional activities of rivers, glaciers, winds and waves. Valleys,beaches and sand dunes are some examples of third order landforms.

Erosion is the process of removal of surface material from the Earth's crust. The eroded materials are transported and deposited on the low lying areas. This process is called as Deposition.

4. Oceans

The Earth looks blue when we see it from space. This is because, two-thirds of it is covered by water. The water is found in oceans and seas. Oceans are vast expanse of water. Seas are water bodies partially or fully enclosed by land. As you have studied previously, there are five main oceans in the world.

4.1 The Pacific Ocean

The Pacific Ocean is the largest and deepest ocean on the Earth. It covers about one-third of the Earth's total area and spreads for about 168.72 million sq.km. It is bounded by Asia and Australia in its west and North America and South America in its east. It stretches from the Arctic Ocean in the north to the Southern Ocean in the south.

If Mount Everest,which is the highest point (8,848 metres) was plugged into the Mariana Trench, still there would be 2,146 metres of water left. The depth in meters from mean sea

level is denoted as m-

This ocean's shape is roughly triangular with its apex in the north at the Bering Strait which connects the Pacific Ocean with the Arctic Ocean. The Bering Sea, the China Sea, the Sea of Japan, Tasman Sea and the Philippine Sea are some of the marginal seas of the Pacific Ocean. Indonesia, Philippines, Japan, Hawaii, New Zealand are some of the islands located in this Ocean. The deepest point Mariana Trench is 10,994 m- and is located in the Pacific Ocean. A chain of volcanoes is located around the Pacific Ocean called the
Pacific Ring of Fire.

The Spanish navigator Ferdinand Magellan named the ocean Pacific, meaning calm or tranquil.

The Atlantic Ocean

The Atlantic Ocean is the second largest ocean on the Earth. It covers one sixth of the Earth's total area and spreads for about 85.13 million sq.km . It is bounded by North America and South America in the west and Europe and Africa in the east. Like the Pacific, it stretches from the Arctic Ocean in the north to the Southern Ocean in the south. The shape of the Atlantic Ocean resembles the letter 'S'. The Strait of Gibraltar connects theAtlantic Ocean with the Mediterranean Sea. The Atlantic Ocean is the busiest shipping route between the Eastern and Western hemispheres. The deepest point is the Milwaukee Deep in the Puerto Rica Trench. It has a depth of about 8600 m-. The Caribbean Sea, the Gulf of Mexico, the North Sea, the Gulf of Guinea and the Mediterranean Sea are important marginal seas of the Atlantic Ocean. St. Helena, Newfoundland, Iceland and Falkland are some of the islands found in this ocean.

The Indian Ocean

The Indian Ocean is the third largest ocean on the Earth's surface. It covers an area of about 70.56 million sq.km. It is named after India. It is triangular in shape and bounded by Africa in the west, Asia in the north and Australia in the east. The Andaman and Nicobar Islands, Lakshadweep, Maldives, Sri Lanka, Mauritius and the Reunion Islands are some of the islands located in the Indian Ocean. Malacca strait connects the Indian Ocean and the Pacific Ocean.

Palk Strait connects the Bay of Bengal and Palk Bay.

The Bay of Bengal, the Arabian Sea, the Persian Gulf and the Red Sea are some of the important marginal seas of the Indian Ocean. The Java trench (7,725 m) is the deepest point in the Indian Ocean.

- 6° Channel separates Indira Point and Indonesia
- 8° Channel separates Maldives and Minicoy islands
- 9° Channel separates Lakshadweep Islands and Minicoy islands
- 10° Channel separates Andaman and Nicobar Islands

The Southern Ocean

The Southern Ocean surrounds the continent of Antarctica and is enclosed by the 60°S latitude. It covers an area of 21.96 million sq.km. It is bordered by the southern parts of the Pacific, the Atlantic and the Indian Oceans. The Ross Sea, the Weddell Seaand the Davis Sea are the marginal seas of this Ocean. Farewell Island, Bowman Island and Hearst Island are some of the islands located in this ocean. The water in this ocean is very cold. Much of it is covered by sea ice. The deepest point in this ocean is South Sandwich Trench with a depth of 7,235 m-.

The Arctic Ocean

The Arctic Ocean is the smallest ocean. It covers an area of 15.56 million sq.km. It lies within the Arctic Circle. It remains frozen for most of the year. The Norwegian Sea, the Greenland Sea, the East Siberian Sea and the Barents Sea are some of the marginal seas of this ocean. Greenland, New Siberian Island and Novaya ZemlyaIsland are some of the islands located in the Arctic Ocean. The North Pole is situated in the middle of the Arctic Ocean. The Eurasian Basin is the deepestpoint in the Arctic Ocean, which is about 5,449 m- in depth.

Wrap-up

- The surface of the Earth is covered by 71 percent of water and 29 percent of land.
- The landforms are classified as first order, second order and third order landforms.
- Continents and oceans are the first order landforms.
- There are seven continents and five oceans on the Earth's surface.
- Mountains, plateaus and plains are the second order landforms.
- Valleys, beaches and sand dunes are the third order landforms.
- Many islands and marginal seas are found in the oceans.

6th term – II
Unit – 1 Resources

- Resource is anything that fulfills human needs. When anything is of some use it becomes valuable. All resources have value. The value can be either commercial or non-commercial. Commercial resources have great economic value. (e.g.) Petroleum. The Non-commercial resources are very abundant in availability (e.g.) Air.

- Resources can be natural, man-made and human resources.

Natural Resources:

- All resources that have been directly provided by nature are called Natural resources. The air, water, soil, minerals, natural vegetation and wild life around us are all natural resources. The use of any natural resource depends on the place it is available, the form in which it is available and the technology necessary to avail it.

Classification of Natural Resources

- Natural resources can be classified into different groups depending on origin, development, renewability, distribution, ownership etc.

A. On the basis of origin: On the basis of origin, resources can be classified into biotic and abiotic resources.

i. All living resources are biotic resources, plants, animals and other microorganisms are biotic resources.
ii. Abiotic resources are non-living things. Land, water, air and minerals are abiotic resources.

- The biotic resources were mere substances till they were recognized by humans. According to the human needs the substances were collected by the ancient men and preserved for use. In the beginning, man had only three basic needs-food, clothing and shelter. He collected things through primary activities such as hunting, food gathering, fishing and forestry. Later when food became scarce, they had to cultivate and that became agriculture and the cattle were also reared on their farms to fulfill their basic needs.

- The abiotic resources were also sought after by the early men. They went in search of better landforms where they had enough water resources for agriculture and their cattle. They were in need of tools right from hunting to agriculture. Primarily the tools were only made of stones. Later man dug the earth for better abiotic resources and found copper first and iron later. He also mined precious metals simultaneously for making ornaments. Later mining became one of the leading primary activities and still holds an important place among the economic activities.

B. On the basis of development: Based on the level of development, resources can be divided into actual and potential resources.

i. Actual resources are resources that are being used and the quantity available is known. (e.g.) Coal at Neyveli.

ii. Potential resources are resources that are not being used in the present and its quantity and location are not known. The technology to extract such resources is also yet to be developed. (e.g.) Marine yeast found in the Bay of Bengal and Arabian Sea.

C. On the basis of exhaustibility: On the basis of renewability resources can be classified as renewable resources and non-renewable resources.

i. Resources once consumed can be renewed with the passage of time are called renewable resources. (e.g.) Air, Water, Sunlight. Misuse of such resources can also limit its available quantity. So, they have to be used wisely.

ii. Natural resources which are limited can be called non-renewable resources. They become exhausted after use and the time they take to replace does not match the life cycle. (e.g.) Coal, petroleum, natural gas and other minerals.

- The resources which cannot renew themselves are either scarce or totally absent. So man is in search of new resources and is conducting several researches. He confirms that a substance is a resource only after research. He tries to harness it and also searches the regions where it may be found in. They are potential resources. Wind energy is one such example. The places where the wind energy can be utilized are still unknown.

D. On the basis of distribution: On the basis of distribution, resources can be classified into localized resources and universal resources.

i. When resources are present in specific regions they are called localized resources. (e.g.) Minerals.

ii. Some resources are present everywhere such resources are called universal resources. (e.g.) Sunlight and air.

E. On the basis of ownership: Based on ownership resources can be classified into Individual resources, Community-owned resources, National resources and International resources.

i. Individual resources are resources privately owned by individuals. (e.g.) Apartments.

ii. Community-owned resources are resources which can be utilised by all the members of the community. (e.g.) Public parks.

iii. National resources are resources within the political boundaries and oceanic area of a country. (e.g.) Tropical forest regions of India.

iv. International resources are all oceanic resources found in the open ocean. Resources found in this region can be utilized only after an international agreement. (e.g.) Ambergris.

Man-made resources:

- Natural resources are modified or processed by technology into man-made resources. (e.g.) sugarcane processed to get sugar. All structures built by man can also be called man-made resources. (e.g.) Bridges, Houses, Roads.

- This transforming of raw materials into finished goods is called Secondary Activities. Man's skills and ideas are the basic requirements for these activities.

Human resource:

- Human resources are groups of individuals who use nature to create more resources. Though human beings are basically natural resources, we classify human beings separately. Education health, knowledge and skill have made them a valuable resource. (e.g.)Doctors, Teachers, Scientists. Tertiary activities are basically concerned with the distribution of primary and secondary products through a system of transport and trade (e.g) Banking, Trade and Communications. The quantity and quality of institutions and organizations involved in making the professionals decide the human resource of a country.

Gandhian thought on Resources: There is enough for everybody's need and not for anybody's greed. Mahatma Gandhi blamed "human beings" for depletion of resources because of

i. over exploitation of resources

ii. Unlimited needs of human beings. So, conservation is very important.

Resource planning / Management

- Resource planning is a technique or skill of proper utilization of resources. Resource planning is necessary because

i. Resources are limited, their planning is quite necessary so that we can use them properly and at the same time we can save them for our future generation.
ii. Resources are not only limited but also they are unevenly distributed over the different parts of the World.

iii. It is essential for the production of resource to protect them from over exploitation.

Conservation of resources:

- Careful use of resources is called conservation of resources. Resources are being used at a very fast rate due to the rapid increase in population. So, natural resources are depleting fast; wisely using resources can control the depleting ratios.

- Development is necessary without affecting the needs of the future generations. If the present needs of resources are met and the conserving of resources for the future are balanced, we call it sustainable development. Sustainable development can take place when

    i. The reasons of depletion are identified.
    ii. Wastage and excess consumption is prevented.
    iii. Reusable resources are recycled.
    iv. Pollution is prevented.
    v. Environment is protected.
    vi. Natural vegetation and wild life are preserved.
    vii. Alternative resources are used.

- The easiest way to conserve resources is to follow the '3R's: Reduce, Reuse and Recycle.

NOTE

- ❖ Anything becomes a resource only when its use is discovered. The needs of human beings are ever changing. According to the ever changing needs, resources keep changing. Time and Technology are two important factors that determine whether a substance is a resource or not. for example: Sun's energy to generate electricity was made possible after the invention of solar panels (technology); and the receding of coal and petrol was in need of an inexhaustible resource (time).
- ❖ Marine yeast have greater potential than the terrestrial yeast. They can be used in baking, brewing, wine, bio-ethanol and pharmaceutical protein production.
- ❖ Tropical rain forests are called the 'World's largest Pharmacy' as 25% of the natural vegetation are medicinal plants. (e.g.) Cinchona.
- ❖ Ambergris is an extract from the sperm whale. A pound (0.454kg) of sweet – smelling ambergris is worth US $63,000 and used in perfume industries.

6TH TERM 3
Unit 1 Asia and Europe

ASIA

Asia is the largest and the most populous continent in the world. It covers about 30 percent of the world's land area and about 60 percent of the world's population. Most of the land of Asia lies in the northern hemisphere. It has different types of physical and cultural features. Lofty mountains, plateaus, plains, islands and peninsulas are the major physiographic features of Asia. Many perennial rivers flow through different parts of Asia. These river valleys are the cradles of ancient civilizations (Indus valley, Mesopotamian and Chinese civilizations). Let us know more about our home continent.

Location and Area Asia extends from 10˚11' South to 81˚12' North latitudes and from 26˚2' East to 169˚40' West, longitudes. It spreads for an area of 44 million km2.

Boundaries

Asia is surrounded by the Arctic Ocean in the north, Pacific Ocean in the east, Indian Ocean in the south and the Ural Mountains, Caucasus Mountains, Red Sea, Mediterranean Sea, Caspian Sea and Black Sea in the west. The Suez Canal separates Asia from Africa. The narrow Bering Strait separates Asia from North America.

Political Divisions

There are forty eight countries in Asia. The countries are grouped into several realms based on landscape and political status such as 1.East Asia 2.Southeast Asia 3.South Asia 4.Southwest and 5.Central Asia

Physiographic Divisions

Asia is the land of long mountain ranges, snow-capped high mountains, vast plateaus, extensive plains, river valleys and sea coasts. These diverse physical features encourage the people of this continent to involve in diverse economic activities. The physiography of Asia can be divided into five major groups. They are;

1. The Northern lowlands
2. The Central High Mountains
3. The Southern Plateaus
4. The Great Plains and
5. The Island Groups

1. **The Northern Lowlands**: The most extensive lowland in Asia is the Siberian plain. It extends from the Ural Mountains in the west to the Verkhoyansk Range in the east.

2. **The Central Highlands:** The central highlands stretches from Turkey to the Bering Strait. There are two knots found in Asia. They are 1. The Pamir Knot 2.The Armenian Knot.

The Hindukush range, the Sulaiman range, the Himalayan range and the Tian Shan range radiate from the Pamir Knot. The Hindukush range continues westward as the Elburz, whereas the Sulaiman range continues south west as the Zagros range. The Elburz and the Zagros converge at the Armenian knot. The Taurus and the Pontine ranges radiate from the Armenian knot. The other important mountain ranges are the great Khingan, the Altai, the Verkoyansk and the Arakan yoma. The Himalayan mountain range is the highest mountain range in the world Mt. Everest (8848 m) is the highest peak in Asia, as well as the world. The lowest point in the world is located in Dead Sea in Asia. Intermundane plateaus are found in these mountain ranges. The important plateaus are 1. The plateau of Anatolia (Pontine to Taurus) 2. The plateau of Iran (Elburz to Zagros mt) 3.The plateau of Tibet (Kunlun to Himalayas)

The Southern Plateaus: The southern plateaus are relatively lower than the northern plateaus. The four important southern plateaus are the Arabian Plateau (Saudi Arabia), Deccan Plateau (India), Shan Plateau (Myanmar) and the Yunnan Plateau (China). Among these plateaus, the Arabian Plateau is the largest Plateau.

The Great Plains: The great plains are formed by the major rivers of Asia. They are the West Siberian plain (Ob and Yenisey), Manchurian Plain (Amur), Great Plain of China (Yangtze and Sikiang), Indo-Gangetic Plain (Indus and Ganga), Mesopotamian plain (Tigris and Euphrates) and the Irrawaddy plain (Irrawaddy).

The Island Groups

Numerous islands are found in the Pacific coast of Southeast Asia. Kuril, Taiwan, Singapore and Borneo are the important island groups.
The Philippines, Japan islands and Indonesia are the major archipelagos in Asia. Smaller archipelagos are also located in the Indian Ocean such as the islands of Maldives and Lakshadweep in the Arabian Sea. Bahrain is in the Persian Gulf. Sri Lanka is an island, which is located in the Bay of Bengal.

Drainage

The rivers of Asia originate mostly from the central highlands. The Ob, Yenise and Lena are the major rivers that flow towards the north and drain into the Arctic Ocean. These rivers remain frozen during winter. On the other hand, South Asia has many perennial rivers (e.g.) Brahmaputra, Indus, Ganga and Irrawaddy which originate from the snow covered high mountains that do not freeze during winter. The Euphrates and Tigris flow in West Asia. The Amur, Huang He, Yangtze and Mekong rivers flow in the south and south eastern parts of Asia. Yangtze is the longest river in Asia.

S. No	Name of the River	Origin	Outflow	Length in KM
1.	Yangtze	Tibetan plateau	East China sea	6,350

2.	Huang He	Tibetan plateau	Gulf of Pohai	5,464
3.	Mekong	Tibetan plateau	South China sea	4,350
4.	Yenisei	Tannuala Mountain	Arctic Ocean	4,090
5.	Ob	Altai Mountain	Gulf of Ob	3,650
6.	Brahmaputra	Himalayas	Bay of Bengal	2,900
7.	Indus	Himalayas	Arabian Sea	3,610
8.	Amur	Confluence of Shika and Argun rivers	Tatar Strait	2,824
9.	Ganga	Himalayas	Bay of Bengal	2,525
10.	Irrawaddy	North Myanmar	Bay of Bengal	2,170

Climate

Asia exhibits a variety of climate. The northern part of Asia experiences severe long winter and cool summer. (Winter -37°C and Summer 10°C). Precipitation is in the form of snow (250 mm to 300 mm).The north eastern part of Asia experiences cold winter and warm summer and a moderate rainfall of 50 mm to 250 mm. The south, south east and eastern parts of Asia are strongly influenced by monsoon winds. Summer is hot and humid while winter is cool and dry. The summer monsoon winds bring heavy rainfall to India, Bangladesh, Indo-China, Philippines and Southern China (1500 mm to 2500 mm). In India, Mawsynram (11871 mm) receives the highest rainfall. So, this place is called the wettest place in the world. The areas found in and around the equator have uniform climate throughout the year. There is no winter. The average temperature is 27°C and the mean rainfall is 1270 mm.

The west and central parts of Asia have hot, dry climate. The temperature is very high during the day and very low during the night. Rainfall varies from 25 mm to 200 mm. The West coastal fringe of Asia (along the Mediterranean Sea) receives rainfall in winter and is warm in summer. Deserts are found along the western part of Asia. The major hot deserts are the Arabian (Saudi Arabia) and Thar (India and Pakistan) deserts. The cold deserts of Asia are Gobi and Taklamakan. The largest desert in Asia is the Arabian Desert.

Natural Vegetation

Natural vegetation depends upon rainfall, temperature and soil. As Asia stretches from the equator to poles, all types of vegetation are found here. Some rare species are found in Asia. (Orang- Utan, Komodo Dragon, Giant panda). The Asian flora and fauna are listed below:

S. No	Climate	Location	Flora	Fauna
1.	High Temperature, High rainfall	Indonesia, Malaysia, Singapore Sri Lanka	Evergreen trees- Mahogany, Rubber, Rosewood, Sal	Rhinoceros, tiger, Babirusa, Orangutan Komoda Dragon
2.	Summer rainfall,	India, Vietnam,	Deciduous trees –	Tiger, Elephant, Indian

	Dry winter	Cambodia, Thailand, Southern China	Teak, Sandal Wood, Bamboo	Cobra, viper
3.	Extreme temperatures	Arabian desert, North, North West India	Cactus, Dates (Oasis), Thorny shrubs, Babul tree	Bactrian Camel, The Sand grouse, desert oryx
4.	Dry winter, Warm summer	East China, Japan, North and South Korea	Cherry, Apricot, Plum	Giant Panda, Japanese macaque
5.	Warm Summer and winter rainfall	Israel, Lebanon, Turkey, Syria	Figs, Olives, Citrus fruits	Lynx, Jackrabbit
6.	Long and dry winter, short and cool summer	Siberia, Himalayas	Coniferous trees– Pine, Fir, Spruce	Siberian Tiger, Brown bear, Wolf
7.	Permanent snow cover	Beyond the snow line	Lichen, mosses Grass	Polar bear, Lemming Reindeer, Arctic fox

Resource Base and Economic Activities of Asia

Mineral Resources

Asia has a variety of mineral deposits. It holds an important place in the production of Iron, Coal, Manganese, Bauxite, Zinc, Tungsten, Petroleum, Tin etc. Oil and Natural Gas found in the west Asian countries. One third of the world's oil is produced in Asia. Among the west Asian countries, Iran has a considerable wealth of mineral resources. The important minerals found in Asia are:

- ✓ **Iron Ore:** Asia has the largest deposits of iron ore in the world. China and India are the important iron ore deposit countries ofAsia. Turkey,Philippines, Malaysia, Thailand, Myanmar etc.,are a few othercountries that have iron ore deposits.
- ✓ **Coal:** Coal is a fossil fuel. Asia has the largest deposits of coal intheworld. China and India are the largest producers of coalin Asia.
- ✓ **Petroleum:** Petroleum is a mineral oil. The largest petroleum reserves arefound in South West Asia. The important petroleumproducing countries are Saudi Arabia, Kuwait, Iran, Bahrain,Qatar and UAE. South China, Malaysia, Brunei, Indonesia,India, Russia are the other important petroleum producingcountries in Asia.

Bauxite is found in India and Indonesia. India is the largest producer of Mica in the world. Tin is found in Myanmar, Thailand, Malaysia and Indonesia.

Agriculture

Only about 18 percent of the total area is cultivable in Asia. Agriculture is the chief occupation of the people here. The river valleys in the South, South East and East Asia have rich alluvial soil. Agriculture is intensively practised in the riverine plains of Asia.

However, some areas are not suitable for agricultural practices. **India** has the largest area of arable lands in Asia. Most of the west Asian countries cultivate their crops where the ground water level is nearer to the surface. Iraq practices agricultural activities based on the availability of rainfall and supply of water from Euphrates and Tigris rivers.

Rice and Wheat are the staple food crops in Asia. China and India are the leading producers of rice in the world. Other important rice producing countries are Myanmar, Japan, Bangladesh and Thailand. Monsoon Asia is suitable for rice cultivation because of the abundant rainfall, fertile plains and availability of labour. Thailand is called the Rice bowl of South East Asia.Wheat is grown in the temperate regions of Asia. Russia, India, China and Pakistan are the leading producers of wheat in Asia. Millets like Bajra, Jower, Ragi and Sorgham are grown in the drier parts of Asia. These are widely cultivated in India, Pakistan and a few gulf countries. Apart from these, pulses, spices and oil seeds are also cultivated in various parts of Asia.

Jute and cotton are the important natural fibres cultivated in Asia. One third of the world's cotton is produced by Asia. The major cotton producing countries are India, China, Russia and Kazakhstan. India, Pakistan, China and Bangladesh are the leading producers of jute. The tropical wet and dry climate is suitable for sugarcane cultivation in Asia. India, Indonesia and Philippines are the major producers of sugarcane. Coffee, Tea, Rubber, Palm trees and Cocoa are the important plantation crops. India, Sri Lanka, Thailand, Vietnam, Malaysia and Indonesia are importantan producers of plantation crops. Malaysia and Thailand are the leading producers of natural rubber. Dates are produced in west Asia, among the countries Iran is the largest producer of dates in the world.

1. **Fishing:** Fishing is an important economic activity in Asia. It is prevalent in open seas as well as inland water bodies. China and Japan are the leading fishing nations. In Cambodia, Tonle Sap lake is one of the world's richest sources of fresh water fishing. Bay of Bengal is the major fishing ground for India, Sri Lanka, Myanmar and Bangladesh. Fishing is the mainstay of the national economy in Maldives. Pearl fishing (Bahrein) is popular in the eastern coast of Arabia.

2. **Industrial Regions:** In China, Manchurian, Shanghai- Wuhan, Peking—Shenyang, Guangdone- Hongkong regions are the major industrial regions. In Japan, the major regions are Tokyo, Yokohama and Osaka-Kyoto regions. In India, Mumbai, Ahmedabad, Coimbatore, Bengaluru and Chottanagpur are the important industrial regions.

3. **Transport:** Transport is the backbone of the economic development of a region. Many Asian countries are developing their transport network for their economic progress. Roadway is the most common mode of transport in Asia.

4. **Roadways:** The Asian Highway connects Tokyo in the east to Turkey in the west, Russia in the north to Indonesia in the south and the total length of road is 1,41,000 km. It passes through 32 countries. The Asian Highway 1(AH 1) is the longest

highway among the Asian Highway Network (20557 km). It connects Tokyo to Turkey. The Asian Highway 43 (AH 43) runs from Agra in India to Matara in Sri Lanka (3024 km).

5. **Railways:** The Trans - Siberian Railways (9258 km) is the longest rail route in the world. It is a transcontinental railway line which connects Leningrad and Vladivostok. The Trans Asian Railway links Singapore and Istanbul in Turkey. The Shinkansen, bullet train is the world famous super express train that runs between Osaka and Tokyo in Japan at a speed of 352 km/h. The Indian railway network is the second largest railway network in Asia.

6. **Waterways:** The Cape of Good Hope route connects Europe to South Asia. The Trans Pacific route connects the ports of eastern Asia to the ports of western American countries. The Suez Canal route passes through the heart of the world trade route and connects Europe with South and Southeast Asia. Tokyo, Shanghai, Singapore, Hong Kong, Chennai, Mumbai, Karachi and Dubai are the important seaports in Asia.

Cultural Mosaic of Asia

1. **Population:** Asia is the most populated continent in the world. Approximately six-tenth of the world's population lives in Asia. The population is unevenly distributed because of various physical features. China and India alone covers three fifth of Asia's population. Apart from these two countries, Bangladesh, Indonesia, Japan, Pakistan and Philippines have more than 100 million populations. The population density in Asia is 143 persons per Km2. India, Japan, Bangladesh and Singapore have high population density. River plains and industrial regions have high density of population, whereas low density is found in the interior parts of Asia.

2. **Religion & Language:** Hinduism, Islam, Buddhism Christianity and Sikhism are the major creeds in Asia. The minor creeds Zoroastrianism, Jainism, Shintoism, Confucianism and Taoism are also practised in Asia. Mandarin, English, Indonesian, Japanese, Arabic, Korea, Vietnamese and Hindi are the most widely spoken languages in Asia.

3. **Art and Architecture:** Asia is the home land of three civilizations.(Mesopotamian, Indus valley and Chinese civilizations).These three contributed to the architectural works at an early stage. Among the seven wonders of the world, two are located in Asia (The Tajmahal in India, The Great wall of China).The people of Yemen built a mud skyscraper thousands of years ago. Ankorwat in Cambodia, Buddhist Temple in East and Southeast Asia, Mosques in west Asia and the temples and forts in India are fine examples of Asian architecture.

4. **Food:** Rice, Wheat, Maize and Barley are the staple food in Asia. Dairy products, fruits and nuts are also consumed. In East Asia, bread and noodles are the staple food where rice is not available. Tea, Coffee and green tea are the chief beverages. In West Asia, meat, herbs and olive oil are the prime ingredients in their food.

5. **Dance and Music:** In Asia, Yangee, Dragon Dance, Kabaki are popular in East Asia RamThai in Thailand, Bhangra, Kathak and Bharathanatyam in India are also important dances in Asia. Sufi music and Arabic classical music are common in west Asia. Tinikling is the national dance of Philippines.

6. **Festivals:** The mid-autumn festival / moon festival in China, Taiwan and Vietnam. Holi and Mahara Sankaranthi / Pongal in major parts of India and Sukkoth in Israel are the important harvest festivals of Asia. The snow sculpture festival, Chinese New Year, Thaipusam, Diwali, Taiwan Lantern festival, Songkran, winter light festival are also some of the famous festivals in Asia.

7. **Land of contrasts:** Asia is the biggest continent. It has different types of land features such as mountain, plateau, plain, valley, bay, island etc. It also has different climatic conditions from the equator to polar region. Apart from this, many races, languages, religions and cultures are followed by people who live in Asia. So, Asia is called 'the land of contrasts'.

Europe

Europe is the sixth largest continent in size and the third largest in population in the world. It has diverse landforms and people. It is the birth place of western civilizations (Roman and Greek), democracy and Industrial Revolution. It is the most developed continent in the world. Let us explore the continent.

Location and size

Europe spreads from 34^{o} 51' North latitude to 81^{o} 47' North latitude and from 24^{o}33' West longitude to 69^{o} 03' East longitude. The Prime Meridian 0^{o} longitude passes through Greenwich in England.

Europe is found in the northern hemisphere and it covers an area of 10.5 million sq.km. It is surrounded by the Arctic Ocean in the North, the Black Sea and Mediterranean Sea in the south, the Atlantic Ocean in the west and the Ural mountains in the east. So it looks like a giant peninsula.

Physical Divisions

Europe has diversified physical features such as mountains, plains, plateaus, peninsulas, bays, islands and river basins. It can be divided into four physical divisions.

1. The North Western Highlands
2. The Central Plateaus/High land
3. The Alpine Mountain system
4. The North European plains

1. **The North Western highlands:** This region includes the mountains and plateaus of Norway, Sweden, Finland, Scotland and Iceland. This region has themost beautiful fjord coast. It was created by glaciations in the past. This region has a lot of lakes, which serve as reservoirs for producing hydroelectricity. Norway and Sweden are the largest producers of hydroelectricity in the world.

2. **The Central Plateaus:** The plateaus are found in east west direction across central Europe. Many rivers in Europe such as, the Danube, the Volga and the Tagus originate from this plateau. The important plateaus of this region are The Pennines (England), The Meseta (Spain), The Central Massif and Jura (France). The Black forest (Germany) in these region has rich mineral resources. The Pennines is called the backbone of England.

3. **The Alpine Mountain System**: The alpine mountain system consists of a chain of young fold mountains found in the southern part of Europe. The important mountain ranges are the Sierra Nevada, the Pyrenees, the Alps, the Apennines, the Dinaric Alps, the Caucasus and the Carpathian. The Pyrenees forms a natural boundary between Spain and France. Thehighest peak in Europe is Mt. Elburz (5645 m) in the Caucasus range. The Mont Blanc (4,807 m) found in the Alps is the second highest peak in the Alpine System.There are several active volcanoes found in the Alpine mountain system. Mt. Etna, Mt. Vesuvius and Mt. Stromboli are the important volcanoes found in Europe. Earthquakes are common in this region. The Stromboli is called the 'light house of the Mediterranean'.

4. **The North European plain**: The north European plain stretches from the Atlantic Ocean in the west to the Ural Mountains in the east. On the north, it is surrounded by the Baltic Sea and on the South by the alpine mountain. It is narrow in the West and wide towards the East. Major European rivers such as the Seine, the Rhine, the Danube and the Don criss-cross this region and deposit their alluvium. The Andalusian Plain, The Hungarian Plain and the Wallachian Plain are also found in this region. It has rich deposits of coal and iron ore. The north European plain is densely populated region and cities like Paris, Moscow and Berlin are located here.

S. No	Rivers	Length (km)	Source	Out flow
1.	Volga	3,692	Valdes plateau	Caspian Sea
2.	Danube	2,860	Black forest	Black Sea
3.	Dnieper	2,145	Valdai Hills	Black Sea
4.	Rhine	1,230	Alps (Switzerland)	North Sea
5.	Rhone	813	Swiss Alps	Mediterranean Sea
6.	Po	652	Cottian Alps	Adriatic Sea
7.	Thames	346	Kemble	North Sea

Drainage

The rivers play an important role in the development of Europe. These rivers are used to irrigate farmland and also help to produce electricity.Most of the rivers originate in the Alps and the central plateau of Europe. These rivers are useful for inland navigation in central and Eastern Europe. The Volga is the longest river in Europe. The river Danube passes through nine countries in Europe.

Climate

The climate of Europe varies from the subtropical to the polar climate. The Mediterranean climate of the south has warm summer and rainy winter. The western and northwestern parts have a mild, generally humid climate, influenced by the North Atlantic Drift. In central and eastern Europe, the climate is humid continental-type. In the northeast, subarctic and tundra climates are found. The whole of Europe is subject to the moderating influence of prevailing westerly winds from the Atlantic Ocean.

Natural vegetation: The natural vegetation of Europe can be classified as follows:
1. Tundra, 2. Taiga or Coniferous, 3.Mixed Forest, 4. Mediterranean Forest , 5. Grassland

The Arctic and northern Scandinavian highland have Tundra type of vegetation made up of lichens and mosses.Coniferous or Taiga vegetation's are found to the south of the Tundra region in Norway, Sweden, Finland, Germany, Poland and Austria. Pine, fir, spruce and larch are the important tree varieties of taiga forest.
The mixed forest comprising of birch, beech, poplar, oak and maple trees found in the western part of Europe particularly in western France, Belgium, Denmark, Britain etc. Mediterranean trees like cypress, cork, oak, olive and cedar are found along the borders of the Mediterranean Sea. Eastern Europe is covered by grasslands (Steppe).

Resources Base and Economic Activities of Europe

Availability of resources, efficient educated work force, research, contact with other nations and innovations have transformed Europe into a modern and economically developed continent in the world. Europe is an industrially developed continent in the world. It has great diversity in its topography, climate and soil. These interact to produce varied patterns of agricultural activities such as Mediterranean agriculture, Dairy farming, mixed livestock and crop farming and horticulture (Truck Farming) Wheat is the dominant crop throughout Europe. Barley, Oats, sugar beet, rye, potatoes and hay are also common crops. Corn (maize) is an important crop in the lower Danubian lowlands and southwestern European Russia, France and Italy. Rice (northern Italy) and citrus fruits, olive trees (Spain, Sicily) depend on irrigation.

The northernmost countries grow few cereals (mainly oats) and concentrate on animal husbandry, especially cattle and dairying. Mixed farming and the use of well-tried crop rotations are widely practised. Viticulture is mostly practised in Italy, France and Germany. As for industrial crops, European Russia, Ukraine, and Belarus are large producers of flax and hemp, sugar beets and sunflower seeds. Tobacco is grown in Belarus and is also important in Bulgaria, Italy, and Macedonian Greece. European Russia,

Sweden and Finland are the major producers of softwood and hardwood. Fishing is a large industry in Norway, Iceland, Russia, Denmark, the United Kingdom, the Netherlands etc., The Dogger Bank in North Sea is an important fishing ground in Europe.

Industries

Europe produces a significant portion of the world's steel and iron ore. Shipbuilding, motor-vehicle and aircraft construction are widely distributed all over Europe. Europe is also a large producer of pharmaceutical drugs. A wide range of small-scale industries (i.e., those that produce nondurable goods) is found throughout Europe. Some countries have a reputation for specialty goods, as in the case of English, Italian, and Dutch bicycles, Swedish and Finnish glass, Parisian perfumes and fashion goods and Swiss precision instruments.

Cultural Mosaic of Europe

Europe is the third most populous continent, after Asia and Africa. The population of Europe was 742 million in 2018, which accounted for 9.73% of the world's population. The population density in Europe is 34 persons / km2. High population density is often associated with the coalfields of Europe. Other populous areas are sustained by mining, manufacturing, commerce, offering large market, labour forces and productive agriculture. Monaco, Malta, San Marino, and the Netherlands are the most densely populated countries; Iceland and Norway have very low density of population. In general, population is scantiest in the mountain regions, some highlands, arid parts of Spain and the Arctic regions of Russia. Monaco has the highest density of population in Europe (26,105 persons / km2) as well as in the world. Iceland has a very low density of population (3 persons/ km2).

Religion & Language

Europe is a continent of great linguistic and cultural difference. English, Spanish, Portuguese, French, Italian and Slavic are the broadly spoken languages in Europe. Christianity is the major religion in Europe. A considerable number of Hindus, Muslims and Jews are spread throughout Europe. More than 90 percent of the people belong to the Caucasoid race.

Art and Architecture

European art and architecture mostly reveals the ordinary human being and is popular all over the world. Acropolis, the Colosseum, the statue of David, The thinker, Eiffel tower, Big Ben, Pisa Tower and Mona Lisa are some of the master pieces of art and architecture in Europe.

Food and Festivals

Bread, fish, meat, potatoes and dairy products are the staple food in Europe. The Europeans celebrate both religious and holiday festivals. Christmas, Easter, Good Friday, the Saint Day, Redentore, Tomatina and Carnival are the important festivals of Europe. They play Rugby, foot-ball, basket-ball, ice hockey and skiing. Bull fighting in Spain is the world's attractive game.

A Comparison of Asia and Europe

Asia and Europe are integrated geographically and separated politically. Europe is the giant peninsula of Asia. Both the Himalayas (Asia) and the Alps (Europe) were formed during the same geological period. The Steppe grass lands and coniferous forests are spread over several hundred kilometres from Europe to Asia. Generally, the plains are found in the northern part and the mountains in the southern part in both the continents. The two continents are the homeland of ancient civilizations. From the ancient period, these two continents had trade relationship through the silk route and the spice route. Despite the various geographical similarities, these two continents have striking differences.

NOTE

- Europe is called as the 'Peninsula of Peninsulas'.
- **European Union:** The European Union (EU) is an economic and political union of 28 member countries for their welfare. It has own flag and the com
- **The Netherlands:** About 25 percent of the Netherlands lies below sea level. So they have built dikes. They have reclaimed new land from the sea with the help of dikes. These reclaimed lands are called polders. mon currency, the Euro (€).
- **Fjord:** A fjord is a narrow and deep sea inlet between steep cliffs. It helps in the following ways.
  - ✓ It reduces the speed of wind, irrespective of its direction.
  - ✓ The force of sea waves are also controlled.

  Hence, areas with fjords are best suited for natural harbours.
- **Black forest**: The lush and dark coloured fig and pine trees give black colour to this region.
- **The Matterhorn**: The pyramid-shaped Matterhorn Mountain is located in the Swiss Alps a height of 4478 m. It is popular for its shape.
- **Climate Divider:** The Alps Mountain separates the Mediterranean climate from the cold climate of the north.
- **North Atlantic Drift** is a warm ocean current which brings warmth to the western Europe. The westerly wind further transports warmth across Europe.

Asia	Europe
1. It is the largest continent, both by area and population.	1. It is the smallest continent by area and the most developed.
2. It extends from 10° 11′ 81° 12′ N latitudes. That is from the equatorial	2. It extends from 34°51′N to 81° 47′N latitudes. That is, from the sub-tropical

region to the polar region.	region to the polar region.
3. It is located on the eastern hemisphere	3. It is located at the centre of the earth.
4. The Bering Strait separates Asia and North America.	4. The Strait of Gibraltar separates Europe from Asia
5. The Arabian, Indo China, India and Korea are the important peninsulas in Asia.	5. The Scandinavian, Iberian, Italian and Balkan are the important peninsulas in Europe.
6. The important parallels such as the Equator, Tropic of Cancer, Arctic Circle pass through it.	6. Only the Arctic Circle passes through it.
7. All kinds of climatic conditions are found here. It also enjoys the distinctive monsoon type of climate Southern Asia receives summer rainfall.	7. It lies largely in the temperate zone. It enjoys the distinctive Mediterranean type of climate. Southern Europe receives winter rainfall.
8. Both hot and cold deserts are located here.	8. There are no deserts here.
9. It has a variety of mineral deposits.	9. Mineral resources are limited, except for coal & iron.
10. Plantation crops such as tea, rubber and dates are largely cultivated in Asia.	10. Citrus fruits, olives and grapes are cultivated mostly in Asia.
11. A majority of people in Asia are involved in primary activities.	11. A majority of people in Europe are involved in secondary and tertiary

7TH TERM 1
1. Interior of the Earth

Introduction

The earth, our homeland, is a dynamic planet. The earth's surface has lofty mountains, high plateaus, large plains and deep valleys etc. The earth's surface is constantly undergoing changes inside and outside. Have you ever wondered what lies in the interior of the earth? What is the earth made up of?

Interior of the Earth

The structure of the earth may be compared to that of an apple. The earth too has shells like that of an apple. If we cut a section through the earth, we will get a view as shown in figure. On the basis of the study of earthquake waves the spherical earth isfound to be three concentric layers. They are: 1. The crust, 2. The mantle and
3. The core.

1. The Crust

The crust is the outermost layer of the earth. Its average thickness varies from 5 to 30 km. It is about 35 km on the continental masses and only 5 km on the ocean floors. Despite greater thickness, the continental crust is less dense than the oceanic crust because it is made of both light and dense rock types. The oceanic crust is composed mostly of dense rocks such as basalt. The crust comprises two of distinct parts. The upper part consists of granite rocks and forms the continents.

It has the main mineral constituents are silica and alumina. So it is collectively referred to as Sial. It has an average density of 2.7g/cm3.The lower part is a continuous zone of denser basaltic rocks forming the ocean floors, comprising mainly of silica and magnesium. It is therefore called Sima. It has an average density of 3.0g/cm3. The sial and the sima together form the earth's crust. Since the sial is lighter than the sima, the continents can be said to be 'fl oating' on a sea of denser sima.

2. The Mantle

The next layer beneath the crust is called the mantle. It is separated from the crust by a boundary called Mohorovicic discontinuity. The mantle is about 2,900 km thick. It is divided into two parts. (i) The upper mantle with a density of 3.4 – 4.4g/cm3. extends down to 700 km. (ii) The lower mantle having a density of 4.4– 5.5g/cm3 extends from 700 to 2,900 km.

3. The Core

The innermost layer of the earth is called the core. It is also known as barysphere.It is separated from the mantle by a boundary called Weichart-Gutenberg discontinuity. The

core is also divided into two parts. (i) The outer core, which is rich in iron, is in liquid state. It extends between 2,900 – 5,150 km. (ii) The inner core, composed of Nickel and Ferrous (Nife), is solid in state. The central core has very high temperature and pressure. It extends from 5,150 km to 6,370 km. The average density of core is 13.0 g/cm3

The Earth Movements

The lithosphere is broken into a number of plates known as the Lithospheric plates. Each plate, oceanic or continental moves independently over the asthenosphere. The movement of the Earth's lithospheric plates is termed as tectonic movements. The energy required to move these plates is produced by the internal heat of the earth. These plates are moves in different directions at different rates. At places, these plates move away from each other creating wide rifts on the earth's surface. At some places, these plates come closer and collide.

When an oceanic plate collides with a continental plate, the denser oceanic plate is forced below the continental plate. As a result of the pressure from above the rocks heats up and melt. The molten rocks rise again forming volcanic mountains along the continental edge. Alternatively, a trench may be formed between two plates. In some cases when two continental plates converge, neither plate can be forced under the other. Instead, folds may be created. Great mountain ranges like the Himalayas have been formed in this way.

The movement of these plates causes changes on the surface of the earth. The earth movements are divided on the basis of the forces which cause them. The forces which act in the interior of the earth are called as Endogenic forces and the forces that work on the surface of the earth are called as Exogenic forces.Endogenic forces sometimes produce sudden movements and at the other times produce slow movements. Sudden movements like earthquakes and volcanoes cause mass destruction over the surface of the earth.

Earthquake

A sudden movement of a portion of the earth's crust which produces a shaking or trembling is known as an earthquake. Earthquakes may cause widespread damage to life and property. The point where these vibrations originate is called the focus of the earthquake. The point of the earth's surface directly above the focus is called the epicentre of the earthquake. From the focus, the earthquake vibrations travel in different directions in the form of seismic waves.The earthquake waves are recorded by an instrument known as seismograph. The magnitude of an earthquake is measured by the Richter scale. The numbers on this scale range from 0 to 9.

Causes of Earthquake

The chief cause of earthquake is the sudden slipping of the portion of the earth's crust along fractures or faults. The movement of the molten rocks underneath the surface produce strains which break the rocks apart. The sudden shifting of landmass causes

upheavals in the crust of the earth sending vibrations or waves into the surrounding portions of the earth. Sometimes the surface of the earth itself cracks. Another cause of earthquake is volcanic activity. A violent or explosive eruption often causes the earth in its vicinity to quake. Earthquakes are often common in most volcanic areas.

Effects of Earthquakes

Earthquakes may cause changes in the earth's surface. Vibrations often set landslides in mountainous regions.A greater danger in an earthquake is the falling of buildings. Most of the houses which collapsed were made of mud and bricks and proved to be death traps. Fire is another great danger. Underground water system is naturally disturbed by such movements.

An earthquake which originates below or near the sea causes great disturbance in the water. The floods and waves cause great loss of life, sometimes more than the earthquake itself. Tsunami, a Japanese term, is the name given to the huge wave caused in the sea by an earthquake. Tsunamis are quite common along the coasts of Japan and other regions in the Pacific Ocean.

Distribution of Earthquakes

The world's distribution of earthquakes coincide very closely with that of volcanoes. Regions of greatest seismicity are circum-Pacific areas, with the epicenters and the most frequent occurrences along the Pacific Ring of Fire. It is said that about 68 percent of earthquakes occur in this belt. Another 31 % of earthquakes take place in the Mediterranean-Himalayan belt including Asia Minor, the Himalayas and parts of north-west China. The remaining percent of earthquakes are occur in Northern Africa and Rift valley areas of the Red sea and Dead sea.

In India, the Himalayan region and the Ganga-Brahamaputra valley are prone to earthquakes. A number of earthquakes have been experienced in this region. Some of them were very severe and caused extensive damage, e.g., the earthquake of Uttar Kashi in 1991 and Chamoli in 1999. The Deccan Plateau, which was supposed to be comparatively free from the dangers of the earthquakes, has experienced two severe earthquakes in the past, the Koyna earthquake in 1967 and the Latur earthquake in 1993.

World Distribution of Earthquakes

Volcanoes

A volcano is a vent or an opening in the earth's crust through which hot magma erupts from deep below the surface. The opening is usually circular in form. Volcanic eruptions may also take place through a long crack or fissure through which steam and other materials flow out. The molten rock material within the earth, together with gases, is called magma. After it rises to the surface, it is called as lava. In course of time, lava and other materials flow out of a volcano accumulate around the opening and form a conical

hill or a mountain vent is an opening or mouth of a volcano. The top of this cone is usually marked by a funnel-shaped depression, which is called a *crater*.

If the crater of a volcano is of great size and is shaped like a The temperature increases as the depth increases at the rate of 1^{o}c for every 35 metres. There is also great pressure. At a depth of about 15 km the pressure is about 5 tonnes per cm2of rock. Under these circumstances, the interior of the earth is in a semi-molten state called magma. The magma, under great pressure has the capacity to dissolve great volume of gas; some gases are also combustible. This makes volcanic material burst forth through the weak spots in the earth's crust.

Nature of volcanic eruptions

Sometimes, magma rises slowly to the surface and spreads over a vast area. Th is is known as fi ssure eruption. Some plateaus and plains have been formed in this way, e.g., Deccan Plateau in India and the Colombian Plateau in North America. If the magma rises quickly to the surface, lava is thrown high into the atmosphere. Besides lava, ash, steam, gases and pieces of rocks are also thrown out. This type of eruption is known as explosive eruption. The terrible explosion on the island of Krakatoa (27th August 1883) in Indonesia is an example for explosive type of eruption. Lava flow is affected by viscosity. For example, honey has high viscosity, so it flows slowly, whereas water has low viscosity, so it flows easily. The viscosity of lava is determined by the amount of silica and water in magma. Highly viscosity lava is rich in silica and has little water. Low viscosity lava has little silica, but a lot of water. It moves rapidly forming smooth flows.

Types of Volcanoes

The shape of a volcano depends on the type of lava and the force of the eruption. On the basis of shape, there are three types of volcanoes. They are: 1. Shield volcano, 2. Cinder-cone volcano, 3. Composite volcano

1. **Shield volcano**: A shield volcano is formed by quiet eruption of lava with a low silica content. Such a volcano has a wide base and a cone with gentle slopes. Volcanoes of the Hawaii islands are of this type.
2. **Cinder-cone volcano**: Silica-rich magma traps gases inside the volcano until enough pressure is built to push the magma out of the earth's crust. When this type of volcano erupts, it shoots gases, ash, etc. with great force throwing them several kilometres up into the atmosphere. Such volcanoes have steep slopes and are made of cinder and ash. They are known as cinder-cone volcanoes. Many volcanoes of Mexico and Central America belong to this group.
3. **Composite volcano**: Composite volcanoes are made of alternate layers of lava, cinder and ash. They are also called strato volcano. St. Helens is an example of composite volcano.

Volcanoes are also grouped according to their periodicity of eruptions such as active, dormant and extinct. These names refer to the state of activity rather than the types of

volcanoes. *Active* Valcanoes that erupt frequently are called active volcanoes. Most of the active volcanoes lie in the Pacific Ring of Fire belt which lies along the Pacific coast. There are about 600 active volcanoes in the world, such as Mt. Stromboli in Mediterranean Sea, St.Helens in USA, Pinatubo in Philippines. Mauna Loa in Hawaii (3,255m.) is the world's biggest active volcano.

Dormant volcanoes have shown no sign of activity for many years but they may become active at any time. It is also called Sleeping Volcano Vesuvius mountain of Italy, Mt Fujiyama in Japan, Mt. Krakatoa of Indonesia are famous examples of this types. Extinct The top of extinct volcanic mountains have been eroded. Mt Popa of Myanmar and Mt. Kilimanjaro and Mt. Kenya of Africa are examples of extinct volcanoes.

Distribution of Volcanoes in the world

Volcanoes are located in a clearly-defined pattern around the world. They are closely related to regions that have been intensely folded or faulted. There are about 500 active volcanoes and thousands of dormant and extinct ones. They occur along the coastal mountain ranges, as off-shore islands and in the midst of oceans, but there are a few in the interior of continents. The volcanic belts are also the principal earthquake belts of the world. There are three major zones of volcanic activities in the world. They are: 1. The Circum – Pacific belt, 2. The Mid continental belt, 3. The Mid Atlantic belt

- **Circum Belt:** This is the volcanic zone of the convergent oceanic plate boundary. It includes the volcanoes of the eastern and western coastal areas of Pacific Ocean. This zone is popularly termed as the Pacific Ring of Fire which has been estimated to include two-thirds of the world's volcanoes.

- **Mid continental belt**: This is the volcanic zone of convergent continental plate boundaries that includes the volcanoes of *Alpine mountain chains*, the *Mediterranean Sea and the fault zone of eastern Africa*. The important volcanoes are Vesuvius, Stromboli, Etna, Kilimanjaro and Kenya. Surprisingly, the Himalayas have no active volcanoes at all.

- **Mid Atlantic Belt**: This belt represents the divergent boundary of plates located along the mid-Atlantic ridges. Volcanoes of this area are mainly of fissure eruption type. Iceland is the most active volcanic area and is located on the mid-Atlantic ridge. St. *Helena* and *Azores* Island are other examples.

NOTE

- **Earth is called as blue Planet. 71% of the earth is covered by water.**
- The crust forms only 1 per cent of the volume of the earth, 84 % consists of the mantle and 15 % makes the core.
- The radius of the earth is 6371 km.
- Asthenosphere **- The asthenosphere is the part of the mantle that flows and moves the plates of the earth.**

- **<u>An earthquake of 2.0 on Richter scale or less can be felt only a little. An earthquake over 5.0 on Richter scale can cause damage from things falling. A 6.0 on Richter scale or higher magnitude is considered very strong and 7.0 on Richter scale is classified as a major earthquake.</u>**
- There are three types of earthquake waves:
  - P waves or longitudinal waves
  - S waves or transverse waves
  - L waves or surface waves
- On 26th Dec 2004 TSunami in the Indian Ocean swept coastal area of Indonesia, India, Srilanka, Thailand etc., They caused immense damage to life and property in the coastal area. The scientific study of valcanoes are called volcanology. People who study valcanoes are called volcanologists.
- Barren island is situated in the Andaman Sea, and lies about 138 km northeast of the territory's capital. It is only in active volcano along the chain from sumatra to myanmar. Last eruption occurred in 2017.
- Stramboli is known as the 'light house of Mediterranean sea'

2. Landforms

In the earlier class, we have learnt that the surface of the earth is not the same everywhere. The earth has an infinite variety of landforms named mountains, plateaus, plains, valley etc., Some parts of the lithosphere may be rugged and some flat. These landforms are a result of two processes – the endogenic process and the exogenic process. The endogenic process (internal process) leads to the upliftment and sinking of the earth's surface at several places.The exogenic process (external process) is the continuous wearing down and rebuilding of the land surface.
Gradation is the process of levelling of highlands through erosion and filling up of lowlands through deposition.

Landforms

The landscape is being continuously worn away by two processes – weathering and erosion. Weathering is the breaking and falling apart into small pieces of the rocks on the earth's surface. Erosion is the wearing away of the landscape by different agents like water, wind, ice and sea waves. The eroded material is carried away by water, wind, etc. and eventually deposited. This process of erosion and deposition create different landforms on the surface of the earth.

River

- ✓ The water flowing from its source to river mouth, along a definite course is called a River. Rivers generally originate from a mountain or hill.
- ✓ The place of origin of the river is known as its *Source*. The place where it joins a lake or sea or an ocean is known as the *River mouth.*
- ✓ The running water in the river erodes the landscape, which creates a steep-sided valley like the letter 'V' known as *'V' shaped valley*.
- ✓ Falling of river water over a vertical step in the river bed is called *waterfall*. It is formed when the soft rock are removed by erosion. E.g. Coutrallam falls across the river Chittar in TamilNadu.
- ✓ Plunge pool is a hollow feature at the base of a waterfall which is formed by cavitation. Alluvial fan is a deposition of sediment occurs at which the river enters a plain or the foot-hills.
- ✓ As the river enters the plain it twists and turns forming large bends known as *Meanders*. Eg. Meanders along the River Vellar near Sethiyathope in Cuddalore District, Tamil Nadu.
- ✓ Due to continuous erosion and deposition along the sides of the meander, the ends of the meander loop comes closer and closer. In due course of time the meander loop cuts off from the river and forms a cut-off lake, also called an *Ox-bow lake*.
- ✓ At times the river overflows its banks. This leads to the flooding of the neighbouring areas. As the river floods, it deposits layers of fine soil and other material called *sediments* along its banks. This leads to the formation of a flat fertile *floodplain.* The raised banks are called *levees.*

As the river approaches the sea, the speed of the flowing water decreases and the river begins to break up into a number of streams called distributaries. The velocity of the river becomes so slow that it begins to deposit its load. Each distributary forms its own mouth. The collection of sediments from all the mouths form Delta. Deltas are excellent productive lands. They have more minerals which favour cultivation. E.g. Cauvery delta, Ganges delta, Mississippi delta.

- ✓ **Glacier:** A large body of ice moving slowly down a slope or valley due to gravity is called a glacier. Glaciers are grouped into Mountain or Valley Glaciers and Continental Glaciers.
- ✓ **Continental Glacier**: The glacier covering vast areas of a continent with thick ice sheets. E.g. Antarctica, Greenland
- ✓ **Mountain or Valley Glacier** is a stream of ice, flowing along a valley. It usually follows former river courses and are bounded by steep sides. E.g. The Himalayas and the Alps.
- ✓ Glaciers erode the landscape by levelling soil and stones to expose the solid rock below. Cirque is a glacially eroded rock basin, with a steep side wall and steep head wall, surrounding an armchair-shaped depression. E.g. Corrie – Scotland (United Kingdom), Kar – Germany.
- ✓ As the ice melts, they get filled up the cirque with water and become beautiful lakes in the mountains called as Tarn Lake. When two adjacent cirques erode towards each other, the previously rounded landscape is transformed into a narrow rocky, steep – sided ridge called Aretes.
- ✓ U' Shaped Valley is found beneath the glaciers which is deepened and widened by the lateral and vertical erosion. The material carried by the glacier such as rocks - big and small, sand and silt get deposited. These deposits form glacial moraines.

Wind

- ✓ Have you ever visited a desert? Try to collect some pictures of sand dunes. An active agent of erosion and deposition in the deserts is wind. In deserts you can see rocks in the shape of a mushroom, commonly called mushroom rocks.
- ✓ More than the upper part. Therefore, such rocks have narrower base and wider top. An isolated residual hill, standing like a pillar with rounded tops is called Inselbergs. E.g. Inselberg in the Kalahari Desert of South Africa.
- ✓ When the wind blows, it lifts and transports sand from one place to another. When it stops blowing the sand falls and gets deposited in low hill – like structures. These are called *sand dunes*. The crescent shaped sand dunes are called *Barchans.*
- ✓ When the grains of sand are very fine and light, the wind can carry it over very long distances. When such sand is deposited in large areas, it is called *Loess*. Large deposits of loess are found in China.

Coast

- ✓ A part of the land adjoining or near the sea is called the Sea coast. The boundary of a coast, where land meets water is called the Coast line. The coastal areas are subject to change due to wave erosion and wave deposition.

- ✓ The erosion and deposition of the sea waves give rise to coastal landforms. *Sea Cliffs* are steep rock faces formed, when the sea waves dash against them. Sea waves continuously strike at the rocks. Cracks develop. Over time they become larger and wider. Thus, hollow like caves are formed on the rocks. They are called *Sea Caves*.

- ✓ As the cavities of sea caves become bigger and bigger only the roof of the caves remains, thus forming *Sea Arches*. Further, erosion breaks the roof and only walls are left. These walllike features are called *Stacks*.

- ✓ The sea waves deposit sediments of sand and gravel along the shores forming Beaches. Sand bar is an elongated deposition of sand or mud found in the sea, almost parallel to the coast.

3. Population and Settlement

Introduction

Population Geography is a study of demographic phenomena which includes natality, morality, growth rates etc., through both space and time. Increase (or) decrease in population indicates population distribution and growth. The study of movements and mobility of population is called migration. Among the human people from place to place the ancient origin is grouped under major races such us language and religion.

The Races

Race has been defined as a biological grouping within the human species. The race is a group of people with more (or) less permanent distinguishing characteristics that are inherited. The most widely found human racial types are based on visual traits such as head shape, facial features nose shape, eye shape and colour, skin colour, stature, blood groups etc.,The major world Human races are

- ✓ Caucasoid (European)
- ✓ Negroid (African)
- ✓ Mongoloid (Asiatic)
- ✓ Australoid (Australian)

1. **Causasoid:** The Caucasoid is known as European race. This group is the one with fair skin and dark brown eyes, wavy hair and narrow nose. The Caucasoid are also found in Eurasia.
2. **Negroid**: Negroid have the dark eyes, Black skin, black wooly hair, wide nose, long head, and thick lips. They are living in different parts of Africa.
3. **Mongoloids:** The mongoloid race is commonly known as the Asian-American race. The mongoloid have the light yellow to brown skin, straight hair, flat face, broad head and medium nose. Such people are found in Asia and Arctic region
4. **Australoids:** Australoids have wide nose, curly hair dark skin, and short in height. They are living in Australia and Asia.

Races of India

India is said to be one of the cradle lands of human civilization. The ancient Indus valley civilization in India was believed to have been of Dravidian origin in northern India. The Dravidian people were pushed south when the Indo-Aryan came in later. South India was dominated by the three Dravidian kingdoms of the chera, the cholas, and the pandyas. The Dravidian languages are Tamil, Telugu, kannada, Malayalam and Tulu almost all the Dravidians live in the southern part of India.

Religion: Religion means a particular system of faith and worship, which brings human being with human society. Religion, is a symbol of group identity and a cultural rallying point.

Classification of Religion

a. **Universalizing Religions:** Christianity, Islam and Buddhism.
b. **Ethnic Religions:** Judaism, Hiduism and Japanese Shintoism.
c. **Tribal or Traditional Religions:** Animism, Shamanism and Shaman.

Religion	Place of worship
Buddhism	Vihara
Christianity	Church
Hinduism	Temple
Islam	Mosque
Jainism	Basadi
Juadism	Synagogue
Zoroqstrianism	Agiyari

Language: Language is a great force of socialization. Language, either in the written or oral form, is the most common type of communication. Language promotes the transmission of ideas and the functioning of political, economic, social and religious systems.

Languages of India: India has many languages and culture. Each state has its own language though the national language is Hindi, 22 major language were spoken by about 97 percent population of the country. India follows, kashmiri Urdu Punjabi, Hindi Rajasthani, Gujarati, Bengali and Assamese etc., these language are followed in North India. The main language of the Dravidian family are Tamil, Telugu, Kannada, Malayalam etc., These languages are mainly spoken in southern India.

Today usage of language has changed. It is often used as communicational skill. With the different means of communication and fast moving world advancement in technology helps in understanding of different languages very easily with easy access to electronic media along with its pronunciations. These technologies have really brought the world closer.

Date	Event
11th July	World population day
21st February	International mother language day
Third Sunday in January every year	World Religious day
21st May	The World cultural diversity day

Settlement

Settlement is a place where people live and interact through activities such as agriculture, trading and entertainment. A rural settlement is a community, involved predominantly in primary activities such as agriculture, lumbering, fishing and mining. An urban settlement engages in predominantly in secondary and tertiary activities, such

as industries, trade and banking. There is often a correlation between the functions, size of population and population density.

A rural settlement tends to have a small population and low population density. Urban settlement often has a large population size and high population density. Site and situation refers to the location of the actual settlement. The initial choice of a site for a settlement depends on how it is useful for meeting our daily needs, like water supply, availability of farmland, building material and fuel etc.,

Old House Types

In the early periods of human settlement, houses were built using local materials. The form of the house was closely related to the environment. In the agricultural regions, houses were built with mud walls and the roof was made of stalks of paddy (or) other crops of grass (or) thatch. Local wood was used to provide frame for the roof. Such old houses had wide verandahs and an open air circulation. The size of the house depended on the economic status of its inhabitants.

Patterns of Settlements: Settlements also be classified into Compact settlements and Dispersed settlement

Compact settlements

Compact settlement is also known as nucleated settlement. In this type large a number of houses are built very close to each other such settlement develop along the river valleys and fertile plains, In India compact settlements are found in the northern plains and the coastal plains of peninsular India.

Dispersed Settlements

Dispersed settlements are generally found in the areas of extreme climate, hilly tracts, thick forests, grasslands, areas of extensive cultivation. In these settlements, houses are spaced far apart and after interspersed with fields. In India this type of human settlement is found in the northern kosi tract, the Ganga delta ,the Thar Desert of Rajasthan and the foot hills of Himalayas and the Niligris.

A hierarchy of settlements

Rural settlement: Rural settlements are predominantly located near water bodies such as rivers, lakes, and springs where water can be easily available. People choose to settle near fertile lands suitable for agriculture, along with the provision of other basic needs. Hence, they prefer to live near low lying river valleys and coastal plains suited for cultivation. The availability of building materials like wood, stone and clay near settlements is another advantage, for settlements to be built.

Factors Influencing Rural Settlement

- ✓ Nature of topography
- ✓ Local weather Condition
- ✓ Soil and water resources
- ✓ Social organisation
- ✓ Economic condition

Pattern of Rural Settlement

The pattern of settlement has been defined as the relationship between a house or building to another. A rural settlement pattern is a function of relief, climate, water supply and socio-economic factor. It is broadly classified under the following patterns, such as Linear, Rectangular, Circular, Star like pattern etc.,In a Linear settlement, houses are arranged along the either side of a road,railway line, river (or) canal,the edge of a valley,etc., e.g. the Himalayas the Alps, the Rockies.

Linear settlement: The rectangular settlements are almost straight, meeting each other at right angles. Such a settlement is found in plain areas (or) inter montane plain. E.g.,Sutlej. Houses built around a central area are known as Circular pattern of settlements. Such settlement develop around lakes and tanks. The Star like pattern of settlement develops on the sites and places where several roads converge and houses spread out along the sides of roads in all directions.e.g. The Indo – Ganga plains of Punjab and Haryana

Wet Point Settlement: A wet point is a site with reliable supply of water from wells, tank, river, spring (or) pond in an area.

Dry Point Settlement: A dry Point settlement is located in low-lying areas in the regions of excessive dampness. Dry point settlements are not affected by flooding, due to the landscape and the source of water. Such settlements are found in the coastal plains of Kerala and deltas along the east coast of India.

Urban Settlements: The settlements in which most of the people are engaged in secondary and tertiary activities are known as urban settlements. In other words, urban is related to cities and towns. The word urban is often used in terms of town, city, mega city, conurbation, megalopolis.

Classification of Urban Settlements: The definition of urban area varies from ourcountry to another. Some of the common bases of classification are

- ✓ Size of population
- ✓ Occupational structure
- ✓ Administration

- **Town:** Town is a general name for an urban place, usually a settlement meeting a prescribed minimum population threshold. Population more than 5000 people. Based

on the function that cities perform they can be classified into the following types of towns, such as administrative, cantonment, academic etc.,

- **City:** The term City is generally applied to large urban places with no strict definitions to separate if from smaller town. City is a nucleated settlement which multifunctional in character, including an established central business district. In India an urban place with more than one lakh population is considered as a city (Population more than 1,00,000).

- **Mega city:** A mega city is a very large city typically with a population of more than 10 million people. A mega city can be a single metropolitan area. E.g. Canton, Tokyo, Delhi, Mumbai are some of the examples of megacities.

- **Megalopolis:** The word megalopolis is given for a large conurbation, when two or more large cities whose total population exceeds ten million. The region made up of cities between Boston and Washington D.C is a well-known megalopolis. In India, Kolkata is the largest urban area which is a megalopolis. Gandhinagar, Surat, Vadodara, Rajput in Gujarat are the important megalopolis cities in India.

- **Conurbation:** A Conurbation is a region comprising of a number of cities, large town, and other urban areas that through population growth and physical expansion have merged to form one continuous urban (or) industrially developed area. West Midland in England, the Ruhr in Germany, Randstad in the Netherlands are example of conurbations. Mumbai in Maharashtra, Gurgaon, Faridabad in Haryana, Noida in Uttar Pradesh are the conurbation cities of India.

- **Satellite Town:** A satellite town is a town designed to house the over population of a major city, but is located well beyond the limits of that city. Satellite towns are generally located outside the rural urban fringe. In India most satellite towns are purely residential in character. Satellite towns occasionally present a look of twin towns such as Dehri and Dalmianager in Rohtas district of Bihar. They may be connected with roads. For e.g. Patna, Barauni, Varanasi and Hajipur.

- **Smart City:** In an urban region, a city which is very much advanced in terms of infrastructure, real estate, communication and market availability is called a Smart City. The first ten smart cities of India are Bhubaneshwar, Pune, Jaipur, Surat, Ludhiana, Kochi, Ahmedabad, Solapur, New Delhi and Udaipur. Tamil Nadu has 12 major cities to be transformed as smart cities. They are Chennai, Madurai, Tirunelveli, Tiruchirappalli ,Thanjavur, Tiruppur, Salem, Vellore, Coimbatore, Thoothukudi, Dindugul and Erode.

Rural	Urban
Rural areas have predominantly primary activities (agriculture)	Urban areas have domination of secondary and tertiary activities (Industries)
Sparsely populated	Densely populated
Villages and hamlet	Cities and towns

Agriculture works	Non Agricultural works
Simple and relaxed life	Fast and complicated life

NOTE

- Human geography is the study of Man and his surroundings to the natural environment
- **Pilgrim settlement: Pilgrim settlement may come up around a place of worship(or) any spot with a religious significance. E.g. Thiruverkadu in Tamil Nadu**
- **World Health Organization (WHO) suggests that among other things a healthy city must have**
  - ✓ **A Clean" and "Safe" environment**
  - ✓ **Meets the basic needs of "All" its inhabitants**
  - ✓ **Involves the "Community" in local government**
  - ✓ **Provides easily accessible "Health service.**

7TH TERM - 2
Geography

Unit 1 Resources

Introduction

A country's social, economic and political strength lies in the distribution, utilization and conservation of its resources. Anything which can be used for satisfying the human needs is called resource. Natural resources are resources that exist without action of humankind. Natural resources are obtained from environment. Many natural resources are essential for human survival. Resources always cannot be consumed in their original form, but they must be processed into usable commodities and usable things.

Importance of resource

- Natural resources satisfy daily needs of man such as food, clothing and shelter.
- Natural resources also contribute immensely to boost up a nation's economy

On the basis of origin, resources may be divided into two types. They are:

1. Biotic resources
2. Abiotic resources

1. Biotic resources

Biotic resources are found in the biosphere which are obtained from living and organic materials. It includes forests, crops, birds, animals, fishes, man and materials that can be obtained from them. Fossil fuels such as coal and petroleum are also included in this category because they are formed from decayed organic matter

2. Abiotic resources

Abiotic resources are the non-living parts of an environment. Examples of abiotic resources include land, water, air, sunlight and heavy metals including ores such as gold, iron, copper, silver etc.

On the basis of renewability, resources can be divided into two types. They are:

1. Renewable resources
2. Non - renewable resources

1. Renewable resources

A renewable resource is a resource which can be used repeatedly and replaced naturally.Renewable resources harvested and used rationally will not produce pollution. The use of renewable resources and energy sources is increasing worldwide.

Example: solar energy, wind energy, and hydropower.

Solar energy

The sun produces energy in the form of heat and light. Solar energy is not harmful to the environment. Photovoltaic devices or solar cells, directly convert solar energy into electricity. Individual solar cell in group panel can perform small applications from charging calculator, watch batteries, to large such as to power residential dwellings. Photovoltaic power plants and concentrating solar power plants are the largest solar applications covering acres. India, China, Japan, Italy and States of America are major utilizers of solar energy in the world

Kamuthi solar power project is one of the largest solar power projects in the world. It issituated in Ramanathapuram District in Tamilnadu. The Kamuthi solar power project was completed on 21st September 2016. Investment of this project is around 4,550 Crores. The installed capacity of this project is 648 MW.

Major wind farms in India

S. No.	Wind Forms	District	State	Installed Capacity (MW)
1.	Muppandal	Kanyakumari	Tamil Nadu	1,500
2.	Jaisalmer	Jaisalmer	Rajasthan	1,064
3.	Brahmanvel	Dhule	Maharashtra	528
4.	Dhalgaon	Sangli	Maharashtra	278
5.	Damanjodi	Damanjodi	Odisha	99

Hydropower

Water is considered as a great source of energy. At present, water is used for producing hydroelectric power. Hydroelectricity is generated from moving water with high velocity and great falls with the help of turbines and dynamos. Hydroelectricity power is the cheapest and most versatile source of energy out of all the known energy. Hydroelectric power is a renewable resource. China, Canada, Brazil, United States of America, Russia, India, Norway and Japan are some countries producing hydroelectricity. China is the largest producer of hydro-electricity

Wind energy

Wind power is clean energy since wind turbines does not produce any emissions. In recent years, wind energy has become one of the most economical and renewable energy technologies. The Classic Dutch windmill harnessed the wind's energy hundreds of years ago. Modern wind turbines with three blades dot the landscape today, turning wind into electricity. Major wind energy producing countries are United States, China, Germany, Spain, India,United Kingdom, Canada and Brazil.

S. No.	Hydro - electricity project	Installed Capacity (MW)	State
1.	Tehri Dam	2,400	Uttarakhand
2.	Srisailam Dam	1,670	Andhra Pradesh
3.	Nagarjuna Sagar Dam	960	Andhra Pradesh
4.	Sardar Sarovar Dam	1,450	Gujarat
5.	Bhakra Nangal Dam	1,325	Punjab
6.	Koyna Dam	1,960	Maharashtra
7.	Mettur dam	120	Tamil Nadu
8.	Idukki dam	780	Kerala

S.No.	Name of the Project	Country	River	Installed Capacity in MW
1.	Three gorges Dam	China	Yangtze	22,500
2.	Itaipu Dam	Brazil and Paraguay	Parana	14,000
3.	Xiluodu Dam	China	Jinsha	13,860
4.	Guri Dam	Venezuela	Caroni	10,235
5.	Tucurui Dam	Brazil	Tocantins	8,370

Three Gorges Dam in China is the largest hydroelectricity project in the world. It'sconstruction started in 1994 and ended in 2012. The installed capacity of the dam is 22,000MW.

Non-renewable resources

Natural resources that once consumed and cannot be replaced is called non-renewable resources. Continuous consumption of non-renewable resources ultimately leads to exhaustion. Examples of non-renewable resources include fossil fuels such as coal, petroleum, natural gas and mineral resources such as iron, copper, bauxite, gold, silver and others. Non-renewable resources can be divided into three types. They are:

- Metallic resources
- Non - Metallic resources
- Fossil fuel resources

Metallic resources

Metallic resources are the type of resources that are composed of metals. These are hard substances, which are the good conductors of heat and electricity. Example for metallic resources are iron, copper, gold, bauxite, silver, manganese, etc.

Iron

Iron is the fourth most common element in the Earth's crust and the most widely available metal. Magnetite and hematite are the common ore for iron, which occurs normally in the rocks of the crust. Iron ore is the key raw material in making steel and 98% of the iron ore extracted is used to make Steel. Pure iron ore is very soft, but its strength is increased many folds by adding small amount of carbon and manganese. It's low cost and high earth strength makes it usable in engineering applications, such as the construction of machinery and machine tools, automobiles, construction of large ships, structural components of building, bridges etc.

Iron ore is mined in about 50 countries. Among the iron ore producing countries China, Australia, Brazil, India and Russia are the principal producers accounting for 85% of the world's total output of iron ore. These countries have 70% of the total reserves of the world. Jharkhand, Odisha, Madhya Pradesh, Chhattisgarh, Karnataka and Goa account for over 95 per cent of the total reserves of India. Iron ores found at Kanjamalai in Tamil Nadu.

Copper

Copper is one of the first metals known and used by man. Copper ranks as the third most consumed industrial metal in the world after Iron and Aluminium. Copper is good conductor of heat and electricity. About three quarters of copper is used to make electrical wires, telecommunication cables and electronics.

Chile is the world's number one country in the production of copper. Other copper producing countries are Peru, China, United States, Congo and Australia.

Gold

It is a rare and precious metal. Hence, it has high demand in world markets. Formerly, it was used for minting coins, but now it is used for making ornaments and in dentistry. It is regarded as a symbol of prosperity and a form of wealth.

China is the world's largest producer of gold. Also, Australia, Russia, United States, South Africa and Canada are the major producers of gold. Among these countries,

Australia has 9500 tons reserves of gold ore and it is world's leading country in gold ore reserves. Karnataka is the largest producer of gold in India. Kolar Gold Field is one of the deepest mines of the world.

Bauxite

Aluminium is produced from bauxite ore. There are several ores that contain aluminium but bauxite contains more aluminium. Aluminium has wide range of uses compared to other metals. Aluminium is light in weight, tough and cheaper, which makes it popular metal for constructional purpose. It is mainly used in the construction of aircrafts, ship, automobiles, railway coaches and etc. Aluminium is a good conductor of electricity and heat, hence, it is used for making electrical cables. It is highly resistant to corrosion. By the addition of small quantities of other metals to aluminium, it creates superior alloy than pure aluminium.
E.g: Duralumin.

Australia is the world's leading bauxite producer. Apart from that, China, Brazil, India, Guinea, Jamaica and Russia also play an important role in bauxite production. One fourth of the bauxite mineral deposits found in Guinea alone. Odisha, Gujarat, Jharkhand, Maharashtra, Chhattisgarh, Tamil Nadu and Madhya Pradesh are the main bauxite producing states in India. The bauxite deposits are mainly found in the Shervaroy hills of Salem district, Tamil Nadu

Silver

Silver is also a precious metal like gold. It has a wider variety of uses than gold. It is used in making jewellery, dentistry, photographic goods, electroplating industry and in the manufacture of luxury goods. About two-third of silver is used for monetary purposes. Like
gold, silver also resists corrosion.

Mexico is the world's leading silver producer. Following Mexico, Peru, China, Russia, Australia and Chile produce more silver. More than 50% of silver is found only in South American countries.

Manganese

Manganese is a steel-greyed, hard, shiny and brittle metal. The common ores of manganese are Pyrolusite Manganese, Psilomelane and Rhodochrosite. Manganese is essential for the production of good quality Steel. Manganese is used in making electrical batteries. It is also used as colouring material in bricks, pottery, floor tiles. Manganese compounds are used in making disinfecting liquids, bleaching powder, fertilizers etc.

South Africa is the world's leading producer of manganese. The significant producers of manganese in the world are China, Australia, Gabon, Brazil and India. All

these producers have large reserves of manganese and are significant exporters in the world.

Non-metallic resources

Non-metallic resources can be described as the resources that do not comprise of metals. These are not hard substances, and are not good conductors of heat and electricity. Example for non-metallic resources are mica, limestone, gypsum, dolomite, phosphate, etc.

Mica

Muscovite and Biotite are the common ores of Mica. It is one of the indispensable minerals used in electrical and electronics industry. It is used as an insulating material in electrical industry. In powder form, it is used for making lubricating oils and decorative wallpapers.

China is the world's top producer of mica. Russia, Finland, United States, Turkey and Republic of Korea also play a major role in the production of mica. About 95 per cent of India's mica is found in just three states of Andhra Pradesh, Rajasthan and Jharkhand.

Limestone

Limestone is a sedimentary rock, composed mainly by skeletal fragments of marine organisms such as coral, foraminifera and molluscs. About 10% of sedimentary rocks are limestones. Mostly limestone is made into crushed stone and used as a construction material. It is used for facing stone, floor tiles, stair treads, windows sills and many other purposes. Crushed limestone is used in smelting and other metal refining process. Portland cement is made from limestone.

China produces more than half of limestone production in the world. Beside this, United States, India, Russia, Brazil and Japan also produce more Limestone. Madhya Pradesh, Rajasthan, Andhra Pradesh, Gujarat, Chhattisgarh and Tamil Nadu Produce over three-fourths of the total limestone of India. In Tamil Nadu, Large scale limestone reserve found in Ramanathapuram, Tirunelveli, Ariyalur, Salem, Coimbatore and Madurai districts.

Fossil fuel resources

Fossil fuel resources are normally formed from the remains of dead plants and animals. They are often referred to as fossil fuels and are formed from hydrocarbon. When fossil fuels are burned, they become a great source of heat energy. Example for fossil fuel resources are coal, petroleum and natural gas.

Coal

This is the most abundantly found fossil fuel that forms when dead plant matter is converted into peat. It is used as a domestic fuel, in industries such as iron and steel, steam engines to generate electricity. Electricity produced from coal is called Thermal Power.

Coal is classified into four types based on carbon content. They are:

1. Anthracite
2. Bituminous
3. Lignite
4. Peat.

The leading coal producers of the world are China. Beside this, India, USA, Australia, Indonesia and Russia also produce more coal. The coal producing areas of India are Raniganj in West Bengal, Neyveli in Tamil Nadu, Jharia, Dhanbad, and Bokaro in Jharkhand.

Most of the coal deposite that we use now, where formed about 300 million years ago.Much of the earth was covered with steamy swamps. As the plants and trees are dead, their remains were buried underneath the swamps. Eventually, they were transformed into coal beneath the ground due to excessive heat and pressure.

Petroleum

Petroleum is found between the layers of rocks and is drilled from oil fields located in Offshore and coastal areas. This is sent to refineries which process crude oil and produce variety of products like diesel, petrol, kerosene, wax, plastics and lubricants. Petroleum and its derivatives are called Black Gold as they are very valuable.

The chief petroleum producing countries are Saudi Arabia, Iran, Iraq and Qatar. The other major producers are USA, Russia, Venezuela, Kuwait, UAE and Algeria. The leading producers in India are Digboi in Assam, Bombay High in Mumbai and the deltas of Krishna and Godavari rivers.

Natural gas

Natural gas is found with petroleum deposits and is released when crude oil is brought to the surface. It can be used as a domestic and industrial fuel. More than 50% of the global natural gas reserves are found in United States of America, Russia, Iran and Qatar. In India, Krishna and Godavari Delta, Assam, Gujarat and some areas of offshore in Mumbai have natural gas resources.

Unit II - Tourism

Introduction

The word tourist was derived from an old English word "tourian" which refers to a person who travels out of his usual environment for not more than one year and less than 24 hours. The purpose of travel may be religious, recreation, business, historical and cultural.

The Basic components of Tourism

Tourism has become an important source of income for many regions and even for the entire countries of the world. Tourism is an essential part of the life of the society because of its direct impact on social, cultural, educational and economic sector of the nation and on theirinternational relations too.

The three main components of tourism are

- Attraction
- Accessibility
- Amenities.

These three components are together known as A3 concept.

Attractions

Attractions mainly comprise of two types such as:

- Natural attraction
- Cultural attraction

Natural attraction includes landscape, seascape, beaches, climatic condition and forests.

Cultural attractions are historic monuments and other intellectual creations. Apart from this, cultural attractions also includes fairs and festivals.

Accessibility

Accessibility means reachability to a particular place of attraction through various means of transportation such as road, rail, water and air. Transport decides the cost of travel andthe time consumed in reaching or accessing a specific attraction.

Amenities

Amenities are the facilities that cater to the needs of a tourist.

1. Accommodations in terms of hotels, restaurants, cafes and other staying units.
2. Travel organizers, Tour operators and Travel Agents
3. Foreign exchange centres, passport and visa agencies
4. Sectors related to Travel Insurance, Safety and Security

Types of Tourism

From the ancient times, travel is a fascination for mankind. Tourism can be divided on the basis of nature, utility, time and distance as indicated below.

- Religious tourism
- Cultural tourism
- Historical tourism
- Eco-Tourism
- Adventure tourism
- Recreational tourism

Religious Tourism

Religious tourism is one of the oldest types of tourism, wherein people travel individually or in groups for pilgrimage to a religious location such as temples, churches, mosques and other religious places. Religious tour to Kasi (Varanasi) by Hindus, to Jerusalem by Christians and to Mecca by Muslims are few of the examples for religious tourism.

Historical Tourism

It focuses on visiting historically important places like museums, monuments, archaeological areas, forts, temples and so on. Angkorwat of Cambodia, Tajmahal of India and Pyramids of Egypt are some of the examples to quote for Historical Tourism.

Eco-Tourism

Eco tourism typically involves travel to destinations where plants and animals thrive in a naturally preserved environment. Amazon rain forest, African forest safari, trekking in theslopes of Himalayas are the famous incredible Eco friendly attractions

Gastronomy refers to an aspectof **cultural tourism.**

Adventure Tourism

Adventure tourism is a type of tourism involving travel to remote or exotic places in order to take part in physically challenging outdoor activities. For e.g. sky dive in Australia, Bungee jumping in New Zealand, mountaineering in the peaks of Himalayas, rafting in the Brahmaputra River at Arunachala Pradesh

Recreational Tourism

This type of tourism aims at enjoyment, amusement or pleasure are mainly for 'funactivity'. Waterfalls, hill stations, beaches, and amusement parks are the attractive spots forrecreational tourism.

Apart from this, there are certain modern types of tourism, which got developed in recent years.

They are

- Annual Holiday tourism
- Industrial Tourism
- Seasonal Tourism
- International Tourism
- Group Tourism
- Sports Tourism
- Health Tourism
- Farm and Rural Tourism.

Inbound Tourism: Touring within the native country. **Outbound Tourism:** Touring in foreign countries

International Tourism

International tourism is undertaken to visit the places of international importance and to gather knowledge about international culture and customs. For this, there are certain travel forms and formalities to be fulfilled by the tourists, such as passport, Visa, ForeignCurrency, Air ticket, Travel insurance, and other immigration details.

VISA – A document issued to a person (or) a stamp marked on the passport of a personwho wants to visit other country. Tourist VISA - Recreation sight seeing Student VISA – Higher education Employment VISA – Work in a country Medical VISA – Medical treatment in a reputed hospital of a country

Basic Elements of Tourism attractions

Certain elements are fundamental to attract tourists as travel destinations. They are

- Pleasant weather
- Scenic beauty
- Historical and cultural monuments

Geographical Components of Tourism

1. Landforms: Mountains, Plateaus, Canyons, Valleys, Caves, Cirques, Sand dunes, Coral reefs, Cliffs, etc.,
2. Water: Rivers, Lakes, Waterfalls, Hot springs and Geysers, Snow and Glacier, Water Currents, Tides and Waves.
3. Vegetation : Forest, Grasslands, Moors, Deserts etc.,
4.Climate: Sunshine, Clouds, Admirable Temperature, Rain and Snow.
5.Animal life:-
(a) Wildlife : Birds, Game Reserves, Zoos.
(b) Hunting and Fishing

6. Settlement features:-

(a) Towns, Cities, Villages
(b) Historical remains and Monuments

7. Culture:-

Ways of life, traditions, folklore, arts and crafts.

Game Reserves: An area of land set aside for the protection of wild animals.

Tourism Attractions in India

India is a country known for its gentle hospitality with spicy food and culture. Visitor friendly traditions with varied life style, culture, heritage, colourful fairs and festivals are abiding attractions for the tourists. All types of land form, varied climate, rich resources for eco and adventure tourism are the versatile specialty of India. Technological parks and science museums, pilgrimage centers with wonderful art and architecture are an added advantage for tourists. Yoga, Ayurveda and Natural remedial Health resorts attract tourists from all over the world.

Religious Tourism

India being a multi-religious country, religious tourism is the most popular type of tourism. Various package tours are organized for the people to attend the religious rituals and to visit places of religious importance. Most famous religious spots of India are as follows:

Rameswaram - Tamil Nadu
Kanchipuram - Tamil Nadu
Varanasi(Kasi) - Uttarpradesh
Saranath - Uttarpradesh
Vaishnavadevi temple - Jammu & Kashmir
St. Francis Xavier Cathedral - Goa

Amritsar - Punjab
Monasteries of Ladakh - Jammu & Kashmir

Scenic attraction is a very important factor in tourism. Scenery consisting of Mountains, Lakes, Waterfall, Glacier, Forests, and Deserts are the major features attracting people to visit them. India is blessed with nature and gifted with immense beauty from rolling hills to deep valley and snow covered mountains to lush green carpet.

Hill Stations in India

The Indian sub continent has seven principal mountains ranges and the largest of all is the Himalayas that lie in the northern part of India. Most of the Himalayan hill stations in India are located in states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, West Bengal, Arunachal Pradesh, Nagaland and Meghalaya. Maharashtra, Karnataka, Tamil Nadu and Kerala have hill stations in the Western Ghats. Andhra Pradesh, Odisha have hill stations in the Eastern Ghats.

The beautiful hill stations in India

Kodaikanal, Ooty - Tamil Nadu
Nainital, Mussoorie - Uttarakhand
Darjeeling - West Bengal
Gulmarg - Jammu & Kashmir
Shillong - Meghalaya
Shimla, Manali - Himachal pradesh
Munnar - Kerala
Gangtok – Sikkim

ITC – Inclusive Tour Charter IATA – International Air Transport Association IATO – Indian Association of Tour Operators TAAI - Travel Agents Association of India TTTHA - Tamil Nadu Tour Travel and Hospitality Association TTDC – Tamil Nadu Tourism Development Corporation

Water falls in India

In India there are many spectacular and wonderful waterfalls covered by dense forest, huge walls of rock and lush green trees. Among these waterfalls, some are seasonal, while some are perennial. Few of the amazing waterfalls are in swing during the monsoon season. This season brings lot of tourists to these bubbling waterfall sites. Notable waterfalls of India are given below:

S.No	Water falls	Geographical location

1.	Thalaiyar waterfalls	Horse tail type located in Dindugul district of Tamil Nadu
2.	Jog water falls	Segmented waterfall (Raja, Rani and thunder) located in Shimogo district of Karnataka
3.	Nohkalikai waterfalls	Tallest plunge type of waterfall situated in the East khasi hill district of Meghalaya.
4.	Talakona waterfalls	It is the highest waterfall in Andhra Pradesh. A lot of medicinal herbs are seen around the region.
5.	Aathirappally waterfalls	The Niagara of India, is located in Thrissur district of Kerala

Wild life and Bird Sanctuaries

India possesses a wide range of forests and grasslands. Diversity of these lands makes it one of the hotspot for flora and fauna. The dense and dark forest of Indian States provides suitable habitat for a wide and an unique variety of animals and birds. Royal Bengal Tigers, Indian Lions, Elephants, Rhinoceros, Indian leopard and Reptiles are the major tourist attractions. Bird sanctuaries attract attention for their exclusive variety of birds. Diverse range of climate of India invite birds from remote places to feed, breed and to nurture their young ones in the Indian bird sanctuaries.

Wildlife Sanctuaries in India

S.No.	Wildlife sanctuary	State	Animals
1.	Mudumalai wildlife sanctuary	Tamil Nadu	Tiger, Elephant , Bison, Deer
2.	Kaziranga National Park	Assam	Tiger,Deer, Buffalo
3.	Ranthambor National Park	Rajasthan	Tiger
4.	Kanha National Park	Madhya Pradesh	Swamp Deer
5.	Sundarbans National Park	West Bengal	Bengal Tiger
6.	Gir National Park	Gujarat	Lions
7.	Bhadra Wildlife Sanctuary	Karnataka	Bison, Leopard, Gaur
8.	Periyar National Park	Kerala	Elephant, Deer
9.	Corbett National Park	Uttarakhand	Tiger

Bird Sanctuaries in India

S.No	Bird Sanctuary	State
1.	Koonthankulam bird sanctuary	Tamil Nadu
2.	Kumarakom bird sanctuary	Kerala
3.	Bharatpur bird sanctuary	Rajasthan
4.	Mayani bird sanctuary	Maharashtra
5.	Uppalapadu bird sanctuary	Andhra pradesh

6.	Nal Sarovar bird sanctuary	Gujarat
7.	Nawabganj bird sanctuary	Uttar Pradesh

Beaches

India is a country with 7517 km long coastline comprising the most beautiful beaches bounded by Arabian sea and Bay of Bengal. Indian beaches are enriched with diverse coastal land forms filled with aquatic flora and fauna. Lush backwater in the lagoons of Kerala and picturesque beaches of Goa such as calangute, Aguda are the notable tourist destinations for water sports activities. The most charming and enchanting beaches of India are listed below.

S.No.	Beaches	States	Geographical features
1.	Dhanushkodi	Tamil Nadu	Turquoise blue sea water
2.	Varkala Beach	Kerala	Sea Cliffs for wonderful sunset views
3.	Tarkarli Beach	Maharashtra	Coral reefs and marine adventure
4.	OM Beach	Karnataka	Two semi circular caves that join together forming the inverted symbol of OM
5.	Aguda Beach	Goa	A huge hill dominates the southern side of the beach.
6.	Marari Beach	Kerala	Saddle like rock(Hammock) Beach

Tourist Attraction in Tamil Nadu

Tamil Nadu has various tourist attractions like religious centres, spiritual retreat centres, beaches, hill stations, waterfalls, wildlife, art, culture, architecture, crafts, heritage monuments etc. The Government of Tamil Nadu has recognized the importance of tourism long ago and facilitated its development in desired directions. Exploring new avenues like medical tourism and adventure tourism in the past decades have helped Tamil Nadu tourism to achieve more than twenty percent annual growth. Tamil Nadu earns the largest share of income from tourism in India.

Religious Tourism

Tamil Nadu is a state popularly known as land of Temples and has been the greatest source for spiritual rejunuvation for travellers all over the world. The state is home to around 33,000 ancient temples that mainly belongs to Dravidian style of architecture. Some of the world renowned religious destinations are as follows:

- Thanjavur Big temple
- Madurai Meenakshi temple
- Rameswaram Ramanathaswami temple
- Temples of Kancheepuram
- Velankanni Madha church
- Nagore Dargah

Hill Stations in Tamil Nadu

Tamil Nadu being situated in the Southern end of the Western and Eastern Ghats, is the home for several hill stations. Popular among them are Udagamandalam (Ooty), Kodaikanal, Yercaud, Coonoor, Valparai, Yelagiri, Sirumalai, Kalrayan Hills and Palani Hills, Shevroy hills and Cardamom Hills. They are also abodes of thick forest and wild life.

Ooty - Queen of Hills
Yercaud - Lake forest (Poor Man's Ooty)
Yelagiri - 14 hairpin bends
Kodaikanal - Princess of Hill Stations
Kotagiri - Green Hills
Velliangiri Hills - Kailash of the South
Kolli Hills - motor able terrain with 70 hairpin bends
Anaimalai Hills - Top slip
Meghamalai - High wavy mountains
Javadi - Nature's Heaven

Waterfalls in Tamil Nadu

Mountains and rivers of Tamil Nadu combined together created many endearing waterfalls. Waterfalls in Tamil Nadu with its inspiring natural wonders attracts many tourists. A trek amidst thick green trees, steep hills and a bath in the gushing water is most rejuvenating. Here is the list of famous water falls of Tamil Nadu.

S.No.	Waterfalls	Geographical location
1.	Hogenakal falls	It is a beautiful waterfall located in Dharmapuri district.
2.	Kumbakkarai falls	River Pambar cascades to form this fall at the foot hills of Kodaikanal in Theni district.
3.	Monkey falls	This waterfall lies on Anaimalai hills range in Coimbatore surrounded by Evergreen forests.
4.	Killiyur falls	Situated in the shervarayon hill ranges of the Eastern Ghats. Madurai Meenakshi Temple
5.	Courtallam	Courtallam is located in Tirunelveli district. It is known for medical spa
6.	Agaya Gangai	It is a waterfall in Puliacholai on Kolli Hills in Eatern Ghats of Namakkal district.
7.	Suruli Falls	This falls is also called as Cloud Land falls (or) Meghamalai falls. It islocated in Theni district.

Wildlife and Bird Sanctuaries in Tamil Nadu

Wildlife sanctuary in Tamil Nadu includes Bird sanctuaries and National Parks. Tamil Nadu is also well known for the diverse natural heritage that it possesses. Hence tourists are highly excited about the wildlife tour across the state. The total area of Tamil Nadu is approximately 130,058 sq.km. 17.6% of the land area comprises of thick forests. Visitors will get to watch a smooth blend of wet evergreen forest, dry and wet deciduous forests, grasslands, sholas, mangroves and thorny scrubs. Besides varied natural vegetation, another prized possession of Tamil Nadu is wildlife Sanctuaries including Tiger, Elephant, Deer, Monkey, Bison etc., for protecting the entire flora and fauna. Wildlife Sanctuaries of the state are enlisted below:

Wildlife Sanctuaries

S.No.	Name of Wildlife Sanctuary	District
1.	Mudumalai Wildlife Sanctuary	Nilgiris
2.	Mundanthurai Wildlife Sanctuary	Tirunelveli
3.	Point Calimere Wildlife Sanctuary	Nagapattinam
4.	Indira Gandhi Wildlife Sanctuary	Coimbatore
5.	Kalakad Wildlife Sanctuary	Tirunelveli

Bird Sanctuaries in Tamil Nadu

S.No.	Name of Birds Sanctuary	District
1.	Vettangudibirds Sanctuary	Sivagangai
2.	Karaivetti birds Sanctuary	Ariyalur
3.	Vellode birds Sanctuary	Erode
4.	Vedanthangal birds Sanctuary	Kancheepuram

National Parks in Tamil Nadu

S.No	Name of National Parks	District
1.	Guindy National Park	Chennai
2.	Gulf of Mannar Marine Park	Ramanathapuram
3.	Indira Gandhi National Park	Coimbatore
4.	Mukurthi National Park	Nilgiris
5.	Mudumalai National Park	Nilgiris

Beaches in Tamil Nadu

Tamil Nadu being a Coastal state in India which consists of several beaches. Some of themare world famous tourist spots. Beach is a lovely place to hang around with

friends, families and kids. All these are ideal destinations for sun bath relaxation and water sports activities.

S.No.	Beaches	Geographical features
1.	Kovalam Beach Kanchipuram	Small fishing village
2.	Marina Beach Chennai	Second longest urban beach
3.	Kanyakumari Beach	Multi-coloured sand
4.	Rameshwaram Beach	Waveless beach
5.	ElliotBeach Chennai	Beautiful beach active in day & night
6.	Mahabalipuram Beach Kanchipuram	Architectural and Archeological beach
7.	Silver Beach Cuddalore	Water sports is the entertainment
8.	Muttukadu Beach Kanchipuram	Calm and Shallow

Environmental Impact of Tourism

The quality of the environment is essential for tourism. The tourism industry createdseveral positive and negative impacts on the environment.

Positive Impacts

- Direct financial Contributions
- Contributions to government revenues
- Improved environmental management and planning
- Increasing environmental awareness
- Protection and reservation of environment

Negative Impacts

1. Depletion of Natural Resources

- Water resources
- Local resources
- Land degradation

2. Pollution

- Air and Noise Pollution
- Solid Waste and Litering
- Sewage

3. Destruction and Alteration of Eco system

- Air
- Water
- Soil

8TH GEOGRAPHY
1 – Rocks and Soil

Rocks

The rocks are the solid mineral materials forming a part of the surface of the earth and other similar planets. The earth's crust (Lithosphere) is composed of rocks. A rock is an aggregate of one or more minerals. Rock is an important natural resource and is found in solid state. It may be hard or soft in nature. An estimation reveals that there are 2,000 different types of minerals found on the earth surface out of which only 12 are the basic minerals commonly found all over the earth. Minerals are chemical substances which exist in nature. They may occur either in the form of elements or compounds.

Classification of Rocks

According to the mode of formation the rocks are classified into three types as follows.**1. Igneous Rocks, 2. Sedimentary Rocks and 3. Metamorphic Rocks**

Igneous Rocks

The igneous rocks are formed by the solidification of molten magma. These rocks are also called as the 'Primary Rocks' or 'Parent Rocks' as all other rocks are formed from these rocks.Characteristics of Igneous Rocks

1. These rocks are hard in nature
2. These are impermeable
3. They do not contain fossils
4. They are associated with the volcanic activities
5. These rocks are useful for construction works

Types of Igneous Rocks

1. Extrusive Igneous Rocks, 2. Intrusive Igneous Rocks

1. **Extrusive Igneous Rocks:** Can you visualize the lava comes out from a volcano? Lava is actually a fiery red molten magma comes out from the interior of the earth on its surface. After reaching the earth surface the molten materials get solidified and form rocks. Rocks formed in such a way on the crust are called Extrusive igneous rocks. These rocks are fine grained and glassy in nature due to rapid solidification. Basalt found in the north western part of peninsular India is the example for this type of rock.

2. **Intrusive Igneous rocks**: The molten magma sometimes cools down deep inside the earth's crust and becomes solid. The rocks formed this way is called 'Intrusive Igneous Rocks'. Since they cool down slowly, they form large grains. Intrusive Igneous rocks are of two types. The deep seated rocks are called 'Plutonic rocks' and the ones formed at shallow depths are called 'Hypabysal rocks'. Granite, Diorite and

Gabbro are the examples of plutonic rocks and Dolerite is an example of hypabysal rocks. Since the intrusive Igneous rocks consist of large crystals, they are also called as 'Crystalline rocks'.

Sedimentary Rocks

The word 'Sedimentary' has been derived from Latin word 'Sedimentum' means settling down.The sedimentary rocks are formed by the sediments derived and deposited by various agents. Due to high temperature and pressure, the undisturbed sediments of long period cemented to form sedimentary rocks. Sedimentary rocks consist of many layers which were formed by the sediments deposited at different periods. As it consists of many strata, it is also known as 'Stratified rocks'.Characteristics of Sedimentary rocks

1. They have many layers.
2. They are non-crystalline rocks.
3. They contain fossils.
4. They are soft and get eroded easily

Types of Sedimentary Rocks

1. **Organic Sedimentary Rocks:** These rocks are formed as a result of the decomposition of dead plants and animals. It contains fossils. Chalk, Talc, Dolomite and Limestone rocks are of this category.
2. **Mechanical Sedimentary Rocks**: These rocks are formed from the disintegration of igneous and metamorphic rocks. The natural agents erode and transport these rocks and deposit them at some places. After a long period of time, they cemented to form rocks. Sandstone, Shale and Clay are the examples of rocks of this type.
3. **Chemical Sedimentary rocks**: These are formed by precipitating of minerals from water. It is formed usually through evaporation of chemical rich solutions. These rocks are also called as evaporates. Rock Salt is an example of this kind.

Metamorphic Rocks

The word Metamorphic is derived from two Greek words "Meta" and "Morpha", Meta means change and Morpha means shape. When Igneous and sedimentary rocks subject to high temperature and pressure, the original rocks get altered to form a new kind of rock called metamorphic rocks. Metamorphism is of two types. They are 1.Thermal Metamorphism: If the change in the rocks is mainly caused by high temperature, the process is called as thermal metamorphism. 2. Dynamic Metamorphism: If the change in the rock is mainly caused by high pressure, the process is called as Dynamic Metamorphism.

- ✓ **Formation of Metamorphic Rocks from Igneous rocks**
  - Granite into gneiss caused by dynamic metamorphism.
  - Basalt into slate caused by thermal metamorphism.

- ✓ **Formation of Metamorphic Rocks from Sedimentary rocks**
  - Sandstone into quartz caused by thermal metamorphism.

- Shale into slate caused by thermal metamorphism.

✓ **Characteristics of Metamorphic Rocks**

- Metamorphic rocks are mostly crystalline in nature.
- They consist of alternate bands of light and dark minerals.

Rock cycle

Igneous rocks are the primary rocks formed first on the earth. These rocks are weathered, eroded, transported and deposited at some places to form sedimentary rocks. The Igneous and Sedimentary rocks are changed into metamorphic rocks under theinfluence of temperature and pressure. The metamorphic rocks are also get disintegrated and deposited to form sedimentary rocks. Formation of igneous rocks takes place when there is an outflow of molten materials. Like this, the rocks of the earth crust keeps on changing from one form to another form under various natural forces and agents. The endless process is referred as Rock Cycle.

Uses of rocks

Rocks have been used by mankind throughout the history. Rocks are highly valuable and important to almost all aspects of our economy. The minerals and metals in rocks have been found essential to human civilization. Rocks are used for many purposes in our life and some of them are given below. Rocks are useful for making

1. Cement
2. Writing chalk,
3. Fire,
4. Building materials,
5. Bath scrub,
6. Kerb stone,
7. Ornament,
8. Roofing materials,
9. Decorative materials,
10. These are valuable source of minerals such asgold, diamond, sapphire etc.

Soil and its Formation

Soil is a mixture of organic matter, minerals, gases, liquids and organisms that together support life. Soil minerals form the basis of soil. It forms on the surface of the earth. It is known as the 'skin of the earth'. Soils are produced from rocks (parent material) through the processes of weathering and natural erosion. Water, wind, temperature change, gravity, chemical interaction, living organisms and pressure differences all help break down parent material. It leads to the formation of loose material. In course of time, they further break down into fine particles. This process release the minerals locked in the rock fragments. Later on, the vegetative cover which develop in that region forms humus content in the soil. This way the soil gets matured gradually.

- **Soil Composition:** The basic components of soil are mineral, organic matter, water and air. It consists of about 45% mineral, 5% organic matter, 25% of water and 25% air. It is only a generalized fact. The composition of soil varies from place to place and time to time.

- **Soil profile:** The soil profile is defined as the vertical section of the soil from the ground surface and extends downwards.

- **Classification of soils:** Soils are classified on the basis of their formation, colour, physical and chemical properties. Based on these, soil is classified into six major types. They are: Alluvial soil, Black soil, Red soil, Laterite soil, Mountain soil, Desert soil

- **Alluvial soil:** These soils are found in the regions of river valleys, flood plains and coastal regions. These are formed by the deposition of silt by the running water. It is the most productive of all soils. It is suitable for the cultivation of sugarcane, jute, rice, wheat and other food crops.

- **Black soils:** These soils are formed by weathering of igneous rocks. Black soil is clayey in nature. It is retentive of moisture. It is ideal for growing cotton.

- **Red Soils:** These soils are formed by weathering of metamorphic rocks and crystalline rocks. The presence of iron oxide makes this soil brown to red in colour. It is usually found in semi-arid regions. It is not a fertile soil. It is suitable for millet cultivation.

- **Laterites soils:** These are the typical soils of trophical regions. These soils are found in the regions which experienced alternate wet and dry condition. As these soils are formed by the process of leaching, it is in fertile. It is suitable for plantation crops of tea and coffee.

- **Mountain soils:** These soils are found over the slopes of mountain. Soils in these regions are thin and acidic. However characteristic of soil differs from region to region based on the altitude.

- **Desert soils:** These are sandy soil found in the hot desert regions. These soils are porous and saline. Since it is infertile agriculture in these soils are not so successful.

- **Soil Erosion**: Soil erosion is the removal or destruction of the top layer of soil by natural forces and human activities. Soil erosion reduces the fertility of soil which in turn reduces the agricultural productivity. Running water and wind are the major agents of soil erosion. Sheet erosion, Rill erosion and Gully erosion are the major types of soil erosion.

Layers of Soil

O-Horizon or Humus	This layer is dominated by organic material (leaves, needles, twigs, moss and lichens).
A- Horizon or Top Soil	It is a part of top soil, composed of organic matter

	mixed with mineral matter.
E- Horizon or Elevated layer	E-Stands for elevated layer. This layer is significantly leached of clay, iron, and aluminum oxides, which leaves a concentration of ore
B- Horizon or Sub-soil	This layer reflects the chemical or physical alteration of parent material. Thus iron, clay, aluminum and organic compounds are found accumulated in this horizon.
C- Horizon or Parent Rock	Partially weathered parent material accumulates in this layer.
R- Horizon Parent Rock	This layer consists of unweathered part of bed rock.

Soil conservation

Soil conservation is the process of protecting the soil from erosion to maintain its fertility. The methods that are widely practiced for conserving soil are afforestation, controlled grazing, construction of dams, Crop rotation, Strip farming, contour ploughing, terrace farming, checking shifting cultivation, wind break etc.,

Uses of soils

Soil is one of the important natural resource. It is a basic requirement for plant growth and supports various life forms on the earth.

- ✓ The minerals present in the soil enhance and nourishes the crops and plants.
- ✓ It is used in making of ceramics or pottery.
- ✓ It is a source of material for construction and handicraft works.
- ✓ It acts as natural filter of water and purifies it.
- ✓ Soil supports ecosystem and play an important role in land management.

Rocks and soils are the important renewable natural resources. Both of them play an important role in everyday life of human beings as well as economic development. Nowadays rock-based companies are in increase which provide employment to a sizeable population. Soils attract human settlement and other economic activities. As India is an agricultural country, the proper management of soil resource will lead to sustainable food production besides its use for various other purposes. So, the soil resources must be conserved.

NOTE

- ❖ Petrology is a branch of geology which deals with the study of rocks. '**Petrology**' is derived from the Greek word "**Petrus**" refers to rock and "**Logos**" refers to study
- ❖ The word **Igneous** is derived from the Latin word '**Ignis**' means '**fire**'
- ❖ Some major **Active Volcanoes**: Mount Vesuvius, Mt. Stromboli and Mt. Etna in Italy and Mauna Loa and Mauna Kea in Hawaii Islands.

- Oldest sedimentary rocks of the world has been identified in Greenland and estimated as 3.9 billion years old.
- Sedimentary rocks are the important source of natural resources like coal, oil and natural gas.
- One of the world wonders TajMahal in India was built by White Marble in a metamorphic rock.
- Quartzite and Marble are the rocks commonly used for construction and sculpture works. Marbles are widely used for making beautiful statues and decorative items such as vase, tiny gift articles and grinded marble is used to produce plastics, paper etc.,
- World Soil Day is observed on 5th December, every year
- **How long does it take to form soil?**
  The time needed to form a soil depends on the Climate. The environments which is characterized by mild climate, takes 200-400 years to form one cm of soil and in wet tropical area, soil formation is faster and takes upto 200 years. To become a well matured soil, it takes about 3000 years.

2. Weather and Climate

Introduction

Climate is one of the basic elements in the natural environment. It affects landforms, soil types, fauna and flora. It influences man to a large extent. In a small village in Dharmapuri district, Tamil Nadu, in the month of May, Yuktha enjoys her vacation with her brother and family. She always wears cotton cloths. Her mother makes food like porridge, buttermilk, lemonade, watermelon etc which suits to summer. At the same time (In May month) Tiya who lives in Auckland, New Zealand with her father and mother wear fleece jacket, jeans, gloves and socks. Her mother makes hot food like sandwich, salmon, oatmeal, soups etc. Yuktha celebrates Christmas with friends in winter, where asTiya celebrates Christmas during summer. Can you think of why? Yuktha and Tiya stay in two different hemispheres and have different way of life. This is because of the difference in weather condition of those places. Weather and climate influence man's activities like what we eat, wear, the house in which we live and work, farming, sailing, fishing, modern transport and even our play time etc. Hence one should have knowledge about the weather and climate. So, in this chapter we are going to learn about weather and climate, its elements and how they influence our lifestyle.

Weather

Weather is the day today conditions(state) of the atmosphere at any place as regards sunshine, temperature, cloud cover, Wind fog condition, air pressure, humidity, precipitation and such other elements. It refers to short periods like a day, a week, a month or a little longer and as such the weather changes from time to time in a day and one period to the other in a year. In the morning the weather might be sunny with a clear sky in a place and evening there might be clouds and rain. Similarly the weather is cool in winter and hot in summer. We often hear people saying "Today the climate is good or bad". It is incorrect to say like that. Instead it has to be said that the weather is good or bad. We could observe the television news readers saying weather report and not the climate report for e.g. cricket match have been postponed due to bad weather etc.

Climate

Climate is generally defined as the average conditions (state) of the weather of a place or a region. The average atmospheric conditions are determined by measuring the weather elements for a long period of time which is usually for 35 years. The elements of weather and climate are the same. The climate does not change often like weather.

Controlling factors of weather and climate

Angle of the sun's rays, the length of daytime, altitude, distribution of land and water bodies, location and direction of mountain ranges, air pressure, winds and ocean currents are the major factors which affect the weather and climate of a region.

The earth is spherical in shape. So, the sun's rays fall unevenly on the earth's surface. The Polar regions receive slanting sun's rays. Hence there is little or no sunlight, thus there is an extreme cold winters. Vertical sun's ray's fall directly on regions around the equator, hence the climate is very hot and almost no winters. The difference in temperature makes the air and water move in currents. Warm air rises and creates more space for air beneath, while cool air settles down.

Elements of weather and climate: Temperature, rainfall, pressure, humidity and wind are the major elements of weather and climate.

a. Temperature

Temperature is one of the key elements of weather and climate. The earth andits atmosphere get heated from the sun through insolation. The degree of heat present in the air is termed as temperature. Apart from sun's rays, the heat in air also depends the atmospheric mass to a small extent.Temperature varies with time due to changes in the level of radiation which reach the earth surface. This is due to motions of the earth (The rotation and revolution) and inclination of the earth's axis. The temperature influences the level of humidity, the process of evaporation, condensation and precipitation. Heat energy from solar radiation is received by the earth through three mechanisms. They are radiation, conduction and convection. The Earth's atmosphere is heated more by terriestrial radiation than insolation. Distribution of weather elements are shown by means of Isolines on maps. Isolines are those which join the places of equal values. Isolines are given different names based on the weather element they represent.

Isotherm	Equal temperature
Isocryme	Equal lowest mean temperature for a specified period
Isohel	Equal sunshine
Isollobar	Equal pressure tendency showing similar changes over a given time
Isobar	Equal atmospheric pressure
Isohyet	Equal amount of rainfall

b. Factors affecting the distribution of temperature

Latitude, altitude, nature of land, ocean currents, prevaling winds, slope, shelter and distance from the sea, natural vegetation and soil are the major factors which affect the distribution of temperature.

c. Measuring Temperature

The temperature of a unit volume of air at a given time is measured in scales like Celsius, Fahrenheit, and Kelvin. Meteorologist measures the temperature by the Thermometer, Stevenson screen and minimum and maximum Thermometer. The energy received by the earth through insolation is lost by outgoing radiation. Atmosphere is

mainly heated by outgoing radiation from 2 to 4pm .So the maximum temperature is recorded between 2 and 4 pm regularly and minimum temperature is recorded around 4 am before sunrise.

Mean Temperature: The average of maximum and minimum temperatures within 24 hours is called mean daily temperature [(87oF+73oF)/2=80oF]. Diurnal range of temperature is the difference between the maximum and minimum temperatures of a day. Annual range of temperature is the difference between the highest and lowest mean monthly temperatures of a year. The distribution of temperature is shown by means of Isotherms. Isotherms are imaginary lines which connect the same temperatures of different places.

d. Heat zones of the earth

The fact that the earth is spherical in shape results in different parts of the earth getting heated differently.Based on the heat received from the sun, Earth is divided into three heat zones. They are

- ✓ **Torrid Zone:** It is a region between the tropic of cancer and the tropic of Capricorn. This region receives the direct rays of the sun and gets the maximum heat from the sun.This zone known as the torrid or the tropical zone
- ✓ **Temperate zone :** This zone lies between the Tropic of cancer and the Arctic circle in the Northern Hemisphere and between the Tropic of Capricorn and the Antartic circle in the southern Hemisphere.This zone gets the slanting rays of the sun and the angle of the sun's rays goes on decreasing towards ds the poles.Thus this zone experiences moderate temperature.
- ✓ **Frigid Zone**: The frigid zone lies between the Arctic circle and the North Pole and between the Antartic circle and the South Pole.This region also known as Polar region.Since it receives the extremely low temperature throughout the year,these regions are covered with snow.

Highest Temperature ever recorded: The highest temperature ever recorded on the earth is 56.7°C (134°F). It was recorded on 10th July 1913 at Greenland Ranch of Death Valley, California, USA.

Lowest Temperature ever recorded: The lowest temperature ever recorded on the earth is −89.2 °C (−128.6 °F; 184.0 K). It was recorded on 21st July, 1983 at Soviet Vostok Station in Antarctica.

Rainfall

Rain is a liquid water in the form of droplets that have condensed from atmospheric water vapour and then become heavy enough to fall under gravity. Rain is a major component of the water cycle and is responsible for depositing most of the fresh water on the Earth. It is the source of water for all purposes. There is a close relationship between

the temperature and rainfall distribution. Generally rainfall is high in the equatorial region and decreases gradually towards poles. Rainfall is measured by Raingauge.

Air Pressure

The weight of air above a given area on the earth's surface is called atmospheric pressure or air pressure. The air pressure is measured by Barometer. The standard air pressure at sea level is 1013.25mb. At the earth's surface the pressure is 1.03kg.per sq cm. The variation in standard atmospheric pressure is found both horizontally and vertically. Based on the level of pressure, it is categorised into low pressure and high pressure. Low pressure area is an area in the atmosphere where the pressure is lower than its surrounding areas. In this situation, the wind from the surroundings blow towards the centre of low pressure. High pressure is an area of atmosphere where the barometric pressure is higher than its surrounding areas.

In this case, the wind from the centre of high pressure blows towards the surrounding low pressure areas. Low pressure system is marked as "L" on weather map, whereas the high pressure system is marked as "H". Low pressure systems are also called as a depression and cyclones. High pressure system is called anti-cyclones. Low pressure leads to cloudiness, wind, and precipitation. High pressure leads to fair and calm weather. Isobar is used to show the distribution of air pressure.Humans are not sensitive to small variation in air pressure. But the small variations in pressure that do exist largely determine the wind and storm patterns of the earth. The distribution of atmospheric pressure is controlled by altitude, atmospheric temperature, air circulation, earth rotation, water vapour, atmospheric storms etc.

Measuring air pressure

Meteorologist uses barometer/aneroid barometer to measure the air pressure. Barograms are used for recording continuous variation in atmospheric pressure.

Humidity: Humidity refers to the degree of water vapour present in the atmosphere in gaseous form in particular time and place. It ranges from 0-5 percent by volume in atmosphere. Climatically it is an important constituent of the atmosphere and its quantity depends on the level of temperature. So, the level of humidity decreases towards poles from equator. Humidity is expressed in different ways.

- ✓ **Specific humidity**is a ratio of the water vapor content of the mixture to the total air content on a mass basis. It is expressed in grams of vapour per kilogram of air
- ✓ **Absolute Humidity**is the mass or weight of water vapour present per unit volume of air. It is expressed usually in grams per cubic meter of air.
- ✓ **Relative humidity** is a ratio between the actual amount of water vapour present in the air and the maximum amount of water vapour it can hold at a given temperature. It is expressed as a percentage.

Generally, warm air holds more water vapour than the cold air. When relative humidity reaches 100%, the air gets saturated. In this condition the temperature is said to be at dew-point. Further cooling will condense the water vapour into the clouds and rain. Relative humidity affects human health and comfortness. Very high and very low humidity are injurious to health. It also affects the stability of different objects, buildings and electrical applications.

Measurement of Humidity: Hygrometer is used to measure the humidity. (which comprises wet and dry bulb-plate side by side in the Stevenson screen)

Wind

The horizontal movement of air is called wind. Vertical movement of air is said as air current. The winds move from high pressure to low pressure. Unlike other elements a wind is made up of a series of gusts and eddies which can only be felt and not seen. Winds get their name from the direction from which they blow i.e, wind blows from south west is called southwest wind. The wind systems are broadly categorized into three as follows.

- ✓ Planetary winds
- ✓ Seasonal winds
- ✓ Local winds

Planetary Winds are the ones which blow almost in the same direction throughout the year. So, they are called as Permanent or planetary winds. Trade winds, Westerlies and polar easterlies are the types of prevailing winds. Seasonal winds are those which change their direction according to season in a year. They are called as monsoon winds. These winds blow from sea to land during summer and land to sea during winter. Local winds are the winds blow over a small area only during a particular time of a day or a short period of a year. Land and sea breezes are example of these winds.

The Beaufort scale is a scale for measuring wind speed. It is based on observation rather than accurate measurement. It is the most widely used system to measure wind speed today. The scale was developed in 1805 by Francis Beaufort, an officer of the Royal Navy and first officially used by HMS Beagle.

Measuring wind direction and speed

Meteorologist measures wind direction using wind vane or weather cock. Wind speed is measured by anemometer. Wind rose is a diagram used to depict the direction and periods (No. of days) of prevailing winds on map. Meteorograph or triple register is an instrument which records wind speed and direction, sunshine and precipitation. It also provides graphic representation.

NOTE

- Earth's atmosphere is a layer of gases surrounding the planet earth and retained by the earth's gravity. It contains about 78% nitrogen, 21% oxygen, 0.97% argon, 0.03% carbon dioxide and 0.04% trace amounts of other gases and water vapour

- The word Climate is derived from the ancient Greek word "Klimo" which means "Inclination".

- Scientific study of weather is called Meteorology and the scientific study of climate is called climatology.

- Temperature varies both horizontally and vertically. Temperature decreases with increasing height is known as Lapse rate which is 6.5 degree celsius per 1000 meters in troposphere .

- **Highest pressure ever recorded:** The highest ever air pressure at sea level was recorded at Agata, Russia on 31st December, 1968. The pressure was1083.8mb

- **Lowest pressure ever recorded:** The lowest pressure of 870mb was recorded at Typhoon Tip, near Guam, Mariana Island in Pacific Ocean on 12th October, 1979.

- As you go up in an airplane, the atmospheric pressure becomes lower than the pressure of the air inside your ears. Your ears pop because they are trying to equalize or match the pressure. The same thing happens when the plane is on the way down and your ears have to adjust to a higher atmospheric pressure.

- With decreasing air pressure,the availability of oxygen to breath also decreases. At very high altitudes, atmospheric pressure and available oxygen get so low that people can become sick and even die. Mountain climbers use bottled oxygen when they ascend very high peaks. They also take time to get used to the altitude as the quick move from high pressure to low pressure can cause decompression sickness. Aircraft create artificial pressure in the cabin which makes the passengers remain comfortable while flying.

- Al-Balakhi, an Arab Geographer collected climatic data from the Arab travellers and prepared the First climatic Atlas of the world

- Brazil has a large area where the average wind speed is low. Gabon, Congo and DR Congo in Africa, Sumatra, Indonesia and Malaysia are the least windy places on earth.

3. Hydrologic Cycle

Introduction

Water is one of the most important elements on earth. All plants and animals need water for survival. Apart from drinking, water is required for domestic, agriculture, industrial purposes etc. Water is very essential for carrying out almost all economic activities. So, water is an indispensible element without which life form on the earth is not possible.

Water on the Earth

About 71% of the earth's surface is covered by water. The quantity of water present on the earth is about 326 million cubic miles. It is hard to visualise this massive quantity of water. Most of the water on the earth is saline and is found in seas and oceans. The salt water constitutes about 97.2% and the fresh water is only about 2.8%. Out of this 2.8%, about 2.2% is available as surface water and the remaining 0.6% as groundwater. From this 2.2% of surface water, 2.15% is available in the form of glaciers and icecaps, 0.01% in lakes and streams and the remaining 0.04% is in other forms. Only about 0.25% of the total ground water of 0.6% can be economically extracted with the present drilling technology. Water resources are useful or potentially useful to humans. Water in India is available in three sources. They are precipitation, surface water and groundwater.

Water Source	Volume of water (Cubic Miles)	Percentage to Total water
Oceans, Seas, & Bays	321,000,000	96.54
Ice caps, Glaciers, & Permanent Snow	5,773,000	1.74
Ground Water	5,614,000	1.69
Soil Moisture	3,959	0.001
Ground Ice & Permafrost	71,970	0.022
Lakes	42,320	0.013
Atmosphere	3,095	0.001
Swamp Water	2,752	0.0008
Rivers	509	0.0002
Biological Water	269	0.0001

Hydrologic Cycle or Water Cycle

Hydrology is the science which deals with the various aspects of water such as its occurrence, distribution, movement and properties on the planet earth. Availability of water on the earth is not uniform. Some places are very rich in water resources while some other places are poor in water resources. Hydrologic cycle is a global sun-driven process where water is transported from oceans to atmosphere, from atmosphere to land and from land back to oceans. The water cycle can be considered as a closed system for the earth, as the quantity of water involved in the cycle is invariable, though its distribution varies over space and time.

Evaporation takes place from the surface water and transpiration from the plants. Water vapour gets condensed at higher altitudes by condensation nuclei and form clouds (resulting in droplet growth). The clouds melt and sometimes burst resulting in precipitation of different forms. A part of water from precipitation flows over the land is called runoff and the other part infiltrates into the soil which builds up the groundwater. Hydrologic cycle is a circulation of water. It is a continuous process and takes place naturally. The three important phases of the hydrologic cycle are: 1. Evapotranspiration, 2. Precipitation and 3. Runoff.

Components of Hydrologic Cycle

There are six main components in hydrologic cycle. They are: 1) Evapotranspiration, 2) Condensation, 3) Precipitation, 4) Infiltration, 5) Percolation, and 6) Runoff.

Evapotranspiration

It is defined as the total loss of water from the earth through evaporation from the surface water bodies and the transpiration from vegetation. In cropped area, it is difficult to determine the evaporation and transpiration separately. Therefore it is collectively called as evapotranspiration.

Evaporation

Evaporation refers to the process in which the liquid form of water changes into gaseous form. Water boils at 100°C (212°F) temperature but, it actually begins to evaporate at 0°C (32°F); and the process takes place very slowly. Temperature is the prime element which affects the rate of evaporation. There is a positive relationship between these two variables. Areal extent of surface water, wind and the atmospheric humidity are the other variables which affect the rate of evaporation. Many studies reveal that the oceans, seas, lakes and rivers provide nearly 90 % of the moisture in the atmosphere through evaporation and the remaining 10 % is contributed by plants through transpiration.

On a global scale, the amount of water gets evaporated is about the same as the amount of water delivered to earth as precipitation. This process varies geographically, as the evaporation is more prevalent over the oceans than precipitation, while over the land, precipitation routinely exceeds evaporation. The rate of evaporation is low during the periods of calm winds than during windy times. When the air is calm, evaporated water tends to stay close to the water body. During windy, the water vapour is driven away and is replaced by dry air which facilitates additional evaporation.

Transpiration: Transpiration refers to the process by which the water content in the plants are released into the atmosphere in the form of water vapour. Much of the water taken up by plants is released through transpiration. The rate of transpiration is also affected by the temperature, wind and humidity. The soil water content and the ability of the soil to conduct water to the roots, the nature of the plant parts including barks and leaves also determine the transpiration rate. In case of

agriculture, the crop characteristics, its environment and cultivation practices also affect the transpiration process.

Condensation: It refers to the process in which the gaseous form of water changes into liquid form. Condensation generally occurs in the atmosphere when warm air rises, cools and loses its capacity to hold water vapour. As a result, excess water vapour condenses to form cloud droplets. Condensation is responsible for the formation of clouds. These clouds produce precipitation which is the primary route for water to return to the earth's surface in the water cycle. Condensation is the opposite of evaporation.

Forms of Condensation

Dew, Fog and Clouds are the three major forms of condensation

a. **Dew:** It is a water droplet formed by the condensation of water vapour on a relatively cold surface of an object. It forms when the temperature of an object drops below the dew point temperature.

Frost: The ice crystals formed by deposition of water vapour on a relatively cold surface of an object is known as frost. It forms when the temperature of an object drops below the freezing point of temperature.

b. **Fog:** Fog is the suspended tiny water droplets or ice crystals in an air layer next to the earth's surface that reduces the visibility to 1,000 m or lower. For aviation purposes, the criterion for fog is 10 km or less.

Mist: Mist is the tiny droplets of water hanging in the air. These droplets form when the water vapour in the air is rapidly cooled, causing it to change from invisible gas to tiny visible water droplets. Mist is less dense than fog.

c. **Clouds:** Clouds consist of tiny water droplets/ice particles which are so small and light in weight. Clouds are formed by microscopic drops of water or by small ice crystals. The size of the droplets generally ranges from a couple of microns to 100 microns. This is the limit beyond which cloud drops become rain drops.

Precipitation

Precipitation refers to all forms of water that fall from clouds and reaches the earth's surface. For the occurrence of precipitation, cloud droplets or ice crystals must grow heavy enough to fall through the air. When the droplets grow large in size, they tend to fall. While moving down, by collecting some small droplets, they become heavy enough to fall out of the cloud as raindrops.

Forms of Precipitation

The form of precipitation in a region depends on the kind of weather or the climate of the region. The precipitation in the warmer parts of the world is always in the form of rain or drizzle. In colder regions, precipitation may fall as snow or ice. Common types of precipitation include rain, sleet, freezing rain, hail and snow.

- **Rain:** The most common kind of precipitation is rain. The precipitation in the form of water droplets is called rain. The precipitation in which the size of rain drops are <0.5 mm in diameter is known as drizzle and the rain drops with >0.5 mm in diameter is known as rain. Generally drizzle takes place from stratus clouds.

- **Sleet:** The precipitation which takes place in the form of mixture of water droplets and tiny particles of ice(5mm in diameter) is known as sleet. Sometimes raindrops fall through a layer of air below 0°C, the freezing point of water. As they fall, the raindrops freeze into solid particles of ice. So, the mixture of water droplets and ice particles would fall on the earth surface.

- **Freezing Rain:** At other times raindrops falling through cold air near the ground do not freeze in the air. Instead, the raindrops freeze when they touch a cold surface. This is called freezing rain and the drops of water are usually greater than 0.5 mm in diameter.

- **Hail**: The precipitation which consists of round pellets of ice which are larger than 5 mm in diameter is called hail or hailstones. Hail forms only in cumulonimbus clouds during thunderstorms. A hailstone starts as an ice pellet inside a cold region of a cloud. Strong updrafts in the cloud carry the hailstone up and down through the cold region many times.

- **Snow:** Often water vapour in a cloud is converted directly into snow pieces due to lowering of temperature. It appears like a powdery mass of ice. The precipitation in the form of powdery mass of ice is known as snowfall. It is common in the polar and high mountainous regions.

Infiltration

Water entering the soil at the surface of the ground is termed as infiltration. Infiltration allows the soil temporarily to store water, making it available for plants use and organisms in the soil. Infiltration is an important process where rain water soaks into the ground, through the soil and underlying rock layers. Some of this water ultimately returns to the surface through springs or low spots down hills. Some of the water remains underground and is called groundwater. The rate of infiltration is influenced by the physical characteristics of the soil, vegetative cover, moisture content of the soil, soil temperature and rainfall intensity. The terms infiltration and percolation are often used interchangeably.

Percolation

Percolation is the downward movement of infiltrated water through soil and rock layers. Infiltration occurs near the surface of the soil and delivers water from the surface into the soil and plant root zones. Percolation moves the infiltrated water through the soil profile and rock layers which leads to the formation of ground water or become a part of sub-surface run-off process. Thus, the percolation process represents the flow of water from unsaturated zone to the saturated zone.

Runoff

Runoff is the water that is pulled by gravity across land's surface. It replenishes groundwater and surface water as it percolates into an aquifer (it is an underground layer of water-bearing rock) or moves into a river, stream or watershed. It comes from unabsorbed water from rain, snowmelt, irrigation or other sources, comprising a significant element in the water cycle as well as the water supply when it drains into a watershed. Runoff is also a major contributor to the erosion which carves out canyons, gorges and related landforms. The amount of runoff that can happen depends on the amount of rainfall, porosity of soil, vegetation and slope. Only about 35% of precipitation ends up in the sea or ocean and the other 65% is absorbed into the soil.

Types of Runoff

Based on the time interval between the instance of rainfall and generation of runoff, the runoff may be classified into following three types

a. **Surface Runoff:** It is the portion of rainfall, which enters the stream immediately after the rainfall. It occurs, when the rainfall is longer, heavier and exceeds the rate of infiltration. In this condition the excess water makes a head over the ground surface, which tends to move from one place to another following land gradient and is known as overland flow. When the overland flow joins the streams, channels or oceans, it is termed as surface runoff or surface flow.
b. **Sub-Surface Runoff:** The water that has entered the subsoil and moves laterally without joining the water-table to the streams, rivers or oceans is known as sub-surface runoff. The sub-surface runoff is usually referred as interflow.
c. **Base Flow:** It is a flow of underground water from a saturated ground water zone to a water channel. It usually appears at a downstream location where the channel elevation is lower than the groundwater table. Groundwater provides the stream flow during dry periods of small or no precipitation.

Geography
Unit 5
Migration and Urbanisation

Introduction

Rajesh and Suresh were new students joined in a school. They were allotted to Section - 'A' in VIII standard. The class teacher and other students of the class welcomed them. Teacher said, "You are going to have two new friends today. So, you all introduce yourselves to others; say your name and place from where you are coming, okay". They started from the first bench. Rajesh and Suresh were sitting in the second bench. Rajesh had a turn to introduce himself. He said, "I am Rajesh, as my mother has been transferred to this school, we migrated from Chennai to Krishnagiri". Now Suresh had a turn to introduce himself. He said, "I am Suresh, coming from the Village called Pudupatti, it is five kilometres away from the school; Madam, Please tell me the meaning of 'migration the word used by Rajesh". The teacher said, "yes, from this lesson you are going to learn in detail about it".

Migration

Migration has been defined differently by different experts. In general, migration is defined as the permanent or semi permanent change of residence of an individual or group of people over a significant distance. So, the term
migration refers to the movement of people from one place to another.

United Nations Organization Definition: Migration is a form of geographical mobility of population between a geographical unit to another, generally involving a permanent change of residence.

One of the most important aspects of social science is "Human Migration". It has maintained a close relation with mankind from its earliest stage. Migration is one of the most important dynamic human activities from the very beginning of human life. During the early days, people moved from one place to another in search of food. When most of the people ceased to live in forest and adopted civilized life, they developed relationship with domesticated animals and fertile land. As a result, mobility of mankind changed considerably. They almost left the nomadic life and started to live in permanent settlements. At this stage, people continued to move from one region to another in search of fertile land for cultivation. Afterwards, the nature of mobility frequently changed over a period of time.

Factors of Migration

There are a number of factors which are responsible for the migration of humanpopulation. These factors can be grouped under the heads of favourable and unfavourable factors. The favourable factors which attract people towards a location are

called pull factors. The unfavourable factors which make the people to move out from a location are called push factors.
The various causes which are responsible for human migration is categorized under five groups as follows.

a) Ecological or Natural Causes of Migration

The causes operate under this category are natural ones. They include volcanic eruption, earthquake, flood, drought etc. These events force the people to leave their native places and settle in the new areas. The conditions like theavailability of water resources, areas free from hazards, pollution etc., attract the migrants.

b) Economic causes of Migration

Economy is one of the most important causes of human migration from one area to another. Various economic causes determine the level and direction of migration. The availability of fertile agricultural land, employment opportunities, development of technology etc., are some of the economic causes that attract the migration. The mass poverty and unemployment force the people to move outfrom their native places to the places where the better employment opportunities are available.

Pull Factors	Push Factors
Natural Causes	
Least hazard prone zones	Hazard prone zones
Favourable climate	Climate change (including extreme weather events)
Abundance of natural resources and minerals (e.g.water,oil,uranium)	Crop failure and scarcity of food
Economic Cause	
Potential for employment	Unemployment
Socio-cultural Cause	
Unification	Family conflicts
Demographic Cause	
Under population	Over population
Political Causes	
Political security	War, civil, unrest
Independence and freedom	Safety and security concerns (ethnic, religious, racial or cultural persecution
Affordable and accessible urban services (including healthcare, education, utilities	Inadequate or limited urban services and infrastructure (including healthcare,

and transport)	education, utilities, transport and water)

Share of Regions in World Population and International Migrants by Origin – 2017

S.No	Name of the Region	Total Population	Percentage of Global Population	International Migrants by origin	Percentage of International Migrants
1	Africa	1,256,268	16.6	36,266	14.1
2	Asia	4,504,428	59.7	105,684	41.0
3	Europe	742,074	9.8	61,191	23.7
4	Latin America and the Caribbean	645,593	8.6	37,720	14.6
5	Northern America	361,208	4.8	4,413	1.7
6	Oceania	40,691	0.5	1,880	0.7
7	Unknown	n/a	n/a	10,560	4.1
8	**World**	**7,550,262**	**100.0**	**257,715**	**100.0**

c) Socio-cultural causes of Migration

Socio-cultural causes also play some roles in the process of migration. Migration of women after marriage and migration associated with pilgrimage are based on the socio-cultural customs

d) Demographic causes of Migration

In demographic sense, the population composition like age and sex, over population and under population are the major causes of migration. It is well known fact that adults are more migratory than any other age-groups.Women mostly migrate after their marriage. Generally over population is considered as a push factor and under population to be pull factor in the context of migration

Female migrants outnumber male migrants in Europe, Northern America, Oceania and Latin America and the Caribbean, while in Africa and Asia, particularly Western Asia, migrants are predominantly men. (International Migration Report, 2017).

e) Political causes of Migration

Various political causes like colonization, wars, government policies etc. have always been playing important role in human migration from time to time. Wars have been one of the significant causes of migration since ancient time.

Types of Migration
Migration can be classified in several ways.It is usually categorized as follows

In 2017, India was the largest country of origin of international migrants (17 million), followed by Mexico (13 million) (International Migration Report, 2017).

a) Based on the movement associated with administrative limits

(i) Internal migration: The movement of people within a country is known as internal migration. Further, the internal migration is classified into four categories on the basis of the place of origin and destination of migrants. Ruralto Urban Migration is the movement of population from rural areas to growing towns and cities mainly in search of employment,education and recreation facilities. Urban toUrban Migration is the migration between one urban centre to the other like in search of higher salaries. Rural to Rural Migration is driven by fertile land for cultivation and other sociological factors like Marriage etc. Urban toRural Migration is the movement from urban
centres to rural areas to get rid-off the urban problems and returning to native places after retirement from jobs. Rural to urban migration is the most common one.

(ii) International migration– Migration that occurs across the national boundaries are known as international migration.

b) Based on the willingness of the migrants for migration

(i) Voluntary migration: If the migration takes place on person's free will, initiative and desire to live in a better place and to improve their financial status, the migration is said to be voluntary.

(ii) Involuntary or forced migration: If the migration takes place against the will of migrants, the migration is termed as involuntary migration. The push factors like war may force the people to emigrate from a place is of this type.

c) Based on the duration of stay of migrants in the place of destination

(i) Short term migration: In this kind of migration, the migrants stay outside only for a short duration before returning to the place of origin. The duration may be from a few days to few months.

(**ii) Long term migration**: It is a kind of migration in which the migrants stay outside at least for a few years.

(iii) Seasonal migration: In this type of migration usually a group of people migrates from their native places during a particular season and returns after end of that season. People migrating to hill stations during summer and the migration of agricultural workers during

sowing seasons belong to this category. Transhumance is an another example of seasonal migration.

The number of international migrants worldwide has continued to grow rapidly in recent years, reaching 258 million in 2017, up from 220 million in 2010 and 173 million in 2000 (International Migration Report, 2017).

Consequences of Migration

Migration affects both the areas of origin of migration and the areas of destination. The following are the major consequences of migration.

a) Demographic consequences: It changes age and sex composition of population. Migration of females after their marriage leads to decline in sex ratio in the source regions and increase the sex ratio in the regions of destinations. The migration of male workers in search of jobs decreases the independent population of the source regions which increases the dependency ratio.

b) Social consequences: The migration of people from different regions towards an urban area leads to the formation of plural society
It helps the people to come out of narrow mindedness and people become generous.

c) Economic consequences: The migration of more people from over populated to under populated regions results the imbalance of the resource-population ratio. In some cases, the regions of over and under population may become the regions of optimum population. Migration may influence the occupational structure of the population of an area. Through this it will certainly affect the economy of the regions also. **Brain drain** is a consequence of migration. Brain drain refers to the migration in which skilled people from economically backward countries move to developed countries in search of better opportunities. Eventually, this leads to backwardness in source regions. This is called as **"backwash effect".**

d) Environmental consequences: Large scale movement of people from rural to urban areas causes overcrowding in cities and puts heavy pressure on resources. It leads to rapid growth of cities. The over population in urban areas leads to the pollution of air, water and soil. Scarcity of drinking water, lack of space for housing, traffic congestions and poor drainage are the common environmental problems prevail in urban areas. The lack of space for housing and the rising of land cost lead to the formation of slums.

Urbanisation

Urbanisation refers to the process in which there is an increase in the proportion of population living in towns and cities.

Causes of Urbanisation

Urbanisation is driven by three factors: natural population growth, rural to urban migration and the reclassification of rural areas into urban areas. Present day urbanisation includes changes in demographics, land cover, economic processes and characteristics of geographic area.

In 2007, for the first time in history, the global urban population exceeded the global rural population and the world population has remained predominantly urban thereafter. (World Urbanisation Prospects, 2014 Revision, Highlights).

Origin and Growth of World Urbanisation

The process of urbanisation in the world has a long history.

Ancient Period: The urban centres started developing during the pre-historic period (before 10000 years). During this period primitive man started domestication of plants and animals. It was the period of development of permanent settlements. The river valley regions of the Egypt, Greece and India gave rise to agrarian communities which eventually formed the urban communities and urban centres. The excess production of food grains was the major reason for urbanisation. **Ur and Babylonin Mesopotamia, Thebes and Alexandriain Egypt, Athens in Greece, Harappa andMohenjodaro in India were noted prehistoriccities of the world.**

In ancient period the increase in the number and size of urban centres occurred during the two great colonizing periods of the Greeks and Romans. During the beginning of the 7th century itself many cities were found near the Aegean Sea. During the Greek colonizing period, the expansion of trade promoted the growth of towns and cities

India, China and Nigeria – together are expected to account for 35 % of the growth in the world's urban population between 2018 and 2050. India is projected to add 416 million urban dwellers, China 255 million and Nigeria 189 million(World Urbanisation Prospects, 2018, Key facts)

Medieval Period: It refers to the period after the 11th century. During this period, the European countries, increased their overseas trade which played an important role in the revival of European towns and cities after a period of low development. **At the end of the thirteenth century, Paris, London, Geneva, Milan and Venice were the important cities found in Europe.**

Modern Period: This period starts from 17th century. It marks the third phase of development in urbanisation. The industrial revolution in the19th century accelerated the growth of towns and cities. The Europeans with urban civilization gave birth to a large number of new towns in North America and Soviet Union. The modern means of transport and communication, the development of new trade routes during 19th century had strengthened the trade centres and urban areas. The latest development in

urbanisation was noticed in the continent of Africa. Before 1930, Africa had towns only on its coasts but now it has 50 towns with population exceeding 1,00,000. Major cities in Africa are Cairo, Nairobi, Mombasa, Bulawayo, Duala, Abidian, Logos, Accra, Addis Abba, Leopoldville, Luanda, Cape Town, Natal, Pretoria etc. Thus, in modern age, the accelerating urbanisation is resulting in a redistribution of population throughout the world.

In 1950, 30% of the world's population was urban, and by 2050, 68 % of the world's population is projected to be urban (World Urbanisation Prospects, 2018, Key facts).

World Urbanisation

S.No	**Name of the Region**	**Urban Population in %**
1	North America	82
2	Latin America and Caribbean	81
3	Europe	74
4	Oceania	68
5	Oceania	50
6	Africa	43
World Average		55

World Top Five Cities

S.No	**Name of the city**	**Population in Million**
1	Tokyo **(**Japan)	37
2	Delhi (India)	29
3	Shanghai (China)	26
4	Mexico city (Mexico)	22
5	Sao Paulo	22

	(Brazil)	

Consequences of Urbanisation

a) Housing and Slums: There is a lack of space for housing and a marked reduction in the quality of housing in the urban areas due to increase in population. This problem may increase in the years to come. Rapid rate of urbanisation results the development of slums.

b) Over Crowding: Over-crowding leads to unhealthy environment in the urban areas. It also the cause of many diseases and riots.

c) Water supply, Drainage and Sanitation: No city has round the clock water supply inthe world. Drainage situation is equally bad. The removal of garbage is a Himalayan task for urban local bodies.

d) Transportation and Traffic: Absence of planned and adequate arrangements for traffic and transport is another problem in urban centres. The increasing number of two wheelers and cars make the traffic problem worse. They cause air pollution as well.

e) Pollution: Towns and cities are the major polluters of environment. Several cities discharge their entire sewage and industrial effluents untreated into the nearby rivers. Industries in and around the urban centres pollute the atmosphere with smoke and toxic gases

Unit 5 - Hazards

Introduction

Teacher : Good morning students.
Students : Good morning teacher.
Teacher : Are all present today?
Krithika : No teacher, Shruthi is absent today.
Teacher : Why is she absent today?
Pavithra : Teacher, don't you know what happened to her?
Teacher : No my dear child, what happened to her?
Theshmitha : Teacher, Yesterday, while returning home, she was struck by a big branch of a tree due to heavy rain and got injured.
Teacher : Oh my God….what a pity? Students, you all must be very careful while moving around to avoid the problems from hazards.
Kamalesh: Teacher, what do you mean by hazards? You mean the Belgian football player **'Hazard'**?
Teacher : No…no, it is an event which can affect the living and non-living things of earth. I think today is the right day to get into the interesting chapter 'hazards'.

Hazards

In the beginning of twenty-first century, the earth supported a human population that was more numerous and found healthier and wealthier than ever before. At the same time,there were a lack of awareness on the risks that faced by the people. By keeping this in mind, the present lesson of hazards is intended to familiarise the different types of hazards to promote awareness among students regarding hazards.

Hazards are defined as a thing, person, event or factor that poses a threat to people, structures or economic assets and which may cause a disaster. They could be either humanmade or naturally occurring in the environment. The word 'hazard' owes its origin to the word 'hasart' in old French meaning a game of dice (in Arabic -az-zahr; in Spanish -azar).Though the society experiences several types of hazards, it is important for a region to be aware of those threats that are most likely to affect the community most severely.

A natural hazard is a natural process and event that is a potential threat to human life and property. The process and events themselves are not a hazard but become so because of human use of the land.

A disaster is a hazardous event that occurs over a limited time span in a defined area and causes great damage to property/ loss of life, also needs assistance from others.

A catastrophe is a massive disaster that requires significant expenditure of money and a long time (often years) for recovery

Types of Hazards

Some hazards occur frequently and threat the people. Hazards are classified in different ways.

I. Based on their causes of occurrence.
II. Based on their origin.

I. Based on their causes of occurrence

Hazards can be broadly classified into three types: natural, human-made and socio-natural hazards.

1. Natural hazards: These are the results of natural processes and man has no role to play in such hazards. The main examples of natural hazards are earthquakes, floods, cyclonic storms, droughts, landslides, tsunamis and volcanic eruptions.

2. Human-made hazards: these are caused by undesirable activities of human. It can result of an accident, such as an industrial chemical leak or oil spill, or an intentionalact. Such hazards can disturb the safety, health, welfare of people and cause damage or destruction to property. The following are the examples of human-made hazards. They are explosions, hazardous wastes, pollution of air, water and land, dam failures, wars or civil conflicts and terrorism.

3. Socio-natural hazards (Quasi-natural hazards):these are caused by the combinedeffect of natural forces and misdeeds of human. Some of the examples are:

- The frequency and intensity of floods and droughts may increase due to indiscriminate felling of trees, particularly in the catchmentareas of the rivers.
- Landslides are caused by natural forces and their frequency, and impact may beaggravated as a result of construction of roads, houses etc., in mountainous areas,excavating tunnels and by mining andquarrying.
- Storm surge hazards may be worsened by the destruction of mangroves.
- Smog is a serious problem in most big urban areas. The emissions from vehicles and industries, combustion of wood and coal together combined with fog leads to smog.

II. Based on their origin

Hazards can be grouped into eight caregories

1. Atmospheric hazard – Tropical storms, Thunderstorms, Lightning, Tornadoes, Avalanches, Heat waves, Fog and Forest fire.
2. Geologic/Seismic hazard – Earthquakes, Tsunamis, Landslides and Land subsidence.
3. Hydrologic hazard – Floods, Droughts, Coastal erosion and Storm surges
4. Volcanic hazard – Eruptions and Lava flows.

5. Environmental hazard – Pollution of soil/ air/water, Desertification, Global warming and Deforestation.
6. Biological hazard – Chickenpox, Smallpox, AIDS [HIV] and Killer bees.
7. Technological hazard – Hazardous material incidents, Fires, Infrastructure failures [Bridges, Tunnels, Dams] and Nuclear/ Radiological accidents.
8. Human-induced hazard – Terrorism, Mass shootings, War, Transportation accidents and Civil disorder

1) Earthquakes
Earthquake is a violent tremor in the earth's crust, sending out a series of shock waves in all directions from its place of origin. Earthquake prone regions of the country have been identified on the basis of scientific inputs relating to seismicity, earthquakes occurred in the past and tectonic setup of the region. Based on these inputs, Bureau of Indian Standards has grouped the country into four seismic zones: Zone II, Zone III, Zone IV and Zone V (No area of India is classified as Zone I).

Seismic Zones of India

Seismic Zones	Level of Risk	Regions
Zone V	Very High	Comprises entire northeastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Rann of Kutch in Gujarat, part of North Bihar and Andaman &Nicobar Islands
Zone IV	High	Covers remaining parts of Jammu and Kashmir and Himachal Pradesh, National Capital Territory (NCT) of Delhi, Sikkim, northern parts of Uttar Pradesh, Bihar and West Bengal, parts of Gujarat and small portions of Maharashtra near the west coast and Rajasthan
Zone III	Moderate	Comprises Kerala, Goa, Lakshadweep Islands, remaining parts of Uttar Pradesh, Gujarat and West Bengal, parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Odisha, Andhra Pradesh, Tamil Nadu and Karnataka.
Zone II	Low	Covers remaining parts of country.

2) Floods
Flood is an event in which a part of the earth's surface gets inundated. Heavy rainfall and large waves in seas are the common causes of flood

The major causes of floods are:
A. Meteorological factors
i) Heavy rainfall
ii) Tropical cyclones
iii) Cloud burst
B. Physical factors
i) Large catchment area

ii) Inadequate drainage arrangement

C. Human factors

i) Deforestation
ii) Siltation
iii) Faulty agricultural practices
iv) Faulty irrigation practices
v) Collapse of dams
vi) Accelerated urbanisation

The following map shows the major flood prone areas in India. Gangetic plains covering the states of Punjab, Haryana, Uttar Pradesh, North Bihar, West Bengal and Brahmaputra valley are the major flood prone areas in north and northeast India. Coastal Andhra Pradesh, Odisha and southern Gujarat are the other regions which are also prone to flood often.

3) Cyclonic Storms

A cyclonic storm is a strong wind circulating around a low pressure area in the atmosphere. It rotates in anti-clockwise direction in Northern Hemisphere and clockwise in the Southern Hemisphere.

Tropical cyclones are characterised by destructive winds, storm surges and exceptional levels of rainfall, which may cause flooding. Wind speed may reach upto 200 km/h and rainfall may record upto 50 cm/day for several consecutive days.

A sudden rise of seawater due to tropical cyclone is called storm surge. It is more common in the regions of shallow coastal water.

East coastal areas vulnerable to storm surges

i) North Odisha and West Bengal coasts.
ii) Andhra Pradesh coast between Ongole and Machilipatnam.
iii) Tamil Nadu coast (among 13 coastal districts, Nagapattinam and Cuddalore districts are frequently affected).

West coastal areas vulnerable to storm surges

The west coast of India is less vulnerable to storm surges than the east coast.

i) Maharashtra coast, north of Harnai and adjoining south Gujarat coast and the coastal belt around the Gulf of Cambay.
ii) The coastal belt around the Gulf of Kutch.

4) Droughts

Any lack of water to satisfy the normal needs of agriculture, livestock, industry or human population may be termed as a drought. Further, the drought could be classified into three major types as,

i) **Meteorological drought:** it is a situation where there is a reduction in rainfall for a specific period below a specific level.

ii) **Hydrological drought:** it is associated with reduction of water in streams, rivers and reservoirs. It is of two types, a) Surface water drought, and b)Groundwater drought.

iii) **Agricultural drought:** it refers to the condition in which the agricultural crops get affected due to lack of rainfall

Drought

Droughts in India occur in the event of a failure of monsoon. Generally monsoon rainfall is uneven in India. Some areas receive heavy rainfall while other regions get moderate to low rainfall. The areas which experience low to very low rainfall are affected by drought.

The major areas highly prone to drought are:
1) The arid and semi-arid region from Ahmedabad to Kanpur on one side and from Kanpur to Jalandhar on the other.
2) The dry region lying in the leeward side of the Western Ghats.

5) Landslides

Landslide is a rapid downward movement of rock, soil and vegetation down the slope under the influence of gravity. Landslides are generally sudden and infrequent. Presence of steep slope and heavy rainfall are the major causes of landslides. Weak ground structure, deforestation, earthquakes, volcanic eruptions, mining, construction of roads and railways over the mountains are the other causes of landslides. belt around the Gulf of Cambay.

About 15% of India's landmass is prone to landslide hazard. Landslides are very common along the steep slopes of the Himalayas, the Western Ghats and along the river valleys. In Tamil Nadu, Kodaikanal (Dindigul district) and Ooty (The Nilgiris district) are frequently affected by landslides.

6) Tsunamis

Tsunami refers to huge ocean waves caused by an earthquake, landslide or volcanic eruption. It is generally noticed in the coastal regions and travel between 640 and 960 km/h. Tsunamis pose serious danger to the inhabitants of the coastal areas.

The word 'Tsunami' is derived from Japanese word 'tsu' meaning harbour and 'nami' meaning wave (Harbour wave).

Indian Ocean Tsunami of 2004

- On December 26, 2004, at 7:59 a.m. local time, an undersea earthquake with amagnitude of 9.1 struck off the coast of the Indonesian island of Sumatra.
- The tsunami killed at least 2,25,000 people across a dozen countries, with Indonesia, Sri Lanka, India, Thailand, Somalia and Maldives, sustaining massive damage.

7) Hazardous Wastes

The wastes that may or tend to cause adverse health effects on the ecosystem andhuman beings are called hazardous wastes. The following are the major hazardous wastes.

i) Radioactive substance: tools and unused fuel rods of nuclear power plants.
ii) Chemicals: synthetic organics, inorganic metals, salts, acids and bases, and flammables and explosives.
iii) Biomedical wastes: hypodermic needles, bandages and outdated drugs.
iv) Flammable wastes: organic solvents, oils, plasticisers and organic sludges.
v) Explosives: the wastes resulting from ordnance manufacturing and some industrial gases.
vi) Household hazardous wastes:pesticides, waste oil, automobile battery and household battery.

Chernobyl nuclear disaster site (near Pripyat) to become an official tourist spot
Before:

- Chernobyl (then Soviet Union) nuclear accident was happened on 26th April,1986.
- The radiation emitted was more than 400 times than that released by the atomicbomb dropped on Hiroshima (Japan) in 1945. This accident remains the largest nuclear accident in history.
- More than 3,50,000 people were evacuated from the area and severe restrictions onpermanent human settlement are still in that place.

Now:

- 33 years after the accident, the Exclusion Zone, which covers an area now in Ukraine and Belarus is inhabited by numerous animals and more than 200 bird species.
- In 2016, the Ukraine part of this zone was declared as a radiological and environmental biosphere reserve by the government.

8) Pollution of Air

Air is a mixture of several gases. The main gases are nitrogen (78.09%) for forming products such as, fertilisers for plants and for making the
air inert, oxygen (20.95%) for breathing and carbon dioxide (0.03%) for photosynthesis. Some other gases like argon, neon, helium, krypton,
hydrogen, ozone, zenon and methane are also present. Besides, water vapour and dust particles make their presence felt in one way or the other.

Air pollution is the contamination of the indoor or outdoor air by a range of gases and solids that modify its natural characteristics and percentage. Air pollutants can be categorised into primary and secondary pollutants.

A **primary pollutant**is an air pollutant emitted directly from a source. A **secondarypollutant**is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere.

Primary Pollutants
i) Oxides of Sulphur
ii) Oxides of Nitrogen
iii) Oxides of Carbon
iv) Particulate Matter
v) Other Primary Pollutants
Secondary Pollutants
i) Ground Level Ozone
ii) Smog

9) Pollution of Water

Water pollution may be defined as alteration in the physical, chemical andbiological characteristics of water, which may cause harmful effects in human and aquatic life.

In India, water pollution has been taking place on a large scale and since a long period. Both surface and groundwater bodies are polluted to a great extent. The major causes of water pollution in India are:

i) Urbanisation
ii) Industrial effluents
iii) Sewages
iv) Agricultural runoff and improper agricultural practices
v) Seawater intrusion
vi) Solid wastes.

Need for PreventionMeasures

Prevention is defined as the activities taken to prevent a natural calamity or potential hazard from having harmful effects on either people or economic assets.

- Prevention planning consists of i) hazard identification, and ii) vulnerability assessment.
- Delayed actions may increase the economic losses.
- For developing countries like India, prevention is perhaps the most criticalcomponents in managing disasters.

Nature is emerging as a new weapon of mass destruction, do you agree?
Around 22,000 people have died in India in 10 years until 2017 due to major environmental disasters – Indian Meteorology Department. In the past two decades (1998-2017) over 5,00,000 people have died due to extreme weather events around the world – stated by Global Climate Risk Index Report Published by Germanwatch (German-based non-profit organisation).

8TH BOOK
UNIT – 6 INDUSTRIES

Introduction

Anbu and Kabilan were studying in 8th standard like you. One day it was raining while they were playing in the school play ground. They started running towards the class room. Kabilan planned to stay under a nearby tree in the rain and called Anbu to accompany him. But he denied saying that lightning might strike the tree. Finally, they reached the class room.

They saw an attractive new cotton towel in the class room. They used the towel for wiping their heads. Other students in the class room said to them,'' The towel was brought by the teacher and you made it wet. So, she might shout at you". In order to please the teacher, Kabilan asked the teacher some questions. He said, "Madam this is so cute and colourful. From where did you buy this? How is it made?" The teacher was very happy and started explaining the raw materials used, the way it was manufactured and marketed.

Industry

Industry is a process by which the raw materials are changed into finished products. Many raw materials are not fit for human consumption. Therefore, there is a need for conversion. This transformation of commodities from one form to another form is the essence of manufacturing industry or the secondary group of economic activities. Arrival of Science and Technology helped the man to fabricate raw materials into finished products. The economic strength of a country is always measured by the development of manufacturing industries. Therefore, any country in the world is basically depends on the effective growth of industries for its economic development.

Economic Activity

Any action that involves in the production, distribution, consumption or services is an economic activity.

Basics of Economic Activities

The following are the major and fundamental economic activities.

1. Primary Economic Activities (e.g., Raw cotton production)
2. Secondary Economic Activities (e.g., Spinning mill)
3. Tertiary Economic Activities (e.g. Trade, Transport)
4. Quaternary Activities (e.g. Banking sector)
5. QuinaryActivites (e.g. Judicial sector)

1) Primary Economic Activity: These are the economic activities which have been originated in the very beginning. It includes the activities such as, forestry, grazing, hunting, food gathering, fi shing, agriculture, mining, and quarrying.

2) Secondary Economic Activity: Secondary activities are those that change raw materials into usable products through processing and manufacturing. Bakeries that make flour into bread and factories that change metals and plastics into vehicles are examples of secondary activities.

3) Tertiary Economic Activity: Tertiary economic activities are those that provide essential services and support the industries to function. Oft en it is called service industries, this level includes the transportation, fi nance, utilities, education, retail, housing, medical and other services. We are educated by school. Since, school is doing service, it comes under tertiary activity.

4) Quaternary Economic Activity: Quaternary activities are associated with the creation and transfer of information, including research and training. Oft en called information industries, this level has been dramatic growth as a result of advancements in technology and electronic display and transmission of information. e.g., we watch television. Th e programs are telecasted from television stations. It is an example of quaternary activity.

Services sector is the one of the largest sectors of India. Currently this sector is the backbone of the Indian economy and contributing around 53% of the Indian

5) Quinary Economic Activity: Quinary economic activities refer to the high level decision making processes by executives in industries, business, education, and government. Th is sector include top executives or officials in the fi elds of science and technology, universities, health care etc. In our house, our parents purchase household articles and make decisions by themselves in some situations. Similarly, the council of ministers take decisions to introduce various people welfare schemes in the state. These two are examples of quinary activities.

Factors responsible for location of Industries

Industrial locations are complex in nature. They are influenced by the availability of many factors. Some of them are: Raw Materials, Land, Water, Labour, Capital, Power, Transport, and Market. The locational factors of industries are grouped into: Geographical factors and Non-Geographical factors.

I. Geographical Factors

1. Raw Material: Bulky goods and weight losing materials cannot be transported for long distances. Therefore, industries like iron and steel and sugar industries are located near the place of availability of iron ore and sugar cane respectively. Steel Plant in Salem is located near Kanjamalai, where iron ore is available. Similarly, Sugar industries are located near he sugarcane growing areas.

2. Power: Power is base and essential to run the entire industry. Power is mostly generated from the conventional sources like coal, mineral oil, and water. So, any one of these sources must be located near the industries to fulfil its power requirement.

3. Labour: Availability of cheap and skilled labour is another important requirement for labour intensive industries (e.g., Tea industry).

4. Transport: It is needed for transporting raw materials to the industries and also for sending the finished products to the market. Availability of easy transportation always influences the location of an industry. So, the junction points of waterways, roadways and railways become active centres of industrial activity.

5. Storage and Warehousing: The finished goods should reach the market at the end of the process of manufacturing. Hence, such finished products should be stored at suitable storage or warehouse till the goods are taken to the market.

6. Topography: The site that is selected for the establishment of an industry must be flat. So, it can be well served by different modes of transport.

7. Climate: Climate of the area selected for an industry is also one of the important factors of location of industries. Extreme climate condition is not suitable for the successful industrial growth. Moreover, there are certain industries which require a specific climate. Example: Cool- humid climate is ideal for cotton textile industry. As Coimbatore and Tiruppur have such type of climate, many cotton textile industries are located in this zone.

8. Water Resources: Availability of water is another important factor that influences the industrial location. Many industries are established near rivers, canals, and lakes for this reason. Iron and steel industries, textile industries and chemical industries require plenty of water, for their proper functioning.

II. Non-Geographical Factors

1. Capital: Capital or huge investment is needed for the establishment of industries without which no industry can be established.

2. Availability of Loans: In most cases, it is not possible to start an industry with enough capital in hand. So, the investors seek loan to start the industries. Thus, the organizational set up which provides loan and insurance are required.

3. Government Policies/Regulations: Government policies are another important factor that influences industrial location. The government sets certain restriction in the allocation of land for industries in order to reduce regional disparities, to control excessive pollution and to avoid the excessive clustering of industries in big cities. So, the policies also affect the industrial locations.

Classification of Industries

Industries are classified on various basis in the following ways.

(i) Agro Based Industries: These industries use plant and animal based products as their raw materials. Example: Food Processing, Vegetable Oil, Cotton Textile, Dairy Products, etc.

(ii) Mineral Based Industries: These are the industries that use mineral ores as their raw materials. Iron made from iron ore is the product of mineral based industry. Cement, Machine Tools, etc. are the other examples of mineral based industries.

(iii) Marine Based Industries: These industries use products from the sea and oceans as raw materials. Example; Processed Sea Food, Fish Oil manufacturing units etc.

(iv) Forest Based Industries: These industries use forest products as their raw materials. Example: Pulp & Paper, Furniture and Some Pharmaceuticals industries, etc.

On the basis of Size and Capital

(i) Large Scale Industries: The capital required for the establishment of an industry is more than one crore the industry is called as large scale industry. Iron & steel, Oil refineries, Cement and Textile industries are the best examples for large scale industries.
(ii) Small Scale Industries: The capital required for the establishment of an industry is less than one crore, the industry is called as small scale industry. Silk weaving and household industries belong to this category.

Detroit of India

Detroit city in Michigan State, USA is known as the world's traditional automotive centre. In India Chennai is known as 'Detroit of India'. It has the world famous automobile industries such as GM, Ford, Hyundai and Mahindra. The city accounts for 60% of the country's automotive exports.

Apart from the above cited industries, cottage or household industries are also a type of small scale industry where the products are manufactured by hand, by the artisans with the help of family members. These industries are also classified and grouped as miscellaneous categories. Example: Basket weaving, Pot Making, handicrafts etc.

On the basis of Ownership

(i) Private Sector Industries: These type of industries are owned and operated by individuals or a group of individuals. Example: Bajaj Auto, Reliance, etc.

(ii) Public Sector Industries: These type of industries are owned and operated by the Government. Hindustan Aeronautics Limited (HAL), Bharat Heavy Electricals Ltd (BHEL), Steel Authority of India Ltd (SAIL) are the examples of Public sector industries.
(iii) Joint Sector Industries: These types of industries are owned and operated jointly by the Government and Individuals or a Group of Individuals. Example: Indian Oil Sky Tanking Ltd, Indian Synthetic Rubber Ltd, Mahanagar Gas Ltd, MarutiUdyog etc.,
(iv) Co-operative Sector Industries: Industries of this kind are owned and operated by the producers or suppliers of raw materials orworkers or both. Anand Milk Union Limited (AMUL) is the best example of the Co-operative sector.

9TH GEOGRAPHY
1. Lithosphere – I Endogenetic Processes

Pathway

The Earth is a unique planet of the Solar family. The Earth is composed of four spheres namely, the lithosphere, the atmosphere, the hydrosphere and the biosphere. This lesson focuses on the internal processes of the Earth. The sequence of lessons generally follows the spheres of the Earth system in a comprehensive manner.

Spheres of the Earth

Earth's surface is a vast area of510 million sq.km, where four spheres of the Earth interact. The abiotic spheres are the lithosphere, atmosphere and hydrosphere. The biotic sphere is the biosphere. Together, these spheres constitute the planet, Earth. This topic 'lithosphere' has been bifurcated for the sake of convenience. It is divided into Endogenetic processes (Internal processes) and Exogenetic processes (External processes). This lesson deals with the Endogentic processes in detail, the next lesson will deal with the Exogenetic processes.

Spheres of Earth

The outer surface and inner core of the Earth are totally different in their nature and structure. The structure of the Earth's interior is divided into three layers namely the crust, the mantle and the core.

Crust

Crust is the outer layer of the Earth, where we live. It is the skin of our Earth, which ranges between 5 to 30 km. It is the solid and rigid layer of the Earth. The thickness of the crust is greater below the continents than the ocean floor. The crust is classified as continental crust and oceanic crust. The major elements of crust are Silica (Si) and Aluminium (Al) and thus, it is termed as SIAL.

Mantle

The interior part beneath the crust is called mantle, which is about 2,900 km thick. The major elements of the mantle are Silica (Si) and Magnesium (Mg) and hence it is also termed as SIMA. In the upper part of the mantle, the rock remains solid, whereas in the lower part of the mantle, rocks are in molten form. This molten rock inside the Earth is called 'magma'.

Core

The core is the innermost and hottest layer of the Earth which lies below the mantle. It is composed mainly of Nickel (Ni) and Iron (Fe). Hence it is called NIFE. The core is

divided into Solid inner core and Liquid outer core. The presence of large quantities of iron in the core is responsiblefor the Earth's gravitational force. As the Earth rotates on its axis, the liquid outer core spins over the solid inner core and generates the Earth's magnetic field. This is responsible for the functioning of the magnetic compass. Due to high pressure, the materials in the inner core are unable to move and hence remain solid.

DATA ON THE EARTH'S INTERIOR				
Layers	**Thickness (km)**	**Top**	**Bottom density (g/cm3)**	**Types of rocks found**
Crust	30	2.2	- 2.9	Silicic Rocks Andesite, Basalt at base, Aluminum
Upper mantle	720	3.4 -	4.4	Peridodite, Eclogite, Olivine, Spinel, Garnet, Pyroxene Perovskite, Oxides
Lower Mantle	2,171	4.4	-	Magnesium and silicon oxides
Outer core	2,259	9.9	- 12.2	Iron oxides, Sulphur, Nickel Alloy
Inner core	1,22,	12.8	-	Iron oxides, Sulphur, Nickel Alloy
Total Thickness	**6,401**			

Rocks: The crust is a storehouse of rocks. An aggregate of minerals on the Earth's crust is called 'rock'. It may be hard and compact like 'granite' or soft as 'clay' or loose as 'sand'.

Types of Rock: Based on formation, rocks are classified as: 1. Igneous, 2. Sedimentary and 3. Metamorphic.

1. **Igneous Rocks:** The word 'igneous' is derived from the Latin word Ignis meaning 'Fire'. The interior of the Earth contains very hot molten material called 'Magma'. When the magma reaches the Earth's surface, it is referred to as 'Lava'. The lava on the surface cools down and gets solidified as rocks called igneous rocks. Granite and basalt are examples of such rocks. Igneous rocks are also called Primary or Mother rocksbecause all other rocks are directly or indirectly formed from them.

2. **Sedimentary Rocks:** These sedimentary rocks are named after the latin word 'sediment' meaning ' settle. Rivers, glaciers and winds carry bits of rock and soil and deposit them in layers.After a few million years, these deposits harden into compact rocks and are called Sedimentary rocks. The bodies of plants and animals that fall on the deposits get embedded in the layers and form Fossils. Sandstone, limestone, chalk, gypsum, coal and onglomerate are examples of sedimentary rocks.

3. **Metamorphic Rocks:** The term 'metamorphic' is derived from the word 'metamorphosis', which means, 'change of form'. When igneous or sedimentary rocks are subjected to extreme heat and pressure, they undergo a complete change in their form and character .i.e., in course of time, granite may get transformed to gneiss, basalt to schist, limestone to marble and sandstone to quartzite.

Types of Rocks	Examples	Uses
Igneous	Granite Basalt	Construction work Laying roads
Sedimentary	Gypsum Limestone	Manufacturing of wall board, cement, plaster of Paris etc. Construction and purification of Iron in blast furnaces
Metamorphic	Diamond Marble	Jewellery making Sculpture and construction

Rock Cycle: The Rock cycle is a continuous process through which igneous, sedimentary and metamorphic rocks are transformed from one form to another.

Geomorphic Processes

The formation and deformation of landforms on the surface of the Earth is a continuous activity of two broad processes i.e. internal and external. These processes cause stress and deformation on Earth materials and finally bring changes on the surface of the Earth. These are referred as Geomorphic Processes.

The forces that act from the Earth's interior towards the Earth's surface are called Internal processess or Endogenetic processes. These forces build the landscape and create topographic relief.

The forces that act on the surface of the Earth due to natural agents like running water, glacier, wind, waves etc. are called External processes or Exogenetic processes. These external processes tear the landscape down into relatively low elevated plains.

Internal Processes: The internal processes generate heat and eject materials from deep below the Earth's crust. Internal radioactivity is the principal source of power for this process.

Plate Tectonics:

The lithosphere is divided into a number of huge slabs of rocks called 'Tectonic plates.' These tectonic plates are divided into major and minor plates. These plates float independently over the mantle. Collisions of these plates produce mountain ranges and other irregular surface features, both on land and the ocean floor. This phenomenon is called 'plate tectonics'. The movement of tectonic plates is due to thermal energy from the

mantle. Now we have a better understanding about the plate movements and its relation to Earthquake and volcanic activities.

Types of Plate Boundaries

- **Convergent Boundary:** Here the plate moves toward each other and sometimes, a plate sinks under another. The location where the sinking of a plate occurs is called a subduction zone.

- **Divergent Boundary:** Here the plates pull away from each other as magma pushes up from the mantle.

- **Transform Boundary**: Here the plates slide horizontally past each other.

Movements of Continental Plates

Due to lateral compressional forces, the plates are forced to move upwards and downwards. This is called 'Folding'. Mountains formed by folding are called fold mountains. the Process of folding creates lofty mountain ranges such as the Himalayas and the Alps The movement of plates also create stress and tension in the rocks, causing them to stretch and crack. This is called 'Faulting'. The great rift valley of East Africa is a notable example for the process of faulting. The process of folding and faulting together with volcanoes and Earthquakes continually reshape the continents and seafloor.

According to plate tectonics, the plates are in constant motion with an average rate of few centimetres per year. The movement might seem slow, but over millions of years, the plates and the continents riding on them move a long way. For example, about 250 million years ago, the Indian Plate was a part of the Gondwana land, which comprised of modern Africa, Australia, Antarctica, and South America.

Approximately 140 million years ago, the Indian plate broke away from the ancient super continent 'Gondwana' and began moving north and collided with Asia. The collision with the Eurasian Plate along the boundary between India and Nepal formed the Orogenic belt that created the Tibetan Plateau and the mighty Himalayan Mountains.

Earthquake

Earthquakes are generally caused by the sudden vibrations in the Earth's crust, which spreads outward in all directions as waves from the source of disturbance.The point of origin of an Earthquake is called 'Focus' (Hypocenter) which generates a series of elastic waves. 'Epicentre' is a point on the Earth's surface that lies directly above the focus. The impact of the Earthquake is felt the most at the epicentre.

Seismic Waves

- **Earthquakes generate seismic waves:** The nature, force and speed of these seismic waves depend on the nature of the medium through which it passes. Accordingly, there are three major types of waves.

- **Primary or P-waves**are the fastest of all the Earthquake waves and the first to reach the epicentre. These waves pass through solids, liquids and gases, either through push or pull with an average velocity of 5.3km per second to 10.6 km per second.

- **Secondary or S-waves**travel only through solids. These transverse waves shake the ground perpendicular to the direction in which they propagate. The average velocity of these waves is 1Km per second to 8 km per second.

- **Surface Waves (or) L-waves**are similar to P-waves but they travel primarily along the ground surface. These waves travel comparatively slower and are the most destructive waves. The average velocity of these waves are 1 km per second to 5 km per second.

Tsunami

The word 'Tsunami' is a Japanese term, meaning harbour waves. It is adopted to describe large seismically generated sea waves caused by Earthquakes, submarine explosions and landslides. These waves travel at a great speed (more than 500 km per hour) and the length of the waves exceeds 600 km. These waves reach to a height of more than 15 m near the sea shore and are capable of causing destruction along the coastal area. The 2004 Indian Ocean Earthquake that caused tsunami is the sixth-deadliest natural disaster which travelled at a speed of 600 km per hour with an estimated death toll of 2,80,000. The Earthquake which occurred near Indonesia at 00.58 hours took nearly 7 hours to reach Chennai.

Volcanoes

A volcano is a vent or an opening on the surface of the Earth crust, through which hot solid, liquid and gaseous materials (Magma) erupt out to the surface from the Earth's interior. Magma rises up and ejects on the surface as Lava. Volcanoes are also formed when plates move apart. Volcanoes generally have the following major components. They are:

i. **Magma chamber**: a large pool of liquid rock found beneath the surface of the Earth
ii. **Vents**: an opening serving as an outlet for air, smoke, fumes, magma etc
iii. **Volcanic cone:** a landform built by the magma ejected from the vent in the shape of a cone.
iv. **Crater:** a bowl shaped depression found at the top of the volcano through which the magma flows out.

Based on the periodicity of eruptions, volcanoes are classified into i. Active volcano, ii. Dormant volcano, iii.Extinct volcano.

i. **Active Volcano:** Active volcanoes are those which constantly eject volcanic lava, gases and fragmented materials. (eg.) Mount St. Helens in the United States.
ii. **Dormant Volcano:** Volcanoes that do not show any sign of volcanic activity for a long period of time are known as dormant volcanoes. Sometimes there may be a sudden explosion which may cause unimaginable loss to life and property (e.g.) Mt. Fuji , Japan
iii. **Extinct or Dead Volcano:** When a volcano permanently stops its volcanic activity, then it is called as extinct or dead volcano (e.g.) Mt. Kilimanjaro, Tanzania

Volcanoes can also be classified based on their structure and composition as composite volcano, shield volcano and dome volcano

- **Composite Volcano:** Composite volcano, also known as strata volcano, is a conical volcano built by many layers of hardened lava, pumice and volcanic ash. These are commonly found in the Pacific Ocean Eg. Mt. Fuji, Japan

- **Volcanic Dome:** A lava dome or volcanic dome is roughly a circular mound formed due to the slow ejection of viscous lava from a volcano. As the lava is rich in silica with intense viscosity, it is prevented from flowing far from its vent. e.g. Paricutin, Mexico

- **Shield Volcano:** Shield volcanoes are formed by intense viscous lava. These are shallow depositions with gently sloping sides. Hence the lava flows out in all directions to create a shield. E.g., Mauna Loa, Hawaii

Distribution of Earthquakes and Volcanoes

Most Earthquakes and volcanic eruptions do not strike randomly, but occur along the plate boundaries. One such area is the circum-Pacific Ring of Fire, where the Pacific Plate meets many surrounding plates. The Ring of Fire is the most seismically and volcanically active zone in the world. The other distinctive major belts are Mid-Oceanic Ridges and Mid- Continental Belts.

Effect of Volcanoes
Constructive Effects

Volcanic materials enrich the soil fertility that promotes agricultural activities. The hot volcanic region helps in generating geothermal energy. Many dormant and active volcanoes are the most attractive tourist spots of the world. Most of the volcanic materials are used as building materials.

Destructive Effects

Volcanic eruption causes Earthquakes, fast floods, mud slide and rock fall. Lava can travel very far and burn, bury, or damage anything in its path. The large amount of dust and ash makes breathing hard and irritable. Volcanic eruptions can alter the weather conditions and disrupt transport (Iceland volcanic eruption) in and around the volcanic region.

- "The Earth can physically be described as a ball of rock (the lithosphere), partly covered by water (the hydrosphere) and wrapped in an envelope of air (the atmosphere). To these three physical zones it is convenient to add a biological zone which includes all the living organisms (the biosphere)."- Arthur Holmes
- The 'Pedosphere' is a part of the lithosphere made up of soil and dirt. It exists at the interface of lithosphere, atmosphere, hydrosphere and biosphere.
- The lithosphere is the solid outer part of the Earth.
- The atmosphere is a thin layer of gases that surrounds the Earth.
- The hydrosphere is the watery part of the Earth's surface including oceans, rivers, lakes and water vapour
- The biosphere is the layer of Earth where life exists.
- The terms 'lithosphere' and 'crust' are not the same. The lithosphere includes the crust and the uppermost part of the mantle.
- All terrestrial planets have lithosphere. The lithospheres of Mercury, Venus, and Mars are much thicker and more rigid than that of the Earth.
- The Deepest Place ever reached by human technology vary from time to time. Till 2011 Kola Super Hole (12,262m) in Murmansk, Russia was the deepest place. But in 2012, Z-44 Chavyo Well (12,376m) broke the record, and is supposed to be 15 times the height of Burj Khalifa in Dubai. The exploration of Earth's interior continues.
- The ancient city of Petra in Jordan is an example of an entire city carved out of rocks. There are many specimens of magnificent rock-cut architecture in India, like the Ajanta and Ellora caves in Maharashtra, the Aihole and Badami temples in Karnataka, the Konark temple in Odisha and Mamallapuram in Tamil Nadu.
- C.F. Richter devised a scale to measure the magnitude of Earthquakes. This scale relates to the energy released at the epicentre and provides an estimation of the severity of an Earthquake. It is an open ended scale. The highest magnitude ever recorded is 9.5 on Richter scale (Bio-Bio, Chile in 1960).
- The instrument which records the Earthquake waves is called 'seismograph' or 'seismometer'. The science that deals with Earthquakes is called 'seismology'.
- On 26 December 2004 a tsunami occurred in the Indian Ocean. It was the result of the Indio- Australian Plate subducting below the Eurasian Plate. It was caused by an Earthquake measuring a magnitude of above 9 in the Richter scale. The Earthquake caused the seafloor to uplift, displacing the seawater above.
- The term 'volcano' is derived from the Latin term VULCAN, which is the name of Roman "God of Fire".

2 - Lithosphere – II Exogenetic Processes

The Earth is a dynamic system that undergoes various changes due to internal and external processes. The continuous interaction of these two processes controls the structure of the earth's surface. The external processes are the consequence of solar energy and gravitational forces, whereas the internal processes are an outcome of the earth's internal heat.

Exogenetic process

↓↓

Weathering and Mass Movement			**Gradation**	
↓	↓	↓	↓	↓
Physical	Chemical	Biological	Degradation	Aggradation

Weathering and Mass Movement

Weathering is the disintegration and decomposition of materials of the earth's crust by their exposure to atmosphere. Movement of huge volumes of weathered rock material down the slope due to gravity is called mass movement or mass wastage. Example: rock slide, land slide, debris fall, mud flow. The nature and magnitude of weathering differs from place to place and region to region. Weathering is affected and controlled by factors such as temperature, rock structure, land slope and vegetation. There are three types of weathering 1. Physical weathering, 2.Chemical weathering and 3.Biological weathering

Physical weathering

It is the breakdown of rocks without changing their chemical composition, through the action of physical forces. The constant freezing and thawing of rocks during the night and day leads to the expansion and contraction of rocks. Cracks are formed and disintegration occurs eventually. Exfoliation, block disintegration, granular disintegration etc., are the different types of weathering.

- ✓ **Exfoliation:** The alternate heating and cooling on rounded rock surfaces leads to the peeling of rocks, layer by layer like an onion. This is called exfoliation. Sheeting and shattering are the other forms of exfoliation.

- ✓ **Granular Disintegration:** Granular disintegration takes place in crystalline rocks where the grains of the rocks become loose and fall out. This is due to the action of temperature and frost.

- ✓ **Block Disintegration:** Repeated expansion and contraction of rocks during day and night respectively causes stress on the joints of the rocks which results in block disintegration.

Chemical Weathering

Disintegration and decomposition of rocks due to chemical reactions is called Chemical Weathering. This is predominantly high in the hot and humid regions such as the equatorial, tropical and sub tropical zones. Chemical weathering takes place through the processes of oxidation, carbonation, solution, and hydration. The agents of Chemical weathering are Oxygen, Carbon-dioxide and Hydrogen.

- ✓ **Oxidation:** Oxygen in the atmosphere reacts with the iron found in rocks, thus leads to the formation of iron oxide. This process is known as oxidation, which results in the weakening of rocks.

- ✓ **Carbonation:** Carbonation is the mixing of water with the atmospheric carbon-dioxide, forming carbonic acid. Carbonation is important in the formation of caves, in limestone region. When the carbonic acid reacts with the carbonate rocks, the rocks get disintegrated.

- ✓ **Solution:** The process of dissolution of rock substances in water result in the loosening of the rock particles. This inturn breaks down the rocks.

- ✓ **Hydration**: Certain chemicals in the rock enlarge in size in humid conditions. These minerals found in the rock swell and this results in the development of cracks and the rock wears down. This type of weathering is called hydration.

Biological Weathering

Biological weathering occurs due to the penetration and expansion of plant roots, earthworms, burrowing animals (rabbits, rats) and some human activities.

Gradation: Gradation is the process of levelling of the land by means of natural agents like rivers, ground water, winds, glaciers, and sea waves. These agents produce various gradational relief features in due course of time. Gradation takes place in two ways: degradation and aggradation

- **Degradation or denudation**is the wearing down of the land surface by various natural agents.
- **Aggradation**is building up of landforms due to natural agents.
- **Gradation** = Erosion + Transportation + Deposition

Agents of Gradation

Running water (River)

The work of running water (rivers) is the most extensive among all the other agents of gradation. Rivers originate on higher landforms like, mountains, hills and plateaus that receive water from various sources like the rain, glaciers, springs, lakes, etc.The place where the river originates is called its source and where it joins the sea is known as its

mouth. The primary functions of a river are (i) erosion (ii) transportation and (iii) deposition. The work of a river depends on various factors such as volume of water, velocity of the river, slope of land, load of sediment and structure of rock, and load of sediment.

Courses of River:

Rivers generally originate from mountains and end in a sea or lake. The whole path that a river flows through is called its course. The course of a river is divided into: i. The upper course, ii. The middle course and, iii.The lower course

i. **The Upper Course:** Erosion is the most dominant action of river in the upper course. In this course, a river usually tumbles down the steep mountain slopes. The steep gradient increases the velocity and the river channel performs erosion with great force to widen and deepen its valley. The land features carved by a river in its upper course are V- shaped valleys, gorges, canyons, rapids, pot holes, spurs, and waterfalls.

ii. **The Middle Course:** The River enters the plain in its middle course. The volume of water increases with the confluence of many tributaries and thus increases the load of the river. Thus, the predominant action of a river is transportation. Deposition also occurs due to the sudden decrease in velocity. The river in the middle course develops some typical landforms like alluvial fans, flood plains, meanders, ox-bow lakes etc.,

iii. **The Lower course:** The River, moving downstream across a broad, level plain is loaded with debris, brought down from its upper and middle courses. Large deposits of sediments are found at the level bed and the river, splits into a number of channels called distributaries. The main work of the river here is deposition and it develops typical landforms like delta and estuary.

Erosional Landforms of River

- ✓ **Gorges and Canyons:** When the river flows through a mountainous region made up of hard rocks, it forms a valley with almost vertical sides called gorge. In India, deep gorges have been formed by Brahmaputra and Indus in the Himalayas. A deep gorge with steep sides that runs for hundreds of kilometres is referred to as canyon e.g. Grand Canyon of the river Colorado in the U.S.A.

- ✓ **Waterfall:** When a river flows in a region where hard rocks lie over soft rocks horizontally, the soft rocks get eroded quickly and the hard rocks projects outwards. Thus, the river falls vertically from a steep slope to form a waterfall. When the water falls with great force, it erodes the rock material beneath and creates a depression called a plunge pool. Shallow fast flowing water in a stream is called a rapid.

- ✓ **V-shaped valley:** A 'V'- shaped valley is formed by the vertical erosion of the river where the valley is deepened and widened.

- ✓ **Pot hole:** Due to the river action, cylindrical holes are drilled vertically in the river bed, with varying depth and diametre. These are called pot holes.

- ✓ **Meander**: As the river loaded with debris flows slowly, it forms sweeping loops and bends. It is referred to as meanders.

- ✓ **Ox bow lake**: Meanders in due course of time become almost a complete circle with narrow necks. This in turn gets abandoned and forms a lake. This is called an Ox-bow lake.

Depositional Landforms of River

- ✓ **Alluvial Fan:** A fan shaped deposition made by the river at the foothills is called an alluvial plain

- ✓ **Flood Plain:** Fine sediments are deposited on river banks when a river floods. These sediments make the region rich and fertile. This is called a flood plain. As the height of the river banks gets increases due to continuous deposition of a flooded river, levees are formed.

- ✓ **Estuary**:Estuary is formed where the rives meets the sea. Deposition of silt by the river is not possible here in the estuaries like delta as if the waves keep on eroding the deposits. Ex. River Narmada and Tapti.

- ✓ **Delta:** A triangular shaped low lying area formed by the river at its mouth is called delta. Deltas have fine deposits of sediments enriched with minerals. Eg. Cauvery Delta, Tamil Nadu.

Groundwater

Water that percolates through the pores and fissures of rocks gets collected beneath the earth's surface. This is normally referred to as groundwater or sub-surface water. The rate of percolation depends on the nature of the rocks. The rocks that allow water to percolate are called porous rocks or permeable rocks. The rocks that do not allow water to seep through them are called non-porous rocks or impermeable rocks.The percolated water in course of time returns back to the surface in the form of springs, geysers, hot springs, wells, tanks, artesian wells etc. that are useful for human activities. As an agent of gradation, underground water creates distinct landforms in limestone regions called Karst Topography.

Karst Topography

Ground water is an active agent in limestone regions. Karst topography is formed due to the dissolution of soluble rocks such as limestone, dolomite and gypsum. Limestone topography of Western Slovenia extends for a distance of 480 km in length and

80 km in width which is termed as Karst in the Slavic language. The world's largest karst area is the Nullarbar located on the Great Australian Coast. Karst regions are also found in Southern France, Spain, Mexico, Jamaica, Western Cuba, Central New Guinea, Sri Lanka and Myanmar. Karst topography also exhibits both erosional and depositional features.

Erosional Landforms of Underground Water

Most of erosion takes place due to the process of solution. When rain water mixes with carbon-di- oxide and enters into a limestone region, it dissolves and destroys much of the limestone. As a result, landforms such as Terra rossa, Lappies, sinkholes, swallow holes, dolines, uvalas, poljes, caves and caverns are formed.

- ✓ **Terra Rossa (Italian term for Red soil):** Deposition of red clay soil on the surface of the Earth is due to the dissolution of limestone content in rocks. The redness of the soil is due to the presence of iron oxide.

- ✓ **Lappies:** When the joints of limestone rocks are corrugated by groundwater, long furrows are formed and these are called LAPPIES.

- ✓ **Sinkhole:** A funnel shaped depressions formed due to dissolution of limestone rock is called sinkholes. Their average depth ranges between three and nine meters.

Caves and Caverns: Caves and caverns are subterranean features of karst topography. Caves are hollows that are formed by the dissolution of limestone rocks when carbon di oxide in air turns into carbonic acid after its reaction with water. They vary in size and shape. Caverns are the caves with irregular floors. Eg. Guptadham caves in Western Bihar.

All types of deposits in the caves and caverns are collectively called speleothems which includes travertines, tufa, dripstones. Swallow Holes, Uvalas, Dolines, Poljis are other erossional Features of karst regions predominant in other parts of the world.

Depositional Landforms Underground Water

It is interesting to know that a variety of depositional features are formed on the floor, ceiling and walls of the caves and caverns of the Karst Topography.

Stalactite, Stalagmite and Column

When the water containing dissolved calcite gradually drips from the ceiling of the caves, water evaporates and the remaining calcite hangs from the ceiling. Thus Stalactites are formed. When the calcite deposits rises upward like a pillar Stalagmites are formed. Sometimes, Stalactites and Stalagmites meet together to form Columns and Pillars.

Glaciers:

A Glacier is a large mass of ice that moves slowly over the land, from its place of accumulation. It is also known as 'River of ice'. The place of accumulation is called snowfield. The height above which there is a permanent snow cover in the higher altitude or latitude is called snowline. Higher the latitude, lower the snowline from sea level. The gradual transformation of snow into granular ice is called 'firn' or ' neve' and finally it becomes solid glacial ice.

Movement of Glacier

The large mass of ice creates pressure at its bottom and generates heat. Due to this, the glacier melts a little and starts to move .The rate of movement of a glacier varies from a few centimetres to several hundred meters a day. The movement of glaciers depends on slope, volume of the glacier, thickness, roughness at the bottom (friction) etc., and Temperature. Like the rivers, glaciers also carry out erosion, transportation and deposition.

Types of Glacier

Glaciers are broadly divided into two types based on the place of occurrence, such as Continental glacier and valley glacier.

Erosional Landforms of glacier

Glaciers are powerful erosive agents. Some of the important erosional landforms are Cirque, Aretes, Matterhorn, U-shaped valley, Hanging valley, Fiords etc., Most of these glacial features are predominantly seen in countries like Switzerland, Norway etc.,

- ✓ **Cirque:** The glacier erodes the steep side walls of the mountain and forms a bowl-shaped armchair like depression, it is termed as Cirque
- ✓ **Arete:** Aretes are narrow ridges formed when two cirque walls joined together back to back, and forms narrow knife like ridges.
- ✓ **Matterhorn:** The pyramidal peaks formed when three or more cirques meet together, are referred as Matterhorns.

- ✓ **U-Shaped Valley:** When the glacier moves down along a river valley, the valley further gets eroded deep and wide to form a 'U' shaped valley.

- ✓ **Hanging Valley:** These are valleys eroded by tributary glacier and that hangs over the main valley.

- ✓ **Fjord:** Fjords are glacial valleys that are partly submerged in the sea.

Depositional Landforms of glacier

After getting eroded, fragments of rocks and boulders along with dirt form glacial debris. Glacial debris gets deposited in the low lying areas and form depositional features like moraines, drumlins, eskers, kames and outwash plains.

- ✓ **Moraine:** Landforms formed by the glacial deposits of valley or continental glaciers are termed as moraines. They are of various shapes and sizes, like ground, terminal and lateral moraines etc.

- ✓ **Drumlin**: Drumlins are deposits of glacial moraines that resemble giant inverted teaspoons or half cut eggs.

- ✓ **Esker:** Long narrow ridges composed of boulders gravel and sand deposited by streams of melting water which run parallel to a glacier are called eskers.

- ✓ **Outwash Plain:** An outwash plain consists of glacial sediments deposited by the melting ice at the terminus of a glacier. It appears as an extensive accumulation of sand, gravel and silt.

- ✓ **Wind:** When air blows horizontally at or near the earth's surface is called wind. The erosional, transportational and depositional action of wind is predominant in arid regions. This is called as Aeolian Process.

Erosional Landforms of wind

Some of the erosional landforms of wind are mushroom rocks, Inselbergs and yardangs.

- ✓ **Mushroom Rock:** Rocks are made up of hard and soft layers. When a rock's bottom is soft, the sand-laden winds blow against it and wear it down. By the constant wearing down action of the wind, the bottom gets eroded away to form a mushroom like structure. This is called a mushroom or pedestal rock. Such rocks are found near Jodhpur in Rajasthan.

- ✓ **Inselberg:** Inselberg is a German term which means an island mountain. Certain hard rocks like igneous rocks are more resistant to wind action. Such isolated residual hills rising abruptly from their surroundings are termed as inselbergs. Eg. Uluru or Ayers Rock, Australia.

- ✓ **Yardang:** In arid regions, certain rocks have hard and soft layers arranged vertically. When winds blow over these rocks, the soft layers get eroded leaving irregular crests. These are called yardangs.

Depositional Landforms of wind

Deposition occurs when the speed of wind is reduced by the presence of obstacles like bushes, forests and rock structures. The sediments carried by wind get deposited on both the wind ward and leeward sides of these obstacles. Some of the depositional landforms are sand dunes, barchans and loess.

- ✓ **Sand Dune:** In deserts, during sandstorms, wind carries loads of sand. When the speed of wind decreases, huge amount of sand gets deposited. These mounds or hills of sand are called sand dunes. There are different types of sand dunes.

- ✓ **Barchan:** Barchans are isolated, crescent shaped sand dunes. They have gentle slopes on the windward side and steep slopes on the leeward side.

- ✓ **Transverse Dunes:** Transverse dunes are asymmetrical in shape. They are formed by alternate slow and fast winds that blow from the same direction.

- ✓ **Longitudinal Dunes:** Longitudinal dunes are long narrow ridges of sand, which extend in a direction parallel to the prevailing winds. These dunes are called Seifs in Sahara

- ✓ **Loess:** The term loess refers to the deposits of fine silt and porous sand over a vast region. Extensive loess deposits are found in Northern and Western China, the Pampas of Argentina, in Ukraine and in the Mississippi Valley of the United States.

- ✓ **Wave:** A steady up (crest) and down (trough) movement of surface water are called waves. Sea waves are the most powerful agents of gradation and their erosional, transportational and depositional processes are confined to a very narrow belt along coastal areas.

Erosional Land Forms of Waves

Some of the erosional landforms of sea waves are sea cliff, sea cave, arch, stack, beach, bar and spit and wave cut platform.

- ✓ **Sea Cave**: Prolonged wave attack on the base of a cliff erodes rock materials, which result in the formation of caves.

- ✓ **Sea Arch:** When two caves approach one another from either side of a headland and unite, they form an arch. (Eg.) Neil Island, Andaman and Nicobar

- ✓ **Sea Stack**: Further erosion by waves ultimately leads to the total collapse of the arch. The seaward portion of the headland will remain as a pillar of rock known as stack. Eg the Old man of Hoy in Scotland.

- ✓ **Sea Cliffs:** Sea cliffs are steep rock faces formed when sea waves dash against them. The rocks get eroded to form steep vertical walls.

- ✓ **Wave Cut Platforms:** Flat surface found at the foot of sea cliffs are called as wave cut platforms. Wave cut platform is also referred as beach, shelf, terrace and plain.

Depositional Landforms of Waves

- ✓ **Beach:**Sand and gravel are moved and deposited by waves along the shore to form beaches. This is the most dominant and constructive work of the sea. (Eg.) Juhu beach along Mumbai coast, Puri beach in Odisha and Marina beach in Chennai.

- ✓ **Bar:** A bar is an elongated deposit of sand, shingle or mud found in the sea, almost parallel to the shoreline.

- ✓ **Spit:** A spit is a ridge or embankment of sediment, attached to the land on one end and terminating in open water on the other end. Spits are common at the mouth of estuaries. Eg. Kakinada spit.

NOTE

- ❖ The disintegrated rock materials, in due course of time, are weathered further, to form soil. Soil is a mixture of disintegrated rock material and decayed organic matter called humus.
- ❖ **Tributary**– Small streams that join the main river. Eg. River Bhavani
- ❖ **Distributary**– River channels that get separated from the main river. E.g., River Kollidam.
- ❖ The highest waterfalls in the world is Angel falls (979 m) in Venezuela.
- ❖ The world's largest oxbow lake is Lake Chicot is Arkansas of USA. Lake Kanwar in Bihar (India) is Asia's largest fresh water ox bow lake.
- ❖ The Greek letter () pr△nounced delta closely resembles the triangular delta of the river Nile. The Ganga-Brahmaputra Delta is the largest delta in the world.
- ❖ The world's best known geyser is the Old Faithful geyser in the Yellowstone National Park in Wyoming, U.S.A
- ❖ **Karst Areas in India**
  - Guptadham caves - Western Bihar,
  - Robert cave and Tapkeshwar temple - Uttarakhand.
  - Pandav caves Pachmari - Madhya Pradesh,
  - Kutumsar - Bastar district in Chattisgarh,
  - Borra caves of Visakhapatnam - Andhra Pradesh.
- ❖ The World's deepest sinkhole is China's xianozhai Tienkang at 2172 feet. There are as many as 15000 Sinkholes in Illinois
- ❖ **Geo Connect:** Cave insects lose their senses of sight and develop extraordinary long antenna to compensate the loss of sight
- ❖ The thickest known deposit of loess is, 335 metre found in the loess plateau in China.
- ❖ **Major land forms**: First order land form - continents and oceans. • Second order land form – Mountains, plateaus and plains in both continents and oceans.

- **Minor Land Forms**: Third order land forms – deltas, fjords coasts, sand dunes, beaches valleys, cirques, Mushroom rocks, limestone caves.

3. Atmosphere

Earth is a unique planet where life is found. Can you imagine life on the earth without air? No. The air is essential for the survival of all forms of life. The blanket of air that surrounds the Earth is called the atmosphere. It is held close to the earth by gravitational attraction.

1. Composition of the Atmosphere

Atmosphere is a mixture of gases, water vapour and dust particles in different proportions. Nitrogen (78%) and Oxygen (21%) are permanent gases of the atmosphere. They constitute 99% of the total composition and their percentagesalways remain the same without any change. The remaining one percentage is occupied by Argon (0.93%), Carbon-dioxide, (0.03%), Neon (0.0018%), Helium (0.0005%), Ozone (0.00006%) and Hydrogen (0.00005%). Krypton, Xenon and Methane are also present in trace. Water vapour (0 - 0.4%) is also found in the atmosphere, which plays an important role in predicting weather phenomenon. The other solid particles present in the atmosphere includes dust particles, salt particles, pollen grains, smoke, soot, volcanic ashes etc.,.

Oxygen is most important for living organisms. CO2 absorbs heat and keeps the atmosphere warm by insulation and radiation. Nitrogen acts as a diluent and is chemically inactive. Ozone helps in protecting the earth from radiation. The solid particles in the atmosphere acts as nuclei on which water vapour condense to form precipitation.

2. Structure of the Atmosphere

The atmosphere is thick near the earth surface and thins out until it eventually merges with space. The five atmospheric layers are: Troposphere, stratosphere, Mesosphere, Thermosphere and Exosphere.

Troposphere:

The lowest layer of the atmosphere is the troposphere. The Greek word 'tropos'means 'turn' or change. The layer extends up to 8 kms at the poles and up to 18 kms at the Equator. The temperature decreases with increasing height. Almost all weather phenomenons take place in this layer. Hence it is called weather making layer. The upper limit of the troposphere is called as tropopause.

Stratosphere

Stratosphere lies above the troposphere. It extends to a height of about 50km above earth surface. Since this layer is a concentration of ozone molecules, it is also referred as ozonosphere. The temperature increases with increase in height in this layer. Large jet planes normally fly here. The upper limit of the stratosphere is called as stratopause.

Mesosphere

Mesosphere extends between 50km and 80km. The temperature increases with increasing height. Radio waves transmitted from earth are reflected back to earth from this layer. Most of the meteors nearing the earth get burned here. The upper most limit of the mesosphere is the mesopause.

Thermosphere

Thermosphere exists above the mesosphere. It extends to about 600 km. The composition of gases in the lower thermosphere is more or less uniform, hence it is called"Homosphere". T e upper portion of the thermosphere has uneven composition of gases and hence it is referred as "Heterosphere". Here the temperature increases with increasing height. Ionosphere is a layer of the thermosphere that contains Ions and free electrons.

Exosphere

The uppermost layer of the atmosphere is called exosphere. T is layer is extremely referred with gases and gradually merges with the outer space. T is zone is characterized by aurora Australis and aurora borealis.

Weather and Climate

Weather and climate are the terms that are related to the atmospheric conditions. Weather denotes the way the atmosphere behaves every day and climate reveals the average of weather conditions over relatively long periods of time. The difference between the two may be clearly understood with the following table.

Weather		Climate	
Partly sunny	Weather is the study of atmospheric conditions for short duration over small	Climate is the study of the average weather condition observed over a long period of time for a larger area.	Warm Climate
Windy	The weather changes very often; hour to hour and day to day	Climate is more or less permanent and remains the same always.	Monsoon
Rainy	A place can experience different types of weather	A place can experience almost the same type of climate	Wet climate

	conditions in a day. Eg. A day with hot morning can have a rainy moon.		
Chilly	Weather data is collected every day in the observatories	Climate is average of the weather data.	Extreme Climate
Stormy	Study of weather is called Meteorology	Study of climate is called Climatology	Cyclone

2. There are many factors that influence weather and climate.

- ✓ Distance from the equator
- ✓ Altitude
- ✓ Nearness to the sea
- ✓ Nature of the prevailing winds
- ✓ Mountain barrier
- ✓ Cloud cover
- ✓ Ocean currents Natural vegetation

✓ **Distance from the Equator:** The sun's rays fall vertically on the equator. The rays are inclined on the regions away from the equator and near the poles due to the spherical shape of the earth. The vertical rays heat up the earth more than the inclined rays. Thus, the places near the equator are warmer than the places which are far away from the equator.

✓ **Altitude:** Altitude refers to the height above sea level. The temperature decreases at the rate of 1° C for every 165 mt of height.This is called Normal lapse rate. So, places at the higher altitude have a lower temperature.

✓ **Nearness to the sea:** The climate of a place varies according to its nearness to the sea. Places near the coast experience equable climate due to the influence of the winds from the sea. Places located in the land, far from the sea, does not experience the moderating influence of the sea, such places experience a continental type of climate.

✓ **Nature of the Prevailing Winds:** The winds change the climate of a place based on, from where they blow. When wind blows from a warm region, it makes the place warm and cold, when blows from a colder region. The on-shore winds cause rainfall making the place cool whereas the off-shore winds bring dry weather.

✓ **Mountains barriers:** The location of the mountains influence the climate of a place. The mountain chains act as natural barrier for the wind. Sometimes they prevent the entry of cold winds into the country or the escapeof monsoon winds, thus having a great influence over the climate.

- ✓ **Cloud Cover:** Clouds reflect a large amount of radiation from the sun. This prevents the entry of heat to the earth's surface. So, in areas generally of cloudless sky like the deserts, temperature is very high. On the other hand under cloudy sky, the temperature is low.

- ✓ **Ocean currents:** The warm ocean currents raise the temperature of the nearby coastal areas, while the cold current lower the temperature of aw place.

- ✓ **Natural vegetation:** The trees release water vapour into the air and makes it cool. Thus forest areas have lower range of temperature throughout the year in contrast to non-forested areas.

3. Elements of Weather and Climate

- ✓ Temperature
- ✓ Pressure
- ✓ Wind
- ✓ Cloud
- ✓ Precipitation
- ✓ Humidity

Temperature:

Temperature is a measure of the warmth of an object expressed in terms of Celsius or Fahrenheit, measured with thermometer. Sun is the chief source of energy for the Earth.The atmosphere acts as an insulator and maintains the temperature of the earth. Without atmosphere, the earth would experience great extremes of temperatures during day and night. Some of the processes that are responsible for atmospheric heat are radiation, Conduction, Convection and Advection.

- **Heat Zones:** Based on the amount of insolation received from the sun and the heat, Earth is classified into three heat zones namely torrid zone, temperate zone and frigid zone.

- **Torrid Zone:** This largest thermal zone covers almost 50% of the earth's surface. It is located between the Tropic of Cancer (23½°N) and Tropic of Capricorn (23½°S). Torrid Zone experiences vertical sun rays almost throughout the year and is hot.

- **Temperate Zones:** The Temperate Zone stretches out between Tropic of Cancer (23½°N) andArctic Circle (66½°N) in the northern hemisphere and between Tropic of Capricorn (23½° S) and Antarctic Circle (66½° S) in the southern hemisphere. The sun's rays never fall vertical in this region. The Frigid Zone is found between Arctic Circle (66½°N) and North Pole (90° N)in the northern hemisphere and stretches out between Antarctic Circle (66½° S) and South Pole (90°S) in the southern hemisphere. The sun's rays fall slanting in this zone. These are the coldest regions of the world. The surface remains permanently frozen under thick snow.

Pressure

The atmospheric pressure is the weight exerted by air on a particular area of the earth surface. It is measured with a mercury barometer and the unit of measurement is millibar (mb).The distribution of atmospheric pressure on the surface of the earth is not uniform. It varies both vertically and horizontally.

Vertical distribution of atmospheric pressure:

Air pressure decreases with altitude. The air molecules become scattered and more widely spaced at higher altitudes. The air pressure decreases by 34 millibars per 300 metres increase in height.

Horizontal distribution of atmospheric pressure:

The horizontal distribution of atmospheric pressure in the world is not uniform. It varies from time to time and place to place due to (i) air temperature (ii) the earth's rotation (iii) presence of water vapour etc., The pressure belts along the latitudes are characterized by alternate high or low pressure belts. The pressure belts of the world are:

- Equatorial low
- Sub-tropical highs
- Sub-polar lows
- Polar highs

The Equatorial Low Pressure Belt: This belt extends from equator to 5° N and 5° S latitudes. At the equator, the earth gets heated by the vertical sun rays and in turn heats the air in contact with it. The heated air expands and raises upwards resulting in a low pressure belt. This belt is called doldrums due to virtual absence of surface winds.

The Subtropical High Pressure Belts: The sub-tropical high pressure belts extend from the tropics to about 35° latitudes in both the hemispheres. The air that raises in the equatorial region, becomes cold and heavy, and starts to descend in the Sub Tropical regions. This result in sub-tropical high pressure belts referred as the Horse latitude.

The Sub-polar Low Pressure Belts: The sub-polar low pressure belts extend between 45°N and the Arctic Circle in the northern hemisphere and between 45°S and the Antarctic Circle in the southern hemisphere. The air present in this layer moves to the sub-tropical high pressure belt and polar high pressure belt making it free from air pressure forming the sub polar low pressure belt. This is made possible by the rotation of the earth.

The Polar High Pressure Belts: Sun rays are always slanting at poles resulting in low temperatures. Because of low temperature, air compresses and its density increases. Hence, high pressure is found here. Winds from these belts blow towards sub-polar low pressure belts.

Winds

The horizontal movement of air along the surface of the earth is called the "Wind' while the vertical movement of air is a called an "Air Current". The winds always blow from a high pressure area to a low pressure area. Wind is mostly named after the direction from which it blows. For example, the wind blowing from the east is known as the easterly wind.An "anemometer" records wind speed while a "wind vane" measures the direction of the wind. The unit of measurement is kilometre per hour or knots

Types of Winds

Winds are generally classified into the following four major types:

- Planetary winds
- Periodic winds
- Variable wind
- Local wind

- **Planetary winds**

The winds which constantly blow in the same direction throughout the year are called the planetary winds. They are also called as permanent winds or the prevailing winds. These winds include Trade winds, Westerlies and Polar Easterlies

- ✓ **Trade Winds:** Trade winds blow from the subtropical high pressure belt to the Equatorial low pressure belt in both the hemispheres. They blow with great regularity, force and in a constant direction throughout the year. These winds were very helpful to traders who depended on the winds while sailing in the seas. And so, they are named as Trade winds. As they travel over vast oceans, they collect more moisture and bring heavy rainfall to the East Coast of the continents of the tropics. As they move westwards, they become dry and do not give rainfall.

- ✓ **Westerlies:** Westerlies are the permanent winds that blow from the tropical high pressure belt to the sub polar low pressure belt in both the hemispheres. They blow from South West to North East in the northern hemisphere and North West to South East in the southern hemisphere. The velocity of westerlies become so vigorous and fast to be called Roaring Forties at 400, Furious Fifties at 500 and Screaming Sixties at 600 latitudes.

- ✓ **Polar Easterlies:** Polar easterlies are cold and dry polar winds that blow from the polar highpressure belt to the sub polar low pressure belt. These are weak winds blowing from North East direction in the Northern Hemisphere and South East direction in the Southern Hemisphere.

- **Periodic winds:**

The periodic winds are the seasonal winds that change their direction periodically.These winds are caused by the differential heating of land and ocean.Winds which reverse their direction with the change of seasons are called monsoons. A tropical Monsoon wind of Indian subcontinent is a best example.

- **Variable winds:**

The disturbance and the changes in the local weather cause variations in the prevailing winds. These winds are known as the variable winds. Variable winds usually end up with the development of cyclones, anticyclones and storms.

✓ **Cyclones:**The term cyclone is a Greek word meaning "coil of a snake". Cyclones are centres of low pressure where, winds from the surrounding high pressure area converge towards the centre in a spiral form. Due to the rotation of the earth, the cyclonic winds in the northern hemisphere move in anti-clock wise direction, where as they move in clockwise direction in the southern hemisphere.Cyclones can be classified into: 1. Tropical cyclones, 2. Temperate cyclones, 3. Extra tropical cyclones

- **Tropical cyclones:** Tropical cyclones develop in the Inter tropical convergence zone [ITCZ]. They are formed due to the differential heating of land and sea.Tropical cyclones are known as 'cyclones' in Indian ocean, 'typhoons' in the western pacific ocean, 'hurricanes' in the Atlantic and eastern Pacific ocean, 'Baguio's' in Philippines and 'willy willy' in Australia. Tropical cyclones often cause heavy loss of life and property on the coasts and become weak after reaching the landmasses.

- **Temperate cyclones:** Temperate cyclones are formed along a front where hot and cold air masses meet in mid-latitudes between 35° and 65°N and S. Temperate cyclones do not become weak like the tropical cyclones on reaching the land. Temperate cyclone commonly occurs over the North Atlantic Ocean, North West Europe, Mediterranean basin. Mediterranean basin's temperate cyclones extend up to Russia and India in winter. In India it is as called western disturbances.

- **Extra tropical cyclones:** Extra tropical cyclones occur in the latitudes between 30° and 60° in both the hemispheres. They are also called as mid-latitude cyclones. They collect energy from temperature differences which are found in higher latitudes. Extra tropical cyclones produce mild showers to heavy gales, thunderstorms, blizzards, and tornadoes.

✓ **Anticyclones:** Anticyclones are the opposite of cyclones. Here an area of high pressure region is found in the centre surrounded by low pressure on all sides. The wind from the high pressure region move outwards to the low

pressure regions in a spiral form. Anticyclones are often accompanied by cold and heat waves.

Cyclonic occurrences in Tamil Nadu						
Year	**Cyclone Name**	**District**	**Atmospheric Pressure** (in millibars)	**Wind Speed** (km/h)	**Fatalities** (in numbers)	**Property loss(**M-Million G-Billion)
2010	**JAL**	Chennai	988	100	78	1.73M
2011	**THANE**	Cuddalore	972	140	48	235M
2012	**NILAM**	Mahapalipuram & Chennai	992	85	75	56.7M
2013	**MADI**	Chennai	986	120	323	1.5G
2016	**ROANU**	Nagapattinam & Chennai	983	85	22	2.0G
2016	**KYANI**	Chennai	997	85	-	-
2016	**NADA**	Chennai	1000	75	-	-
2016	**VARDAH**	Chennai	982	130	38	5.1G
2017	**OCKHI**	Kanyakumari	975	155	245	5.07G

- **Local Winds:**

Local winds are the winds that blow only in a particular locality for a short period of time, the effect of these local winds are experienced only in that particular area.They are mostly seasonal and have local names like....

- ✓ Foehn (Alps-Europe)
- ✓ Sirocco (North coast of Africa)
- ✓ Chinook (Rockies-North America)
- ✓ Loo (Thar Desert- India)
- ✓ Mistral (Mediterranean sea in France)
- ✓ Bora (Mediterranean sea in Italy)

5. Clouds

Large amount of water evaporates each day from the surface of the sea. This is the principal source of atmospheric moisture. Cool moisture laden air, gets collected around particles like dust, salt content from the sea, smoke etc., and forms clouds. Sometimes, mixing of warmer and cooler air also produces clouds. A visible mass of condensed water vapour floating in the air above the ground level is called a cloud. The three layers of atmosphere such as troposphere, stratosphere and mesosphere are specific locations of clouds. According to their height, clouds are classified into the following types 1. High clouds (6-20km Height), 2.Middle clouds (2.5km-6km Height), 3.Low clouds (ground surface to 25 km height. These major types of clouds are further divided into different types on the basis of shape and structure.

High clouds

- **Cirrus:** Detached clouds in the form of white delicate fibrous silky filaments formed at the high sky (8000 meters to 12000 meters) are called Cirrus clouds. These clouds are dry and do not give rainfall.
- **Cirro-cumulus**: White patched, sheet or layer like clouds composed of ice crystals.
- **Cirro-stratus:** Smooth milky transparent whitish clouds composed of tiny ice crystals.

Middle clouds

- **Alto-stratus:** Thin sheets of grey or blue coloured clouds in uniform appearance. consisting of frozen water droplets
- **Alto-cumulus:** Clouds fitted closely together in parallel bands, called as 'Sheep clouds' or wool pack clouds.
- **Nimbo stratus:** These are clouds of dark colour very close to the ground surface associated with rain, snow or sleet.

Low clouds

- **Strato-cumulus**: Grey or whitish layer of non-fibrous low clouds found inrounded patches at an height of 2500 to 3000 metres, associated with fair or clear weather
- **Stratus**: Dense, low lying fog-like clouds associated with rain or snow
- **Cumulus**:- Dome-shaped with a flat base often resembling a cauliflower, associated with fair weather
- **Cumulo-nimbus**:- Fluffy thick towering thunderstorm cloud capable of producing heavy rain, snow, hailstorm or tornadoes

Precipitation

Falling down of condensed water vapour in different forms is called Precipitation. When the dew point is reached in the cloud water droplets become saturated and start to fall. Hence, they fall on the earth as Precipitation. The climatic conditions/ factors influencing the forms of precipitation mainly are:

- Temperature.
- Altitude
- Cloud type.
- Atmospheric conditions.
- Precipitation process.

The main forms of precipitation include drizzle, rain, sleet, snow, hail etc.

- **Drizzle:** Falling of numerous uniform minute droplets of water with diameter of less than 0.5 is called a drizzle.mm from low clouds. Sometimes drizzles are combined with fog and hence reduce visibility.

- **Rain:** Rain is the most widespread and important form of precipitation in places having temperature above the freezing point. It occurs only when there is abundantmoisture in the air. The diameter of a rain drop is more than 5mm.

- **Sleet:** Sleet refers to a precipitation, in the form of pellets made up of transparent and translucent ice. This precipitation is a mixture of snow and rain
- **Snow:** Snow is formed when condensation occurs below freezing point. It is the precipitation of opaque and semi opaque ice crystals. When these ice crystals collide and stick together, it becomes snowflakes.

- **Hails:** Hails are chunks of ice (greater than 2cm in diameter) falling from the sky, during a rainstorm or thunderstorm.Hailstones are a form of solid precipitation where small pieces of ice fall downwards. These are destructive and dreaded forms of solid precipitation because they destroy agricultural crops and human lives.

Rainfall

Rainfall is the most predominant type of Precipitation. Moisture laden air masses raise upwards, forms clouds and bringrainfall. Based on the mechanisms of raising the air, there are three types of rainfall.

- Convectional rainfall
- Frontal or cyclonic rainfall
- Orographic rainfall.

- **Convectional rainfall:** Earth surface is intensely heated through solar radiation during the day time. When the air near the earth surface is heated, it rises and expands. This heating results is the formation of convectional air currents. Thus the ascending moist air cools, condenses and results in convectional rainfall. Convectional rainfall occurs regularly in the equatorial region in the evenings. It is also experienced in tropical, sub-tropical and temperate regions in the summer months and on warmer days.

- **Cyclonic rainfall:** Cyclonic precipitation occurs during cyclones when air masses are made to converge and move upward so that adiabatic cooling occurs. Cyclonic rainfall occurs in tropical as well as temperate regions. When warm and cold air masses converge,condensation and precipitation takes place on the boundary between warm and cold air masses called as Frontal rainfall.

- **Orographic rainfall** Orographic rainfall, also called relief rainfall, is caused when air is forced to rise against a high mountain. The mountain barriers lying across the direction of air flow, force the moisture laden air rise along the mountain slope. This results in the cooling of the air, which leads to the formation of clouds and rain. This rainfallis called Orographic rainfall. The side of the mountain facing the wind is called the windward side and receives heavy rainfall. It is called the rainfed region. The other

side of the mountain that does not face the wind is called the leeward side and receives less rainfall becomes rain shadow region.

Humidity:

Humidity is an important aspect of the atmosphere because it affects both weather and climate. The amount of water vapour present in the atmosphere is referred to as humidity. Humidity of the atmosphere is high when it has large quantities of water vapour. The amount of water vapour in the atmosphere is called absolute humidity. The ratio between the amount of water vapour in the atmosphere and the amount of watervapour it can hold is relative humidity Hot air can hold more water vapour then cold air. Relative humidity increases when air gets cold and decreases when air gets heated up.

NOTE

- In 1772 CE Daniel Rutherford discovered Nitrogen in atmosphere. In 1774 Joseph priestly discovered oxygen in atmosphere
- Magnetosphere lies beyond the exosphere. It is the earth's magnetic belt, where proton and electrons, coming out from the sun are trapped by the earth. The magnetic field extends to around 64,000 km above the Earth.
- Auroras are cosmic glowing lights produced by a stream of electrons discharged from the Sun's surface due to magnetic storms that are seen as unique multi-coloured fireworks hanging in the polar sky during midnight
- During the day, the land masses get heated more rapidly than the oceans. Heated air ascends and this causes low pressure on the adjoining ocean. Therefore, the wind blows from ocean to land in the afternoon. This is called sea breeze. **Sea breeze** helps in reducing the temperature of the coastal region especially during the summer season. During the night, the land cools more rapidly than the ocean. Cool air sinks and forms high pressure. The wind blows from land to sea during the night, this is called **land breeze**.
- The windward is the side of a mountain which faces the prevailing wind. It receives heavy rainfall. The leeward side of the mountain is the side sheltered from the wind. It receives very less rainfall.
- Heat is the energy which makes objects hot, while temperature measures the intensity of heat.
  - The amount of heat received from the sun in the form of short waves is called Insolation or Incoming Solar Radiation.
  - The outgoing heat from the earth to space in the form of long waves is called terrestrial radiation. This is also called as re-radiation
  - Albedo is the fraction of solar energy reflected from the earth back into space without reaching or heating the earth surface.
  - There is a balance between insolation and radiation. This balance is termed as a heat budget of the earth.
  - Isotherms are imaginary lines drawn on maps, connecting points that have equal

temperatures. Temperature varies from place to place, season to season and continent to continent. The average global surface temperature is about 13 °C.

- **Conduction** is the transfer of heat from hot body to a cold body through contact.
- **Convection** is transfer of heat by movement or circulation of air in a mass.
- **Advection** is the transfer of heat through the horizontal movement of air.
- An isobar is an imaginary line drawn through places having equal atmospheric pressure reduced to sea level.
- At the top of Mount Everest (elevation 8848m), the air pressure is only about one third the pressure at sea level. When we fly in aircraft or travel fast on road to hill stations, our ears pop as they adjust to a rapid change in pressure when ascending or descending.
- **ITCZ and Doldrums:** The Inter Tropical Convergence Zone (ITCZ) is the belt of converging winds and rising air encircling Earth near the Equator. Doldrums (the zone of calm) lies in the equatorial region with calms, light unpredictable winds and sudden cyclones
- **HORSE LATITUDE:** In olden days vessels with cargo of horses passing through sub-tropical high pressure belts found difficulty in sailing under calm conditions. With little water and food left for the humans, sailors used to throw the horses in to the sea in order to make the vessels lighter. Henceforth these belts or latitudes are also called 'horse latitudes'.
- The rotation of the Earth causes deflection of winds from their original path, called the "Coriolis effect". Winds are deflected to the right in the northen hemisphere and to the left in the southern hemisphere which is known as "Ferrel's law". This was profounded by William Ferrel. He used "Coriolis force" named after G.G Coriolis (1792-1843) for proving Ferrel's Law
- **Super Cyclone**: A violent cyclone that hit Odisha, on Friday, 29 October 1999, was one of the most devastating and strongest storm to hit the Indian coast. Winds of up to 260 kph raged for over 36 hours. The winds caused a seven-metre tidal wave that swept more than 20 km inland and brought massive destruction and death to a number of coastal districts in the state of Odisha. It is estimated that more than 10 million people in 12 coastal belt districts were affected by the cyclone. More than 10,000 people lost their lives.
- A front is the boundary separating warm and cold air masses. One type of airmass is usually denser than the other, with different temperatures and humidity. This meeting of airmass causes rain, snow, cold days, hot days, and windy days.
- Deliberations for naming cyclones in the Indian ocean region began in 2000 and a formula was agreed upon in 2004. Eight countries in the region Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Srilanka, and Thailand contributed a set of names which our assigned sequentially whenever a cyclonic storm develops.
- During sunset cirrus clouds look colourful hence they are called as "Mare's Tails".
- The only sphere which contains all clouds in the atmosphere is troposphere
- Any thunderstorm which is associated with fall of hail stones is known as hailstorm. Hailstorm is one of the most feared weather phenomenon because it has the potential to destroy plant, trees, crops, animals and human life.
- Mawsynram is the wettest place of India as it is located in the windward side of the Purvachal hills, whereas Shillong lies on the leeward side and thus receives

less rainfall. This is the same, in the case of Mumbai and Pune.

- Absolute humidity is expressed in terms of grams of water vapour present per cubic metre of air. Relative humidity is expressed in percentage.
- When the relative humidity of the air is 100%, the air is said to be saturated. Saturated air will not absorb any more water vapour. The temperature at which air gets saturated is called dew point. Humidity of the atmosphere is measured by the wet and dry bulb thermometer also called the Hygrometer

4. Hydrosphere

One of the most indispensable natural resources on earth is water. The Earth is also called the Blue planet, as it holds water in abundance and thus stands unique among all other planets. Hydrosphere consists of water in various forms found on the earth. Over 97% of the water on the Earth's surface is confined to oceans. Less than 3% of water is held on land as glaciers, ice caps, groundwater, rivers, lakes, and also as the water vapour in air.

Hydrological Cycle

The Earth's water is not static. It is always in motion. This continuous movement of water on, above and below the earth's surface is called the Hydrological Cycle. The three major processes involved in the water cycle are evaporation, condensation and precipitation. Water changes its form constantly i.e. Ice, water and water vapour. This process happens in the blink of an eye or even over millions of years. Water resources of the Earth can be broadly divided into fresh water and salt water.

Fresh Water

Rain water is considered to be the purest form of water, as it contains very less proportion of salts when compared to the oceans and seas. Hence it is called fresh water. A major part of fresh water is found in the frozen state in the form of ice caps and glaciers. Around 1% of it is found in the liquid state as rivers, streams, lakes, ponds etc. Surface water may also penetrate through porous rocks and gets collected beneath the Earth's surface. This is called groundwater.

Oceans

The ocean is a continuous body of salt water that forms the major part of hydrosphere. Geoscientists believe that the oceans were formed on Earth nearly three billion years ago. It is difficult to believe that in the beginning there was no water on our planet. In due course of time, when the Earth started cooling, steam escaped from the interior and entered the atmosphere to form clouds. At first, the clouds brought incessant rains. The rain water filled the depressions for tens of thousands of years and eventually a super ocean was formed.

The continents and oceans are however, not evenly distributed in the northern and the southern hemispheres. The northern hemisphere holds 61% of land whereas the southern hemisphere holds 81% of water. It is because of this pattern of land and water distribution, the northern hemisphere is called as the land hemisphere and the southern hemisphere is called as the water hemisphere. Oceans and seas are considered as resource bowl of the earth because of the immense availability of food, minerals etc., Present distribution of the world's oceans and major seas are illustrated in the map.

Relief of the Ocean Floor

The ocean floor is not flat as it was believed to be in the earlier days. It comprises of many complex and varied relief as observed on the earth's surface. The ocean floor also has high mountains, deep trenches and large flat plains. These features are formed due to the tectonic, volcanic and depositional activities.

Comparative study of major oceans of the world

Ocean	Location	Average Depth(m)	Deepest Point(Below mean sea level)	Important Seas	Important Islands
Pacific Ocean	Bounded by North and South America on the east, Asia and Australia on the west and Antarctica on the South.	4,028	Challenger Deep in Mariana Trench (10,924 m)	Bering Sea, Sea of Japan , Okhotsk sea, yellow Sea, South china Sea, Coral sea	Hawali, Vancouver, Shakalin, Fiji
Atlantic Ocean	Extends from Greenland in the North to Antarctica in the South and located between North and South America in the west and Europe and Africa in the East.	3,926	Puerto Rico Trench (8,605 m)	Baltic sea, Black sea, Caribbean sea, North sea, Mediterranean sea, Norwegian sea	Canary island , New Found land, Azores, Greenland, Iceland,
Indian Ocean	Bounded by Asia in the north, Africa in the west, Australia in the east and Antarctica in the south.	3,963	Java Trench in Sunda Deep (7,258 m)	Red sea, Persian Gulf, Arabian sea, Andaman sea, bay of Bengal	Andaman and Nicobar, Islands, Lakshadweep Island, Sri Lanka, Pamban Islands
Southern Ocean	Found to the south of 60° South latitude and encircle Antarctica.	4,000 to 5,000	South Sandwich Trench (7,235 m)	Weddell sea, Amundsen sea, Davis sea, Ross sea	Trinity Islands Barry Islands, Wednesday Islands, Saddle Islands, Tasmania
Arctic Ocean	Surrounded by Europe, Asia, North America, Greenland, and by several	1,205	Fram Basin (4,665 m)	Beaufort sea, Hudson Bay, White sea,	Amsterdam Island, Monumental Islands, Hyde

	islands.				Parker Islands, Shoe Islands

The ocean basins are characterised by the following major relief features:

A. Continental shelf
B. Continental slope
C. Continental rise
D. Deep sea plain or Abyssal plain
E. Oceanic deep
F. Oceanic ridge

A. Continental Shelf: A shallow and gently sloping platform extending out from the adjoining continental land mass into the sea is called Continental Shelf. It is almost a uniform zone of sea bed with a gentle gradient. The continental shelf is of great significance for the following reasons:

- ✓ They are shallower, thus enables sunlight to penetrate through the water. This encourages abundant growth of grass, sea weeds and plankton. Hence these zones become the richest fishing grounds in the world. Eg. The Grand Banks of Newfoundland.
- ✓ The continental shelves have extensive deposits of minerals and mineral fuels. Hence, this zone becomes accessible for oil drilling and mining activities. E.g. Mumbai High in Arabian Sea.

B. Continental Slope: A steep slope which descends from the edge of the continental shelf to the deep ocean-bed is called continental slope. It forms a boundary between the Continental Crust and the oceanic crust. This zone is free from deposits as they are steep. The most important characteristic of continental slope is the presence of deep canyons and trenches. Due to the low penetration of sunlight, the slope has nearly freezing temperature. Hence aquatic life has very slow rate of metabolism.

C. Continental Rise: At the base of the continental slope is a gently sloping layer of sediments which merge into the deep-sea floor. This underwater feature found between continental slope and abyssal plains is called the continental rise. It consists of submarine fans which are similar to the alluvial fans found on land.

D. Deep Sea Plains or Abyssal Plains: The deep sea plains or abyssal plains are underwater plains found on the deep ocean floor. These plains extend from continental rise to the mid oceanic ridges. The gradient of the slope is very gentle and it appears as a uniform flat and featureless plain. These plains are usually covered by the thick layer of sediments composed of clay, silt and sand, brought by the rivers. These are often characterized by features like abyssal hills, sea mounts, guyots, coral, atoll etc.

E. Oceanic Deeps: Trenches are the deepest part of the oceans and occupy about 7% of the total relief of the ocean floor. The ocean temperature in the trench is slightly cooler than the freezing temperature. As they are sediment free, most trenches are V-shaped with steep sides. Epicentre of the great earthquakes are all found in the trenches.

F. **Oceanic Ridge:** Oceanic ridge is a continuous submarine mountain chain. They are made of young basaltic rock formed when two tectonic plates moves apart. The mid-ocean ridge is probably the most extensive single feature of the earth's topography. Two of the most well known mid- ocean ridges are the Mid-Atlantic Ridge and the East Pacific Ridge. The Mid-Atlantic Ridge is the largest unbroken oceanic ridge.

Ocean Temperature and Salinity

Like land masses, ocean waters also vary in temperature from place to place, both at the surface and at its depths. As the warming and cooling of water is slower than the land, the annual range of temperature in any part of the ocean is very much lower. The mean annual temperature of the ocean water in equatorial regions is about 21^{o} C and almost drops down to freezing point at the polar region.

The degree of concentration of salts in the sea water is called salinity. It is usually expressed in terms of parts per thousand (ppt or ‰). Salinity varies both horizontally and vertically. The influence of temperature on ocean salinity depends upon the heating up of the surface water, which varies from tropics to polar regions. When the sun heats up the surface layer of water in the tropics, the salt content is left out in the oceans after evaporation. Thus salinity is maximum at the tropics and lower at the equator and the poles.

Movement of the Ocean Water

The ocean water is dynamic. Temperature, salinity, density, external forces of the sun, moon and the winds keep the ocean waters in movement, both horizontally and vertically. Waves and currents are in horizontal motion while tides have vertical motion.

Waves:

Of all the movements of the oceans, sea waves are considered to be the strongest. Sea waves are ripples on water caused when winds blow over the sea. The height of these waves depends on the speed of wind, its duration and the direction from which they blow. Sometimes waves are also caused by tremors felt on the ocean floor. Such waves are quite destructive and called Tsunami.

Tides

- ✓ The periodic rise and fall of sea water due to the gravitational pull of the sun and moon on earth are called tides. They are classified broadly into Spring tides and Neap tides.
- ✓ When the Sun, Moon and Earth are aligned in the same line, the collective gravitation pull of the sun and moon on earth's water strengthens to form a high tide known as spring tide. Such tides always occur on full moon and new moon days.

- ✓ When the sun and the moon are at right angles, their gravitational forces work against each other, causing a low tide called neap tide. A neap tide occurs between two spring tides i.e., twice a month, when the first and last quarter moon appears.

Oceans Currents

The movement of oceanic water on the surface and at the depths in a definite direction is called ocean current. Ocean currents are in clockwise motion in the northern hemisphere and in the anti-clockwise motion in the southern hemisphere. The factors that generate ocean currents are: 1. Earth's rotation, 2. Prevailing winds and, 3. Differences in temperature and salinity of ocean water. On the basis of temperature, ocean currents are classified as warm currents and cold currents. The movement of ocean currents from the low latitudes (tropical zones) towards high latitudes (temperate and polar zones) is called warm current. Eg. Gulf Stream in Atlantic Ocean, North Equatorial Current in Pacific Ocean.

CASE STUDY Tides and Border Security Force(BSF).

The strategic role played by the Border Security Force (BSF) to guard the creek of Rann of Kutch is an enormous one. Firstly, most of the creek area gets submerged due to high tide and at times of low tide, the creek emerges out along with poisonous creatures like snakes, scorpions, etc. Even the landscape view differs in the morning and in the evening due to tidal effects twice a day. Secondly, the turbulence here in the creek area is more violent than the open sea. Thirdly, the salt marshy terrain and the humid weather conditions affect the health of the soldiers. Strong winds, scorching heat waves, high salinity of the coastal waters and mirages also affect the eyes of the soldiers. Natural factors like currents, tides, shifting sand bars and lack of permanent landmarks on the boundary, lead to great difficulty in safeguarding this sensitive area under military domain.

Distribution of Major Ocean Currents and Effects

Ocean	Name of the Current	Effects
South Atlantic Ocean	Benguela Current (Cold)	Leads to foggy conditions along the coast of Namibia. Helped in the development of Namibian & Kalahari deserts
North Atlantic	Canaries (Cold)	Influences the extension of Sahara Desert
	Gulf Stream (Warm)	Its confluence with the Labrador current produces heavy fog along the coast of Newfoundland, obstacles the navigation. Hence, Newfoundland is one of the major fishing grounds of the world.
	North Atlantic Drift	It keeps the ports at higher latitudes ice-free throughout the year. Eg. Port of

Ocean	(warm)	Rorvik (Norway), Murmansk and Severodvinsk (Russia)
	Labrador (Cold)	Its confluence with Gulf Stream creates fog and hinders navigation.
South Pacific Ocean	Peruvian / Humboldt Current (Cold)	Helped in the desertification of the Atacama desert. EL-Nino effects the weather in western & S. America. It also affects timely arrival of Indian monsoon
North Pacific Ocean	Kuroshio Current (Warm)	It plays a vital role in carrying large amount of heat to the adjacent land areas and forms cloud cover that a use rainfall.
	Oyashio /Kurile Current (Cold)	Its confluence with the Kuroshio current produces heavy fogs around Hokkaido, which become potential hazards for navigation. Hence, Hokkaido acts as the major fishing ground of the world.
	Alaska Current (Warm)	Keeps the seaports of Alaska open throughout the year.
	California Current (Cold)	Leads to foggy Conditions along the coast of California. It helped in the development of Arizona & Sonata deserts.
India Ocean	West Australian Current (Cold)	Leads to foggy conditions along the western coast of Australia. It helped in the genesis of west Australian desert.

Marine Resources

The biotic and abiotic resources found in the oceanic water and at the bottoms are called marine resources. The ocean's resources play a vital role in sustaining the needs of society. A diverse array of marine organisms is used for food, medicine, cosmetics, and a wealth of industrial applications. The world's demand for energy, minerals and water have become increasingly dependent on non-living marine resources.

Marine Resources	Biological Resources: Eg. Fishes, Plankton, sea grass, Coral etc.
	Mineral Resources: Petroleum, Natural gas, Metallic minerals, Sand, Gravel etc.
	Energy resources: Eg. Energy fuels, Tidal energy, wave Energy etc.

Conservation of Marine Resources

Oceans are the life blood of planet earth and mankind. The humankind depends on the marine resources for its survival. They are also essential for the economic prosperity, social well-being and quality of life. Oceans have extensive deposits of oil reserves. Besides a major fishing ground, it helps in generating non-conventional energy, development of many ports and harbours for trade activities. Coastal tourism also attracts people around the world, thereby contributing to the economy of many countries.

The marine environment is faced with a number of increasingly severe threats. These include loss of biodiversity, loss of habitats, contamination through dangerous substances, and the impacts of climate change. Yet the marine resources are not deteriorating, it is necessary to find better ways of managing it.

NOTE

- Finland is known as the land of thousand lakes. There are 1,87,888 lakes in Finland.
- Water table is a level below the ground, where water is found collected beneath the Earth's surface. Aquifers are porous rock strata filled with water, found below the earth's surface.
- Sylvia Earle is a famous American oceanographer . She was named as the first, 'Hero for the Planet' by Time magazine for her efforts towards marine life protections.
- Jacques-Yves Cousteau (1910-1997) was a famous French Ocean explorer, who conducted extensive under-sea investigations.
- He belonged to the information service of the French Navy, and was sent on missions to Shanghai and Japan (1935– 1938) and in the USSR (1939).
- Honours: Cross of War 1939–1945 (1945), U.S. Presidential Medal of Freedom (1985)
- A Hypsometric Curve is a graphic representation which shows the height of a certain place found on land and the height of ocean features at sea. 'Hypso' means height in Greek.
- ONGC: Oil and Natural Gas Corporation is India's largest oil and gas exploration and production company. Its latest estimate is that about 20 million tons of oil reserves are found west of Mumbai High off shore.
- Abyssal plains in the Atlantic and Indian Oceans tend to be extensive than the Pacific Ocean because, majority of the world's largest rivers empty their sediments into either Atlantic or Indian Ocean. E.g. Amazon, Ganga and Brahmaputra rivers.
- Dragon Hole is the deepest known underwater sink hole in the world. The local fishermen call it the 'eye' of the South China Sea.
- **Fathoms:** A nautical measurement of the depth of water in the ocean.
- **Isobath:** An imaginary line on a map joining the points of equal depths.
- **Isohaline:** An imaginary line on a map joining the points of equal salinity in oceans.
- The Bermuda Triangle, also called the Devil's Triangle, is a loosely defined region in the Western part of the North Atlantic Ocean, where a number of aircraft and ships are said to have disappeared. Collect recent news about this triangle and have a discussion about the same in your class room.
- The sea / ocean water does not contain calcium in great quantities. Many of the aquatic

animals with shells use the dissolved calcium in the sea water to build their protective shells.

- The energy of the falling wave water is used to turn hydro turbines to generate power. Wave energy power plants have been installed at Vizhinjam in Kerala coast and Andaman and Nicobar islands of India.
- Potential tidal energy zones of India are the Gulf of Khambhat, Gulf of Kutch and Sundarbans.
- Maritime boundary of most the Countries is fixed to be 12 nautical miles from the baseline. This was fixed by the U.N. Convention on the Law of the sea 2013 where -as Jordan and Palau have 3 nautical miles as their maritime boundary and Benin, Republic of Congo, EI Salvador, Peru and Somalia have 200 nautical miles.
- NIO(National Institute of Oceanography) was established in 1st January 1966. The headquarters of NIO is located at Dona Paula, Goa. It Conducts research and observations to understand oceanic features, Ocean engineering, marine Archaeology etc.
- The Gangetic Dolphin was declared the National Aquatic Animal in 2010. This has become an endangered species. Are the Dolphins really at risk? If so, list out the reasons.
- **The Great Barrier Reef**: The Great Barrier reef is the world's largest coral reef system composed of 2,900 individual reefs and 900 islands stretching for about 2,000 kilometres. It covers an area of about 3,50,000 km. The reef is located in the Coral sea, off the coast of Queensland,Australia. The Great Barrier Reef can be seen from the outer space. This sprawling coral reef system is one of the most biologically diverse places on the planet.Coral reefs are built by billions of tiny organisms, known as Coral polyps. CNN labelled it as one of the seven natural wonders of the world.

5. BIOSPHERE

Biosphere, the fourth sphere of the Earth, is a life supporting layer that exists on the earth's surface. This layer on earth encompasses the Lithosphere, Hydrosphere and Atmosphere. It includes flora and fauna that thrive on or near the earth's surface. The vertical range of the biosphere is approximately 20 km, which is measured from the ocean floor to the troposphere. However, most plants and animals live in a very narrow section for about 1 km above and below the Mean Sea Level (MSL). Biosphere is made up of different ecosystems and biomes. All living things, large or small, are grouped Into Species.The area in which an animal, plant or micro organism lives is called its habitat. A wide variety of plants and animals live in a particular habitat known as *biodiversity.*

Ecosystem

An ecosystem is a community, where all living organisms live and interact with one another and also with their non-living environment such as land, soil, air, water etc. Ecosystems range in size from the smallest units (Eg: bark of a tree) that can sustain life to the global ecosystem or ecosphere. (Eg: Cropland, Pond ecosystem, Forest ecosystem, Desert ecosystem etc.). Biosphere harbours all ecosystems on the earth and sustains life forms including mankind.

Components of ecosystem

An ecosystem consists of three basic components, namely

a. Abiotic components
b. Biotic components and
c. Energy component

a. Abiotic Components: Abiotic components include the non-living, inorganic, physical and chemical factors in the environment. Eg. Land, Air ,Water, Calcium, Iron etc.

b. Biotic Components: Biotic components include plants, animals and micro-organisms. Biotic components can be classified into three categories:

- **Producers**are self-nourishing components of the ecosystem. Hence they are calledAutotrophs. They are found both on land and water. Eg. Plants, Algae, Bacteria etc.
- **Consumers**are those that depend on producers, directly or indirectly. Hence they are called Heterotrophs. The common category of consumers are:
  - ✓ **Primary consumers**depend on producers for their food. They are exclusively herbivores. Eg. zebra, goat etc.
  - ✓ **Secondary consumers**are small carnivores i.e., they consume herbivores. Eg. lion, snake etc.

- ✓ **Tertiary consumers**are top carnivores that prey on both herbivores and carnivores. Eg. owl, crocodile etc.

- **Decomposers**are some organisms that are incapable of preparing its own food. They live on dead and decaying plants and animals. Hence they are called Saprotrophs. Eg. fungus, mushrooms etc.

c. Energy Components: All organisms in the biosphere use energy to work and convert one form of energy into another. The Sun is the ultimate source of energy for the biosphere as a whole. The solar energy gets transformed into other forms of energy through the various components in the ecosystem. The producers, consumers and the decomposers contribute a lot to the energy flow in an ecosystem.

Functions of an ecosystem

The living organisms form an interacting set of flora and fauna which are organized into trophic levels, food chains and food webs. The functioning of an ecosystem depends on the pattern of the energy flow, as it helps in the distribution and circulation of the organic and inorganic matter within an ecosystem. Energy flow generally takes place in a hierarchical order in an ecosystem through various levels. These levels are called trophic levels. The chain of transformation of energy from one group of organisms to another, through various trophic levels is called a food chain. A system of interlocking and interdependent food chains is called a food web.

Biodiversity

Biodiversity or biological diversity refers to a wide variety of living organisms (plants, animals and other micro-organisms) which live in a habitat. It is highly influenced by topography, climate as well as human activities. It represents the strength of the biological resources of a place on earth. In biodiversity, each species, no matter how big or small, has an important role to play in the ecosystem. It maintains the ecological balance and facilitates social benefits such as tourism, education, research etc. over an area.

Loss of biodiversity

The extinction of species (flora and fauna) due to human and natural influences is called loss of biodiversity. The biodiversity loss has a great impact on mankind and also affects land, water, air etc. Habitat destruction due to deforestation, population explosion, pollution and global warming are the major cause for loss of biodiversity. Sometimes, habitat loss is so severe or happens so quickly that it results in a species being eliminated from the planet. Scientists are still trying to decide what caused the mass extinction of dinosaurs. A healthy eco system provides clean water, pure water, enriched soil, food, raw materials, medicines etc. Hence stable biosphere has to be conserved.

Biomes

A biome is a geographically extensive ecosystem where all flora and fauna are found collectively. It is the total assemblage of plant and animal life interacting within the biosphere. Biomes are defined by abiotic factors like, relief, climate, soils and vegetation. They are classified into two broad categories, terrestrial biomes and aquatic biomes.

Terrestrial Biomes

Terrestrial biomes is a group of living organisms that live and interact with one another on land. They are mainly determined by temperature and rainfall. Some of the major terrestrial biomes of the world are A. Tropical Forest Biomes, B. Tropical Savanna Biomes, C. Desert Biomes, D. Temperate Grassland Biomes, E. Tundra Biomes

A. Tropical Forest Biomes

The tropical forest biome is comprised of several sub-biomes, including evergreen rainforest, seasonal deciduous forest etc. This biome extends between 10° N and 10° S of the Equator. Central and South America possess half of the world's tropical forests. The climate in these biomes shows little seasonal variation with high annual rainfall and relatively constant, high temperature. This unique weather condition favours thick vegetative cover. Tropical forests have the highest biodiversity and primary productivity of any of the terrestrial biomes.

The Amazon basin, Congo basin and Indonesian islands are the major regions of this biome. These regions have very dense forests and so have great economic importance. Human settlements are found scattered here. They sustain their livelihood through food gathering, fishing, lumbering and shifting cultivation. Due to the humid nature of this biome, the people get afflicted to tropical diseases like malaria, yellow fever etc. The chief trees found here are rubber, bamboo, ebony, etc. Bats, pheasants, jaguars, elephants, monkeys etc. are the important birds and animals found here.

B. Tropical Savanna (Grasslands) Biomes

Tropical grasslands are generally found between tropical forests and deserts. Tropical Savanna biomes are found between 10o to 20o N and S latitudes. These grasslands are generally flat and are found in the Sahel, south of Sahara in East Africa and in Australia. This biome is generally hot and dry and experiences moderate to low rainfall. So, the grass which grow here are tall and sharp. Hence the chief occupation of the people found here is herding. The primitive people living here are nomadic. The common animals found here are the lion, leopard, tiger, deer, zebra, giraffe etc. Flora such as Rhodes grass, red oats grass, lemon grass etc. are found in this biome.

C. Desert Biomes

Deserts are usually found on the western margins of the continents between 20° and 30° N and S latitudes. The annual rainfall is less than 25 cm in these regions. Due to the lack of rainfall and arid conditions, these regions do not possess any vegetation but have special vegetation type called Xerophytes. As the soil is sandy and saline, deserts remain agriculturally unproductive. Drought resistant thorny scrubs and bushes, palms are found here.

Tribal people who live here practice food gathering and hunting. They move their temporary settlements frequently in search of pastures. Transportation becomes very difficult here and is carried on by camels. Reptiles like snakes, lizards, scorpions etc., are most commonly found here.

D. Temperate Grassland Biomes

Temperate Grasslands are usually found in the interior of the continents and are characterized by large seasonal temperature variations, with warm summer and cold winter. The type of grassland in these regions strongly depends upon precipitation. Higher precipitation leads to tall and soft grass and lower precipitation leads to short and soft grass. These regions favour wheat cultivation. Extensive mechanised agriculture is practised due to lack of farm labour. Pastoral industry becomes the main occupation, thereby facilitating slaughtering of animals, packing of raw and processed meat, dairy products etc. The common birds and animals are grass hopper, wolf, bison, prairie dog etc.

E. Tundra Biomes

These vast lowlands are found where the ground remains frozen. Greenland, Arctic and Antarctic regions and Northern parts of Asia, Canada and Europe fall in this biome. These regions are also called Barren lands. This biome experiences long severe winter and short cool summer. Due to the prevailing of low temperature and short growing seasons, the net primary productivity is very low in tundra. People are nomadic. Hunting and fishing are their major occupations. The population here is extremely sparse and the harsh environment makes them change their settlement frequently.They live in igloos in winter and in tents during summer. Arctic moss, Arctic willow, lichens etc. grow here. Fauna like the polar bear, wolverine, reindeer, snowy owl are found here.

Aquatic Biomes

Aquatic biome is a group of living organisms that live and interact with one another and its aquatic environment for nutrients and shelter. Like terrestrial biomes, aquatic biomes are influenced by a series of abiotic factors.It is broadly classified as fresh water biomes and marine biomes.

A. Fresh water Biomes: It comprises lakes, ponds, rivers, streams, wetlands etc. It is influenced by various abiotic components such as the volume of water, water flow, composition of oxygen, temperature, etc. Humans rely on freshwater biomes for drinking water, crop irrigation, sanitation and industry. Water lily, lotus, duck weeds etc. are the

common plants found here. Trout, salmon, turtles, crocodiles etc. are the animals found here.

B. Marine Biomes: They are the largest aquatic biomes on earth. They are continuous bodies of salt water and provide a wide range of habitats for marine plants and animals. Coral reefs are a second kind of marine biomes within the ocean. Estuaries, coastal areas where salt water and fresh water mix, form a third unique marine biome. As water provides maximum mobility to marine organisms, nutrients are circulated more quickly and efficiently here than the terrestrial biomes.

Apart from animals, plants such as kelp, algae, phytoplankton etc. also grow in water. Aquatic biomes are not only important for plants and animals, but also for humans. Humans use aquatic biomes for water, food and leisure activities. Some of the threats and issues to aquatic biomes are overfishing, pollution and rise in sea level.

Difference between Aquatic and Terrestrial ecosystem

Aquatic Ecosystem	Terrestrial Ecosystem
Aquatic ecosystem exists on water covering 71% of the earth surface.	Terrestrial ecosystem exists on land covering 29% of the earth surface.
Aquatic animals use 20% of energy to obtain oxygen.	Terrestrial animals use only 1-2% of energy to obtain oxygen.
In this ecosystem there is abundant of water with limited oxygen supply.	In this ecosystem there is less availability of water, greater availability of gases and temperature fluctuation.
The small drifting photo synthetic organisms of the ocean called photo phytoplankton are regarded as the major primary producer.	The primary producer is the plants that produce food through photosynthetic process.
Aquatic environment is more stable with smaller fluctuation in temperature and other variable.	Terrestrial environment is quite unstable as the land surface is affected by great risks from external impacts.

Conservation

The biosphere extends from the deep ocean trenches to lush rain forests. People play an important role in maintaining the flow of energy in the biosphere. At the same time, the primary cause of today's loss of biodiversity is habitat alteration caused by human activities. The ever increasing population results in over exploitation of biological resources. This has an adverse impact on flora and fauna on earth. There are places on earth that are both biologically rich and deeply threatened. Hence it is man's duty to conserve and care for the earth and make it a better place to live in.

Case Study-Biosphere II

Scientists have created an artificial Biosphere called Biosphere-2, to understand the Earth which is refered as Biosphere-1.

Facts and Numbers

- ✓ Biosphere-2 covers 3.15 acres and is located in Arizona, America.
- ✓ It is 91 feet at its highest point.
- ✓ It is sealed off from earth below by 500 ton welded stainless steel liner.
- ✓ A host of instruments constantly monitors the air, soil and water.
- ✓ The 25 foot ocean contains a million gallons of salt water.
- ✓ Biosphere-2 contains five biomes - a rain forest, desert, savanna, marsh and ocean.
- ✓ It has more than three thousand species of living organisms.
- ✓ The habitat is opened for public tours. (To visit biosphere-2 log on to www.biosphere2.org)

Gulf of Mannar – Marine Treasure

- ✓ **Location:** Lies between the southeastern tip of India and the west coast of Sri Lanka, in the Coromandel Coast region.
- ✓ **Marine National Park**: The gulf of Mannar Marine National Park is a protected area consisting of 21 Small Island and adjacent coral reefs in the Gulf of Mannar in the Indian Ocean.
- ✓ **History:** Gulf of Manner was declared as National park in 1986. Later deckared as a biosphere reserve in 1989.
- ✓ **Flora**: They consist of species belonging to the mangrove, Rhizophora, Avicennia, Bruguiera, Ceriops and Lumnitzera genus.
- ✓ **Fauna:** Indo – Pacific bottlenose dolphin, Common dolphin, Melon-headed whale, and critically endangered whale species.

6. Man and Environment

Early man depended entirely on nature for food, clothing and shelter. Man has enjoyed a dominant position over the other living organisms around him because of his erect posture, hands and intelligence. From the paleolithic period to the neolithic period, man has invented and developed the wheel, fire, tools and patterns of agriculture and housing to his comfort, which led him to improve the standard of living making himself technologically advanced. Thus, modern man modified the environment where he multiplied in numbers to increase population and has always extended his territories, leading to the exploitation of natural resources.

Classification of Environment: Environment is generally classified as

a. Natural environment
b. Human environment and
c. Man made environment

a. Natural environment: Earlier, we have learnt about the natural components of environment such as lithosphere, atmosphere, hydrosphere and biosphere. In this chapter, we will study about the human and man-made components in a detailed manner.

b. Human Environment: Human environment is defined as the interaction between man as an individual, with his family, occupation and society. It is also related to various cultural aspects such as education, religion, economics and politics.

c. Man-made environment: Man-made environment has been created by man himself for the purpose of fulfilling his needs and to make his life more convenient and easy. For example, building, transport, park, industrie, monument, etc. To bring an equilibrium between man and the environment, man has to study the distribution of population, availability of resources, development in technology, alternate means of fulfilling the increasing demand created by the growing population and other man-made features.

Population

Can you imagine a world without human beings? Humanbeings are important to develop the economy and society. The Latin word 'populus' means 'people'. Population is the total number of people living together in a particular place at the given point of time.

Population Growth

'It is easy to add but difficult to maintain'

Population is a dynamic phenomenon where the number, distribution and composition are constantly changing. Human population increases as babies are born and decreases as people die. For most of human history, births have only slightly exceeded deaths every year. As a result, human population grow slowly. About the time of Industrial Revolution, it began to increase rapidly.

Natural increaseof population is the difference between the birth rate and death rate. In fact population is always increasing but only in very rare cases it may decrease through natural or man-made disasters such as famine, landslides, earthquakes, tsunami, epidemics, extreme weather conditions and war.

Population changerefers to an increase or decrease in the population of an area influenced by the number of births, deaths and migration. The population of the world doubled from 500 million in 1650 to 1000 million in1850.The projected population for 2025 and 2050 is about 8 billion and 9 billion respectively.

Population growthrefers to an increase in the number of people who reside in a particular area during a particular period. Population increases when there are more births and immigration. It decreases when there are more deaths and emigration. Population growth, can be calculated asPopulation growth = (Birth rate + Immigration) - (Death rate + Emigration).

The important features associated with the population studies in Tamil Nadu are as follows:

S. No	Term	Definition	Data for Tamil Nadu
1.	Birth Rate	Indicates the number of live births per 1000 people in a year	15.4% (2014)
2.	Population Growth	The average annual growth of population	15.6% (2011)
3.	Population Density	The average number of people per square kilometer	555/ Km2 (2011)
4.	Total Fertility Rate	The average number of children born per woman during her child bearing years (usually ages 15 to 44)	1.6 Birth Per Woman (2016)
5.	Infant Mortality	The number of deaths under one year of age for every 1000 live births in a year	17 per 1000 live births (2016)
6.	Life Expectancy at Birth	The average number of years an individual is expected to live	70.6 years (2010-14)
7.	Literacy Rate	The percentage of people in a given population who can read and write a language	80.09% (2011)

8.	Sex Ratio	The number of females for 1000 males in a given population	996:1000 (2011)

Distribution of Population

Population distribution refers to the way in which people are spread out across the earth's surface. The world population is not uniformly distributed, owing to the following factors.

A. **Physical Factors**: Physical factors include temperature, rainfall, soil, relief, water, and natural vegetation, distribution of minerals and availability of energy resources.
B. **Historical Factors**: Regions with historical importance (river valley civilizations), war and constant invasions fall under historical factors responsible for population distribution.

Density of population

Density of population refers to the number of people living per square kilometer. An area is said to be sparsely populated when it has a large area with less number of people. Similarly, smaller the area with a large number of people, it is said to be densely populated.

$$\text{Population Density} = \frac{\text{Total Population}}{\text{Total land area}}$$

The world's population density is divided into three main groups.

- Areas of high density (above 50 people per sq.km) - East Asia, South Asia, North West Europe & Eastern North America.
- Areas of moderate density (10 to 50 people per sq.km) - The sub tropical regions like Angola, Congo, Nigeria and Zambia in Africa.
- Areas of low density (less than 10 people per sq.km) - Central Africa, Western Australia, Northern Russia, Canada, etc…

Migration

Migration is defined as the permanent or semi-permanent change of home of an individual or a group of people over a significant distance from their place of origin.The causes of migration may be physical (climate, drought, flood, earthquake, volcanic eruption, epidemics etc.), social inequalities, economic opportunities, technology, education, cultural clashes, war or political issues. There are two types of migration:

1. **Internal Migration:** The movement of people within a country i.e. between states, districts, villages, etc is called as Internal migration.
2. **International Migration:** The movement of people from one country to another, across international borders is called as International migration.

Push and pull factors of migration

Push factors are those factors which force people to move to new areas to live, while pull factors are those factors that attract migrants to a new location. Given below are some of the push and pull factors of migration.

Push Factors of migration	Pull factors of migration
• Insufficient jobs and few opportunities	• Better job opportunities
• Primitive conditions	• Better living conditions
• Desertification	• Fertile land
• Slavery or forced labour	• Socio economic independence
• Poor medical care	• Better health care
• Death threats	• Security
• Pollution	• Clean environment
• Poor infrastructural facilities	• Better infrastructural facilities
• Bullying	• Education
• Natural Disasters	• Living Stability
• War	• Industry
• Lack of political or religious freedom	• Political and religious freedom

Human settlements

A settlement can be described as any temporary or permanent unit area where people live, work and lead an organized life. It may be a city, town, village or other agglomeration of buildings. During the early days, man preferred tree branches, caves, pits or even rock cuts as his shelter. As days passed by, man slowly learnt the art of domesticating animals and cultivating food crops. The evolution of farming took place along four major river basins i.e. the Nile, Indus, Hwang Ho, Euphrates - Tigris. Man built huts and mud houses. Slowly settlements came into existence. A settlement generally consisted of a cluster of houses, places of worship and a place of burial. Later, small settlements developed into villages. Several villages together formed a town. Bigger towns developed into cities. Settlements were formed in different shapes, sizes and locations.

Classification of settlements

On the basis of occupation, settlements may be classified as rural and urban settlements.

Rural Settlements

Any settlement where most of the people are engaged in primary activities like agriculture, forestry, mining and fishery is known as a rural settlement. Most of the world's settlements are rural, that are mostly stable and permanent. The most important and unique feature of rural settlements is the vast, open spaces with green, pollution-free environment.

Patterns of rural settlements:

- **Rectangular pattern:** Rectangular pattern of settlements are found in plain areas or valleys. The roads are rectangular and cut each other at right angles.

- **Linear pattern**: In a linear pattern, the houses are located along a road, railway line and along the edge of the river valley or along a levee.

- **Circular or semicircular pattern**: The pattern of settlement that is found around the lakes, ponds and sea coasts are called circular or semi circular pattern.

- **Star like pattern**: Where several metalled or unmetalled roads converge, star shaped settlements develop. In the star shaped settlements, houses are spread out along the sides of roads in all directions.

- **Triangular pattern:** Triangular patterns of rural settlement generally develop at the confluence of rivers.

- **T-Shaped, Y-Shaped, Cross-Shaped or Cruciform settlements**: T-shaped settlements develop at tri-junctions of the roads (T), while Y-shaped settlements emerge as the places where two roads converge with the third one. Cruciform settlements develop on the cross-roads which extend in all four directions.

- **Nebular pattern:** The arrangement of roads is almost circular which ends at the central location or nucleus of the settlement around the house of the main landlord of the village or around a mosque, temple or church.

Urban Settlements

Urban is the term related to cities and towns where people are primarily engaged in non-agricultural activities, such as secondary, tertiary and quaternary activities. The common characteristic feature of an urban unit is that they are compact, congested and liable to a large number of population. They comprise of mostly man-made structures that fulfill the requirements of a society's administrative, cultural, residential and religious functions. The factors responsible for urbanization are better employment opportunities, suitable conditions for business, education, transport, etc.

Classification of Urban Settlements

Urban centres are classified as towns, cites, metropolitan cities, mega cities, conurbation, etc., depending on the size and services available and functions rendered to it.

- **Town:** A town is generally larger than a village, but smaller than a city. It has a population of less than 1 lakh. E.g.: Arakkonam near Chennai
- **City:** Cities are much larger than towns and have a greater number of economic functions. The population in cities are estimated to be more than 1 lakh. E.g.: Coimbatore
- **Metropolitan cities**: Cities accommodating population between 10 lakhs and 50 lakhs are metropolitan cities. E.g.: Madurai
- **Megacities:** Cities with more than 50 lakh population are called Megacities. E.g.: Greater Chennai
- **Conurbation:** A conurbation is a region comprising of a number of cities, large towns and other urban areas. E.g.: Delhi conurbation

Economic Activities

Economic activities are those efforts or actions that involve production, distribution and consumption of commodities and services at all levels within a region. Types of Economic Activities

Primary Activities: Primary Activities pertain to the extraction of raw materials from the earth's surface. For example: food gathering, hunting, lumbering, fishing, cattle rearing, mining and agriculture.
Secondary Activities: Secondary Activities transform raw materials into finished goods. For example: Iron and Steel industries, automobile manufacturing etc.

Tertiary Activities: Activities which by themselves do not produce goods, but support the process of production are called tertiary activities. For example: Transport, communication, banking, storage and trade.

Quaternary Activities: The activities related to Research and Development, as well as knowledge are called Quaternary activities. For e.g. Services like consultation, education and banking,

Quinary Activities: The activities that focus on the creation, rearrangement and interpretation of new and existing ideas are called quinary activities. It includes the highest levels of decision making in a society or economy. E.g.: Senior business executives, scientists and policy makers in the Government.

Environmental Issues: Environment is the basic life support system that provides air, water, food and land to all living organisms. But human beings degrade the environment through rapid industrialization.

Human life will be at risk if they don't live in harmony with the environment. Environmental problems are not limited to the local, regional and national level, but there are several global issues. Scientific and technological revolutions has given a lot of facilities to mankind, but at the same time it is responsible for the depletion of resources. Thus, several environmental problems have emerged. Some of the environmental issues that we are going to learn are:

1. Deforestation,
2. Pollution such as air, water ,noise, etc,
3. Urbanization,
4. Fracking,
5. Waste disposal

Deforestation: Deforestation is the cutting down of trees permanently by the people to clear forests in order to make the land available for other uses.

Effects of Deforestation: Deforestation results in many effects like floods and droughts, loss of soil fertility, air pollution, extinction of species, global warming, spread of deserts, depletion of water resource, melting of ice caps and glaciers, rise in sea level and depletion of ozone layer.

The United Nations Conference on Environment and Development (UNCED) by name Earth Summit Conference held at Rio de Janeiro, Brazil, on June 1992 concluded that all member countries should reduce their emission of carbon dioxide, methane and other green house gases thought to be responsible for global warming.

Conservation of forests

i. Conservation of forests can be done through the regulation of cutting of trees.

ii. **Control over forest fire**: Through regular monitoring and controlling the movement of the people forest fire can be prevented.

iii. **Reforestation and afforestation**: Reforestation involves the replanting or regeneration of areas of forest which have previously been damaged or destroyed. Sometimes forests are able to regenerate naturally. Afforestation is the process of planting trees or sowing seeds on barren land devoid of any trees to create a forest.The term afforestation should not be confused with reforestation, which is the process of specifically planting native trees into a forest that has decreasing number of trees. While reforestation is increasing the number of trees of an existing forest, afforestation is the creation of a new forest.

iv. **Proper use of forest products**: We depend on forests for our survival from the air we breathe, to the wood we use. Besides providing habitats for animals and livelihoods for humans, forest products are one of the most essential things in our day to day life. Therefore we must use forest products properly.

v. **Sustainable forest management**: The use of forest and forest lands in a way and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill the global levels should not cause damage to other eco systems. Forest Management seeks to achieve a balance between the society's increasing demands for forest products, its benefits and the preservation of forest health and diversity too. This balance is critical to the survival of forests and to the prosperity of forest dependent communities.

Pollution

Environmental pollution occurs when pollutants contaminate the natural surroundings. Pollution disturbs the balance of our eco system affecting our normal life styles and gives rise to human illnesses and global warming. The word 'pollute' means to degrade or to make dirty. Pollution is thus, an unfavourable modification of the natural world, caused entirely or partly due to direct or indirect actions of human beings.There are many types of pollution degrading the environment. They are

1. Air pollution
2. Water pollution
3. Land pollution
4. Noise pollution
5. Light pollution

A. Air pollution

Due to some human activities or natural processes, the amount of solid wastes or concentration of gases, other than oxygen increases in air. Air thus becomes polluted and this process is called air pollution. The pollutants are generally grouped as natural and manmade. The natural pollutants are volcanic eruptions, wind erosion, pollen disposal, evaporation of organic compounds and radioactive elements etc.,

Natural air pollution does not occur in abundance and also creates a little impact on the environment. But, manmade pollutants like vehicular emission, industrial wastes, smoke from thermal power plants and refineries badly affect the environment. The main pathological effects caused by air pollutants, particularly oxides of sulphur, nitrogen and carbon-di-oxide, include respiratory disorders, jaundice, irritation of eyes and throat, headache, cancer and even death.

Ozone Depletion: Ozone layer is depleted by the pollutants like CFCs, HFCs, methyle bromide, etc. Due to the depletion of ozone layer, UV rays fall on the earth's surface, warming the earth surface and leads to impervious diseases like skin cancer, blindness, loss of plankton etc.,

Ozone layer: Ozone is a poisonous gas made up of molecules consisting of three oxygen atoms (O3). This gas is extremely rare in the atmosphere, representing just three out of every 10 million molecules. The ozone layer is not really a layer at all, but has become known as such because most ozone particles are scattered between 19 and 30 kilometre up in the earth's atmosphere, in a region called the stratosphere. Ozone layer in the atmosphere absorbs most of the harmful ultraviolet radiation from the sun. It also screens out the deadly UV-C radiation the ozone shield is this essential to protect life.

B. Water Pollution:

Water pollution is any chemical, physical or biological change in the quality of water that has a harmful effect on any living thing that drinks or uses or lives in it. The water bodies including ponds, lakes, rivers, ground water and oceans are contaminated by the chemical wastes from industries, domestic wastes and sewage etc.

Major water pollutants

a. The disease – Causing agents; bacteria, viruses, protozoa and parasitic worms that enter sewage – systems and untreated waste.
b. Oxygen demanding bacteria: Wastes that can be decomposed by oxygen requiring bacteria.
c. Water soluble inorganic pollutants: Acids, Salt and toxic metals.
d. Organic compounds: Oil, plastics and pesticides in the water.

Our role in conserving water;

1. Do not dump in or around rivers. Clean up rivers that have a lot of trash in and around them.
2. Never dispose of cooking fats and oils by pouring them down the sink.
3. In the bathroom, take short showers and draw less water for baths. When you buy a new toilet, purchase a low flow model (1.6 gallons or less per fl ush). Check your toilet for "silent" leaks by placing a little food coloring in the tank and see if it leaks into the bowl.
4. Turn off water while brushing teeth, washing, gardening and shaving.
5. Keep a gallon of drinking water in the refrigerator, rather than running the tap for cold water. Run your washing machine with a full load of clothes. Wash with warm water instead of hot water, rinse with cold water instead of warm water.

Causes of Water Pollution: Main pathological problems caused due to water pollution include diarrhoea, liver cirrhosis, lung cancer, kidney diseases, paralysis, chronic pain, bone deformities, cancer and even death and so on.

C. Land Pollution

Land pollution is contaminating the land surface of the earth through dumping of urban waste matter. It arises from the breakage of underground storage tanks, application of pesticides and percolation of contaminated surface water, oil and fuel dumping, leaching of wastes from landfills or direct discharge of industrial wastes to the soil.

Preventive Measures

1. Things used for domestic purposes can be reused and recycled.
2. Organic waste matter should be disposed off far away from the settlements.
3. Inorganic wastes can be separated, reclaimed and recycled.

D. Noise Pollution

Noise pollution is basically a problem of urban areas, industrial areas, transport areas due to bombardment, traffic etc. It has an impact on the habitat of animals migration and health of inhabitants. E.g. Chandipur Missile Launching Centre has created migration of sea birds. Hearing loss, hypertension, stress and mental illness are the major health hazards that human beings face.

The control measures of noise pollution

1. Development of green belt vegetation.
2. Installation of decibel meters along highways and in places of public gatherings.
3. Planting trees along the compound wall to protect houses.

E. Light pollution

Light pollution is an unwanted consequence of outdoor lighting and includes such effects as sky glow, light trespass and glare. It is caused by streetlights, parking lot lights, floodlights, signs, sports field lighting decorative and landscape lights. It affects the environment, energy resources, wildlife, humans and astronomy research.

Urbanization

Urbanization refers to the process of increase in urban population and urban areas in a country.

Problems of urbanization

As the town expands, it mounts more pressure on transport system, water supplies, sewage and profuse disposal. The overall development creates problems like air pollution, water pollution, traffic congestion and noise pollution etc., This disturbed environment affects the human beings as mental illness, heart troubles, breathing problems etc.

Fracking:

The modern technology applied to extract oil and gas while fracturing the rocks artificially with the use of pressurized liquid is called fracking. Fracking fluid is a mixture of water, sand and thickening agents. The first successful implementation of the process was done in 1950.Methane is one of the most important chemicals used in fracking process. It is estimated that four percent of methane escapes into the atmosphere during extraction. Methane is 25 times stronger than carbon di-oxide in terms of trapping heat. The spills of this gas is detrimental to the air quality of the surrounding fracking sites. Pollutants decrease the availability of clean air for workers and local residents.

Other Environmental Concerns

Fracking not only pollutes water and air but also pollutes the soil. The oil spills during fracking can harm the soil and the surrounding vegetation. The use of high pressure at the time of oil extraction and the storage of waste water on site may cause earthquakes.

Waste disposal

Things become waste when their purpose of consumption is over. Wastes can be classified into five types, which are commonly found around the house. These include liquid waste, solid rubbish, organic waste, recyclable rubbish and hazardous waste like e-waste.

How to dispose of waste:

- Do not litter your surroundings. Use a proper waste bin to store your wastes.
- People should practise to segregate degradable and non-degradable wastes and should dispose them in proper coloured bins. Wastage is generally classified into three types. They are

    1. Wet Waste: Which comes from the kitchen/cooking/food, etc.
    2. Dry Recyclable Waste: Such as newspapers, cardboard, packing plastics, bottles, cans, etc., should go to a different bin.
    3. Rejected Waste: Which does not belong to the above two categories, including bio waste like diapers and bandages, etc..

    Sewage sludge is produced by waste water treatment processes. Due to rapid urbanization, there has been an increase in municipal waste water. Common disposal practices of sewage should be send to sewage treatment plant through proper drainage pipes.

Electronic Waste (e-waste):

It can be defined as any electrical goods, devices or components that you no longer want or have already thrown away. For example, computers, televisions, mobiles and fax machines. This waste can take many years to break down, if at all and can contain toxic chemicals such as mercury, lead and lithium that leach into the ground and cause illness. Even short-term exposure to high levels of lead can result in vomiting and diarrhea. Instead of sending e-waste to the dump, components from electronics can be reused to make new products.

Sustainable Development

Humans on earth are facing many problems, such as pollution, climatic changes, poverty, war and uneven distribution of resources. These problems directly affect the survival of mankind. Therefore to sustain mankind, we have to educate people on what sustainable development is.In 1987, the Brundtland Commission cited the definition of sustainability.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs".For sustainable development to be achieved, it is crucial to harmonize three core elements: economic growth, social aspects and environmental protection. These elements are interconnected and are crucial for the well-being of individuals and societies. To achieve true sustainability, we need to balance the economic,social and environmental factors of sustainability in equal harmony.

Social Sustainability

The ability of a social system such as a country, family or organization to function at a defined level of social well-being and harmony is called social sustainability. Problems like war, endemic poverty, widespread injustice and low education rates are symptoms of a system in socially unsustainable. The balancing capacity of a government in maintaining peaceful existence towards other countries and at the same time providing the requirements of its citizens without affecting the environment creates social sustainability.

Economic Sustainability

The people on earth consume far more than what is their fair share.

1. The economic sustainability is successfully implemented through strong Public Distribution System.
2. Economic sustainability ensures that our economic growth maintains a healthy balance with our ecosystem.

Environmental Sustainability

Environmental sustainability is the ability of the environment to support a defined level of environmental quality and natural resource extraction rates forever to mankind. Unnecessary disturbances to the environment should be avoided whenever possible.

Why is sustainability important?

The excessive usages of natural and manmade resources deplete its availability for the future generation. We need to look after our planet, our resources and our people to ensure that we can hand over our planet to our children to live in true sustainability. Hence conservation and awareness are the two important terms that can bring sustainability to our living. When we use the word sustainability to mean maintain, it means to maintain it forever. This is because our actions have a lasting effect on the environment and we should protect it for our future generations.

How to help the value of sustainability grow among students?

1. **Lifestyle:** Your lifestyle is your choice and you can change it. For example, when you go to the grocery store, make sure you always carry a cloth bag. This way the shopkeeper does not have to give you many plastic bags.

2. **Fixing:** If your watch or a toy or a camera is broken or not working, try getting it fixed before you buy yourself a new one.

3. **Recycle:** Try and be conscious about the things around you. When you consume something, see if you can re-use it later.

4. **Needs vs Wants :** Before you buy something, ask yourself the question- do I NEED this or do I WANT it?Remember sustainability begins with you. So act locally and think globally.

Case Study

The Mangroves of Palk Bay towards Sustainable Development

The sections above have discussed environmental degradation and climate change along with the concept of sustainable development. The connection between environment protection and restoration and sustainable development has also been presented. As an example, the case of the Mangroves of Palk Bay will help demonstrate these concepts in more practical terms.

Palk Bay is the area located roughly between Kodiakkarai or Point Calimere and Rameshwaram Island in Tamil Nadu on the southeastern coast of India. Palk Bay is home to mangrove ecosystems or tidal swamps. Characterised by plants and trees that can withstand high salinity, these swamps are rich in biodiversity. The Mangrove trees

themselves, offer coastal protection by checking erosion. Erosion affects not just the coastline, but also coral reefs. The tangled roots of mangrove trees help retain and trap loose soil and thereby protect coral reefs and seaweed meadows from siltation. Coral reefs are important ecosystems in maintaining healthy fish population. Mangrove forests also help fish population by providing space which act as nurseries for juvenile fish.

In the recent decades, the mangroves of Palk Bay have been heavily degraded due to the Tsunami of 2004, land encroachment, rapid urbanisation, cattle grazing and agriculture. The degradation of mangroves resulted in the reduction of nursery space for juvenile fish, impacting fish populations in the region and as a result,the livelihood of the fishing communities of the region.

Given the scale of the problem, solutions needed to be multipronged and involve multiple stakeholders. Local communities, government and civic organisations all came together not just to conserve the remaining mangroves, but also to restore it. Saplings of native species of plants and trees are being grown, planted and cared for. Live colonies of coral from the Gulf of Mannar Biosphere Reserve are being transplanted to Palk Bay. The existing mangroves and the region are being mapped and the way land is used around the mangrove is being studied.
The local communities are actively involved in the conservation and restoration of the mangroves. Education and awareness programmes about mangrove ecosystem are being undertaken.

Along with awareness programmes, the communities are also being provided with livelihood training, so they can earn an income in more ways than just fishing. All of these efforts are on-going. The health of the mangroves are improving and as it does, the fish population will improve in quality and quantity, improving the lives of the communities. As one can see, sustainable solutions take the needs of the people into consideration and the environment because both are interconnected.

7. Mapping Skills

Map as a Tool

A map is the basic tool of a geographer. It illustrates the earth's surface clearly and effectively through a combination of drawings, words and symbols. Thus, maps form an integral part of teaching geography. A map is a location guide.

History of Mapping

The ancient Babylonians, Romans, Greeks and Egyptians were the first people to create maps. For thousands of years, most people thought that the earth was flat.
For many centuries, hand-drawn flat maps and charts assembled from information collected visually by explorers were produced. As early as 300 BC(BCE), the ancient Greeks theorized that the earth was round and discarded maps of a flat earth. Herodotus, Anaximander, Pythagoras, Eratosthenes, Ptolemy and Al Idrisi were some of the major contributors who mapped the world.

The introduction of printing press during the 12th century in China and 15th century in Europe helped to produce more maps. Spanish adventurers made maps of North America as the continent was explored during the 15th century. Gerardus Mercator from Belgium was the leading cartographer of the mid-16th century, who developed projections in map making. The uses of aerial photographs and satellite imageries stimulated map-making in the nineteenth and twentieth centuries.

The foundation for map-making in India was laid during the Vedic period. Mahabharata conceived a round world surrounded by water. Surveying and map-making were an integral part of the revenue collection procedure in the medieval period. E.g.: Sher Shah Suri's revenue maps and Rajendra Chola's land survey techniques. Today, the Survey of India produces maps at different scales for the entire country.

Maps and Cartography

Maps are drawings of an area as seen from above. A map is defined as the miniature image of the 3 dimensional earth's surface on a paper/cloth or any flat surface. Maps can show a whole or part of the world. Maps are drawn to a scale and direction. Maps have legends to explain the meaning of symbols and colours used on it. The art of map - making is called Cartography.

Components of a map

A map should include the following components namely, the title, scale, direction, grid system, projection, legend, conventional signs and symbols.

A. Title: It indicates the purpose or theme of the map. Example: India – Physical, World – Political, Tamil Nadu – Transport.

B. Scale: Scale makes it possible to reduce the size of the whole earth to show it on a piece of paper. A scale is a ratio between the actual distance on the map to the actual distance on the ground. Scales can be represented in three methods. They are the Statement, Representative Fraction (R.F) and Linear or Graphical scale methods.

Statement scale

The statement scale describes the relationship of map distance to ground distance in words, such as one centimetre to ten kilometres. It is expressed as 1cm = 10 km.

The Representative Fraction (R.F)

It describes the proportion or ratio of the map distance to ground distance. It is usually abbreviated as R.F. It is stated as 1/100000 (or) 1:100000. This means that one unit on the map represents 100,000 of the same unit on the ground. This unit may be an inch or a centimetre or any other linear measurement unit. Thus,

$$\text{Representative Fraction (R.F.)} = \frac{\text{Distance on the map}}{\text{Distance on the ground}}$$

For example:

To find the RF when the scale is 1 cm to 1km. Here, 1 cm =1 km
According to the formula, R.F=
Convert the km to cm. Therefore, 1km =100000 cm.So, RF. is 1:100000.

Linear (or) Graphical scale

In a map, a linear scale is represented by a straight line divided into equal parts (Primary and secondary) to show what these markings represent on the actual ground. This scale helps in the direct measurement of distance on the map.

C. Direction: Maps are drawn normally with north orientation. North direction in a map is always towards the North Pole of the earth. If you position yourself looking at the North Pole, on your right will be the east; your left will be the west; at your back will be south. These four main directions are called the cardinal directions. Direction is usually indicated on a map by a North-South line, with the North direction represented by an arrow head.

D. Grid System: The location of a place can be simply defined by its latitude and longitude. In normal practice, latitude is stated first and then comes the longitude. The latitude and longitude of a place can be expressed in units of degree, minutes and seconds. A grid is a set of lines with alphanumeric codes for defining a location on a

map in many topographical sheets. The lines that run horizontally from left to right of the map are known as northings, whereas, the lines that run vertically from the top to the bottom of the map are called easting's. The points at which the vertical and horizontal lines of the grid intersect are called coordinates which are identified by numbers or letters.

E. Projection : A map projection is a way of showing the spherical shaped earth on a flat piece of paper. Where does the word 'projection' come from? Imagine a clear globe with latitude and longitude lines and the outlines of the landmasses on it. Suppose there was a light bulb inside the globe. If you wrapped a piece of paper around the globe and turned on the light bulb, the outlines of the grid and landmasses would be projected onto the paper. Map projection is defined as the transformation of spherical network of latitudes and longitudes on a plane surface. Projections are drawn to maintain the shape, area and directions.

The three methods in widest use are as follows:

- Projection on the surface of a cylinder.
- Projection on to the surface of a cone**.**
- Projection directly onto a flat plane, called planar or zenithal or azimuthal projection

F. Legend: The legend of a map helps to understand the map details which are placed at the left or right corner at the bottom of the map

G. Conventional signs and symbols: A map is a global language and it needs to be drawn according to the international standards. Conventional signs and symbols are standard symbols used on a map and explained in the legend to convey a definite meaning. The topographic map contains a variety of information about physical and cultural features. These are shown by using signs and symbols in various colours so that the clarity of the map is maintained.There are three types of map symbols

- Point Symbols - buildings, dipping tanks, trigonometrical beacons
- Line Symbols - railways, roads, power lines, telephone lines
- Area Symbols - Cultivated lands, ponds, orchards and vineyards

The following colour codes are used with map symbols

1. **Brown**: Land or earth features - contour lines, eroded areas, prominent rockoutcrops, sand areas and dunes, secondaryor gravel roads
2. **Light Blue**: Water features - canals, coastlines, dams, lakes marshes,Swamps and levees, ponds, rivers and water towers.
3. **Dark Blue**: National waterways
4. **Green**: Vegetation features - cultivated fields, golf courses, natureand game reserve boundaries, orchards and vineyards,recreation grounds, woodland

5. **Black**: Construction features - roads, tracks, railways, buildings,bridges, cemeteries, communication towers, dam walls,excavations and mine dumps, telephone lines, power lines,windpumps, boundaries
6. **Red**: Construction features - national, arterial and main roads,lighthouses and marine lights
7. **Pink**: International boundaries

Classification of Maps

It is not possible to show all the data of an area on a map. The details that are to be shown may vary according to requirement. Therefore, it is essential to consider the scale and purpose while preparing maps.

Types of Maps

a. On the basis of scale, maps can be classified into:

- Large scale maps: Large amount of detail; can only show a small area.
- Small scale map: Small amount of detail; can show a large area.

b. On the basis of utility and purpose, they are classified as:

- General maps / Topographic Maps (physical and political maps)
- Thematic map (spatial variations of single phenomena)
- Special purpose maps (Braille maps for blind people, maps for neo literates, military maps, navigational charts, etc).

Topographical maps and weather maps

Topographical maps show main features like landforms, water features, forests, settlements, agricultural fields, other land use, transportation and communication networks. These maps are general purpose maps and are drawn at quite large scales. The Survey of India prepares the topographical maps in India for the entire country.A weather map is the technique of meteorologists to display all the weather data recorded at various stations of a country at a particular point of time into a compact outline map using symbols and isolines. A weather map, otherwise called a synoptic chart, helps in weather analysis and weather forecast of the country/region for the next two to three days.

Survey

Surveying is done to measure the angle, direction, area, height and distance of an object or place on the surface of the earth using instruments. Surveying techniques are used to obtain the field data and to prepare maps. A knowledge of surveying helps one in map-making, particularly in the preparation of physical maps.Geographers mainly use Chain, Prismatic compass, Plane table, Dumpy level, Abney level, Clinometre, Theodolite, Total Station and GNSS to measure the distance, angle, altitude and position of the area of survey.

Remote Sensing as a Source of Map Data

Remote Sensing refers to the observation and measurement of earthly objects without touching them. 'Remote' means far away and 'Sensing' means observing or collecting information. Remote sensing means acquiring information of things/places from a distance, using a variety of tools and methods.Remote sensing has a long history, dating back from the use of cameras carried by balloons and pigeons in the 18th and 19th centuries. During the 20th century, airborne photographs and satellite remote sensing developed swiftly.

Aerial photography

Aerial photography refers to the technique of obtaining information about places or objects or phenomena with the help of photographs taken using cameras mounted on low flying birds, balloons, helicopters, aeroplanes and drones. The aerial photographs are captured continuously with a time gap of 10-30 seconds at a fixed height. Each photo will have a slight overlap of the area in the preceding photo. By making a mosaic of all the photos excluding the overlapping areas, a stereoscopic (3D) image of the study area can be produced.Nowadays you might have seen drones being used for photography during grand occasions such as conferences, weddings, etc.

Satellite Remote Sensing

Satellite remote sensing is the science of collecting data about an object or area from artificial satellites orbiting the Earth. The term 'satellite imagery' refers to digitally transmitted images of the satellites.

Components of remote sensing

- Energy source
- Transmission path
- Target
- Sensor

Process of remote sensing

A. The EMR (Electro Magnetic Radiation) or solar radiation is the primary source of energy for remote sensing.
B. Sunlight travels from the sun through the atmosphere, before it reaches the earth surface. In the atmosphere, the sun's rays are not obstructed by any object.
C. When solar radiation falls on the earth's surface, some of its energy is absorbed. While some is transmitted through the surface, the rest is reflected. Surfaces naturally emit radiation in the form of heat. The reflected energy travels from the earth surface back to space.

D. Sensors in the satellite record the reflected and emitted radiation. Each surface/object possesses a characteristic spectral signature, a unique pattern of reflecting sunlight.
E. The energy recorded by the sensor has to be transmitted to a ground station where the data are processed into an image.
F. The processed image is interpreted either visually by human interpreters or by computer aided techniques called digital image processing to identify and distinguish between the different spectral signatures to get information about objects/places.
G. Finally, we understand and apply the extracted information in mapping the area or assist in solving the particular problem.

Satellite remote sensing	Aerial Photography
• High cost of satellite systems. Takes at least 10 years to plan, construct, test and lunch.	• Surveying can be planned and executed in a shorter time economically.
• Satellites collect large amount of data of the entire area in a short span.	• Takes more time to capture and area. Aircraft needs to fly back and forth.
• It allows global coverage and does not require permission.	• It covers a small area and needs permission from authorities.
• Satellites circle the Earth: they can repeat and revisit easily.	• Revisits or repeatability involves extra cost.
• Weather does not affect the functioning of satellites.	• Adversely affected by bad weather
• All information is digital; it can be easily integrated with software for image improvement.	• It is an analogue record, so no further improvement is possible after obtaining photographs.

Advantages of Remote sensing

- It is the only practical way to obtain data from inaccessible regions, e.g. Antarctica, Amazon forest.
- It helps in constructing cheap base maps in the absence of detailed land surveys.
- It detects the spread of natural calamities such as flood, forest fire and volcanic eruption, so that immediate rescue operations and planning can be carried out.

Disadvantages of Remote sensing

- It is difficult to prepare large scale maps from obtained satellite data.
- The technique is very expensive for small areas requiring one time analysis.

Remote sensing and Disaster Management

Remote sensing technology is highly used in disaster management to study the effects of earthquakes, tsunamis, cyclones, volcanic eruption, floods and wildfires.

Recent usage of Remote Sensing device in India and Malaysia

The whereabouts of the former Andhra Pradesh Chief Minister Y.S. Rajasekhara Reddy remained uncertain, after a helicopter carrying him went missing over a dense forest area prompting a continuing massive search operation on September 3rd, 2009. Low flying Air craft of the National Remote Sensing Agency has taken 41 imagery photographs of Nallamala forest area where the search operations were undergone to pick metal signals. ISRO processed the photographs in Hyderabad.

Overview of remote sensing application for search of missing Malaysia Airline MH370

This Boeing Commercial Airplane had disappeared on 8 March 2014 with 237 passengers onboard from Kuala Lumpur to Beijing. Numerous satellite images from diverse times, day and night, were used for the search for the missing flight. It became the most expensive search in aviation history, relying mostly on analysis of data from the Inmarsat (British satellite) to look into the airplane, flight data recorder and cockpit voice recorder, as well as the possible path. Search for oil slicks or debris or a piece of wing from MH370 with satellite image processing using ENVI software was done by thousands of volunteers.

After analyzing the 23 March 2014 satellite imagery, two weeks after MH370 disappeared, 12 objects in the ocean classifying as "probably man-made", were found to suspect the burst of the flight. The communications between Flight 370 and the satellite communication network relayed by the Inmarsat-3 F1 satellite provided significant clues to the location of Flight 370. The search goes on with no confirmed results yet. The preliminary data is retrieved from satellites like LANDSAT, CARTOSAT, OCEANSAT, etc. Fire and flood details can be extracted and delivered to relevant authorities within two hours of satellite image capture. E.g. major earthquakes in China and New Zealand, bushfire in Victoria and floods in Kerala.Dynamic phenomena such as flood, movement of wild animals, shoreline changes, finding lost ships and planes. Researchers use satellite imageries for these.

Global Navigation Satellite System (GNSS)

Have you ever booked a cab using a smart phone app? Did you see the map showing the route of your travel and movement of your vehicle on mobile phones? How is it possible to calculate the time duration of your travel?

In the 21st century, GNSS has become a part of our lives to promote the safety and convenience of transport. Global Navigation Satellite System (GNSS) is a satellite system connected with a small electronic receiver or tracker to locate, monitor and track a user's vehicle wherever in the world. It can also set up instant alerts when a driver of a vehicle speeds or deviates from a particular area. GNSS applications are used in tracking or mapping vehicles, ships and aircraft. A group of satellites (Space Segment) working with a network of ground stations (Control Segment) provide location data. The receiver (User Segment) converts satellite signals into location, speed and time data.

Examples of GNSS

- Europe's Galileo
- USA's NAVSTAR Global Positioning System (GPS)
- Russia's Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS)
- China's BeiDou Navigation Satellite System
- India's NAVIC satellite system

a. Global Positioning System (GPS)

Without the Global Positioning System (GPS) on our vehicles and mobile phones, we would feel lost. GPS is the U.S. implementation of the world's first and currently the most used Global Navigation Satellite System (GNSS) created by the U. S. Department Of Defense (DOD). It became fully operational in 1995. NAVSTAR (Navigation Satellite Timing and Ranging) is a network of 24 U.S. satellites in six different orbits in space flying 20,350 km above the surface of the Earth; each one circles the planet twice a day to provide continuous, worldwide coverage. GPS receivers now come in all shapes and sizes, Most are the size of a cellular phone. Some are handheld, others are installed in ships, planes, trucks and cars.

Advantages of GPS

- GPS technology has tremendous applications in everything from mobile phones, watches, bulldozers, shipping containers and ATMs.
- The main purpose of GPS is to help in providing accurate transport data (distance, route and direction). It helps in military searches and rescue in wars. It can work as a reliable tourist guide.
- GPS helps during accident and rescue efforts, speeding the delivery of emergency services and disaster relief.
- Weather forecasting, earthquake monitoring and environmental protection can be done effectively by using GPS.

b. Geographic Information System (GIS)

Geographic Information System is a computer-based tool for managing a large amount of data collected for a given geographic region through remote sensing, GPS and other sources. The Geographic Information System is a combination of computer hardware, software, geographic data and the personnel.

G - Geographic - A particular area
I -Information - facts in order
S -System – arrangement

GIS was first recognised in the late 1950s by Waldo Tobler and Roger Tomlinson (Canada). Prime examples of importing GIS for public welfare are Google Maps, Yahoo Maps and Google Earth. The key ingredient is location. We must have a coordinate, an

address or a distance from a known point that helps us to link the information to a location on a map. Each type of data of an area is stored as a separate 'layer' of the map. In GIS, layers may be used some times and removed according to need. Examples are hospitals, schools, water bodies, parks and ATMs. The computers can create maps showing any combination of data.

Advantages of GIS

- Maps produced by GIS analysis can be used to pinpoint problem areas.
- GIS finds its strongest use in resources management, telecommunications and urban and regional planning.
- GIS helps in planning the land-use requirements. The local government uses GIS for taxation and planning.

The hardware and software functions of a GIS include

- Data input and verification
- Compilation
- Storage
- Updating and changing
- Management and exchange
- Manipulation
- Retrieval and presentation
- Analysis and combination

BHUVAN

Bhuvan (Sanskrit for Earth) is a free internet based computer application launched by the Indian Space Research Organization (ISRO) on August 12th 2009. It enables visualization of Indian Remote Sensing (IRS) images taken over a year ago, by ISRO's seven satellites, including CartoSat-1 and CartoSat-2. Using Bhuvan connected to Internet, one can explore places of interest, scenes of events in the news or parts around the world they may never visit in person, by either entering the names of places or co-ordinates (latitudes and longitudes). Bhuvan has tremendous uses for scientists, academicians, policy makers and the general public.

Advantages

- Bhuvan, due to 3D rendering, gives the impression of moving through real space through the entire globe
- Students can use Bhuvan to understand subjects ranging from Sciences to History of places.
- It provides information on natural resources and timely information on disasters.
- Administrators use it for monitoring various developmental schemes.

Google Earth

Google Earth is a web based computer application. Google Earth is a virtual globe that renders a 3D representation of the Earth. It combines the power of Google Search with maps, satellite imageries, aerial photographs, GIS data and 3D buildings to visualize the world. Google Earth allows users to see cities and buildings looking perpendicularly down or at a tilted angle. Google Earth allows users to search for addresses of some countries, enter coordinates or simply use the mouse to browse a location. Google Earth also has Digital Elevation Model (DEM) data for many major cities. This means one can view Mount Everest or buildings in three dimensions, instead of 2D.

Do you want to locate your house using Google Earth? Follow the following steps

1. Start Google Earth by double-clicking on the Google Earth Icon or browse the icon in the 'Start' menu. This will start the program. The entire Earth (as a globe) will be shown by default.
2. Close Start-Up-Tip and start to explore and familiarize yourself with the Google Earth main menu on the top left on your screen,.
3. Windows-based: Click on 'Tools', select 'Options' and note the five tabs across the top of the 'Options' box. Mac-based: Under the Google Earth' main menu select 'Preferences'

In the '3D View' tab in the 'Terrain' box near the bottom, set 'Elevation Exaggeration' to '3'. Click 'Apply' to close the box. This will exaggerate the elevation relief by a factor of 3. Google Earth Options '3D View' tab with 'Terrain' Elevation Exaggeration circled in red.With development of such tools enabling flexible ways of viewing and interacting with geographic information, the ability of users to understand the information presented and the overall understanding of the world around us will surely progress.

NOTE

- More commonly known as the Babylonian Map of the World, the Imago Mundi is considered the oldest surviving world map. It is currently on display at the British Museum in London. It dates back to between 700 and 500 BC(BCE) and was found in a town called Sippar in Iraq. The carved map depicts Babylon at the centre. Nearby are places like Assyria and Elam, all surrounded by a "Salt Sea" forming a ring around the cities. Outside the ring, eight islands or regions are carved onto the tablet. The map is accompanied by a cuneiform text describing Babylonian mythology in the regions depicted on the stone.
- A cartographer is one who measures, analyzes and interprets geographical information to create mapsand charts for political, cultural and educational purposes.
- Anaximander was the first ancient Greek to draw a map of the known world. It is for this reason that he is considered by many to be the first map maker (the first cartographer).
- Mnemonic device or memory technique to recall cardinal directions is the sentence "Never Eat Soggy Wheaties." (North, East, South and West)

- The mainland of India extends from 8o4'N to 37o6'N latitude and from 68o7' E to 97o25' E longitude. Here, (o) is degree and (') is minutes.
- The actual shape of the Earth is termed Geoid, which is an oblate spheroid. The "azimuthal" polar projection is depicted on the United Nations flag. North America was prominent on the initial 1945 UN flag (which had the longitude line 90 degrees west pointing upwards). The following year, the map on the flag was reoriented to be more neutral by having the International Date Line (180 degrees east, lying in the middle of the Pacific Ocean) pointing upwards. The map ends at 60 degrees South latitude, meaning Antarctica does not appear.
- We operate three remote sensing organs in our body.
  - Eyes -sense of sight
  - Nose - sense of smell
  - Ear – Sense of hearing
- Felix Nadar was a French photographer, journalist, novelist and balloonist. In 1858, he became the first person to take aerial photographs. He took his first photograph in 1853 and pioneered the use of artificial lighting in photography, working in the catacombs of Paris. Around 1863, Nadar built a huge (6000 m^3) balloon named Le Géant ('The Giant').
- Remote sensing can be either passive or active. Active systems emit their own source of light energy such as RADAR, whereas passive systems depend on sunlight as energy source.
- People cannot be tracked generally by satellite or aerial photographs but they can be tracked by their mobile phone signals.
- Cyber cartography is a term that is used to define all the aspects of current state of Web and virtual mapping.
- Geographical objects in the real world are matched to program objects known as *geo objects*. Geo objects include placemarks, circles, polylines, rectangles, polygons and their collections. Place markers indicate a place on a map.

8. Disaster Management: Responding to Disasters

Case Study - Tsunami

Shortly before 8 am on 26 December 2004, the cicadas fell silent and the ground shook in dismay. The Moken, an isolated tribe on the Andaman Islands in the Indian Ocean, knew that the Laboon, the 'wave that eats people', had stirred from his ocean lair. The Moken also knew what was next: a towering wall of water washing over their island, cleansing it of all that was evil and impure. To heed the Laboon's warning signs, elders told their children, run to high ground. 'If the water recedes after an earthquake, run immediately to high ground' The tiny Andaman and Nicobar Islands were directly in the path of the tsunami generated by the magnitude 9.1 of earthquake off the coast of Sumatra. Final total put the islands' death toll at 1,879 alone with another 5,600 people missing. The islanders who had heard the stories about the Laboon or similar mythological figures survived the tsunami essentially unscathed.

Most of the casualties that occurred in the southern Nicobar Islands were outsiders, leaving them with no indigenous tsunami warning system to guide them to higher ground.So, humans have passed down stories through the ages that helped cultures to cope when disaster inevitably struck. These stories were fodder for anthropologists and social scientists, but in the past decade, geologists have begun to pay more attention to how indigenous people understood and prepared for disaster. These stories, which couched myth in metaphor, could ultimately help scientists prepare for cataclysms to come. In this lesson, you will learn about how to respond to certain disasters to become resilient. A disaster is "a catastrophe that causes great damage or loss of life and property".

Disaster Response

Disaster response entails restoring physical facilities, rehabilitation of affected population, restoration of lost livelihoods and reconstruction efforts to restore the infrastructure lost or damaged. The Response Phase focuses primarily on emergency relief: saving lives, providing first aid, restoring damaged systems (communications and transportation), meeting the basic life requirements of those impacted by disaster (food, water and shelter) and providing mental health and spiritual support and care.

Who are the first responders?

No matter how large or small, local communities are expected to provide immediate disaster response. On a daily basis, police officers, firefighters, and emergency medical technicians are a community's first responders, whether during fire, flood or acts of terrorism. Mental health professionals and the community's hospitals may also be activated in those early minutes and hours after disaster. Disaster management includes Prevention, Mitigation, Preparedness, Response and Recovery.

Disaster management involves all levels of government. Non-governmental and community based organizations play a vital role in the process. Modern disaster management goes beyond post-disaster assistance. It now includes pre-disaster planning and preparedness activities, organizational planning, training, information management, public relations and many other fields. Crisis management is important, but is only a part of the responsibility of a disaster manager.The traditional approach to disaster management has a number of phased sequences of action or a continuum. These can be represented as a disaster management cycle. We mainly focus on the way how the community should respond to disasters.

Earthquake

An earthquake is a sudden vibration of the part of the earth caused by plate movements. It occurs along the plate boundaries. The place inside the earth where an earthquake originates is focus. The point on the earth's surface above the called a focus is called an epicentre. The damage caused by the earthquake is the highest near the epicentre. The earthquake is measured by an instrument called a Seismograph. It is recorded in Richter scale. Let us now see how the communities can better respond to earthquakes.

What to do during an earthquake?

Be aware that some earthquakes are actually foreshocks and a larger earthquake might occur later. Minimize your movements to a few steps that reach a safe place nearby and stay indoors until the shaking has stopped and you are sure exiting is safe.

If indoors

DROP to the ground; take COVER by getting under a sturdy table or other piece of furniture and HOLD ON until the shaking stops. If there is no table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.
Protect yourself by staying under the lintel of an inner door, in the corner of a room, under a table or even under a bed.
Stay away from glass windows, outside doors and walls and anything that could fall (such as lighting fixtures or furniture).
Stay inside until the shaking stops and go outside.

If outdoors

1. Move away from buildings, trees, streetlights and utility wires.
2. If you are in open space, stay there until the shaking stops. The greatest danger exists directly outside buildings at exits and alongside exterior walls. Most earthquake-related casualties result due to collapsing walls, flying glass and falling objects.

If in a moving vehicle

1. Stop as quickly as safety permits. Avoid stopping near or under buildings, trees, overpasses and utility wires.
2. Proceed cautiously once the earthquake has stopped. Avoid roads, bridges or ramps that might have been damaged by the earthquake.

Tsunami

A tsunami can kill or injure people and damage or destroy buildings and infrastructure as waves come forth and recede. A tsunami is a series of enormous ocean waves caused by earthquakes, underwater landslides, volcanic eruptions or asteroids. Tsunamis can travel 700-800 km per hour, with waves 10-30 meter high. It causes flooding and disrupts transportation, power, communications, and water supply.

How to respond to Tsunami?

1. You should find out if your home, school, workplace or other frequently visited locations are in tsunami hazard areas along the sea-shore.
2. Plan evacuation routes from your home, school, workplace, or any other place you could be, where tsunamis poses a risk.
3. Use a weather radio or stay tuned to a local radio or television station to keep informed of local watches and warnings.
4. Discuss tsunamis with your family. Everyone should be aware of what to do when tsunami strikes. Discussing tsunamis ahead of time will help reduce fear and save precious time in an emergency. Review flood safety and precautionary measures with your family.

What to do after a Tsunami?

1. You should continue using a weather radio or staying tuned to a Coast Guard emergency frequency station or a local radio or television station for updated emergency information.
2. Check yourself for injuries and get first aid if necessary, before helping injured or trapped persons.
3. If someone needs to be rescued, call professionals with the right equipment to help.
4. Help people who require special assistance, like Infants, elderly people, those without transportation, large families who may need additional help in an emergency situation, people with disabilities, and the people who care for them.
5. Stay out of a building if water remains around it. Tsunami water, like floodwater, can undermine foundations, causing buildings to sink, floors to crack, or walls to collapse.
6. Check for gas leaks. If you smell gas or hear a blowing or hissing noise, open a window and get everyone outside quickly.

Riot

Though riot may seem dramatic, an angry mob can be just as dangerous and unpredictable as just about any natural disaster. Thousands of people are killed in riots all over the world each year, and these riots erupt from a number of racial, religious, economic, political, or social causes that cannot be predetermined. As per Pew Research Center analysis of 198 countries on April 11, 2015. Syria tops in riot in the world followed by Nigeria, Iraq and India.If you've found yourself in the middle of a riot, you may not be able to run away immediately, but you can take some measures to protect yourself from harm. If you want to know how to survive a riot, just follow these steps.

Surviving a Riot

At Travel Destination: What to Do

1. Keep abreast of the current news if you are in a volatile area.
2. If you come across a demonstration, don't become inquisitive, just leave the area and find another route to your intended destination.
3. Avoid any place where police or security forces action is in progress.

If caught in a riot:

1. If you find yourself caught up in a demonstration, keep to the edge of the crowd where it is safer. At the first opportunity, break away and seek refuge in a nearby building or find a suitable doorway or alley and stay there until the crowd passes.
2. When leaving the fringe of the demonstration, just walk away – don't run as this will draw attention to you.
3. In the event that you are arrested by the police/military, do not resist. Go along peacefully and contact your law advisor to help you resolve your predicament.
4. If you are caught up in the crowd, stay clear of glass shop fronts, moreover, move with the flow.
5. If shooting breaks out, drop to the ground and cover your head and neck, and lie as flat as you can.

Fire

1. Wildfires occur when vegetated areas are set alight and are particularly common during hot and dry periods. They can occur in forests, grasslands, bush and deserts, and with blowing wind, can spread rapidly.
2. Fires can lead to the destruction of buildings, wooden bridges and poles, power, transmission and telecommunication lines, warehouses containing oil products and other fuel. It causes injury to people and animals.
3. The most common causes of fires are lightning strikes, sparks during arid conditions,eruption of volcanoes and man-made fires arising from deliberate arson or accidents.

4. A side-effect of wildfires which also threatens inhabited areas is smoke. Fires create large quantities of smoke, which can be spread far by wind and poses a respiratory hazard.
5. On an average, in India, every year, about 25,000 persons die due to fires and related causes. Female accounts for about 66% of those killed in fire accidents. It is estimated that about 42 females and 21 males die every day in India due to fire.

Fire Safety Do's and Don'ts

1. Know your building's evacuation plan.
2. Evacuate calmly and quickly, whenever a fire alarm or carbon monoxide alarm sounds.
3. Before opening a door, feel it with the back of your hand. If the door is hot, do not open it.
4. If you encounter smoke during your evacuation, stay low to the floor.
5. Know the outside rally point for your building.
6. Know the locations of fire extinguishers, fire alarm pull stations and exits.

What you should do during a fire:

1. Stay calm.
2. Pull the nearest fire alarm or call 112.
3. Give your name and location of the fire. Do not hang up until the police dispatcher tells you to do so.
4. Leave the building immediately.
5. Inform others as you pass them to leave the building immediately.
6. Walk—don't run—to the nearest exit.
7. Never use elevators—an elevator may become a trap.

NOTE

- Japan is in a very active seismic area and it has the densest seismic network in the world.
- Which country actually has the most number of earthquakes? Indonesia is in a very active seismic zone also, but because it is larger than Japan, it has more earthquakes.
- Which country has the most earthquakes per unit area? This would probably be Tonga, Fiji or Indonesia, since they are all in extremely active seismic areas along subduction zones.

10TH GEOGRAPHY
1 India – Location, Relief and Drainage

Introduction

India is the seventh largest country in theworld and second largest country in Asia. Itforms a part of south Asia and is separated bythe Himalayas from the rest of the continent.India accounts for about 2.4 % of the total areaof the world with an area of 32,87,263 sq.km.many of the India states are larger than severalcountries of the world.

India's Land and Water Frontiers

India shares its 15,200 km long landfrontier with Pakistan in the west, Afghanistanin the north-west, China, Nepal and Bhutan inthe north and Bangladesh and Myanmar in theeast. India's longest border is with Bangladesh(4156 km)while the shortest border is with Afghanistan. (106 km) About 6,100 km long coastline of India is washed on three sides of the country by the Indian Ocean and its two arms namely the Arabian sea in the west and the Bay of Bengal in the east. The total length of the coast line of India including the islands is 7,516.6 km. India and Sri Lanka are separated by a narrow and shallow sea called Palk Strait.

India and the World

The Indian land mass has a central location between, the East and the West Asia. India and the southward extension of the Asian continent. The trans Indian ocean routes which connect the countries of Europe in the west and the countries of East Asia provide a strategic central location to India. Thus it helping India to establish close contact with West Asia, Africa and Europe from the western coast and with South East, east Asia from the eastern coast. India: A SubcontinentIndia along with the countries of Myanmar, Bangladesh, Pakistan, Nepal, Bhutan and Sri Lanka is called a subcontinent. This region is separated from the rest of Asia by a chain of mountains in the northwest, north and northeast and by seas in the south. This region also possesses a distinct continental characteristicsin physiography, climate, natural vegetation, minerals, human resources etc. Hence India is known as 'subcontinent'.

Location and Extent

India extends from 8°4 'N to 37°6 'N latitudes and 68°7 'E to 97°25 'E longitudes.Hence India is located of the north EasternhemisphereThe southernmost point of the countryis Pygmalion Point or Indira Point (6°45'Nlatitude) located in the Andaman and NicobarIslands. The southernmost point of main landof India is Cape Comorin (Kanyakumari).The north-south extent of India is 3,214 kmand it extends from Indira Col in Jammu andKashmir in the north to Kanyakumari in thesouth. The east-west extension is 2933 km andit stretches from Rann of Kutch (Gujarat) inthe west to Arunachal Pradesh in the east. TheTropic of Cancer (23°30' N) passes through themiddle of the country

dividing it into two halvesas northern temperate and southern tropicallands. India has been politically divided into 29states and 7 union territories for administrativeconvenience.

Indian Standard Time (IST)

The longitudinal difference between Gujarat in the west and Arunachal Pradesh in the east is about 30°. The Earth rotates through its axis around 360° in 24 hours. Thus, a difference of 1° longitude will make a difference of 4 minutes in time. The difference in longitude between Gujarat (68°7 'E) and Arunachal Pradesh (97°25 ' E) is 29°18'. Hence the difference in local time between these two places is 29°18' X 4' (minutes) = 1 hour 57 minutes 12 seconds (approximately 2 hours). Since Arunachal Pradesh is towards east, it will have sunrise about two hours earlier than the sunrise at Gujarat which is in the west. In order to avoid these differences, Indian standard time is calculated. The local time of the central meridian of India is the standard time of India. India's central meridianis 82°30' E longitude. It passes through Mirzapur and roughly bisects the country in terms of longitude. The IST is 5.30 hrs ahead of Greenwich Mean Time (GMT).

Major Physiographic Divisions of India

The majestic Himalayan peaks in the north, the beautiful beaches in the south, the great Indian desert in the west and the breathtaking natural heritage in the east make India a geographically vibrant, colourful and truly incredible country. There is a varied nature of physiographic divisions in India. Though the country has many landforms based on the major differences, it is divided into the following five physiographic divisions:

1. The Himalayan Mountains
2. The Great Northern Plains
3. The Peninsular plateau
4. The Indian Desert
5. The Coastal Plains
6. The Islands

Himalayan Mountains

The Himalayan Mountains (Northern Mountains) consist of the youngest and the loftiest mountain chains in the world because they have been formed only few millions years ago and also they were formed because of the folding of the earth crust due to tectonic activity.

It stretches for a distance of 2,500 km from the Indus gorge in the west to Brahmaputra gorge in the east. The width of the Northern Mountains varies from 500 km in Kashmir to 200 km in Arunachal Pradesh. The Pamir Knot, popularly known as the "Roof of the World"is the connecting link between the Himalayas and the high ranges of Central Asia. From the Pamir, Himalayas extend eastward in the form of an arc shape. The term "Himalaya" is derived from Sanskrit. It means "The Abode ofSnow". The Northern

Mountains that function as a great wall is grouped into three divisions. 1) The Trans-Himalayas, 2) Himalayas,3) Eastern or Purvanchal hills.

1. The Trans-Himalayas

It is also known as western Himalaya's. It lies to the north of the great Himalayanrange. It lies in Jammu and Kashmir and Tibetian plateau. As its areal extent is more in Tibet, it is also known as Tibetean Himalayas. The Trans-Himalayas are about 40 km wide in its eastern and western extremities and about 225 km wide in its central part. They contain the Tethys sediments. The rocks of this regioncontain fossils bearing marine sediments which are underlain by 'Tertiary granite'. It has partly metamorphosed sediments and constitutes the core of the Himalayan axis. The prominent ranges of Trans Himalayas are Zaskar, Ladakh, Kailash, and Karakoram.

2. The Himalayas

Peak	Country	Height in Metres
Mt. Everest	Nepal	8848
Mt. K2 or Godwin Austen	India	8611
Kanchenjunga	India	8598
Makalu	Nepal	8481
Dhaulagiri	Nepal	8172
Nanga Parbat	India	8126
Annapurna	Nepal	8078
Nanda Devi	India	7817
Kamet	India	7756
Namcha Barwa	India	7756
Gurla Mandhata	Nepal	7728

It constitutes the core part of northern mountains. It isan young fold mountain. It was formed by the movement of Angara land mass in the north and Gondwana land mass in the south. The Tethys sea found between these two land masses was uplifted by the compression and the resultant landform was the Himalayas. It consists of many ranges. The main divisions of the Himalayas are the (i) Greater Himalayas,(ii) the Lesser Himalayas and (iii)the Siwaliks

The Greater Himalayas or the Himadri

The Greater Himalayas rise abruptly like a wall north of the Lesser Himalayas. The Greater Himalayas are about 25 km wide. Its average height is about 6,000 m. The Greater Himalayas receive lesser rainfall as compared to the Lesser Himalayas and the Siwaliks. Physical weathering is less effective over the Greater Himalayas as compared to the other ranges. Almost all the lofty peaks of Himalayas are located in this range. The notable ones are Mt. Everest (8,848 m) and Kanchenjunga (8,586 m). Mt. Everest is located in Nepal and

Kanchenjunga is located between Nepal and Sikkim. This range is the most continuous of all ranges. It is region of permanent snow cover. So, it has many glaciers. Gangothri, Yamunothri and Siachen are some of them.

The Lesser Himalayas or the Himachal

It is the middle range of Himalayas. Height of this range varies from 3, 700 to 4,500 m. Its width varies upto 80 km. The major rocks of this range are slate, limestone and quartzite. This region is subjected to extensive erosion due to heavy rainfall, deforestation and urbanization. Pir Panjal, Dhauladhar and Mahabharat are the mountain ranges found in this part. Major hill stations of the Himalayas are located in this range. Shimla, Mussourie, Nainital, Almora,Ranikhet and Darjeeling are the familiar ones.

The Siwaliks or OuterHimalayas

The Siwaliks extend from Jammu andKashmir to Assam. It is partly made by the debris brought by the Himalayan rivers. The altitude varying between 900-1100 metres elevation of this range is 1300 m. The width of Siwaliks varyfrom 10 km in the east to 50 km in the west. It is the most discontinuous range. The longitudinal valleys found between the Siwaliks and the Lesser Himalayas are calledDuns in the west and Duars in the east. Theseare the ideal sites for the development of settlements in this region.

Purvanchal Hills

These are the eastern off-shoot of Himalayas. It extended in the north-eastern states of India. Most of these hills are located along the border of India and Myanmar while others are inside India. Dafla Hills, Abor Hills, Mishmi Hills, Patkai Bum Hills, Naga Hills, Manipur Hills, Mizo Hills, Tripura Hills, Mikir Hills, Garo Hills, Khasi Hills and Jaintia Hills are the hills which are collectively known as purvanchal Hills.

Importance of Himalayas

- ✓ Himalayas blocks southwest monsoon winds and causes heavy rainfall to north
- ✓ India.
- ✓ It forms a natural barrier to the subcontinent.
- ✓ It is the source for many perennial rivers like Indus, Ganges, Brahmaputra etc.
- ✓ The Northern Mountains are described as the paradise of tourists due to its natural beauty.
- ✓ Many hill stations and pilgrim centres like Amarnath, Kedarnath, Badrinath and
- ✓ Vaishnavidevi temples are situated here.
- ✓ It provides raw material for many forest based industries.
- ✓ It prevents the cold winds blowing from the central Asia and protects India from severe cold.
- ✓ Himalayas are renowned for the rich biodiversity.

Longitudinal Divisions of Himalayas

1. The Kashmir Punjab Himachal Himalayas- Located between the rivers of Indus and Sutlej.
2. The Kumaun Himalayas- Located between the rivers of Sutlej and Kali.
3. The Central-Nepal Himalayas- Located between the rivers of Kali and Tista.
4. The Assam Eastern Himalayas- Located between rivers of Tista and Dihang.

The Great Northern Plains

The fertile land extending across seven north Indian states forms the Great Northern Plains. This extensive plain lies to the south of the northern mountains. This plain is one of the most extensive stretches of the alluvium in the world and is deposited by the rivers Indus, Ganga, Brahmaputra and their tributaries. The length of the plain is about 2,400 km and the width varies from 240 to 320 km. Its width increases from east to west. It covers an area of over 7 lakh sq.km. The Great Plains of India is remarkably a homogeneous surface with an imperceptible slope. They are formed mostly by the depositional process of the Himalayan and Vindhyan rivers. These rivers deposit enormous quantity of sediments deposited along the foothills and flood plains. The important characteristics featuress of sediment deposition in the plains areas as follows.

The Bhabar Plain

This plain is made up of gravels and unassorted sediments deposited by the Himalayan rivers. The porosity of this plain is so high that most of the small streams flow over this region disappear. It lies to the south of the Siwalik from west to east (Jammu Division to Assam). Its width varies from 8 to 15 km. It is wider in the western plains (Jammu Division) than in the east (Assam). This plain is not suitable for cultivation, only big trees with large roots thrive in this region.

The Tarai Tract

It is a zone of excessive dampness, thick forests and rich wild life. This tract lies to the south of Bhabar plains. The width of this belt is 15-30 km. The Tarai is wider in the eastern parts of the Great Plains, especially in Brahmaputra Valley due to heavy rainfall. In many states, the Tarai forests have been cleared for cultivation.

The Bhangar Plains

The Bhangar represent the upland alluvial tracts of the Great Plains of India, formed by the older alluviums. The Bhangar land lies above the flood limits of the rivers. This soil is dark in colour, rich in humus content, well drained and useful for agriculture.

On the basis of deposition of sediments by various rivers and topographical characteristics, the Northern Plains of India is divided into the following four major regions:

a. Rajasthan Plains: It is located to the west of Aravalli range. It covers an area of about 1,75,000 sq.km. Rajasthan plain is formed by the deposition of the river Luni and the long vanished river Saraswathi. There are several salt lakes in Rajasthan. The Sambhar salt lake (Pushkar Lake) near Jaipur is the prominent one.

b. Punjab - Haryana Plains: It lies to the north-east of the Great Indian Desert. This plain is found over an area of about 1.75 lakh sq.km. The Punjab - Haryana plains are formed by thedeposition of the rivers Sutlej, Beas and Ravi. This plain acts as water - divide (doab). The twomajor watershed it divides are Yamuna – Sutlej and Ganga – Yamuna.

c. Ganga Plains: It extends from the Yamuna River in the west to Bangladesh in the east. The totalarea covered by this plain is about 3.75 sq.km. River Ganga and its tributaries such as Ghaghra,Gandak, Kosi, Yamuna, Chambal, Betwa etc. constitute this plain by their sediments and makea great plain in India. It is the largest plain of India. The general slope of the entire plain (upper,middle and lower Ganga plains) is towards east and south-east.

d. Brahmaputra Plains: It is located mainly in the state of Assam. It is a low - level plain located in the eastern part of the Great Plains of India and is formed by the deposits of river Brahmaputra. It covers an area of about 56,275 sq.km. These plains create alluvial fans and marshy tracts.

The Khadar Plains

The new alluvium tracts along the courses of the rivers are known as the 'Khadar' or 'Bet' lands. The Khadar tracts are enriched by fresh deposits of silt every year during rainy seasons. The Khadar land consists of sand, silt, clay and mud. It is highly fertile soil.

Delta Plains

The deltaic plain is an extension of the Khadar land. It covers about 1.9 lakh sq.km in the lower reaches of the Ganga River. It is an area of deposition as the river flows in this tract sluggishly. The deltaic plain consists mainly of old mud, new mud and marsh. In the delta region, the uplands are called 'Chars' while the marshy areas are called 'Bils'.

The Peninsular Plateaus

The plateau region lies to the south of the Great Northern Plains. This is the largest physiographic division of our country. It covers an area of about 16 lakh sq.km (about half of the total area of the country). It is an old rocky plateau region. The topography consists of a series of plateaus and hill ranges interspersed with river valleys. Aravalli hills mark the north-western boundary of the plateau region. Its northern and north-eastern boundaries are marked by the Bundelkhand upland, Kaimur and Rajmahal hills.

The Western Ghats and the Eastern Ghats mark the western and eastern boundaries respectively. The altitude of a large portion of the plateau is more than 600 m from mean sea level. The peak of Anaimudi is the highestpoint in the plateau. Its height is 2,695 m and is located in Anaimalai. The general slope of this plateau is towards east. The Great Plateau is a part of the Gondwana (very ancient one) land mass. Due to the old age, the rivers in this region attained their base level and developed broad and shallow valleys.

The river Narmada divides the plateau region of India broadly into two parts. Theregion lying to the north of the Narmada is called the Central Highlands and the region lying to the south of Narmada is called the Deccan Plateau. All the major rivers (Mahanadi, Godavari, Krishna, Kaveri etc.) lying to the south of the Vindhyas flow eastwards and fall into the Bay of Bengal. Narmada and Tapti are the two rivers situated to the south of the Vindhyas flow westward. Their movement towards west is due to the presence of a rift valley in the region.

a. Central Highlands

The Central Highlands extend between the river Narmada and the Northern Great Plains. The Aravallis form the west and north-westernedge of the Central Highlands. These hills extend from Gujarat, through Rajasthan to Delhi in the north-westerly direction for a distance of about 700 km. The height of these hills is about 1,500 m in southwest while near Delhi the height is hardly 400 m. Gurushikhar with 1,722 m is thehighest peak of this range. The Western part of the Central Highland is known as the Malwa Plateau. It lies to thesoutheast of Aravallis and to the north of Vindhyachal Range.

The rivers Chambal, Betwa and Ken drain the Malwa Plateau before they join the river Yamuna. The part of the Central Highlands which extends to the east of Malwa Plateau is known as Bundelkhand and its further extension is known as Bagelkhand. The eastern part of the Central High lands which lies in the north-eastern part of the Indian Plateau is known as Chhota-Nagpur Plateau. It covers much of Jharkhand, adjacent parts of Odisha, West Bengal, Bihar and Chhattisgarh. This region is very rich in mineral resources particularly iron ore and coal.

b. Deccan Plateau

This physiographic division is the largest part of the plateau region of India. The shape of this plateau is roughly triangular. One of the sides of this triangle is marked by the line joining Kanyakumari with Rajmahal Hills and this line passes through the Eastern Ghats. The second arm is marked by the Satpura Range, Mahadeo Hills, Maikal Range and the Rajmahal Hills. The third arm is marked by the Western Ghats. The area of this Plateau is about 7 lakh square km and the height ranges from 500 to 1000 m above sea level.

The Western Ghats forms the westernedge of the Peninsular Plateau. It runs parallel to the Arabian Sea coast. The northern part of this range is called as Sahyadris. The height of the Sahyadris increases from north to south. Anaimudi is a sort of tri-junction of the Anaimalai Range, the Cardamom Hills and the Palani Hills. Kodaikanal is a beautiful hill

resort situated on the Palani Hills. Eastern Ghats run from southwest to northeast form the eastern edge of this Plateau. This rangeis also called as Poorvadri. The EasternGhats join the Western Ghats at the Nilgiri hills, bordering Karnataka and Tamil Nadu. The Eastern Ghats are not continuous like the Western Ghats. The rivers of Mahanadi, Godavari, Krishna, Pennar and Kaveri have dissected this range at many places.

The Indian Desert

The Thar desert, also known as the Great Indian desert is a large arid region in the north western part of the Indian subcontinent that covers an area of 2,00,000 km2 and forms a natural boundary between India and Pakistan. It is the world 7th largest desert, and world 9thlargest sub tropical desert located in Western part of the India. The desert lies in the western part of the aravalli range and covers 2/3 of Rajastan state. There are two major divisions in the Thar desert. They are known as the Actual desert region (Marusthali) and the semi desert region (Bhangar). Many different types of sand dunes and salt lakes (Dhands) are seen
here.

The Coastal Plains

The Peninsula Plateau of India is flanked by narrow coastal plains of varied width from north to south, known as the Western Coastal Plains and the Eastern Coastal Plains. They were formed by the depositional action of the rivers and the erosional and depositional actions of the sea-waves. The Indian coastal plains are divided into the following two divisions: 1) The Western Coastal Plains and 2) The Eastern Coastal Plains.

1. The Western Coastal Plain

It lies between the Western Ghats and the Arabian Sea. It extends from Rann of kutchin the north to Kanyakumari in the south and its width varies from 10 to 80 km. It is mainlycharacterised by sandy beaches, coastal sand dunes, mud flats, lagoons, estuary, laterite platforms and residual hills. The northern part of the West Coastal Plain is known as Konkan Plain. The middle part of this plain is known as Kanara. The southern part of the plain is known as Malabar coast which is about 550 km long and 20-100 km wide. This part of the coast is characterized by sand dunes. Along the coast, there are numerous shallow lagoons and backwaters called Kayals and Teris. Vembanad is a famous back water lake found
in this region.

2. The Eastern Coastal Plain

It lies between the Eastern Ghats and the Bay of Bengal and, stretches along the states of West Bengal, Odisha, Andhra Pradesh and Tamil Nadu. These plains are formed by the alluvial fillings of the littoral zone by the east flowing rivers of India. The coastal plainconsists mainly of the recent alluvial deposits.This coastal plain has a regular shoreline with well-defined beaches. The coastal plain between

Mahanadi and Krishna river is known as the Northern Circars and the southern part lies between Krishna and Kaveri rivers is called Coromandal coast. The Marina beach on this coast in Chennai and it is the second longest beach in the world. Among the back water lakes of this coast, lake Chilka (Odisha) is the largest lake in India located to the southwest of the Mahanadi delta, the Kolleru Lake which lies between the deltas of Godavari and Krishna and the Pulicat Lake lies in the border of Andhra Pradesh and Tamil Nadu are the well known lakes in the east coastal plain.

The Islands

India has two major island groups namely Andaman and Nicobar and Lakshadweep. The former group consists of 572 islands and are located in Bay of Bengal, and the later one has 27 islands and are located in Arabian Sea. The islands of Andaman and Nicobar are largely tectonic and volcanic origin. India's only active volcano is found on Barren Island in Andaman and Nicobar group of Islands, while the islands of the Arabian Sea are mainly coral origin.

a) Andaman and Nicobar Islands

These islands are located in an elevated portion of the submarine mountains. Since these islands lie close to the equator, the climate remains hot and wet throughout the year and has dense forests. The area of the island group is about 8,249 sq.km. The entire group of islands is divided into two. They are Andaman in the north and the Nicobar in the south. These island groups are of great strategic importance for the country. Port Blair is the administrative capital of the Andaman and Nicobar islands. The Ten Degree Channel separates Andaman from Nicobar group. The southernmost tip, the Indira Point is a part of Nicobar Island.

b) Lakshadweep Islands

This is a small group of coral islands located off the west coast of India. It covers an area of 32 sq. km. Kavaratti is its administrative capital. Lakshadweep islands are separated from the Maldive Islands by the Eight Degree Channel. The uninhabited "Pitt Island" of this group has a bird sanctuary. Earlier, it had three divisions namely Laccadive, Minicoy and Amindivi. It was named as Lakshadweep in 1973.

c) OffshoreIslands

Besides the two group of islands, India has a number of islands along the Western Coast, Eastern Coast, in the delta region of Ganga and in the Gulf of Mannar. Many of these islands are uninhabited and are administered by the adjacent states.

Drainage System of India

A drainage system is an integrated system of tributaries and a trunk stream which collects and drains surface water into the sea, lake or some other body of water. The total

area drained by a river and its tributaries is known as a drainage basin. The drainage pattern of an area is the result of the geological structure of the respective areas. The river system provides irrigation, drinking water, navigation, power as well as grant livelihoods for a large number of population. The drainage system of India is broadly divided into two major groups on the basis of their location. They are Himalayan rivers and the Peninsular rivers.

Himalayan Rivers

These rivers are found in north India and originate from Himalayas. So, they are also called

River	
Himalayan Rivers	**Peninsular Rivers**
> Indus > Ganga > Brahmaputra	> Mahanadi > Cauvery > Godavari > Narmada > Krishna > Tapti

a. The Indus River System

The Indus River is one of the largest rivers of the world. It originates from the northern slope of the Kailash range in Tibet near Manasarovar Lake at an elevation of about 5,150 m. Its length is about 2,880 km (Only 709 km is in India). The river has a total drainage area extending 11,65,500 sq km in which 321,289 sq km areas are drained in India. The river flows through the Ladakh and Zaskar ranges and creates deep gorges. The river runs through Jammu and Kashmir, turns south near Chillar and enters Pakistan. Its major tributaries are Jhelum, Chenab (Largest tributary of Indus), Ravi, Beas and Sutlej. It enters into with the Arabian Sea.

b. The Ganga River System

The Ganga River system is the largest drainage system of India it extend over and area of 8,61,404 sq km in India. The Ganga plain is the most densely populated place in India and many towns are developed on the banks of this river. The river Ganga originates as Bhagirathi from the Gangotri Glacier in Uttar Khasi District of Uttarkhand state, at an elevation of 7,010 m. The length of the river Ganga is about 2,525 km. Its major tributaries from the north are Gomti, Gandak, Kosi and Ghaghra and from south, Yamuna (largest tributary of Ganga), Son, Chambal etc. The river Ganga is known as the River Padma in Bangladesh. The combined river of Ganga and Brahmaputra creates the World's largest delta known as Sundarbans in Bangladesh before joining the Bay of Bengal.

c. The Brahmaputra River System

The river Brahmaputra originates from the Chemayungdung Glacier of the Kailash range to the east of Lake Manasarovar in Tibet at an elevation of about 5,150 m. The total area is about 5,80,000 sq km but the drainage area lying in India is 1,94,413 sq km This river is known as Tsangpo (Purifier) in Tibet. The length of this river is about 2,900 km (900 km in India). It enters into India through a gorge in Arunachal Pradesh namely Dihang. It has many tributaries. Tista, Manas, Barak, Subansiri are some of them. This river is called as Jamuna in Bangladesh. After it joins with the river Gangain Bangladesh, the river is called as Meghna. Characteristics of Himalayan Rivers

- ✓ Originate from Himalayas
- ✓ Long and wide
- ✓ Perennial in nature
- ✓ Unsuitable for hydro power generation
- ✓ Middle and lower courses are navigable

Peninsular Rivers

The rivers in south India are called the Peninsular rivers. Most of these rivers originate from the Western Ghats. These are seasonal rivers (non–perennial). They have a large seasonal fluctuation in volume of water as they are solely fed by rain. These rivers flow in valleys with steep gradients. Based on the direction of flow, the peninsular rivers are divided into the West flowing and East flowing rivers.

East Flowing Rivers

a. Mahanadi

The river Mahanadi originates near Sihawa in Raipur district of Chattisgarh and flows through Odisha. Its length is 851 km. Seonath, Telen, Sandur and Ib are its major tributaries. The main stream of Mahanadi gets divided into several distributaries such as Paika,Birupa, Chitartala, Genguti and Nun. All thesedistributaries form the Delta of Mahanadi which is one of the largest deltas in India. The Mahanadi empties its water in Bay of Bengal.

b. Godavari

Godavari is the longest river (1,465 km) with an area of 3.13 lakh km2 among thePeninsular rivers. It is also called Vridha Ganga. It originates in Nasik district of Maharashtra, a portion of Western Ghats. It flows through the states of Telangana and Andhra Pradesh before joining Bay of Bengal. Purna, Penganga, Pranitha, Indravati, Tal and Salami are its major tributaries. The river near Rajahmundry gets divided into two Channels called Vasistha and Gautami and forms one of the largest deltas in India. Kolleru, a fresh water lake is located in the deltaic region of the Godavari.

c. Krishna

The river Krishna originates from a springat a place called Mahabaleshwar in the Western Ghats of Maharashtra. Its length is 1,400 km and an area of 2.58 lakh sq km. It is the second longest Peninsular river Bhima, Peddavagu, Musi, Koyna and Thungabhadra are the major tributaries of this river. It also flows through Andhra Pradesh and joins in Bay of Bengal, at Hamasaladeevi.

d. Kaveri

The river Kaveri originates at Talakaveri, Kudagu hills of Karnataka. Its length is 800 km. The river kaveri is called Dhakshin Gangaor Ganga of south Harangi, Hemavati, Kabini, Bhavani, Arkavathy, Noyyal, Amaravathi etc are the main tributaries of the river Kaveri. In Karnataka the river bifurcates twice, forming the sacred islands of Srirangapatnam and Sivasamudram. While entering Tamil Nadu, the Kaveri continues through a series of twisted wild gorges until it reaches Hogenakkal Falls and flows through a straight, narrow gorge near Salem. The Kaveri breaks at Srirangam Island with two channels, river Coleroon and Kaveri. At last, it empties into the Bay of Bengal at Poompuhar.

West Flowing Rivers

a. Narmada: This river rises in Amarkantak Plateau in Madhya Pradesh at an elevation of about 1057 m and flows for a distance of about 1,312 km it covers and area of 98,796 sq km and forms 27 km long estuary before out falling into the Arabian Sea through the Gulf of Cambay. It is the largest among the west flowing rivers of Peninsular India. Its principal tributaries are Burhner, Halon, Heran, Banjar, Dudhi, Shakkar, Tawa, Barna and Kolar.

b. Tapti: The Tapti is one of the major rivers of Peninsular India with the length of about 724 km. It covers an area of 65,145 sq km. Tapti river rises near Multai in the Betul district of Madhya Pradesh at an elevation of about 752 m. It is one of only the three rivers in Peninsular India that run from east to west - the others being the Narmada and the Mahi. The major tributaries are Vaki, Gomai, Arunavati, Aner, Nesu, Buray, Panjhra and Bori. It outfalls into the Arabian Sea through the Gulf of Cambay.

Characteristics of South Indian

Rivers

- Originate from Western Ghats
- Short and narrow
- Non perennial in nature
- Suitable for hydro power generation
- Not useful for navigation

2. Climate And Natural Vegetation Of India Vegetation Of India

Introduction

We drink more water during summer and do not drink the same amount of waterduring winter. Why do we wear cotton or lighter clothes during summer season and heavy woollen clothes during cold weather season in north India? Why do not we wear woollen clothes in south India? This is because of the prevalence of varying weather conditions between north and south India. In the previous chapter, you have learnt about the landforms and drainage of our country, which dealt with the natural environment. In this chapter, you will learn about the climate, rainfall distribution, natural vegetation and wildlife of our country.

The factors affecting theclimate

Climate of India is affected by the factors of latitude, distance from the seas, monsoon wind, relief features and jet stream.

Latitude

Latitudinally, India lies between 8°4'N and 37°6'N latitudes. The Tropic of cancerdivides the country into two equal halves. The area located to the south of Tropic of cancer experiences high temperature and no severe cold season throughout the year whereas, the areas to the north of this parallel enjoys subtropical climate. Here, summer temperature may rise above 40°C and it is close to freezing point during winter.

Altitude

Whenthe altitude increases, the temperatures decreases. Temperature decreasesat the rate of 6.50C for every 1000 metres of ascent. It is called normal lapse rate. Hence, places in the mountains are cooler than the places on the plains. That is why the places located at higher altitudes even in south India have cool climate. Ooty and several other hill stations of south India and of the Himalayan ranges like Mussourie, Shimla etc., are much cooler than the places located on the Great Plains. Distance from the SeaDistance from the sea does not cause only temperature and pressure variations but also affects the amount of rainfall. A large area of India, especially the peninsular region, is not very far from the sea and this entire area has a clear maritime influence on climate. This part of the country does not have a very clearly marked winter and the temperature is equable almost throughout the year. Areasof central and north India experience much seasonal variation in temperature due to the absence of influence of seas. Here, summers are hot and winters are cold. The annual temperature at Kochi does not exceed 30°C as its location is on the coast while it is as high as 40°Cat Delhi, since it is located in the interior part. Air near the coast has more moisture and greater potential to produce precipitation. Due to this fact, the amount of rainfall at Kolkata located near the coast is 119 cm and it decreases to just 24 cm at

Bikaner which is located in the interior part.

Monsoon Wind

The most dominant factor which affects the climate of India is the monsoon winds. These are seasonal reversal winds and India remains in the influence of these winds for a considerable part of a year. Though, the sun's rays are vertical over the central part of India during the mid-June, the summer season ends in India by the end of May. It is because the onset of southwest monsoon brings down the temperature of the entire India and causes moderate to heavy rainfall in many parts of the country. Similarly, the climate of southeast India is also influenced by northeast monsoon.

Relief

Relief of India has a great bearing on major elements of climate such as temperature, atmospheric pressure, direction of winds and the amount of rainfall. The Himalayas acts as a barrier to the freezing cold wind blows from central Asia and keep the Indian subcontinent warm. As such the north India experiences tropical climate evenduring winter. During southwest monsoon, areas on the western slope of the Western Ghats receive heavy rainfall. On the contrary, vast areas of Maharashtra, Karnataka, Telangana, Andhra Pradesh and Tamil Nadulie in rain shadow or leeward side of the Western Ghats receive very little rainfall. During this season, Mangalore, located on the coast gets the rainfall of about 280 cm whereas the Bengaluru located on the leeward side receives only about 50 cm rainfall.

Jet Streams

Jet streams are the fast moving windsblowing in a narrow zone in the upper atmosphere. According to the Jet stream theory, the onset of southwest monsoon is driven by the shift of the sub-tropical westerly jet from the plains of India towards theTibetan plateau. The easterly jet streams cause tropical depressions both during southwest monsoon and retreating monsoon.

Monsoon

The word 'monsoon' has been derived from the Arabic word 'Mausim' which means 'season'. Originally, the word 'monsoon' was used by Arab navigators several centuries ago, to describe a system of seasonal reversal ofwinds along the shores of the Indian Ocean,especially over the Arabian Sea. It blows from the south-west to north-east during summer and from the north-east to south-west during winter.

Monsoons are a complex meteorological phenomenon. Meteorologists have developed a number of concepts about the origin of monsoons. According to the Dynamic concept, Monsoon wind originates due to the seasonal migration of planetary winds and pressure belts following the position of the sun. During summer solstice, the sun's rays fall vertically over the Tropic of cancer. Therefore, all the pressure and wind beltsof the globe

shift northwards. At this time, Inter -Tropical Convergence Zone (ITCZ) also moves northward, and a major part of Indian landmass comes under the influence of southeast trade winds. While crossing equator this wind gets deflected and takes the direction of southwest and becomes southwest monsoon. During the winter season, the pressure and wind belts shift southward, thereby establishing the north-east monsoon (trade winds) over this region. Such systematic change in the direction of planetary winds is known as monsoon.

Seasons

The meteorologists recognize the four distinct seasons in India. They are;

1. Winter or cold weather season (January - February).
2. Pre Monsoon or summer or hot weather season (March - May).
3. Southwest monsoon or rainy season (June - September).
4. Northeast monsoon season (October - December).

Winter or cold weather season

During this period, the vertical rays of the sun falls over tropic of capricornwhich is far away from India. Hence, India receives the slanting sun's rays which results in low temperature. The cold weather season is characterized by clear skies, fine weather, light northerly winds, low humidity and large day time variations of temperature. During this season a high pressure develops over north India and a north-westerly wind blows down the Indus and Ganges valleys. In south India, the general direction of wind is from east to west. The mean temperature increases from north to south, the decrease being sharp as one moves northwards in the north-western part of the country.

The mean daily minimum temperatures range from 22°C in the extreme south, to 10°C in the northern plains and 6°C in Punjab. The rain during this season generally occurs over the Western Himalayas, Tamil Nadu and Kerala. Western disturbances and associated trough in westerlies are main rain bearingsystem in northern part of the country. The jet stream plays a dominantrole in bringing these disturbances toIndia. These disturbances cause rainfall in Punjab, Haryana and Himachal Pradesh, and snowfall in the hills of Jammu and Kashmir. This rainfall is very useful for the cultivation of winter wheat.

2. Pre Monsoon or summer orhot weather season

During this season, the vertical rays of the sun falls over the peninsular India. Hence, there is a steady increase in temperature from south to north. It is practically hot and dry in the entire country in the initial part of this season. Weather over the land areas of the country is influenced by thunderstorms associated with rain and sometimes with hail mostly in the middle and later part. During this season, temperature starts increasing all over the country and by April, the interior parts of south India record mean daily temperatures of 30°C–35°C. Central Indian land mass becomes hot with day-time

maximum temperature reaching about 40°Cat many locations. Many stations in Gujarat, North Maharashtra, Rajasthan and North Madhya Pradesh exhibit high day-time and low night-time temperatures during this season.

Because of the atmospheric pressure conditions, the winds blow from southwest to northeast direction in Arabian Sea and Bay of Bengal. They bring pre monsoon showers to the west coast during the month of May. There are few thunder showers called "MangoShowers" which helps in quick ripening of mangoes along the coast of Kerala and Karnataka. "Norwesters" or "Kalbaisakhis" are the local severe storms or violent thunderstorms associated with strong winds and rain lasting for short durations. It occurs over the eastern and north eastern parts over Bihar, West Bengal and Assam during April and May. They approach the stations from the north-westerly direction.

3. Southwest monsoon or Rainy Season

The southwest monsoon is the most significant feature of the Indian climate. The onset of the southwest monsoon takes place normally over the southern tip of the countryby the first week of June, advances along theKonkan coast in early June and covers the whole country by 15th July. The monsoon is influenced by global phenomenon like ElNino. Prior to the onset of the southwest monsoon, the temperature in north India reaches upto 46°C. The sudden approach of monsoon wind over south India with lightning and thunder is termed as the 'break' or 'burst of monsoon'. It lowers the temperature of India to a large extent. The monsoon wind strikes against the southern tip of Indian land mass and gets divided into two branches. One branch starts from Arabian sea and the other from Bay of Bengal.

The Arabian sea branch ofsouthwest monsoon gives heavy rainfall to the west coast of India as it is located in the windward side of the Western Ghats. The other part which advances towards north is obstructed by Himalayan Mountains and results in heavy rainfall in north. As Aravalli Mountain is located parallel to the wind direction, Rajasthan and western part do not get much rainfall from this branch. The wind from Bay of Bengal branch moves towards northeast India and Myanmar. This wind is trapped by a chain of mountains namely Garo, Khasi and Jaintia are mainly responsible for the heaviest rainfall caused at Mawsynram located in Meghalaya. Later on, this wind travel towards west which results in decrease in rainfall from east to west. Over all about 75% of Indian rainfallis received from this monsoon. Tamil Naduwhich is located in the leeward side receives only a meagre rainfall.

4. Post monsoon or Retreating or Northeast monsoon season

The southwest monsoon begins to retreat from north India by the end of September due to the southward shifting pressure belts. The southwest monsoon wind returns from Indian landmass and blows towards Bay of Bengal. The coriolis force deflects this wind and makes itto blow from northeast. Hence, it is known as Northeast monsoon or Post-monsoon season. The season is associated with the establishment of the north-easterly wind system over the Indian subcontinent. Andhra Pradesh, Tamil Nadu, Kerala and

south interior Karnataka receive good amount of rainfall accounted for 35% of their annual total. Many parts of Tamil Nadu and some parts of Andhra Pradesh and Karnataka receive rainfall during this season due to the storms forming in the Bay of Bengal. Large scale losses to life and property occur due to heavy rainfall, strong winds and storm surge in the coastal regions. The day time temperatures start falling sharply all over the country. The mean temperature over northwestern parts of the country shows a decline from about 38°C in October to 28°C in November.

Indian Monsoons

Distribution of rainfall

The average annual rainfall of India is 118 cm. However, spatial distribution ofrainfall in the country is highly uneven. About11% area receives over 200 cm of annualrainfall, 21% area receives 125 to 200 cm,37% area receives 75 to 125 cm, 24% area gets35 to 75 cm and 7% area gets less than 35 cm.The Western coast, Assam, South Meghalaya,Tripura, Nagaland and Arunachal Pradesh arethe heavy rainfall areas which get more than200 cm rainfall. The whole of Rajasthan,Punjab, Haryana, Western and South-westernparts of Uttar Pradesh, Western MadhyaPradesh, the entire Deccan Trap or Plateauregion east of Western Ghats except for anarrow strip along Tamil Nadu coast receive alow rainfall of less than 100 cm. The rest of theareas receive a rainfall ranging between 100and 200 cm.

Natural Vegetation

Natural vegetation refers to a plant community unaffected by man either directly or indirectly. It has its existence in certain natural environment. Natural vegetation includes all plant life forms such as trees, bushes, herbs and forbs etc, that grow naturally in an area and have been left undisturbed by humans for a long time. Climate, soil and landform characteristics are the important environmental controls of natural vegetation. On the basis of the above factors the
natural vegetation of India can be divided into the following types.

Tropical Evergreen Forest

These forests are found in areas with 200 cm or more annual rainfall. The annual temperature is about more than 22°C and the average annual humidity exceeds 70 percent in this region. Western Ghats in Maharashtra, Karnataka, Kerala, Andaman-Nicobar Islands, Assam, West Bengal, Nagaland, Tripura, Mizoram, Manipur and Meghalaya states have this type of forests. The most important trees are rubber, mahogany, ebony, rosewood, coconut, bamboo, cinchona, candes, palm, iron wood and cedar. These have not been fully exploited due to lack of transport facilities.

Tropical Deciduous Forest

These are found in the areas with 100 to 200cm. annual rainfall. These are called'Monsoon Forests'. The mean annual temperature of this region is about 27oC and the average annual relative humidity is 60 to 70 percent. The trees of these forests drop their leaves during the spring and early summer. (Sub Himalayan - Region from Punjab to Assam, Great Plains- Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Central India - Jharkhand, Madhya Pradesh, Chattisgarh, South India - Maharashtra, Karnataka, Telangana, Andhra Pradesh, TamilNadu and Kerala states are notable for this type of natural vegetation.) Teak and sal are the most important trees. Sandalwood, rosewood, kusum, mahua, palas, haldu, amla, padauk, bamboo and tendu are the other trees of economic importance. These forests also provide fragrant oil, varnish, sandal oil and perfumes.

Tropical Dry Forest

These are found in the areas with 50 to100 cm. annual rainfall. They represent atransitional type of forests. These are found in east Rajasthan, Haryana, Punjab, Western Uttar Pradesh, Madhya Pradesh, Eastern Maharashtra, Telangana, West Karnataka and East Tamilnadu. The important species are mahua, banyan, amaltas, palas, haldu, kikar, bamboo, babool, khair etc., Desert and Semi-desert Vegetation).

These are also called as 'Tropical thorn forests'. These are found in the areas having annual rainfall of less than 50 cm. They have low humidity and high temperature. Theseforests are found in north-west India which includes west Rajasthan, south-west Haryana, north Gujarat and south-west Punjab. They are also found in the very dry parts of the Deccan plateau in Karnataka, Maharashtra and Andhra Pradesh. Babul, kikar and wild palms are common trees found here.

Mountain or Montane Forest

These forests are classified on the basis of altitude and amount of rainfall. Accordingly two different types of forests namely Eastern Himalayas Forests and Western Himalayas Forests.

i. Eastern Himalayan Forest: These are found on the slopes of the mountains in north-east states. These forests receive rainfall of more than 200 cm. The vegetation is of evergreen type. The Altitude between 1200-2400 m found in this type of forest sal, oak, laurel, amura, chestnut, cinnamon are the main trees from 1200 to 2400 m altitude oak, birch, silver, fir, fine, spruce and juniper are the major trees from 2400 to 3600 m height.

ii. Western Himalayan Forest: The rainfall of this region is moderate. These forests are found in the states of Jammu and Kashmir, Himachal Pradesh and Uttarakhand. Upto 900 m altitude semi desert vegetation is found and it is known for bushes and small trees. In altitude from 900 to 1800 m, chir tree is the most common tree. The other important trees of this region are sal, semal, dhak, jamun and jujube. (height from 1800 to 3000 m is covered with semi temperate coniferous forests.) Chir, deodar, blue pine, poplar, birch and elder are the main trees of this region.

Alpine Forest: It occurs all along the Himalayas with above 2400 m altitude. These are purely having coniferous trees. Oak, silver fir, pine and juniper are the main trees of these forests. The eastern parts of Himalayas has large extent of these forests.

Tidal Forest: These forests occur in and around the deltas, estuaries and creeks prone to tidal influences and as such are also known as delta or swamp forests. The delta of the Ganga- Brahmaputra has the largest tidal forest. The deltas of Mahanadi, Godavari and Krishna rivers are also known for tidal forests. These are also known as mangrove forest.

Coastal Forest: These are littoral forests. Generally, coastal areas have these types of forests.Casurina, palm and coconut are the dominanttrees. Both the eastern and western coasts have this type of forests. The coasts of Kerala and Goa are known for this type.

Riverine Forest: These forests are found along the rivers on Khadar areas. These are known for tamarisk and tamarind trees. The rivers of Great Plains are more prominent for this type of natural vegetation.

Wildlife

The term 'Wildlife' includes animals of any habitat in nature. Wild animals are non-domesticated animals and include both vertebrates (fish, amphibians, reptiles, birds and mammals) and invertebrates (bees, butterflies, moths etc.). India has a rich and diversified wildlife. The Indian fauna consists of about 81,251 species of animals out of the world's total of about 1.5 million species. The faunal diversity of the country consists of about 6500 invertebrates, 5000 molluscs, 2546 fishes, 1228 birds, 458 mammals, 446 reptiles, 204 amphibians, 4 panthers and about 60,000 species of insects. Our country is home to tigers, lions, leopards, snow leopards, pythons, wolves, foxes, bears, crocodiles, rhinoceroses, camels, wild dogs, monkeys, snakes, antelope species, deer species, varieties of bison and the mighty Asian elephant. Hunting, poaching, deforestation and other anthropogenic interferences in the natural habitats have caused extinction of some species andmany are facing the danger of extinction.In view of this and the role of wild life in maintaining ecological balance, conservation and management of biodiversity of India is necessary at present situation.

The Indian Board for Wildlife (IBWL) was constituted in 1952 to suggest means of protection, conservation and management of wildlife to the government. The Government of India enacted Wildlife (Protection) Act in 1972 with the objective of effectively protecting the wild life of the country and to control poaching, smuggling and illegal trade in wildlife and its diversities. United Nations Convention on Biological Diversity (CBD) in 1992 recognizes the sovereign rights of states to use their own Biological Resources. To preserve the country's rich and diverse wildlife a network of 102 National Parks and about 515 Wildlife Sanctuaries across the country have been created.

Biosphere Reserves

Biosphere reserves are protected areas of land coastal environments wherein people are an integral component of the system.The Indian government has established 18Biosphere Reserves in India which protect larger areas of natural habitat and often include one or more National Parks preserves along with buffer zones that are open to some economic uses. Eleven of the eighteen biosphere reserves (Gulf of Mannar, Nandadevi, the Nilgiris, Nokrek, Pachmarhi, Simlipal, Sundarbans Agasthiyamalai, Great Nicobar, Kanjanjunga and Amarkantak) of India fall under the list of Man and Biosphere programme of UNESCO.

S. No	Biosphere Reserves	State
1.	Achanakmar- Amarkantak (UNESCO)	Madhya Pradesh, Chattisgarh
2.	Agasthyamalai (UNESCO)	Kerala
3.	Dibru Saikhowa	Assam
4.	Dihang Dibang	Arunachal Pradesh
5.	Great Nicobar (UNESCO)	Andaman and Nicobar Islands
6.	Gulf of Mannar (UNESCO)	Tamil Nadu
7.	Kachch	Gujarat
8.	Kanchenjunga (UNESCO)	Sikkim
9.	Manas	Assam
10.	Nanda Devi (UNESCO)	Uttarkhand
11.	The Niligiris (UNESCO)	Tamil Nadu
12.	Nokrek (UNESCO)	Meghalaya
13.	Pachmarhi (UNESCO)	Madhya Pradesh
14.	Simlipal (UNESCO)	Odisha
15.	Sundarbans (UNESCO)	West Bengal
16.	Cold desert	Himachal Pradesh
17.	Sesahachalam hills	Andhra Pradesh
18.	Panna	Madhya Pradesh

NOTE

- Equable climate is also called as the British climate, Which is neither too hot nor too cold.
- Weather refers to the state of atmosphere of a place at a given point of time.
- Climate is the accumulation of daily and seasonal weather events of a given location over a period of 30-35 years.
- Atacama desert is the driest place on the earth.
- Mawsynram, the place which receives highest rainfall (1141 cm) in the world. It is located in Meghalaya.
- The Nilgiri Tahr is facing a major threat in the Western Ghats. Continuous poaching activities and Eucalyptus cultivation hampering its habitat, the Nilgiri Tahr population is continuously decreasing.
- The Black Buck is the state animal of Andhra Pradesh, Haryana and Punjab.
- Project Tiger was launched in April 1973 with the aim to conserve tiger population in specifically constituted "Tiger Reserves" in India. This project is benefited

tremendously, with an increase of over 60% - the 1979 consensus put the population at 3,015 - while other equally disturbed species like the barasingha (swamp deer), rhino and elephants also fought back from the brink of oblivion.

3. Components of Agriculture

Introduction

Soil is one of the most important natural resources. India's varied natural environments resulted in a great variety of soils compared to any other country of similar size in the world. The rich, deep and fertile soils support high density of population through agricultural prosperity

Soils

Soil is the uppermost layer of the landsurface, usually composed of minerals, organic matter, living organisms, air and water. Grains in the soil are of three categories namely, clay, silt, and sand. Soils are generally formed by the weathering of rocks under different conditions. Some soils are formed by the deposition of agents of denudation. Soils can vary greatly from one region to the other.

Types of Soils:

The Indian Council of Agriculture Research (ICAR) set up in 1953 divides the soils of India into the following eight major groups.

Soils Type	Persentage
Saline & Alkaline Soil	1.29%
Peaty & Marshy Soil	2.17%
Laterite Soil	2.62%
Arid & Desert Soil	6.13%
Forest & Mountain Soil	7.94%
Alluvial Soil	22.16%
Red Soil	28%
Black soil	29.69%

Soil degradation

Soil degradation is an acute problemin India. According to a 2015 report of theIndian institute of remote sensing (IIRS).The estimated the amount of soil erosionthat occurred in India was 147 million hectares. The main problems of the Indiansoils are i) soil erosion (sheet erosion, Rill erosion, Gully erosion, Ravine and Badland) ii) Degradation of Soil, iii) Water-logging, iv) Saline and Alkaline, and v) Salt Flats, types of soils are different erotion.

Methods of Conservation and Management of Soil

1. Afforestation
2. Constructing Dams and Barrages

3. Prevention of Overgrazing
4. Improved methods of Agriculturalpractices
   - ✓ Contour method
   - ✓ Rotation of crops
   - ✓ Contour bunding
   - ✓ Strip cropping
   - ✓ Planting of shelter belts
   - ✓ Adopting the techniques of sustainable agriculture are different conservation methods for better soil management.

Soil Type	Characteristics	Distribution	Crops Growing
Alluvial soil	**Khadar** – light coloured, more siliceous. **Bhangar** – the older allvium composed of lime nodules and has clayey composition. It is dark in colour. **Formation** – sediments deposited by streams and rivers when they slowly loose **Chemical properties** – rich in potash, phosphoric acid, lime and carbon compounds but poor in nitrogen. **Nature** – Sandly –loam-silt-clay profile shows no marked differentiation	Ganga and Brahmaputra river valleys; plains of Uttar Pradesh, Uttaranchal, Punjab, Haryana, West Bengal and Bihar	Rice, Wheat, Sugarcane and Oilseeds
Black soils	**Formation** – Derived from basalts of Deccan trap. **Colour** – black colour, due to presence of titanium, iron. **Chemical properties** – consist of calcium and magnesium arbonates, high quantities of iron, aluminium, lime and magnesia. Rich in potash lime, Aluminium calcium and magnesium poor in Nitrogen Phosphoric acid and humus **Nature** – Sticky when wet High degree of moisture retentively	Maharashtra and Malwa plateaus, Kathiawar peninsula, Telangana and Rayalaseema region of Andhra Pradesh and northern part of Karnataka	Cotton, Millets, Tobacco and Sugarcane
Red soils	**Formation** – decomposition of ancient crystalline rocks like granites and gneisses and from rock type **Chemical properties** – rich in minerals such as iron and magnesium. Deficient in nitrogen, humus, phosphoric acid and lime. **Nature** – Light texture, porous friable presence of limited soluble salts clay fraction of the red soils generally consists of Kaolinitic minerals.	Eastern parts of Deccan plateau, southern states of kerala, Tamil Nadu, Karnataka and chota Nagpur plateau (Jharkhand)	Wheat, Rice, Cotton, Sugarcane and pulses

Laterite soils	**Formation** – formed in the regions where alternate wet and hot dry conditions prevail. It is formed by the process of leaching. **Chemical properties** – Composed mainly of hydrated oxides of iron and aluminium, **Nature** – more acidic on higher areas poor in high level, cannot retain moisture while plains they consist of heavy loam and clay and easily retain moisture.	Assam hills, hill summits of Kerala and Karnataka and eastern Ghats and region of Odisha	Coffee, Rubber, Cashew nut and Tapioca
Forest and mountain soils	Differ from region to region depending on climate. **Formation** – due to mechanical weathering caused by snow, rain, temperature variation **Chemical properties** – are deficient in potash, Phosphorus and lime. **Nature** – light, sandy, thin and found with the pieces of rocks. Very rich in humus. slow decomposition makes it acidic	Coniferous forest belts of Jammu and Kashmir, Himachal Pradesh, Uttarkhand and Sikkim. Eastern and Western Ghats	Coffee, tea, rice, maize, potato, barley, tropical fruits and various types of spices
Arid and desert soils	**Formation** – due to prevalence of the dry climate, high temperature and accelerated evaporation, the soil is dry, it also lacks humus content due to the absence of vegetative cover **Chemical properties** – contain high percentages of soluble salts, alkaline with varying degree of calcium carbonate and are poor in organic matter; rich enough in phosphate though poor in nitrogen **Nature** – light in colour, low hums, friable structure, low in moisture	Rajasthan, Northern Gujarat and Southern Punjab	Millets, barely, cotton, maize and pulses (with irrigation)
Saline and alkaline soils	**Formation** – formed due to ill drainage which causes water logging, injurious salts are transferred from subsurface to the top soil by the capillary action, it causes the salinization of soils. **Chemical properties** – liberate sodium, magnesium and calcium salts and sulphurous acid. **Nature** - Consists of un decomposed rock and mineral fragments which on weathering.	Andhra Pradesh and Karnataka. In the drier parts of Bihar, Uttar Pradesh, Haryana, Punjab, Rajasthan and Maharashtra	

Peaty and marshy soils	**Formation –** formed in humid regions fromthe organic matter. It is found in the areas of heavy rainfall and high humidity peaty soils are black, heavy and highly acidic. **Chemical properties** – deficient in potash and phosphate. Contain considerable amount of soluble salts and 10 – 40 per cent of organic matter; and high proportion of vegetable matter. **Nature** – Contain considerable amount of Soluble salts and 10 – 40 per cent of organic matter; and high proportion of vegetable matter.	Kottayam and Alappuzha districts of Kerala; and coastal areas of Odisha and Tamil Nadu, Sundarbans of West Bengal, in Bihar and Almora district of Uttarkhand	Paddy, jute

Irrigation

Watering of agricultural plants through artificial means is called irrigation. Being a hot country with seasonal and irregular rainfall, it always needs irrigation to carryout agricultural activities during dryperiod. Beside erratic rainfall, prevalence of high temperature, cultivation of annual crops and hydrophytes, commercial farming and porous soil make irrigation an essential one for the agriculture of our country.

Sources of Irrigation

In India, different sources of irrigation are used depending upon the topography,soils, rainfall, availability of surface or groundwater, nature of river (whether perennial or non-perennial), requirements of crops etc. The main sources of irrigation used in different parts of the country are

- Canal irrigation
- Well irrigation and
- Tank irrigation

a. Canal Irrigation

It is the second most important source of irrigation in our country. Percentage ofarea under canal irrigation in our country is 24% (source:Statistical year book 2017 during 2013-2014)Canals are the effective source of irrigation in areas of low level relief, deep, fertile soils, perennial source of water and extensive command area. The canals are of two types:

Area Under Irrigation	
Tanks	3%
Other Sources	11%
Other wells	16%
Canals	24%
Tube wells	46%

1. **Inundation Canals:** In this, water is taken out directly from the rivers without making any kind of barrage or dam. Such canals are useful for the diversion of flood water from the rivers and remain operational during rainy season.

2. **Perennial Canals:** These are developed from perennial rivers by constructing barrage to regulate the flow of water. In our country, most of the canals fall under this category. These canals are useful for irrigation. In India the total area under canal irrigation is about 15.8 million hectares in 2014. About 60 percent of the canal irrigated area falls in the northern plains of India, particularly in Uttar Pradesh, Punjab, Haryana, Rajasthan, and Bihar. In south and central India, Andhra Pradesh,Maharashtra, Karnataka, Madhya Pradesh,Chattisgarh, Odisha, and Tamil Nadu are the important states where canal irrigation is found.

b. Well Irrigation

A well is a hole or trough, usuallyvertical, excavated in the earth for bringing groundwater to the surface. Well irrigation is the most important source of irrigation as it contributes about 62 percent of net irrigated area in India. It is a cheap, dependable, and popular source of irrigation in the country. Well irrigation is unavoidable in the region of low rainfall and becomes an essential one where the canals and tank irrigation are not available. Wells are of two types: i) Open wells and ii) Tube wells

1. **Open Wells:** This type of irrigation is widely practiced in the areas where groundwater is sufficiently available. The areas are in Ganga Plains, the deltaic region of Mahanadi, Godavari, Krishna, Cauvery and parts of Narmada and Tapti valleys.

2. **Tube Wells:** Tube wells are developed in the areas of low water table, sufficientpower supply and soft subsurface geological units. Tube wells are predominant in the states of Gujarat, Maharashtra, Punjab, Madhya Pradesh and Tamil Nadu.

As per the Irrigation – Statistical Year Book India – 2017, the following states are the top five with respect to the percentage of areas under well irrigation during 2013-14.

S. No	Name of the State	Area in %
1.	Uttar Pradesh	26.6
2.	Madhya Pradesh	14.6
3.	Rajasthan	13.1
4.	Gujarat	7.8
5.	Punjab	7.1

c. Tank Irrigation

A tank is a natural or man-made hollow on the surface developed by constructing a small bund around it across a stream. It is used to collect and store water for irrigation and other purposes. Irrigation by tanks is a very old system in India. It also includes irrigation from lakes and ponds. The tank irrigation is popular in thePeninsular India due to the following reasons:

- The undulating relief and hard rocks make difficult to dig canals and wells.
- Natural depressions serve as reservoirs.
- Absence of perennial rivers.
- Impermeable rock structure which donot permit percolation.
- The scattered nature of population and agricultural fields

The following table shows the five leading states in tank irrigation:

S. No	Name of the State	Area in Lakh Hectares (2013 – 14)
1.	Tamil Nadu	3.78
2.	Andhra Pradesh	3.40
3.	Madhya Pradesh	2.64
4.	Telangana	2.30
5.	Karnataka	1.54

Modern irrigation methods

There are many ways in Modern Irrigation among them mostly practiced and following in India are using drips, sprinklers and poly houses central pivot irrigation. Drip System is used to watering like drops at near the roots of plant. It will cover a tiny area at plant, but suitable for big trees and horticultureplants too which used to grow bigger

- **Rain Gun:** Rain gun used to spread water like rain as in name and used to serve for crops which used to grow upto 4 feet's or high also but we have to adjust sprinklers height as per crop size. typical usage of Rain guns are in sugarcane, maize crops.

- **Center:** Pivot irrigation (sometimes called central pivot irrigation), also called waterwheeland circle irrigation, is a method of crop irrigation in which equipment rotates around a pivot and crops are watered with sprinklers

Multipurpose River Valley Projects

It is a scientific management of water resources in our country. Construction of dam across rivers is aimed at many purposes. Hence, it is termed as multi-purpose river valley projects. The various purposes of a dam serves are irrigation, hydro power generation, water supply for drinking and industrial purpose, controlling floods, development of fisheries, navigation etc. Generally, majority of multipurpose projects are combination of irrigation and hydro-power which are the major aims of the projects.

Name of projects	River	Benefit States	Irrigation (sq km)	Hydropower (Megawatts)
Damodar Valley project	Damodar	Jharkhand, West Bengal	5,150	.260
Bhakra – Nangal Project highest gravity dam in the world)	Sutlej	Punjab, Haryana and Rajasthan	52,609	1,500
Hirakud Project (longest dam in the world)	Mahanadi	Orissa	1,41,600	347.5
Kosi Project	Kosi '(Sorrow of Bihar'.)	Bihar & Nepal	8,750	19.2
Tungabhadra Project	Tungabhadra	Andhra Pradesh and Karnataka	1,968	35.
Tehri Dam:	Bhagirathi	Uttarkhand		1,000 MW
Chambal Valley Project	Chambal	Rajasthan and Madhya Pradesh	6000	-
Nagarjuna Sagar Project	Krishna	Andhra Pradesh	-	
Sardar Sarover Project	Narmada	Madhya Pradesh, Maharashtra, Rajasthan		250
Indira Gandhi Canal Project	Satlaj	Rajasthan, Punjab and Haryana	18,450	0
Mettur Dam	Kaveri	Tamil Nadu	-	40

Agriculture

Agriculture is the process of producing food for people, fodder for cattle, fibre and many other desired products by the cultivation of certain plants and the raising of domesticatedanimals (livestock). Though India is industrially a fast developing nation, still the agriculture in India employs more than 50 percent of the population of the country and accounts for about 25 percent of the national income.

Determinants of Agriculture

Agriculture in India is determined by a set of factors. Some of the important factors:

1. Physical factors: relief, climate and soil.
2. Institutional factors: Size of farm holdings, land tenure, and land reforms.
3. Infrastructural factors: Irrigation, power, transport, credit, market, insurance and storage facilities.
4. Technological factors: High yieldingvarieties of seeds, chemical fertilisers,insecticides and machinery.

Types of Farming

Owing to variations in the physicalenvironment and culture, a variety of farming practices and cultivation systems have evolved in different parts of India.

a. Subsistence Farming

A considerable proportion of farmers in the country practice subsistence farming.In this, agricultural land holding is small. As the farmers are poor, they can't apply the modern inputs which cost more. They growcrops with the help of family members and consumes almost the entire farm produce with little surplus to sell in the market. Preference is given to food crops. In addition to the food crops, sugarcane, oilseeds, cotton, jute and tobacco are also cultivated. Traditional farming method results in low productivity. In Punjab, some parts of Rajasthan, Uttar Pradesh and Madhya Pradesh subsistence farming is practiced.

b. Shifting Agriculture

This type of agriculture is performed bytribal people in a piece of forest land after clearing the trees through felling and burning the trunks and branches. Once the land is cleared, crops are grown for two to three years and the land will get abandoned as the fertility of the soil decreases. The farmers then move to new areas and the process will be repeated. They cultivate some grains and vegetable crops using the manual labour. It is also called as "Slash and burn" cultivation.

c. Intensive Farming

Intensive farming is an agricultural intensification and mechanization system that aims to maximize yields from available land through various means, such as heavy use of pesticides and chemical fertilizers. This intensification and mechanization has also been applied to the raising of livestock with billions of animals, such as cows, pigs and chickens, being held indoors. They have become known as factory farms. Intensive farming is practiced in Punjab, parts of Rajasthan, Uttar Pradesh, and Madhya Pradesh in India.

d. Dry Farming

This type of farming is practiced in arid areas where irrigation facilities are lacking. Crops cultivated in these areas can withstand dry conditions. The crops grown generally with the help of irrigation are also grown under dry farming. In such circumstances,the yields are generally low. Most of the areasunder dry cultivation entertain only one crop per year. This is practiced in drier parts of Rajasthan, Gujarat, Madhya Pradesh etc.

e. Mixed Farming Agriculture

Mixed farming is defined as a system of farm which includes crop production, raising livestock, poultry, fisheries, bee keeping etc. to sustain and satisfy as many needs of the farmer as possible.

f. Terrace Cultivation

This type of cultivation is practicedspecially in hilly areas, where lands are of sloping nature. The hill and mountain slopes are cut to form terraces and the land is used in the same way as in permanent agriculture. Since the availability of flat land is limited, terraces are made to provide small patches of level land. Soil erosion is also checkeddue to terrace formation on hill slopes. In our country, terrace cultivation takes place in the states of Punjab, Meghalaya, Haryana, Uttar Pradesh, Himachal Pradesh, and Uttarkhand.

Cropping Seasons in India		
Cropping Seasons	**Major crops cultivated**	
	Northern States	**Southern States**
Kharif Season: June – September	Rice, Cotton, Bajra, Maize, Jowar, Tur	Rice, Ragi, Maize, Jowar, Groundnut
Rabi Season: October – March	Wheat, Gram, Rapeseeds, Mustard, Barley	Rice, Maize, Ragi, Groundnut, Jowar
Zaid Season: April – June	Vegetables, Fruits, Fodder	Rice, Vegetables, Fodder

Major Crops Cultivated in India

The major crops of India are divided into four major categories as follows:

1. Food crops (wheat, maize, rice, millets, pulses etc.).
2. Cash crops (sugarcane, tobacco, cotton, jute, oilseeds etc.).
3. Plantation crops (tea, coffee and rubber).
4. Horticulture crops (fruits, flowers and vegetables).

1. Food Crops

Due to its large population, Indian agriculture is largely dominated by the food crops. Food crops include cereals and pulses, amongst which rice, wheat, jowar, bajra, maize, barley, ragi, gram and tur are important.

- ✓ **Rice:** Rice is an indigenous crop. India is the second largest producer of rice in the worldafter China. It is mainly a tropical crop, growing mainly with mean temperatures of 24°C and annual rainfall of 150 cm. Deep fertile clayey or loamy soils are suited well for rice cultivation. It also needs abundant supply of cheap labour. Rice in India is sown in three ways: i) Broadcasting, ii) Ploughing or drilling, and iii) Transplanting. Due to increased use of High Yielding Variety (HYV) seeds (CR Dhan 205, AR Dhan 306, CRR 451 etc.), many of the indigenous varieties were disappeared. In 2016, the first 10 leading rice producing states are West Bengal (First in India) Uttar

Pradesh, Punjab, Tamil Nadu, Andhra Pradesh, Bihar, Chhattisgarh, Odisha, Assam, and Haryana.

- ✓ **Wheat:** Wheat is the second most important food crop of the country, after rice. It accounts for 22 percent of the total area and 34 percent of the total production of food grains in the country. It requires 10-15°C at the time of sowing and 20-25°C at the time of ripening of grains. Over 85% of the India's wheat production comes from 5 states namely Uttar Pradesh, Punjab, Haryana, Rajasthan and Madhya Pradesh. Apart from these regions, the black soil tract of the Deccan covering parts of Maharashtra and Gujarat also contribute a major wheat production.

- ✓ **Jowar:** Jowar is the third important food crop of our country. It is an indigenous plant of Africa. The plant has a tendency to grow in adverse climatic conditions. Its grains are rich in carbohydrates, protein, minerals, and vitamins. Hence, it provides cheap food to the large section of the poor population. It is alsoused as fodder in many parts of the country. Jowar is essentially a crop of the Peninsular India. Maharashtra, Karnataka, and Madhya Pradesh are the leading producers of Jowar.

- ✓ **Bajra**: Bajra is an indigenous plant of Africa. This forms the staple food for poor people. Its stalks are used as fodder for cattle and for thatching purposes. Bajra is a crop of dry region. Rajasthan is the largest producer of bajra followed by Uttar Pradesh, Haryana, Gujarat and Maharashtra.

- ✓ **Barley:** Barley is one of the important cereals of our country. Besides, being poor man's diet, it is used for making barley water, beer and whiskey. Rajasthan and Uttar Pradesh are the two leading producers of Barley.

- ✓ **Pulses**: Pulses include a large number of crops which are mostly leguminous and richin vegetable protein. They are used as human food and feeding cattle. They fix atmospheric nitrogen in the soil and hence are usually rotated with other crops. India is the largestproducer of pulses. The major pulse growingareas are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra and Andhra Pradesh.

2. Cash Crops

The crops which are cultivated for commercial purpose are called cash crops. These crops include sugarcane, tobacco, fibre crops (cotton, jute, and mesta) and oilseeds.

- ✓ **Sugarcane:** Sugarcane is the most important cash crop of India and is the second largest producer in the world. This crop provides raw material for the sugar industry which is the second largest industrial category of our country. Besides providing sugar, gur and khandsari, it supplies molasses for alcohol industry and bagasse for paper industry.

  India is ranked third in sugar production in the world after Cuba and Brazil. At the state level, Uttar Pradesh is the leading producer of sugarcane followed by Maharashtra, Karnataka, Tamil Nadu and Gujarat.

- ✓ **Cotton:** Cotton is the most important cash crop of India. It provides raw material to the largest industry of India. India ranks second next to China in the production of cotton. About 79% of the total area and production in the country were contributed by four states viz., Gujarat, Maharashtra, Andhra Pradesh and Punjab.

- ✓ **Jute:** It is a tropical fibre crops, grows well in the alluvial soil. It provides raw material for Jute industry. It is used for manufacturing of gunny bags, carpets, hessian, ropes and strings, rugs, clothes, tarpaulins, upholstery etc. West Bengal is the leading state both in cultivation and production of jute. The other cultivators of jute are Bihar, Assam and Meghalaya.

- ✓ **Oil Seeds:** Oil seeds, the premier source of fat in the Indian diet are derived from number of crops like groundnut, rapeseed, mustard, sesame, linseed, sunflower, castor seed, cotton seed, nigerseed etc. These provide oil and oilcake which are used for making lubricants, varnish, medicine, perfume, candles, soaps, manure and cattle feed. Gujarat is India's largest oilseeds producing state. Other major producers of oilseeds are followed by Rajasthan Madhya Pradesh, Maharashtra and Andhra Pradesh. In groundnut production, India is the second largest producer in the world after China.

Plantation Crops

Plantation crops are cultivated for thepurpose of exports. These are cultivated in large estates on hilly slopes. Cultivation near the coast is preferable as it facilitates exports.Tea, coffee, rubber and spices are the majorplantation crops of India.

- ✓ **Tea:** Tea is an evergreen plant that mainly grows in tropical and subtropical climates. Tea is a labour intensive and grows faster under light shade. Tea plants require high rainfall but its root cannot tolerate water logging. Two major varieties of tea are cultivated in India. They are i) Bohea originated from China and ii) Assamica from India. A number of hybrid varieties have been developed by mixing these two. India is the second largest producer of tea after China in the world. Assam is the larger producer of tea in India. Other states are Tamil Nadu, Kerala and West Bengal.

- ✓ **Coffee:** Coffee is grown in shade and it grows effectively in the altitudes between 1,000 and 1,500 m above mean sea level. There are two main varieties of coffee. They are i) Arabica(High quality-cultivated more in India) and ii) Robusta (Inferior quality). India is the 7th largest producer of coffee globally. Karnataka is the leading producer of coffee in India. It produces 71% in India, and 2.5 % in the world (source; coffee board of India-2018).

- ✓ **Rubber:** Rubber plantations were first established in Kerala in 1902. It needs hot and wet climatic conditions (temperature above 20°C and rainfall above 300cm). Most of the land under rubber belongs to small land holders. The major rubber growing areas are Tamil Nadu, Kerala, Karnataka and Andaman and Nicobar Islands.

- ✓ **Spices:** India has been world famous for its spices since ancient times. These spices mostly used for flavouring or tampering cooked food and for preparing medicines, dyes etc. Pepper, chillies, turmeric, ginger, cardamom, clove and areca nut are the major spices cultivated in India. Kerala is the leading producer of spices in India.

4. Horticulture Crops

It refers to the cultivation of fruits, flowers and vegetables. Fruits and vegetables are important supplement to the human diet, as they provide essential minerals, vitamins, and fibres required for maintaining health. India is in the second position in the production of fruits and vegetables. Apple is mostly produced in Himachal Pradesh, Jammu and Kashmirand Uttarkhand. Production of banana is concentrated in Tamil Nadu and Maharashtra. Orange is cultivated in Maharashtra, Uttarkhand, Himachal Pradesh, Jammu andKashmir, Tamil Nadu and Karnataka. Grape is cultivated mainly in Uttarkhand, Himachal Pradesh, Jammu and Kashmir, Maharashtra, Andhra Pradesh, Tamil Nadu and Karnataka.
India contributes about 13% of the world's production of vegetables.

Livestock

Livestock is an integral component of thefarming system in India. The livestock sector is socially and economically very significant due to its multi-functional outputs and contribution to socio-cultural security. It also helps to improve food and nutritional security by providing nutrient-rich food products, generate income and employment and act as a cushion against crop failure, provide draught power and manure inputs to the crop subsector.

Livestock sector contributes approximately 4 percent of national GDP (Gross Domestic Product) and 25.6 percent to agriculture GDP. As per 19th Livestock Census, conducted in 2012 (Government of India, 2014), India's livestock sector is one of the largest in the world with 11.6 percent of world livestock population, which consists of cattle (37.3 percent), goats (26.4 percent), buffaloes (21.2 percent), sheep (12.7 percent) and pigs (2.0 percent) etc.

Distribution of Livestock in India in 2012

Name of the State	Total No.of Livestock in Lakhs (2012)
Uttar Pradesh	687.2
Rajasthan	577.3
Andhra Pradesh	561.0
Madhya Pradesh	363.3
Bihar	329.4

Cattle

Cattle constitute 37.3 percent of livestock population in India. India has second largest cattle population after Brazil at World level. Among the states, Madhya Pradesh leads with 10.3 percent followed by Uttar Pradesh (10.2 percent) and West Bengal (8.7 percent). Cattle population in India belongs to different breeds.These include: 1) Milch Breed, 2) Draught breed, and 3) Mixed or General breed.

The following table shows the Livestock population of India in 2012

Name of the Livestock	Population in Lakhs (2012)
Cattle	1.91
Goats	1.35
Buffaloes	1.09
Sheep	0.65
Pigs	0.10

Goats: The goat is the poor man's cow providing milk, meat, skin and hair. It is the main sourceof meat for the country. While looking at thecurrent status of goat population among Indian states, Rajasthan records first with 16 percent followed by Uttar Pradesh and Bihar.

Buffaloes: Buffaloes are an important source of milk supply for India. Uttar Pradesh has the highest number of buffaloes (28.2%) followed by Rajasthan (9.6%) and Andhra Pradesh (7.9%).

Dairy, Meat and Wool Production

According to State / UT Animal Husbandry Department, during 2016-17, the total production of milk in our nation is 163.7 million tonnes. At this time, the leadingproducer was Uttar Pradesh with 27.6 million tonnes (16.8 percent) followed by Rajasthan with 19.4 million tonnes (11.8 percent) and Madhya Pradesh with 13.4 million tonnes (8.2 percent) in total milk production. While looking at the meat, the total production is 7.4 million tonnes. Uttar Pradesh is the leading producer with 1.3 million tonnes (18.2 percent), where Maharashtra and West Bengal are estimated with 0.8 million tonnes (11.4 percent) and 0.7 million tonnes (9.6 percent) respectively in the total country's production.

The total wool production of our nationis 43.5 million kilograms. The leading state in the wool production is Rajasthan with 14.3 million kilograms (32.9 percent) followed by Jammu and Kashmir with 7.3 million kilograms (16.7 percent) and Karnataka with 6.6 million kilograms (15.1 percent) in country's total wool production.

Fisheries

Fisheries in India are a very important economic activity and a flourishing sector with varied resources and potentials. Fishing in India is a major industry in its coastal states, employing over 14 million people.It produces about 3 percent of World's fish and

occupies second place among the fish producing nations of the world after China. It also helps in augmenting food supply, generating employment, raising nutritional level and earning valuable foreign exchange. The length of Indian coastline is 7,517 kmincluding the coastline of the islands; however the mainland's length is 6,100 km. In India, fishing is categorised into two types: they areMarine or Sea Fisheries: It includes coastal, off-shore and deep sea fisheries mainly on the continental shelf upto a depth of 200 m. Among the coastal states, Kerala leads in the marine fish production in India.

Inland or Fresh Water Fisheries: Rivers, lakes, canals, reservoirs, ponds, tanks etc. are the sources of fresh water and provide fresh water fisheries. About 50 percent of the country's total fish production comes from the inland fisheries and Andhra Pradesh is the leading producer in India. In India, the important varieties of fishes caught by the fisherman are Cat fish, Herrings, Mackerels, Perches, Eels, Mullets etc. In 2014-15, the total inland or fresh water fish production was 65.77 lakh tonnes and the total marine fish production was 34.91 lakh tonnes.In India, the top five fish producing states are Andhra Pradesh, West Bengal, Gujarat, Kerala, and Tamil Nadu.

Major issues faced by farmers in India

Indian agriculture and Indian farmers are plagued by several problems; some of them are natural and some others are manmade.

- **Small and fragmented land-holdings**: The problem of small and fragmented holdings is more serious in densely populated and intensively cultivated states in India. About 67 percent of operational land holdings in India are marginal holdings (< 1 hectare).

- **High Costs of Inputs**: Seed is a critical and basic input for attaining higher cropyields and sustained growth in agricultural production. Unfortunately, good quality seeds are out of reach for many small and marginal farmers due to their high price.
- **Infertile Soil:** Indian soils have been usedfor growing crops over thousands of yearswithout caring much for replenishing. Thishas led to depletion and exhaustion of soilsresulting low productivity.

- **Lack of Irrigation:** Only one-third of thecropped area falls under irrigated area. Tomake agriculture reliable, irrigation facilityhas to be developed.

- **Lack of mechanization**: In spite of thelarge scale mechanization of agriculturein some parts of the country, most of theagricultural operations in larger parts arecarried on by human hand using simpleand conventional tools.

- **Soil erosion:** Large tracts of fertile landsuffer from soil erosion by wind and water.Such kind of areas must be properly treatedand restored to its original fertility.

- **Agricultural marketing:** In rural India,agricultural marketing continues in a bad shape. Due to the absence of sound marketingfacility, the farmers have to depend on

localtraders and middlemen for the disposalof their farm products which is sold at lowprice. Besides, there is a fluctuation in theprices of agriculture products.

- **Inadequate storage facilities:**Storagefacilities in the rural areas are either totallyabsent or grossly inadequate. Under suchconditions the farmers are compelled to selltheir products immediately after the harvestirrespective of the condition of market.

- **Inadequate transport:** One of the mainhandicaps with Indian agriculture isthe lack of cheap and efficient means oftransportation. Even at present there arelakhs of villages which are not well connectedwith main roads or with market centres.

- **Scarcity of capital:** Agriculture is animportant industry which requires ahuge capital. The role of capital plays amajor role in the purchase of advancedfarm machineries and equipment's.

List of important Agricultural Revolutions in India

Revolution	Related Product
Yellow Revolution	Oil seed Production (especially Mustard and Sunflower)
Blue Revolution	Leather / Cocoa / Non-Conventional Products
Brown Revolution	Jute Production
Golden Fibre Revolution	Fruits/ Honey Production / Horticulture Development
Golden Revolution	Fertilizers
Grey Revolution	Onion Production / Pharmaceuticals / Prawn Production
Pink Revolution	Overall production of Agriculture
Evergreen Revolution	Egg Production / Poultry Production
Silver Revolution	Cotton
Red Revolution	Meat Production / Tomato Production
Round Revolution	Potato
Green Revolution	Food Grains
White Revolution	Milk Grains

NOTE

- **Per Drop MoreCrop**: (Improving water useefficiency) - Pradhan MantriKrishi Sinchayee Yojana (PMKSY). The Government of India has been implementing Centrally Sponsored Scheme on Micro Irrigation with the objective to enhance water use efficiency in the agriculture sector by promoting appropriate technological interventions like drip & sprinkler irrigation technologies and encourage the farmers to use water saving and conservation technologies. The following are the five leading states which account for 78% of the total progress under Micro Irrigation scheme: 1. Andhra Pradesh, 2. Karnataka, 3. Gujarat, 4. Maharashtra, and 5. Tamil Nadu.

- **Livestock Census**: First Livestock Census in India was conducted with the title

of Dairy Cattle Census in 1919. Following this, the 19thLivestock census was conducted in October 2012 and it takes place at every five years.

❖ **How is livestock census conducted in Tamil Nadu?**
State Government is conducting Livestock Census with the help of Department of Animal Husbandry at state level and Regional Joint Director at District level under the guidelines of Government of India Ministry of Agriculture and farmers welfare, Department of Animal Husbandry Dairying and Fisheries. The Livestock Census in the country started in the year 1919 – 1920. Since then it has been conducted once in every 5 years. So far 19 livestock census has been conducted and the last census was held in the year 2012. The 20th Live-stock Census – 2017 was scheduled to be conducted from 16th July and will end on 15th October 2017.

4. Resources and Industries

Introduction

Any matter or energy derived from the environment that is used by living things including humans is called a natural resource. Natural resources include air, water, soil, minerals, fossil fuels, plants, wild life etc. Many natural resources are used as raw materials. They play a vital role in the economic development of any region. Natural resources are classified on several basis. Based on continued availability, the resources are categorised into two types. Renewable Resources are those which have natural regeneration after their utilisation. Solar energy, wind energy, biogas, tidal energy, wave energy etc. are the renewable resources. Non- Renewable resources are the sources that cannot be replaced again after utilisation. Coal, petroleum, natural gas etc. fall under this category.

Minerals

Mineral is a natural substance of organic or inorganic origin with definite chemical and physical properties. The process of extracting mineral from the earth is known as mining. The mines near the earth crust are known as open pit mines while the deep mines are known as shaft mines.

Types of Minerals

On the basis of chemical and physical properties, minerals are broadly grouped under two categories. They are metallic and non-metallic minerals.

a. Metallic Minerals

Metallic minerals are the minerals which contain one or more metallic elements in them. Metallic minerals occur in rare, naturally formed concentrations known as mineral deposits. These deposits consist of a variety of valuable metals such as iron, manganese, copper, bauxite, nickel, zinc, lead, gold etc.

i. Iron ore

Iron ore is the most widely distributed elements of the earth crust, rarely occurs in a free state. It enters into thecomposition of many rocks and minerals especially from igneous and metamorphic rocks. The total recoverable reserves of iron ore in India are about 9602 million tons of haematite and 3408 million tons of magnetite. About 79% haematite deposits are found in Assam, Bihar, Chhattisgarh, Jharkhand, Odisha and Uttar Pradesh.About 93% magnetite deposits occurin Andhra Pradesh, Goa, Karnataka, Kerala and Tamil Nadu. Karnataka alone contributes about 72% of magnetite deposits of India.

Iron ores are rocks and minerals from which metallic iron can be economically extracted. The ores are usually rich in iron oxides and vary in

colour from dark grey, bright yellow, or deep purple to rusty red. The iron is usually found in following form.

Form of Iron ores	Iron Content (%)
Magnetite	72.4%
Hematite	69.9%
Goethite	62.9%
Limonite	55%
Siderite	48.2%

Jharkhand is the leading producer of iron ore with 25% the country's production. Singhbhum, Hazaribagh, Dhanbad and Ranchi districts are its major producers. Odisha with 21% production ranks second. Sundargarh, Mayurbhanj, Sambalpur and Keonjhar districts are its major producers. The magnetite production of Chhattisgarh is 18% (Rajgarh and Bilaspur are its leadings districts) and the Karnataka is 20% (Chikmangalur, Chitradurga, Shimoga and Dharwad districts are its major producers). Andhrapradesh and Karnataka produce about 5% each. Kurnool, Guntur, Cuddapah and Anantapur districts in Andhra Pradesh and Salem, Namakkal, Tiruvannamalai, Tiruchirappalli, Coimbatore, Madurai and Tirunelveli districts in Tamil Nadu are notable for the production of iron ore. SAIL (Steel Authority of India Limited): The Ministry of Steel is responsible for planning and development of iron and steel industry in India.

ii. Manganese

Manganese is a silvery grey element. It is very hard and brittle in nature. It is always available in combination with iron, laterite and other minerals. It is an important mineral used for making iron and steel and serves as basic raw material for alloying. It is the most important mineral for making iron and steel. Nearly 10 kg manganese is required for manufacturing one ton of steel. It is also used in the manufacturing of bleaching powder, insecticides, paints and batteries. Manganese deposits occur mainly as metamorphosed bedded sedimentary deposits. The largest deposits of manganese is found in Odisha(44%) followed by Karnataka (22%), Madhya Pradesh (12%), Maharashtra & Goa(7% each), Andhra Pradesh (4%) and Jharkhand (2%). Rajasthan, Gujarat, Telengana and West Bengal together constitute about 2% of the India's manganese resource. Nagpur,Bhandara and Ratnagiri districts in Maharastra and Balaghat and Chhindwara districts in Madhya Pradesh are the leading producers. Odisha is the third largest producer with 24% (Sundargarh,Kalahandi, Koraput and Bolangir districts are the major ones). Other producers are Andhra Pradesh (13%) and Karnataka (6%). Srikakulam, Visakhapatnam, Cuddapah and Guntur districts in Andhra Pradesh andthe districts of Shimoga, Bellary, Chitradurgaand Tumkur are the important districts of Karnataka. It is the most important mineral for making iron and steel. India is the fifth largest producer of manganese in the world.

iii. Copper

Copper is the first metal that prehistoric man has started using for many purposes. Being flexible, it can be made into utensils of any shape. Brass and Bronze are obtained when the copper alloys with zinc and tin respectively. Copper has been commonly used for making cooking utensils and other objects of common utility. In modern days, it is extensively used in vast variety of electrical machinery, wires and cables Largest reserves of copper ore is in the state of Rajasthan (53.81%) followed by Jharkhand (19.54%) and Madhya Pradesh (18.75%). The states of Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Meghalaya, Nagaland, Odisha, Sikkim, Tamil Nadu, Telangana, Uttarkhand and West Bengal account for 7.9% of the total copper reserves of India.

Jharkhand is the largest producer ofcopper with 62% of India's production.Singhbhum and Hazaribagh districts are its leading producers of copper. Odisha is the other major producer with 50.2% production. Rajasthan ranks third with 28% production. The districts of Khetri, Alwar and Bhilwara are notables in this state. The states of Uttarkhand(Dehradun and Garhwal districts),Andhra Pradesh (Guntur, Kurnool and Nellore districts), Karnataka (Chitradurga and Hassan districts) and Tamil Nadu contributes about 7% of production each.

iv. Bauxite

Bauxite is an important ore from which aluminium is extracted. It is found in the rock consisting mainly of hydrated aluminium oxides. Bauxite is widely distributed as surface deposits in the areas of laterite soil. Being light in weight and tough, aluminium is used in the manufacture of aircraft s and automobile engines. Bauxite is also used in the manufacture of cement and chemicals. The main bauxite deposits occur in Odisha – 50.2%, Gujarat – 15.8% (Junagadh, Amreli and Bhavnagar districts), Jharkhand – 11.9% (Ranchi and Gumila districts), Maharashtra – 9.9% (Sindhu durg and Ratnagiri), Chhattisgarh – 6.2% (Ballarpur
and Durg districts), and Tamil nadu – 2.7%. Being light in weight and tough, aluminium is used in the manufacture of aircraft s and automobile engines. Bauxite is also used in the manufacture of cement and chemicals. Orissa is the largest producer of bauxite in India with approx. 1,370.5 million tonnes. India's State and Central Government is very supportive in production of Bauxite and other Industrial Minerals in Orissa, Jharkand, Tamil Nadu.

b. Non-Metallic Minerals

These minerals do not contain metal in them. Mica, limestone, gypsum, nitrate,potash, dolomite, coal, petroleum etc are thenon- metallic minerals.

i. Mica

In ancient time, Mica was used in ayurvedic medicine. Mica became very popular with the development of electrical industry. Abhrak is a good quality mica. It is translucent, easily splitable into thin sheets, flat, colourless, elastic and incompressible. Mica is used in making of insulating properties, as it withstands high voltage and has low

power loss factor. Since it is a non-conductor of electricity, it is exclusively used in electrical goods. It is also used in making of lubricants, medicines, paints and varnishes.

The major deposits of mica are found in Andhra Pradesh(41%) with Nellore, Visakhapatnam, West Godavari and Krishna are its major districts. Other important states in mica deposits are Rajasthan(21%) and Odisha(20%). Bhilwara, Jaipur and Ajmer are the notable districts in Rajasthan and, Rayagada, Bolangir and Sundargarh districts are the major producers in Odisha. Dhanbad, Palamu, Ranchi and Singhbum districts are the major mica mines in Jharkhand state.

ii. Lime Stone

Limestone is associated with rocks composed of either calcium carbonate or the double carbonate of calcium and magnesium or mixture of both. Limestone also contains small quantities of silica, alumina, iron oxides, phosphorous and sulphur. Limestone is used in the industries ofchemicals for soda ash, caustic soda, bleachingpowder, paper, cement, iron and steel, glassand fertilizers. The major producing areas: Andhra Pradesh produces about 20% with major concentration in Cuddapah, Kurnool and Guntur districts. Telengana also accounts for about 20% of the country's production with the districts of Nalgonda, Adilabad, Warangal and Karimnagar as major producers. Rajasthan produces about 18% (Jodhpur, Ajmer, Bikhaner and Kota districts), Madhya Pradesh about 12% (Jabalpur and Satna districts) and TamilNaduabout 8.4% (Salem, Kancheepuram, Tiruchirappalli, Thoothukkudi, Tirunelveli and Virudhunagar districts) of limestone production of India. In terms of the reserves of limestone, the state of Karnataka leads with 27%, followed by Andhra Pradesh and Rajasthan (12% each), Gujarat (10%), Meghalaya (9%), Telangana (8%), Chhattisgarh and Madhya Pradesh (5% each) and the remaining by other states.

iii. Gypsum

Gypsum is a hydrated sulphate of calcium which occurs as white, opaque or transparent minerals in beds of sedimentary rocks such as limestone, sandstone and shale. Gypsum is used in the manufacture of cement, fertilizers, wall board, plaster of paris andin soil conditioning. The state of Rajasthan alone accounts for 81% of its reserves. 14% ofits reserves is found in Jammu and Kashmirand 2% in Tamil Nadu. The remaining 3% resources are found in the states of Gujarat, Himachal Pradesh, Karnataka, Uttarakhand, Andhra Pradesh and Madhya Pradesh. Rajasthan produces 82% of the country'sproduction. Jodhpur, Bikaner and Jaisalmerare notable districts. Jammu and Kashmirproduces 14% of country's gypsum. Baramula,Doda and Uri districts are its major producers.The states of Gujarat (Bhavnagar andJamnagar districts), Uttarkhand (Dehradunand Mussourrie districts), Andra Pradesh(Nellore, Guntur and Prakasam districts)and Tamil Nadu are the other producers withabout 4% each.

Energy Resources

The resources from which the electricity generated are called energy resources. Electricity is an important component of our life. No day to day activity takes without the use of this energy. It is also the key factor for all economic activities and industrial development. Energy resources can be classified into renewable and non-renewable. Coal, petroleum, natural gas and nuclear minerals are the sources of non-renewable energy. Water, sun light, wind, bio gas, tides etc., are the sources of renewable energy.

Non-Renewable Energy

a. Coal

Coal is an inflammable organic substance composed mainly of hydrocarbons. Coal is available in the form of sedimentary rocks. It is used in the generation of thermal power. It has close association with the industrial development of any country. Since it is a valuable one, it is called as "Black Gold". Based on carbon content, it is classifiedin to the following types.

Anthracite: contains 80 to 90% carbon
Bituminous: contains 60 to 80% carbon
Lignite: contains 40 to 60% carbon
Peat: contains less than 40% carbon

Coal is an important source of energy in India with its varied and innumerable uses. It can be converted into gas, oil, electricity and thermal power. Besides, it forms a basic raw material for the production of chemicals, dyes, fertilizers, paints, synthetic and explosives. Indian coal is mostly associated with Gondwana series of rocks and is primarily found in Peninsular India. The states of Jharkhand, odisha, West Bengal and Madhya Pradesh alone account for nearly 90% of coal reserves of the country. About 2% of India's coal is of tertiary type and is found mostly inAssam and Jammu & Kashmir.

Jharkhand is the largest coal producing state in the country followed by odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Andhra Pradesh and Maharashtra. The major coal fields ofJharkhand are Bokaro, North Karanpura, SouthKaranpura, Giridih, Ramgarh, Daltongunj andRajmahal. Talcher and Ranapur in Odisha,Korba and Chirmiri in Chhattisgarh, Umariaand Singrauli in Madhya Pradesh, Tandur, Singareni, Kothagudem and Ramagundam in Andhra Pradesh, Wardha, Ballarpur, Chanda and Kampati in Maharastra and, Raniganj, Asansol and Mejia in West Bengal are the other major coal fields of India.

Indian lignite (brown coal) deposits occur in the southern and western parts of Peninsular India particularly in Tamil Nadu, Pudhucherry and Kerala. The Ministry of coal has over-allresponsibility of determining policies andstrategies in respect of exploration anddevelopment of coal resource in India. Coal IndiaLimited (CIL), NLC India Limited (NLCIL) andSingareni Collieries Company limited (SCCL)are its public sector under takings.

b. Petroleum (or) Crude oil

The word petroleum has been derived from two Latin words petro (meaning – Rock) and oleum (meaning oil). Thus petroleum is oil obtained from rocks of the earth. Therefore, it is also called mineral oil. Petroleum is an inflammable liquid that is composed of hydrocarbons which constitute 90-95% of petroleum and the remaining is chiefly organic compounds containing oxygen, nitrogen, sulphur and traces of organ metallic compounds. Petroleum is used as a source of powerand fuel for automobiles, aeroplanes, ships and locomotives. Lubricants, kerosene, vaseline, tar, soap, terylene and wax are its by-products. Oil in India is obtained from both from on-shore and off-shore areas. As of 2017, the total estimated crude oil reserves of the country is 604.10 million tons. From this, 324.24 million tons (54%) are found in onshore and 279.86 million tonnes (46%) are in offshore areas. The production of crude oil fluctuates from year to year from 2011-12 to 2017-18 but only with marginal variations. The change is invariably in negative. In natural gas production also the trend is negative except the last year. The change is high in the first three years and it is low to moderate in the remaining years.

Western coast offshore oil fields	Eastern coast offshore fields
Mumbai high oil fields (largest 65%)	Bharmaputra valley (Dibrugarh and Sibsagar districts of upper Assam.)
Gujarat coast (2nd largest)	Digboi iol fields (oldest fields in country)
Basseium oil field, south of Mumbai high	Nahoratiya oil fields (south west of digboi)
Aliabet oil field, south of Bhavanagar	Moran – Hugrijian oil fields (sibsagar districts of assam)
Ankleshwar	Rudrasagar – Lawa oil fields (sibsagar districts of assam)
Cambay – Luni Region	Surrma valley (Badarpur, Masimpur, Patharia)
Ahmedabad Kalol Region	Offshore of Andaman and Nicobar, Gulf of mannar, Baleshwar coast, Punjab, Haryana and Uttar Pradesh.

c. Natural Gas

Natural gas usually accompanies thepetroleum accumulations. It is naturallyoccurring hydro carbon gas mixture consistingprimarily of methane, but commonly includesvarying amounts of other higher alkanesand sometimes a small percentage of carbondioxide, nitrogen and hydrogen sulphides. Itis formed when layers of decomposed plantsand animals are exposed to intense heat andpressure over thousands of years. It is usedas a source of energy for heating, cookingand electricity generation. It is also used asfuel for vehicles and as a chemical feedstockin the manufacture of plastics and othercommercially important organic chemicals.

India has a very large proportionof tertiary rock and alluvial depositsparticularly in the extra peninsular India.These sedimentary rocks, which were onceunder the shallow seas, hold the possibility ofharbouring oil and gas deposits. The highestconcentration of

natural gas is found in theBombay high and basseim oil fields. Jagatiaand Gogha in Gujarat, Nahorkatiya andMoran in Assam, Neypaltur, Mangmadam inThanjavur district in Tamil Nadu, Baranuraand Atharnure ranges in Tripura, Barmerand Charaswala in Rajasthan, Miao Pung andLaptang areas in Arunachal Pradesh, Firozpurdistrict in Punjab, Mausar and Maradpurareas in Jammu and Kashmir and Medinipurin West Bengal are the other areas wherenatural gas reserves have been discovered.The Gas Authority of India Ltd [GAIL]is doing pioneer work in the field of naturalgas exploration. Discovery of gas made rapidstrides in the 1985. Oil strikes at Cauveryoffshore, at Nanda in Cambay basin and Tarotin Jaisalmer basin in Rajasthan were majordiscoveries during 1988-89. Recently, it hasbeen found that Krishna- Godavari delta hasreserves of Natural gas.

Conventional Energy Sources

a. Thermal power

Thermal power is generated using fossilfuels like coal, diesel, petroleum and Naturalgas. National Thermal Power Corporation[NTPC] was established in 1975. At presentNTPC has 13 coal based super thermal powerprojects and 7 gas / liquid fuel based combined cycle projects in the states of Assam, Bihar, Jharkhand, Chhattisgarh, Mizoram and West Bengal. It accounts for over 90% of theinstalled capacity. Tamil Nadu produces about5% of the total thermal electricity produced in India. Neyveli, Mettur, Thoothukudi and Ennore (Chennai) are the important thermal power stations in Tamil nadu.

b. Nuclear power

The energy released during nuclear fission or fusion is used to generate electricity.Nuclear energy is generated mainly from the minerals of Uranium and Thorium. Nuclear power programme in India was initiated in 1940's when 'Tata Atomic research commission was incorporated in August 1948. The first nuclear power station was setup at Tarapur near Mumbai in 1969 with the capacity of 320 mw. Later atomic reactors were installed at Rawatbhata (335 MW), near Kota in Rajasthan (100 MW), Kalpakkam (440 MW) and Kudankulam (2,000 MW) in Tamil Nadu and Narora (235 MW) in Uttar Pradesh, Kaiga in (235 MW) in Karnataka and Kakarapara (235 MW) in Gujarat.

Renewable or Non-Conventional EnergyResources

a. Hydro power

Power generated from water is termed as hydroelectricity. Hydro power is the energy harnessed from running water. Hydro power is considered as one of the most economic and non-polluting sources of energy. It contributes nearly 7% of global electricity production. The cost of production of hydroelectricity is relatively low, making it a competitive source of renewable energy. It is also a flexible mode of power generation as the quantity of production can either be increased or decreased very quickly adapting to changing demands. India is fortunate to have a large potential of hydro- power potential. It is quite unevenly distributed in India. Of the total hydro-electricpotential of

the country, rivers of Assam, Arunachal Pradesh, Manipur, Nagaland and Tripura account for 30.4%, eastward flowing rivers of the peninsular India 20.9%, westward flowing rivers of the western Ghats (South of the Tapti) 10.5%, the Ganga Basin (excluding the potential of Nepal) 11.7%, the Indus Basin 16.0% and the rivers of central India 10.5%.

b. Solar Energy

Solar Power is the conversion of sunlight into electricity, either directly using photovoltaic (PV) or indirectly using concentrated solar power (CSP). Concentratedsolar power systems use lenses or mirrorsand tracking system to focus a large area of sunlight into a small beam. Photovoltaic convert light into an electric current using the photovoltaic effect. The mass objectives of the solar thermalenergy programme, being implemented bythe Ministry of Non-Conventional EnergySource (MNES) are market development, commercialisation and utilisation of heat energy requirement of different applications in domestic, institutional and industrial sectors. Solar power is used in water heaters, refrigerators, drying, street lighting, cooking, pumping, power generator, photovoltaic cells, salon parts etc. Andhra Pradesh, Gujarat, Rajasthan, Maharashtra and Madhya Pradesh are the major solar power producers.

c. Wind Energy

Wind energy is extracted from air flow using wind turbines. It is a cheap and pollution free source of energy. Power from wind mills are used for pumping water and to sail propel ships. Windpower is plentiful, renewable, widely distributed, clean and produces no greenhouse gas emissions during operation.These plants occupy only a less space. The development of wind power in India began in 1986 with first wind farms were set up in coastal areas of Gujarat (Okha), Maharashtra (Ratnagiri) and Tamil Nadu (Thoothukudi) with 55 KW Vestas wind turbines. The capacity has significantly increased in the last few years. India has the fourth largest installed wind power capacity in the world.

d. Biomass Energy

Bio energy may be obtained throughbio-degradable materials like animal dung, kitchen wastes, water hyacinth, agricultural residues and city wastes etc. It is clean and cheap source of energy. India has a potential of about 18 GW of energy from Biomass. Currently, about 32% of total primary energy used in India is derived from Biomass. Energy derived from biomass is mostly used for domestic purposes.

e. Tidal and wave Energy

There are two main sources of ocean energy. They are Ocean tides and Ocean waves. It is estimated that India possesses 8,000-9,000 MW of tidal energy potential. The Gulf of Cambay is the best suited area with about 7,000 mw potential of tidal energy. This is followed by Gulf of Kachch (1,000MW) and sunder bans (100MW). At present a 900mw tidal power plant is proposed to be set up in the Gulf of Kachch region. Wave energy

potential in India is estimated to be 40,000 MW. An wave energy power plant of 150KW(maximum) has been installed at vizhinjam near Thiruvananthapuram. An another plant of this kind has been set up near Andaman& Nicobar Islands.

Industries

It refers to the activities which converts the raw materials into finished products. This sector is called as the value addition sector. On the basis of the source of raw materials, Industries are classified into the Agro based industries, Forest based industries andMineral based industries.

Agro based industries

These industries draw their raw materials from agricultural sector. The following part discusses the agro based industries in India.

a. Cotton Textile Industry

Textile is a broad term which includes cotton, jute, wool, silk and synthetic fibre textiles. This sector in India with 3400 textiles mills with installed capacity of more than 50 million spindles and 842000 rotors is the second largest in the world. Traditional sectors like hand loom, handicrafts and small power-loom units are the biggest source of employment for millions of people in rural and semi urban areas. The cotton textile industries contribute about 7% of industrial output, 2% of India's GDP and 15% of the country's export earnings. It is one of the largest sources of employment generation in the country. With over 45 million employees, the total employment in this industry is well over 25million worker. At present there are 1,719 textiles mills in the country. Out of which 188 mills are in public sector, 147 in cooperative sector and 1,284 in private sector. Currently, India is the third largest producer of cotton and has the largest loomarc and ring spindles in the world. At present,cotton textile industry is the largest organizedmodern industry of India. About 16% ofthe industrial capital, 14% of industrial production and over 20% of the industriallabour of the country are engaged in thisindustry.The higher concentration of textilemills in and around Mumbai, makes it as"Manchester of India". Presence of blackcotton soil in Maharastra, humid climate,presence of Mumbai port, availability ofhydro power, good market and well developedtransport facility favour the cotton textileindustries in Mumbai.The major cotton textile industries areconcentrated in the states of Maharashtra,Gujarat, West Bengal, Uttar Pradesh andTamil Nadu. Coimbatore is the most importantcentre in Tamil Nadu with 200 mills out ofits 435 and called as "Manchester of SouthIndia". Erode, Tirupur, Karur, Chennai,Thirunelveli, Madurai, Thoothukudi, Salemand Virudhunagar are the other major cottontextiles centres in the state.

b. Jute Textiles

Jute is a low priced fibre used mainly formaking package materials like gunny bags.Today jute is blended with cotton and wool toproduce textiles. India is the largest producerof jute goods contributing 35% of the world'stotal output. This is the second

important textileindustry in India after cotton textiles. Jute is thegolden fibre which meets all the standards ofgoods packing with its natural, renewable, biodegradable and eco-friendly products.The first jute mill in India was established atRishra near, Kolkata in 1854 by the English manGeorge Auckland.

India tops in the productionof raw jute and jute goods and second inthe export of jute goods next to Bangladesh.Jute production includes gunny bags, canvas,pack sheets, jute web, carpets, cordage, hessians and twines. Now jute is also being used in plasticfurniture and insulation bleached fibres to blendwith wool. It is also mixed with cotton to makecarpet and blankets. The major jute producingareas are in West Bengal and concentratedalong the Hooghly river within the radius of sixkilometre of Kolkata. Titagarh, Jagatdat, Budge-Budge, Haora and Bhadreshwar are the chiefcentres of jute industry. Andhra Pradesh, Bihar,Uttar Pradesh, Assam, Chhattisgarh and Odishaare the other jute goods producing areas.

c. Silk Industry

India has been well known for theproduction of silk. Since the ancient times,India is the second largest producer of raw silknext only to China. Sericulture isa labour intensive industry andprovides employment to 7.56million people make to weakerand marginalised sections ofsociety.Karnataka is the largest producer of silkwith an average of 8200 metric tons everyyear which is about one third of the total silkproduction of India. Other major producers ofsilk are West Bengal, Jammu Kashmir, Bihar,Jharkhand, Chhattisgarh, Uttar Pradesh,Punjab, Assam and Tamil Nadu states. Indiaexports exclusively silk fabrics, silk scarves,dress material and sarees. It exports to theprincipal countries like Europe, U.S.A, U.K,Russia, Saudi Arabia, Kuwait and Singapore.

d. Sugar Industry

Sugar can be produced from sugar cane,sugar-beets or any other crop which havesugar content. In India, sugar cane is the mainsource of sugar. At present this is the secondlargest agro based industry of India aftercotton textiles. India is the world's secondlargest producer of sugar cane after Brazil. Thisindustry provides employment to 2.86 lakhworkers. Sugar industry is decentralized andlocated near the sugarcane growing areas asthey are weight loosing and bulky to transport.Uttar Pradesh is the largest producer ofsugar, producing about 50% of the country's total. Other major producers are Maharashtra,Uttar Pradesh, Karnataka, Andhra Pradesh,Tamil Nadu, Bihar, Punjab, Gujarat, Haryanaand Madhya Pradesh states. These statesaccount for more than 90% of the sugar millsand sugar production.

Forest based industries

Forest provide us with different typesof material which are used as raw materialfor certain industries like paper, lac, sportsgoods, plywood etc.

a. Paper industry

Paper Industry has emerged as adiversified and specialized industry in Indiathat produces numerous types of papers thatcomes in various use such as sheet paper, paper boxes, tissues, paper bags, stationery,envelopes and printed-paper products such asbooks, periodicals, and newspapers. In Indiathe Soft wood is the principal raw materialused for making paper especially newsprintand high class printing papers. Paper is thepre-requisite for education and literacy andits use is an index of advancement in thesetwo fields as well as the overall well-being ofthe society.

The first successful effort was made in 1867 with the setting up of the RoyalBengal paper mills at Ballyganj near Kolkata. Subsequent successful efforts were made atLucknow in 1879, Titagarh in 1882, Pune in 1887, Raniganj in 1892, Kankinra in 1892 and Naihati in 1918.The raw materials for paper industry includes wood pulp, bamboo, salai and sabai grasses, waste paper and bagasse. West Bengal is the largest producer of paper in the country followed by Madhya Pradesh, Odisha and Tamil nadu states.

Mineral based industries

Mineral based industries use both metallic& non-metallic minerals as raw materials. The major mineral based industry of country is the iron steel industry

a. Iron and steel industries

Iron and steel industry is called abasic metallurgical industry as its finished product is used as raw material by host of other industries. Several industries like engineering, heavy machines and machine tools, automobile, locomotives and railway equipment industries use iron and steel as their primary raw material. Due to this, the steel producing capacity of a country is generally taken as an indicator of its level of industrial development. The modernization of the industry was started in 1907 with the establishment of Tata Iron and Steel Company at Sakchi, now called Jamshedpur. Iron and steel industry of India is mainly concentrated in the states of Jharkhand, West Bengal and Odisha. Proximity to the coal fields of Jharia, Raniganj, Bokaro and Karanpura and the iron ore mines of Mayurbhanj, Keonjar and Brona are responsible for this. This area also has sufficient deposits of limestone, dolomite, manganese, silicon and dolomite which are required for the industry.

S.NO	Name of Industry	Place	Establishment year	Product
1.	Tata Iron and Steel Company (TISCO)	Jamshedpur, Jharkhand	1911	Pig Iron
2.	Indian Iron and steel Company (IISCO)	Burnpur, Hirapur, Kulti, West Bengal	1972	Pig Iron & Crude steel
3.	Visweshwaraya Iron Steel Ltd (VISL)	Bhadravati, Karnataka	1923	Alloy and Sponge steel
4.	Hisdustan Steel Ltd (HSL) Collaborated with	Bhilai, Chattisgarh	1957	Railway Equipment's and Ship Building

	Russia			
5.	Hindustan Steel Ltd (HSL) Collaborated with Germany	Rourkela, Odisha	1965	Hot and Cold rolled sheets, Galvanized sheets and electrical plates
6.	Hindustal Steel Ltd (HSL) Collaborated with United Kingdom	Durgapur, west Bengal	1959	Alloy steel, Construction materials and railway equipment's
7.	Hisdustan Steel Ltd (HSL) Collaborated with Russia	Bokaro, Jharkhand	1972	Sludge and Slog
8.	Salem Steel Ltd	Salem, Tamil Nadu	1982	Stainless Steel
9.	Vijayanagar Steel Plant	Tornagal, Karnataka	1994	Flat steel and Long Steel
10.	Visakhapatnam Steel Plant (VSO)	Visakhpatnam, Andhra Pradesh	1981	Hot Metal

Automobile Industry

India is set to emerge not only as a largedomestic market for automobile manufacturers, but also as a crucial link in the global automotive chain. It is one of the most dynamic industrial groups in India. The first automobile industry of India was started in 1947. The industry is the Premier Automobiles Ltd located at Kurla (Mumbai). It was followed by the Hindustan Motors Ltd at Uttarpara (Kolkata) in 1948. At present, India is the 7th largest producer of automobile manufacturers which include two wheelers, commercial vehicles, passenger car, jeep, scooty, scooters, motor cycles, mopeds and three wheelers. Major centres are at Mumbai,Chennai, Jamshedpur, Jabalpur, Kolkata,Pune, New Delhi, Kanpur, Bengaluru, Sadara, Lucknow and Mysuru. Tata Motors, Maruti Suzuki, Mahindra &Mahindra and Hindustan Motors are the largest passenger car manufacturers of Indian companies in the country. Presence of foreign car companies such as Mercedes Benz, Fiat, General Motors, Toyota and the recent entryof passenger car manufacturers BMW, Audi, Volkswagen and Volvo makes the Indian automobile sector a special one. Tata Motors, Ashok Leyland, Eicher Motors, Mahindra &Mahindra and Ford Motors are the major Indian companies which manfacture commercial vehicles. MAN, ITEC, Mercedes-Benz, Scania and Hyundai are the foreign companies engage in the manfacture of commercial vehicles. Twowheeler manufacturing is dominated by Indian companies like Hero, Bajaj Auto and TVS.

The automobile industries are found in four clusters viz; Delhi, Gurgaon and Manesar in North India, Pune, Nasik, Halol and Aurangabad in West India, Chennai, Bengaluru and Hosur in South India and Jamshedpur and Kolkata in East India. Electrical and Electronic

Industries

Heavy electrical industries manufacture equipment used for power generation, transmission and utilization. Turbines for steam and hydro power plants, boilersfor thermal power plants, generators, transformers, switch gears etc. are the chief products of this industry. The most important company in the field of heavy electrical is Bharat Heavy Electricals Ltd (BHEL). It has its plants at Hardwar, Bhopal, Hyderabad, Jammu, Bengaluru, Jhansi and Tiruchirappalli. This Industry covers a wide range of products including television sets, transistor sets, telephone exchanges, cellular telegram, computers and varied equipment's for post and railway, defence and meteorological department. Bengaluru is the largest producer of electronic goods in India, hence it is called as the "Electronic Capital of India". The othermajor producers of electronic goods centers are Hyderabad, Delhi, Mumbai, Chennai, Kolkata, Kanpur, Pune, Lucknow, Jaipur and Coimbatore.

Software Industry

India is home to some of the finestsoftware companies in the world. The software companies in India are reputed across the globe for their efficient IT and business related solutions. The Indian Software Industry has brought about a tremendous success for the emerging economy. In India, software industry began in 1970 with the entry of Tata ConsultancyServices (TCS). Along with this, L & T, InfoTech, i-Flex, Accenture, Cognizant, GalexE Solutions India Pvt Ltd and ITC InfoTech are the major software industries in the country. At present, there are more than 500 software companies all over India. It exports software service to nearly 95countries in the world.The main centres of IT parksare located in Chennai, Coimbatore, Thiruvananthapuram, Bengaluru, Mysuru, Hyderabad, Visakhapatnam, Mumbai, Pune, Indore, Gandhi Nagar, Jaipur, Noida, Mohali and Srinagar.

Major challenges of Indian Industries

Industries in India face many problems. Some major problems are listed below.

- Shortage and fluctuation in Power Supply.
- Non- availability of large blocks of land.
- Poor access to credit.
- High rate of interest for borrowed loan.
- Non- availability of cheap labourers.
- Lack of technical and vocational trainingfor employees.
- Inappropriate living conditions nearbyindustrial estates.

NOTE

- The organisations associated with minerals in India are the Geological Survey of India (Headquarter is at Kolkata), Indian Bureau of Mines (Headquarter at Nagpur) and Non-Ferrous Material Technology Development Centre (NFTDC), located at Hyderabad. The Ministry of Mines is responsible for the administration of all mines

and minerals (Development and Regulation Act, 1957).

- MOIL- Manganese Ore India Limited state-ownedmanganese-ore miningcompany headquarteredin Nagpur. With a marketshare of 50%, it was the largest producer ofmanganese ore in India.
- Hindustan Copper Ltd is a Government-ownedcorporationin the centralpublic Enterprise under theMinistry of minies, India.HCL is the only vertically integratedcopper producer in India engaged in awide spectrum of activities ranging fromMining, Beneficiation, Smelting, Refiningand Continuous Cast Rod manufacturer.Bauxite is an oxide ofaluminium; the name has beenderived after the French wordLe Baux.
- National Aluminium Company Limited, abbreviated as NALCO, (incorporated1981) has units in Odisha at places like Angul and Damanjodi. It was incorporatedas a public sector enterprise of the Ministry of Mines, Government of India in 1981.
- Coal India Limited (CIL) is an Indian state-controlled coal mining company headquartered in Kolkata, West Bengal, its field offices are located at Dhanbad, Ranchi, Bilaspur, Nagpur, Sambalpur,Kothagudam and Asansol. It is the largestcoal-producing company in the world.
- The Ministry of Petroleum and Natural Gas (MOP&NG) is a ministry of the Government of India. It is responsible for the exploration, production, refining, distribution, marketing, import, export, and conservation of petroleum, natural gas, petroleum products, and liquefied natural gas in India.
- Gail (India) Limited (GAIL) (formerly known as Gas Authority of India Limited) is the largest state-owned natural gas processing and distribution company in India. It is headquartered in New Delhi. It has the following business **segments**: natural gas, liquid hydrocarbon, liquefied petroleum gas transmission, petrochemical, city gas distribution, exploration and production, GAILTEL and electricity generation.
- Compressed natural gas (CNG) (methane stored at high pressure) is a fuel which can be used in place of gasoline, diesel fuel and propane/LPG. In comparison to other fuels, natural gas poses less of a threat in the event of a spill, because it is lighter than air and disperses quickly when released. Biomethane – cleaned-up biogas from anaerobic digestion or landfills – can be used. Natural gas vehicles are increasingly used in Delhi, Ahmedabad, Mumbai, Pune, Kolkata Lucknow, Kanpur, Varanasi, etc.
- The Nuclear Power Corporation of India Limited (NPCIL) is an Indian public sector undertaking based in Mumbai, Maharashtra. It is wholly owned by the Government of India and is responsible for the generation of nuclear power for electricity. NPCIL is administered by the Department of Atomic Energy (DAE) is responsible for designing, and operating the nuclear power stations in India.
- NHPC Limited (National Hydroelectric Power Corporation) is located in Faridabad, India
- The first hydro-electric power station in India was established at "Darjeeling" in1897.
- Solar Energy Corporation of India Limited (A Government of India Enterprise)head quarter is located at New Delhi.
- Tamil Nadu has the largest installation of wind turbines in the country in the
- Muppandal-Perungudi area near Kanniyakumari is the largest concentrations of wind farm capacity at a single location in the world.
- The National Institute of Wind Energy (NIWE), Chennai was established in Tamil

Nadu in 1998 as an autonomous institution under the administrative control of the Ministry of New and Renewable Energy. CIWE main activities include resource assessment and testing & certification.

- The first cotton textile mill was established at Fort Gloster near Kolkata in 1818.
- Byssinosis, also called "brown lung disease" or "Monday fever", is an occupational lung disease caused by exposure to cotton dust in inadequately ventilated working environments.
- National jute board is headquarter at Kolkata.
- Ginning is the process of cotton fibre is separated from the cotton seed.
- The first attempt to produce iron and steel unit was set up at Porto Novo in Tamil Nadu in 1830.
- CSTRI is the only research institute in the country dedicated to the Research & Developmental activities related to silk technology. CSTRI was established in the year 1983 by the Central Silk Board, Ministry of Textiles, Govt. of India having head quarter at Bangalore
- Development Commissioner for Handlooms was set up as an attached non-participating office on 20thNovember, 1975 under the Ministry of Commerce. At present it is functioning under the Ministry of Textiles having headquarters at Udyog Bhawan, New Delhi.
- The first paper mill of India was started in 1812 at Serampore in West Bengal.
- National Newsprint and Paper Mills (NEPA) is at Nepanagar in Burhanpur District of Madhya Pradesh.
- Chennai is nicknamed as the "Detroit of Asia" due to the presence of major automobile manufacturing units and allied industries around the city.Make in India program was launched in 2014 to put India on the world map as a major hub for global design and manufacturing.

5. India - Population, Transport, Communication & Trade

Introduction

The study on human population is one of the most important aspects in geography of any region. The human population has many components but the most fundamental are its number, composition, distribution and density. Therefore, it is essential tostudy these components. The study on these aspects also would reveal the workforce of the country. The population of India as per 2011census is 1,210.19 million (1,21,01,93,422). It shows an increase of 19.31crores from the population of 2001. Population Census of India provides the detailed information about the demography of India. Along with population, we will study about the transport and communication of India in this chapter.

Population

The total number of people residing in acountry at a specified period of time is called the 'Population' of that country. India is the second most populous country in the world next only to china. India covers only 2.4 percent of the land area of the world, but is the home of about 17.5 percent of the world's population. It shows that the proportion of population of India is far higher than the proportion of its area. Thus, a little more than one out of every six persons in the world is from India. Our population is almost equal to the combined population of the USA, Indonesia, Brazil, Pakistan, Bangladesh and Japan and total population of these six countries is 1214.3 million.

Census

Population census is the total process of collecting, compiling, analysing or otherwise disseminating demographic, economic and social data pertaining, at a specific time, of all persons in a country or a well-defined part of a country. It happens in an interval of ten years. The data collected through the census are used for administration, planning, policy making as well as management and evaluation of various programmes by the government.

Distribution and Density of Population

The term 'Population Distribution' refers to the way the people are spaced over the earth's surface. The distribution of population in India is quite uneven because of the vast variation in the availability of resources. Population is mostly concentrated in the regions of industrial centres and the good agricultural lands. On the other hand, the areas such as high mountains, arid lands, thickly forested areas and some remote corners are very thinly populated and some areas are even uninhabited. Terrain, climate, soil, water bodies, mineral resources,industries, transport and urbanization are the major factors which affect the distribution of
population in our country.

Uttar Pradesh is the most populousstate in the country with a population of199.5 million followed by Maharashtra(112.3 million), Bihar (103.8 million) WestBengal (91.3 million) and the combinedAndhra Pradesh (84.6 million). These fivestates account for about half of the country'spopulation. More than one fourth of thepopulation live only in the two states of U.Pand Maharashtra. Sikkim is the least populousstate of India(0.61 million). Delhi with 16.75million population tops among the Unionterritories.

The uneven distribution of population in the country is the result of several factors such as physical, socio-economic and historical ones. The physical factors include relief, climate, water, natural vegetation, minerals and energy resources. Socio-economic factors consists of the religion, culture, political issues, economy, human settlements, transport network, industrialization, urbanization,employment opportunity etc.

Density of population

Population density is a better measure of understanding the variation in distribution of population. It is expressed as number of persons per unit area usually per sq km.According to 2011, the average density ofpopulation of India is 382 persons per sq.km. India is one of the most thickly populated ten countries of the world. The most densely populated state of India is Bihar and the state with least population density is Arunachal Pradesh. Among the union territories, Delhi
is the densely populated one with 11,297 per sq.km, while Andaman and Nicobar Islands have the lowest density of population.

Spatial pattern of population density	
Density	**Places**
Very Low density (less than 150 persons per sq.km)	Arunachal Pradesh (17), Andaman and Nicobar Islands (46), Mizoram (52), Sikkim (86) Nagaland (120), Manipur (122), Himachal Pradesh (123), Jammu and Kashmir (124) and Meghalaya (132)
Low Density (150 to 300 persons per sq.km)	Arunachal Pradesh (17), Andaman and Nicobar Island s(46), Mizoram (52), Sikkim (86) Nagaland (120), Manipur (122), Himachal Pradesh (123), Jammu and Kashmir (124) and Meghalaya (132)
Moderate Density (300 to 500 persons per sq.km.)	Gujarat (308), The combined Andhra Pradesh (308) Karnataka (319), Tripura (350), Maharashtra (365), Goa (394), Assam (397) and Jharkhand (414) are the states with moderate population density. Assam has tea estates, Andhra Pradesh, Karnataka and Jharkhand
High Density (500 t0 1000 persons per sq.km)	Punjab (550), Tamil Nadu (555), Haryana (573), Uttar Pradesh (827) and Kerala (859) The union territory of Dadra and Nagar Haveli (698)
Very High Density (greater than 1000 persons per sq.km)	West Bengal (1029), Bihar (1102), Lakshadweep (2013), Daman and Diu (2169), Puducherry (2598), Chandigarh (9252) and Delhi (11.297).

Population Growth and Change

The growth rate of population is an important demographic feature. It not only helps in understanding the population change that a society has undergone in thepast but also helps in predicting the future demographic characteristics of an area. Population growth refers to the change in the number of inhabitants of a country/territory during a specified period of time. The growthof population is expressed in percentage and is described as the growth rate of population. The following table shows the decadal growth rate of population from 1901 to 2011.

Growth of population in India has gone through the different phases. Population of the country in 1901 was 238 million and it grew to 1,210 million over a period of little more than a century. The following are the different stages of population growth of India.

The Period of Stagnant Population(1901-1921): During the first phase of 20 years (1901-1921), the population of India grew by 15 million. The year 1921 registered a negative growth rate of -0.31% which happened only once throughout the demographic history of India and is called the year of Great Demographic Divide.

The Period of Steady Growth (1921-1951): During the second phase of 30 years (1921-1951), the population of India grew by 110 million.

The Period of Steady Growth (1951-1981): During the third phase (1951- 1981), the population of India grew from 361 million in 1951 to 683 million in 1981. Growth rate in this period is almost doubled when compared to the previous phase of growth rate. This period is often referred to as the period of population explosion.

The period of High Growth withDefinite Signs of Slowing Down (1981-2011): Population of India increased from 685 million to 1210 million during this phase. The growth rate of population decreased from one census to other. This marks the beginning of a new era in the demographichistory of India.

Population changerefers to an increase or decrease of population of an area from one period to another period.Population growth is influenced by the birthrate, death rate and migration. These threemake the changes in population.Birth rate refers to the number of livebirths per thousand people in a year and the
Death rate refers to the number of deaths per thousand people in a year. The rapid decline in death rate is the major cause of the rapid growth of population in India.

Migration

It is the movement of people across regions and territories. It can be internal (within a country) or international (betweenthe countries). Internal migration does notchange the size of population of a country butit influences the distribution of populationin a nation. It plays an important role inchanging the composition and distributionof population. In India, the mass migrationis from rural to urban. Unemployment andunder employment in

the rural areas are thepush factors and the employment opportunityand higher wages in the urban areas causedby the industrial development are the pullfactors of migration in the country. 45 outof 121 crores of people in India are reportedto be migrants as per 2011 census. Migrants constitute about 37% of population. Migrants are 48% from female and 52% from male.

Population composition

Population composition refers to the characteristics such as age, sex, maritalstatus, caste, religion, language, education,occupation etc. The study of composition ofpopulation helps us to understand the social,economic and demographic structure of population.

Age composition

The age composition of population refers to the number of people in different agegroups in a country. It is one of the most basic characteristics of a population. It helps us to understand the proportion of population in dependent and independent category. Population of a nation is generally grouped in to three broad categories. In India, the children who have less than 15 years of age constitute 29.5% and the people above 60 years constitute 8.0%. So, the dependent population in India is 37.5%and the independent population (16- 59 yrs) is 62.5%. It shows that our country has enormous manpower.

Sex Ratio

Sex ratio is defined as the number of females per 1000 male population. This isan important social indicator to measure theextent of equality between males and females in a society at a given time. According to 2011 census, the sex ratio of the country is 940 females per 1000 males. This suggests that the size of female population is lower than males. Only in the state of Kerala and the union territory of Pondicherry the sex ratio is greater than 1000. It is 1084 in Kerala and 1038 in Puducherry. The lowest sex ratio is recorded in the union territory of Daman and Diu(618).

Literacy Rate

The people who are able to read and write are known as literates. It is an important indicator of quality of people. The percentage of literate people to the total population is termed as literacy rate. There has been a steady improvement in the literacy levels in India. India's literacy rate as per 2011 census is 74.04%. From this, the literacy rate of male is 82.14% and the female is 65.46%. It shows that still there is a vast gap (16.68%) between the male and female literacy rates. Kerala ranks first in the country with a literacy rate of 93.91% followed by union territory Lakshadweep with 92.28%. The lowest literacy rate is found in Bihar (63.82 %).

Occupational structure

The economically active part ofa country's population is enumerated during the census operations and stated as workers. Workers are placed under threefold categories in census record. They are main workers, marginal workers and non-workers. According to the Census of India, all those who had worked for the major part of the preceding year (at least 6 months or 183 days) are recorded as main workers. Those who worked for less than six months are recorded as marginal workers and the people who have not worked at all comes under non- workers. Work participation rate denotes the percentage of total workers i.e., total main and marginal workers to the total population in an area. The work participation rate in India is 39.79% in 2011, out of which the work participation rate of male is 53.25% and the female is 25.51%. From the workers, main workers constitute 75.23% and the remaining 24.77% of the people belong to marginal workers.

Population Dynamics

Human population dynamics is a field that tracks factors related to changes in thesize of population and its characteristics. Predicting population changes is an important aspect of population studies. The demographic trend affects the economic, social, and environmental systems. An increase in human population can affect the quality of natural resources like biodiversity, air, land, and water. The size of Population and characteristics undergoes changes constantly. These changes are reflected clearly in every other aspect of our country.

Problems of over Population

In India, growing pressure of Population on resource base, created many socioeconomic, cultural, political, ecological and environmental problems. The Population problems vary in space and time and differ from region to region. Some of the major issues created by the overpopulation in our country are overcrowding, unemployment and under employment, low standard of living, malnutrition, mismanagement of natural and agricultural resources, unhealthy environment etc.

Urbanization

The process of society's transformation from rural to urban is known as urbanization. The level of urbanization of a place is assessed based on the size of population of the towns and cities and the proportion of population engaged in non-agricultural sectors. These two are closely linked to the process of industrialization and expansion of the secondary and tertiary sectors ofeconomy.

Urbanization in India

The level of urbanization is measuredin terms of percentage of urban population. The level of urbanization in the country has increased more than three times from 1901 to 2011. The percentage of urban population of India was 27.82% in 2001 and it rose to 31.16% in 2011 shows an increase of 3 % in a decade. The level of urbanization varies

widely among the states. Goa is the most urbanized state with 62.17% of urban population. Himachal Pradesh is the least urbanized state with 10.04% of urban population. Among the Union territories, Delhi is the most (97.50 %) urbanized region followed by Chandigarh (97.25%). Among the major states, Tamil Naducontinues to be the most urbanized state with 48.4% percent of urban population followed by Kerala (47.7%) and Maharashtra (45.2%).

S. No	Type of Towns /UAs / OGs	2001 (in Numbers)	2011 (in Numbers)
1.	Statutory towns	3799	4041
2.	Census Towns	1362	3894
3.	Urban Agglomeration	384	475
4.	Out Growths	962	981

As per 2011 Census, there are 7,935 towns (statutory and census) in the country. Thenumber of towns has increased to 2,774, from 2001 census. In 2011, 475 Urban agglomeration (UAs) with 981 outgrowths (OGs) have been identified as Urban Agglomerations as against384 UAs with 962 OGs in 2001 Census. Out of468 UAs belongs to Class I category, 53 UAs have the population of one million and above each and these urban centres are known as "MillionCities". These are the major urban centres in the country. Among the Million Cities, there are three major Urban Agglomerations withmore than 10 million population each and are known as "Mega Cities". They are Greater Mumbai UA (18.4 million), Delhi UA (16.3 million) and Kolkata UA (14.1million).

Impact of Urbanization

Urbanization and population concentration go hand – in – hand and are closely related to each other. A rapid rate of urbanization in a society is taken as an indicator of its economic development. Urbanization is increasing rapidly in the developing countries including India. Rural to urban migration leads to population explosion in urban areas. Metropolitan cities like Mumbai, Kolkata and Delhi have more population than that can accommodate. The urban population of India hadalready crossed the 377million in 2011, whichis more than the total population of USA. By 2030, more than 50% of India's population is Expected to live in urban areas. The following are the major problems of urbanization in India

- It creates urban sprawl.
- It makes overcrowding in urban centres.
- It leads to shortage of houses in urban areas.
- It leads to the formation of slums.
- It increases traffic congestion in cities.
- It creates water scarcity in cities.
- It creates drainage problem.
- It poses the problem of solid waste management.
- It increases the rate of crime.

Human Development

Dr. Mahabub-ul-haq defined as "it is a process of enlarging the range of people'schoice, increasing their opportunities for education, health care, income and empowerment. It covers the full range of human choices from a sound physical environment to economic, social and political freedom".

Human Development Indicators: (as per UNDP) Population trends, health outcomes,education achievements, national incomeand composition of resources, work andemployment, human security, human andcapital mobility, supplementary indicators:perceptions of well-being and status offundamental rights treaties are the humandevelopment indicators.

Measuring of Human Development

Human Development Index (HDI) isa composite index focusing on three basicdimensions of human development: i) Health- Life expectancy at birth ii) Education - Expected years of schooling for school age children and average years of schooling for theadult population. iii) Income - Measured by-gross national income and percapita income.

Human Development Classification

HDI classifications are based on HDI fixed cut off points, which are derived from the quartiles of distributions of thecomponent indicators. The HDI of less than 0.550 is used for low human development, 0.550 - 0.699 stands for medium humandevelopment, 0.700 - 0.799 for high human development and 0.8 or greater for very high human development.

Transportation

Transport is a system in which passengers and goods are carried from one place to another. Transport system is considered as the lifeline of a country. Earlier man travelled onfoot or used animals for transport. With the discovery of wheel, transport was made easier and gradually different means of transport were developed. There are three major means of transport in the world.

Means of Transport		
Land	**Water**	**Air**
• Road ways • Railways • Pipelines	• Inland • waterways • Ocean routes	• Domestic airways • International Airways

Transport Network in India

Transport is one of the most important components of infrastructure and it is essential for economic development of a country, especially for a large country like India. India has a good transport network of roads, railways, airways and waterways providing necessary connectivity between different parts of the country.

Roadways

Roads play an important role in carrying goods and passengers for short, medium and long distances. It is highly suitable for short distance services. It is comparatively easy and cheap to construct and maintain roads. Road transport system can establish easy contact between farms, fields, factories and markets and can provide door to door transport services. Roads are the most universal mode of transport. Indian roads are cost efficient. It is used by all sections of people in the society. India has the second longest road network in the world with a total length of 56,03,293 km as of 2016. About 85% of passengers and 70 % of freight traffic are carried by roads every year. For the purpose of construction and maintenance, roads are classified intoNational Highways (NH), State Highways(SH), District Roads, Rural Roads (Village roads), Border Roads and International Highways.

1. Classification of Roads in India

a. National Highways (NH)

National Highways form the most important system of road transportation in India. These highways are running through length and breadth of the country connecting capitals of states, major Ports, rail junctions, industrial and tourist centres. Ministry of Road Transport and Highways of India, is responsible for the development and maintenance of National Highways in India. The total length of the National Highways (NHs) in India is 1,01,011 km which accounts for 1.8 % of the total road network length in 2016. The longest National highway is NH-7 which runs from Varanasi in Uttar Pradesh to Kanniyakumari in Tamil Nadu covering a distance of 2369 km. The shortest national highway is NH-47A, which runs from Ernakulum to Kochi port (Willington Island) covering a distance of 6 km.

b. State Highways

The state highways are usually roads that link important cities, towns and district headquarters within the state andconnect them with national highways orhighways of neighbouring states. These roads are administered and financed by state governments. State Highway runs to the length of 1, 76,166 km as of 2016.

c. District Roads

District Roads provide connectivity between the district and taluk headquarters with the state highways and national highways. District Roads are constructed and

maintained by the Public Works Department of the states. The total length of the road of this category is 5,61,940 km(16.81%) in 2016.

d. Rural Roads (Village Roads)

Rural roads connectivity is a key component of rural development. These roads are vital for providing links in the rural areas. It links the different villages with their neighbouring towns. They are maintained by Village Panchayats. The total length of rural roads in India is 39,35,337 km as of 2016. Rural roads consist of Panchayat roads, (Zilla Parishad, Panchayat Samiti, Gram Panchayat); roads of the Pradhan Mantri Gram Sadak Yojana (PMGSY) and those constructed by the State PWDs.

e. Border Roads

These are the roads of strategic importancein border areas. They are constructed and maintained by Border Roads Organization. It was established in 1960 for the development of the roads of strategic importance in the northern and north-eastern border areas. Border Roads Organization has constructed world's highest road joining Chandigarh and Leh in Ladakh. This road runs at an average altitude of 4,270 meters. Golden Quadrilateral: 5,846 km long road of 4/6 lanes connecting, India's four metropolitan cities: Delhi-Kolkata-Chennai-Mumbai-Delhi. This project was launched in 1999. North–South and East-West Corridors: North- South corridor aims at connecting Srinagar in Jammu and Kashmir with Kaniyakumari in Tamil Nadu (including Kochi-Salem Spur) with 4,076km long road. The East-West corridor has been planned to connect Silchar in Assam with the port town of Porbandar in Gujarat with 3,640km of road length. The two corridors intersect at Jhansi.

f. Expressways

These are multi-lane good quality highways for high speed traffic. Some of the important expressways are; (i)Mumbai-Pune Road, (ii) Kolkata-Dumdum Airport road (iii) Durgapur-Kolkata road and (iv) Yamuna expressway between Delhi and Agra.

g. International Highways

These are the roads that link India with neighbouring countries for promotingharmonious relationship with them. These highways have been constructed with an aid from world bank under an agreement with the Economic and Social Commission for Asia-Pacific (ESCAP). These roads connect important highways of India with those of the neighbouring countries such as Pakistan, Nepal, Bhutan, Bangladesh and Myanmar. In India the densest road network is found in the northern plains where it is relatively easy to construct roads. In mountainous area, it is quite difficult to construct roads. Road density is the highest in Kerala and lowest in Jammu &Kashmir.

Railways

Indian railway system is the main artery of the country's inland transport. Railways cater to the needs of large scale movement of traffic, both for freight and passenger, thereby contributing to economic growth. Railways are considered as the backbone of the surface transport system of India. It promotes national integration by bringingpeople together. It also promotes trade,tourism, education etc. Railways help in the commercialization of the agriculture sector by facilitating the quick movement of perishable goods. Its role in transporting rawmaterials to industries and finished goods to markets is invaluable. Indian railway network is the largest in Asia and second largest in the world.

The length of Indianrailways network as of 2017 is 67,368 km with 7,349 railway stations. For operations and management, the Indian Railways is organized into 16 zones. 1) Northern Railway - Delhi 2) North- Western Railway - Jaipur 3) North-Central Railway-Allahabad 4) North-Eastern Railway - Gorakhpur 5) North-East Frontier Railway - Guwahati 6) Eastern Railway - Kolkata 7) East coast Railway - Bhubaneswar 8) East-Central Railway - Hazipur 9) West-Central Railway - Jabalpur 10) Central Railway - Mumbai (VT) 11) Western Railway - Mumbai (Churchgate) 12) Southern Railway - Chennai 13) South- Central Railway - Secunderabad 14) South Eastern Railway - Kolkata 15) South-Western Railway - Hubball and 16) South East Central Railway - Bilaspur.

The Northern Railway accounts for the longest route length, followed by the Western Railway. On the basis of width of the track, the Indian railways fall under four categories. Broad gauge with a width of 1.676 meter, Meter gauge with a width of 1 meter and Narrow gauge with a width of 0.762 meter and Light gauge with 0.610 meter. In recent times, many developments have taken place in the Indian railways. The arrival of Konkan Railway Corporation (KRC), Mass Rapid Transit System (MRTS), Metro and Sub-Urban railways provide easy and efficient means of transport. These are very helpful in avoiding traffic congestion and overcrowding in urban areas.

a. Konkan railway

One of the important achievements of Indian Railways has been the construction of Konkan Railway in 1998. It connects Roha in Maharashtra to Mangaluru in Karnataka and the track measures 760 km. It is considered as an engineering marvel. On its routes, the railway crosses 146 rivers and streams, nearly 2000 bridges and 73 tunnels. Asia's longest tunnel nearly 6.44 km long is in this route. The states of Maharashtra, Goa and Karnataka are partners in this undertaking. The rail link between Banihal in Jammu region and Qazigund in Kashmir valley was opened in 2013. This rail line passes under the Pir Panjal Range through a 11.2 km long tunnel.

b. Metro Railways in India

There are 8 cities with metro rail connectivity in India. They are Kolkata (West Bengal), Chennai (Tamil Nadu), Delhi, Bengaluru (Karnataka), Gurgaon (Haryana), Mumbai (Maharashtra), Jaipur (Rajasthan) and Kochi (Kerala). The metro in Kolkata is the

first one in India. It is also called as Mass Rapid Transit System (MRTS). As of September 2018, India has 507 km of operational metro lines and 381 stations.

Pipeline transport:

Pipelines provided a very convenient mode of transport to connect oil and naturalgas fields, refineries and to the markets. In the past, these were used to transport waterto cities and industries. Now solids can alsobe transported through a pipeline when converted into slurry. The initial cost of laying pipeline is high but subsequent running cost is minimum. It can be laid through difficult terrain as well as under water. It ensures steady supply of goods and reduces the transhipment losses and delays are the major advantages of pipeline transport. Oil field in upper Assam to Kanpur, from Salaya in Gujarat to Jalandhar in Punjab and gas pipeline from the Hazira in Gujarat ot Jagadispur in Uttar Pradesh are the three important network large network of pipeline in the country.

Waterways

A waterway is an important mode oftransport for both passenger and cargo traffic in India. It is the oldest and also the cheapest means of transport and most suitable for carrying heavy and bulky materials from one country to another. It is a fuel-efficient and eco-friendly mode of transport. The water transport is of two types- Inland Waterways and Ocean water ways(sea routes).

a. Inland Waterways

India has an extensive network of inland waterways in the form of rivers, canals, lakes and backwaters. It depends upon the depth and width of the waterways and the continuity of the water flow. The total navigable length of our country is 14,500 km, out of which about 5,200 km length of rivers and 4,000 km length of canals can be used by mechanized crafts. The total cargo carried by inland waterways is just about 0.1% of the total inland traffic of India. For the development, maintenance and regulation of national waterways in the country, the Inland water ways Authority was setup in 1986.

The major national waterways are: National Waterway 1: It extends between Haldia and Allahabad, measures 1620 km and includes the stretches of the Ganga- Bhagirathi-Hooghly river system. National Waterway 2: This waterway includes the stretch of the Brahmaputra river between Dhubri and Sadiya a distance of 891 km. National Waterway 3: This waterway extends between Kollam and Kottapuram in the state of Kerala. It is the first national waterway in the country with 24 hour navigation facilities along its entire stretch of 205 km.

b. Oceanic Routes

Oceanic routes play an important role in the transport sector of India's economy. About 95% of India's foreign trade by volume and 70 percent by value moves through ocean routes. Coastal shipping plays an important role in transport of bulk goods in India.

Shipping is notonly the most economical mode of transport,it is also an environment friendly mode. The sea and oceanic routes are mainly used for international trade and are connected through ports. There are 13 major and 200 minor orintermediate ports in India. The major ports are administered by the Central Government and minor ports are managed and administered by various state governments.

The major ports on the east coast are Kolkata (including Haldia Dock), Paradip, Visakhapatnam, Chennai, Ennore and Tuticorin. The major ports on the west coast are Kandla, Mumbai, Nhava Seva (Jawaharlal Nehru Port), New Mangalore, Marmagao and Kochi. India has four major shipyards. Hindustan shipyard in Vishakhapatnam, Garden Reach workshop in Kolkata, Mazagaon Dock in Mumbai, Kochi Shipyard in Kochi. India is the second largest ship owning country in Asia and ranks 16th in the World.

Air Transport

Airways are the quickest, costliest, mostmodern and comfortable means of transport, Air transport facilitates connectivity on a national, regional and international scale. It has made accessibility easier by connecting difficult terrains like high mountains and sandy deserts. It carries passengers, freight and mail. Air transport plays a key role in times of emergency as well as in the event of natural and man-made calamities like floods, epidemics and wars.

Air transport in India made a beginning on 18th February, 1918 when Henry Piquet carried a mail from Allahabad to Naini. In 1953, eight different airlines which were in operation in the country were nationalised. Domestic Airways fly within the boundaries of a country and InternationalAirways connect major cities of the world. The Indian Airlines and Air India are the two airline services run by the government of India. Indian Airlines provides the domestic air services and Air India provides international air services. Presently, there are 19 designated international airports available in the country.

These airports are managed by Airports Authority of India. Some of them are Netaji Subhash Chandra Bose International Airport, Kolkata, Chennai International Airport, Chennai, Indira Gandhi International Airport, Delhi, Chhatrapati Shivaji International Airport, Mumbai, Thiruvananthapuram International Airport, Thiruvananthapuram, Sardar Vallabh Bhai Patel International Airport, Ahmedabad, Bangalore International Airport, Bengaluru, Rajiv Gandhi International Airport, Hyderbad etc. Besides this, there are about 80 domestic airports and about 25 civil enclaves at defence air fields.

a. Pavan-Hans Helicopter Ltd

Pavan-Hans Helicopter Ltd has beenproviding Helicopter support services to the petroleum sector, including ONGC and oil India Ltd. It is a public sector company based in New Delhi. Its operations are based at the Juhu Aerodrome in Vile Parle (West) Mumbai. Pavan-Hans is a Mini Ratna–I category public sector undertaking. It often provides services to various state governments in India particularly north east India Inter Island, Ferry services in Andaman & Nicobar Islands, services to Lakshadweep Island etc.,

b. Airports Authority of India (AAI)

Airports Authority of India (AAI) was constituted in 1995. It provides security to Indian Airports. AAI under the ministry of Civil Aviation is responsible for creating, upgrading, maintaining and managing civil aviation infrastructure in India.

Communication

Communication is a process that involves exchange of information, thoughts and ideas. Technology does wonders in communication fields. Communication is categorized in to personal and mass communications.

Personal Communication

The exchange of information between the individuals is called personal communication. It includes post and telegraph services, telephone, mobile phone, short message services, fax, internet, e-mail etc. Personal Communication system enables the user to establish direct contact. The Indian postal network is the largest in the world with 1,55,000 post offices. Of these more than 1,39,000 post offices are located in rural areas. The postal service was opened to the public in the country in 1837. The first Indian postal stamp was issued in 1852 in Karachi. Collecting and delivering mail is the primary function of the department of posts. It introduced the Quick Mail Service in 1975 and today it covers the entire country.

Them Quick Mail Service functions on the basis of the system of PIN (Postal Index Number) code which was introduced in 1972. The premium products include the Money order, e-money order, Speed Post, Express Parcel Post, Business Post, Media Post, Satellite Post, Retail Post, Greeting Post, Data Post, SpeedNet and Speed Passport Services. Cards and envelopes are considered first class mail and are airlifted between stations covering both land and air. The secondclass mail includes book packets, registered newspapers and periodicals. They are carried by surface mail, covering land and water transport.To facilitate quick delivery of mails in large towns and cities, six mail channels have been introduced recently.

They are called Rajdhani Channel, Metro Channel, Green Channel, Business Channel, Bulk Mail Channel and Periodical Channel. India has one of the largest telecommunication networks in Asia. Apart from the urban areas more than two-thirds of the villages in India have already been covered with Subscriber Trunk Dialing(STD) telephone facility, while International communication can be made through ISD(International Subscriber Dialing). There is an uniform rate of STD facilities all over India. Telephone is a form of oral communication. It is considered very essential for the growth of commerce. It is the most preferred form as it provides instant communication. Mobile phone, fax and internet are the other personal communication used in the country.

Mass Communication Systems

Mass Communication enables millions of people to get the information at the same time. It is a great way to provide education as well as entertainment. It helps in creating awareness among the people regard in national policies and programmes. The Mass Communication Systems can provide the information to people in two methods. They are Print Media and Electronic Media.

Electronic Media: Radio broadcasting in India was started in 1923 by the Radio club of Bombay. Since then it gained immense popularity and changed the social and cultural life of people. It was named as All India Radio (AIR) in 1936 and again it was renamed as Akashwani in 1957. It broadcasts a variety of programs related to information, education and entertainment. Special news bulletins are also broadcasted on special occasions like session of parliament and state legislatures.

Televisionbroadcasting has emerged as the most effective audio-visual medium for disseminating information and educating the masses. Television network in India is known as Doordarshan (DD) which started Common National Program (CNP) services and it is extended to the backward and remote rural areas. Internet (contraction of interconnectednetwork) is the global system of interconnected computer networks that use the Internet protocol suite to link devices worldwide.

Social media are interactive computer-mediated technologies that facilitate the creation and sharing of information, ideas, career interests and other forms of expression via virtual communities and networks. With over 460 million internet users, India is the second largest online market, ranked only behind China. By 2021, there will be about 635.8 million internet users in India. Despite the large base of internet users in India, only 26 percent of the Indian population accessed the internet in 2015. This is a significant increase in comparison to the previous years, considering the internet penetration rate in India stood at about 10 percent in 2011. Furthermore, men dominated internet usage in India with 71 percent to women's 29 percent.

PrintMedia: Newspapers are the most common but powerful means of communication come under print media. India has many newspapers which carry information on local, national and international events to the people.

Satellite Communication

The use of Satellite in getting a continuous and synoptic view of larger area has made this communication system very vital for the country. Satellite images are used for weatherforecasting, monitoring of natural calamities,surveillance of border areas etc. The communication through satellites emerged as a new era in communication in our country after the establishment of Indian SpaceResearch Organization (ISRO) in 1969.

Satellite system in India can be groupedinto two-the Indian National Satellite System (INSAT) and the Indian Remote Sensing Satellite System (IRS).The INSAT, established in 1983, is a multipurpose system for telecommunication, meteorological

observation and for various other programs. The INSAT series are used for relaying signals to television, telephone, radio, mobile phone. It is also useful in weather detection, internet and military applications.

The INSAT series, GSAT series, KALPANA-1, HAMSAT, EDUSAT are the major communication satellite used for communication purpose. GSAT–7A is the recent launch (December 19, 2018) for communication programs. INSAT-1B launched on 30th August 1983 is the first communication satellite in INSAT series.

Trade

Trade is an important phenomenon that decides the economic growth of a country. Trade is an act (or) process of buying, selling or exchanging of goodsand services. The primitive method of trade was known as the Barter system where goods were exchanged for goods. Later on, money was introduced as a mediumof exchange in buying and selling of goods. The difference in value between the imports and exports is called balance of trade. The situation in which the value of exports exceeds the value of imports is termed as favourable balance of trade and the reverse position is termed as unfavourable balance of trade.

Types of Trade

Trade in general, is of two types. They are Internal and International. The trade carried on within the domestic territory of a country is termed as Internal trade. It is also called as Domestic trade or Local trade.Land transport (roadways and railways) plays a major role in this trade. Local currency isused in internal trade. It helps to promote a balanced regional growth in the country i.e, tea from Assam, coffee from Karnataka, Rubber and spices from Kerala, minerals from Jharkhand etc., are supplied to different parts of our country.Trade carried on between two or more countries is called International trade. It is also called as external trade or foreign trade. Export and Import are two components of International trade. Export means goods and services sold for foreign currency. Import means goods and services bought from overseas producers. Waterways and Airwaysplay a vital role in this type of trade. Foreigncurrency is involved in international trade. The trade between any two countries is called Bilateral trade. The trade between more than two countries is called Mutilateral Trade.

Exports

The major exports of India are tea, marine products, ores and minerals, leather products, gems and jewels, sports goods, chemicals and related products, plastics and rubber articles, articles of stones, plaster, cement, asbestos, mica, glass ware, paper and related products, base metals, optical, medical and surgical instruments, electronic items, machinery, office equipment's, textiles and allied products.

Imports

The major imports are petroleum products, pearls, precious stones and semi-precious stones, gold and telecom instruments. India's Trade PerformanceThe volume of India's foreign trade has increased many fold since independence. During 2008 -2009, the volume of trade was 840755 crores and it rose to 1039797 crores in 2016-2017. The import during 2008-2009 was 1374436 crores and was with a deficit of 40679 crores. The import during 2016–2017 rose to 1396352 crores and was with the deficit of 356555 crores. It reveals that not only the balance of trade is unfavourable but also the increase in the level of deficit.

NOTE

- In India the first census was carried out in the year 1872. But the first complete and synchronous census was conducted in 1881. And the 2011 census represents the fifteenth census of India.
- The ratio between the economically active and economically inactive of population is termed as Dependency Ratio.
- Shershah suri built the shahi (Royal) road to strengthen and consolidate his empire from the Indus valley to the Sonar valley in Bengal. This road from Kolkata to Peshawar was renamed as GrandTrunk(GT) road during the British period. At present, it extends from Amristar to Kolkata. It is bifurcated into 2 segments: (a) (NH)-1 from Delhi to Amristar, and (b) NH-2 from Delhi to Kolkata.
- National Highways Authority of India (NHAI) was established in 1995. It is anautonomous body under the Ministry of Surface Transport.
- The first train steamed off from Mumbai to Thane in 1853, covering a distance of 34 km. In 1951, the systems were nationalized as one unit "The Indian Railways". The headquarter of Indian Railways is New Delhi.
- The first sub-urban railway was started in 1925 in Mumbai.
- Chennai becomes the sixth Indian city with metro railway.
- Gatiman Express is the fastest operational train in India. This train connects New Delhi and Agra and touches 160 km/h. This train takes a travel time of 105minutes to cover 200km journey.
- The state of Meghalaya has no railway network.
- In 2007, the Government ofIndia merged the Air India andIndian Airlines under NationalAviation Corporation of IndiaLimited (NACIL). In whichNACIL (A) provides international services,NACIL (I) provides domestic services andservices to neighbouring countries in southeast Asia and middle East.

Unit – 6 - Physical Geography of Tamil Nadu

Learning Objectives

- To know the history of formation of the state
- To study the major physiographic divisions of the state
- To understand the nature of climate, soils and natural vegetation
- To familiarise the students with the geographical conditions of their living places
- To know the major natural disasters and their occurrences in Tamil Nadu

Introduction

The study of one's own region is the firststep to become a global citizen. The purpose ofstudying our local territory is to understand life in our environment. In the last five lessons, you havelearnt about various geographical characterstics ofour country. In this lesson and those that follow,we shall learn about the geography of Tamil Nadu.You will get to know about the etymology, historyof formation, location, size, physical divisions,rivers, climate, soil and natural vegetation of TamilNadu in this chapter.

Our state Tamil Nadu has a hoary past witha variety of cultural practices and traditions.Its exquisite physiography and climate makesour state unique in India. It has long and sunnybeaches, waterfalls, hills, forests and varied fl oraand fauna.

As per, the StatesReorganisation Act, 1956, stateboundaries were reorganisedon some linguistic basis.

Formation of Tamil Nadu

During Sangam age, the Tamizham wasruled by three great emperors – Cheras, Cholasand Pandyas – and virtuous kings ruling smallkingdoms like Adhiyaman and Pari. For ashort time, the Tamil country was ruled bythe Kalabras, but not much about their time isrecorded or known.

After the Kalabras, the Tamil countrycame under the control of the Pallavas, Cholas,Pandyas, Marathas, Mughals and Vijayanagaraempires in succession until the British tookadministrative control over the entire country,starting from Madras.

During the British period, our countrywas divided into three presidencies, namelyMadras, Bombay and Calcutta for political andmilitary purposes. Tamil Nadu and parts ofAndhra Pradesh, Kerala, Karnataka and Orissa(Odisha) constituted the Madras Presidency.After independence, following the linguisticdivision of states, Telugu-speaking areaswere bifurcated from the Madras state. Afterbifurcation, there were only 13 districts inMadras state. The Madras state was renamed asTamil Nadu by C.N. Annadurai, former Chief
Minister of Tamil Nadu, on January 14, 1969.

Location and Size

Tamil Nadu is one of the 29 states ofIndia, located in the southern most part ofthe country. This landmass extends from8°4'N to 13°35'N latitudes and from 76°18'Eto 80°20'E longitudes. Its eastern and westernextremities are defined by the Point Calimereand the hills of Anaimalai respectively. Thenorthern extremity of the state is marked byPulicat lake and the southernmost point isCape Comorin.

It covers an area of 1,30,058 sq.km and isthe 11th largest state in India. It covers 4% ofthe area of our country.

Boundaries and Neighbours

Tamil Nadu is bounded by Bay of Bengalin the east, Kerala in the west, Andhra Pradeshin the north, Karnataka in the northwest andIndian Ocean in the south. Gulf of Mannarand Palk Strait separate Tamil Nadu from theIsland of Sri Lanka, which lies to the southeastof India. The state has 1,076 km long coastline,the second-longest in India after Gujarat.

Administrative Divisions

Already we have learnt that the state ofTamil Nadu had only 13 districts at the time of itsformation. After that, the state was reorganisedseveral times for the purpose of administrativeconvenience. At present there are 35 districtsin Tamil Nadu, including the newly createddistricts such as Kallakurichi, Tenkasi andChengalpet. The administrative divisions of thestate are given in the following table.

Divisions	Numbers
Districts	35 (32+3)
Revenue Divisions	76
Taluks	226
Firkas	1,127
Revenue Villages	16,564
Municipal Corporations	15
Municipalities	125
Panchayat Unions (Blocks)	385
Town Panchayats	561
Village Panchayats	12,618
Lok Sabha Constituencies	39
Assembly Constituencies	234
Source: maps of india.com 2019	

- Find out the coastal districts of TamilNadu with the help of a map.
- Group the districts of Tamil Naduwhich share their boundary with thestates of Andhra Pradesh, Karnatakaand Kerala separately.

Physiographic Divisions

We have learnt about endogenetic andexogeniec processes in 9th std. Have you everthought what kind of landforms on which youlive? Have you ever noticed the landscapes,you come across while travelling from oneplace to another? Have you ever wonderedhow these landforms were formed? Let's seethe major physical features of Tamil Naduand their characteristics.

Tamil Nadu is located on the PeninsularPlateau, known as Deccan Plateau. It is alsoa part of the ancient Gondwana land thatbroke away 135 million years ago duringCretaceous Period. Tamil Nadu has manyunique land features which include higheroded mountains, shallow deep valleys andplains. The topography of the state slopestowards east. Based on the major differencesin relief, Tamil Nadu is divided into thephysical divisions of Western Ghats, EasternGhats, Plateaus, Coastal and Inland plains.

All districts of TamilNadu except the Chennai,The Nilgiris and Kanyakumariwere bifurcated at differentpoints of time.

Western Ghats

Western Ghats extends from the Niligrisin the north to Marunthuvazh Malai atSwamithope in Kanyakumari district in thesouth. Height of the Western Ghats rangesfrom 2,000 to 3,000 metres. It covers an areaof about 2,500 sq.km. Though the WesternGhats is a continuous range, it has somepasses. The passes are Palghat, Shencottah,Aralvaimozhi, and Achankoil. The Niligris,Anaimalai, Palani hills, Cardamom hills,Varusanadu, Andipatti and Agasthiyar hillsare the major hills of Western Ghats .

Nilgiri Hills

The Nilgiri hills is located in theNorthwestern part of Tamil Nadu. It consistsof 24 peaks with more than 2,000 metresheight. Doddabetta is the highest peak (2,637metres) of this hills followed by Mukkuruthi(2,554 metres). Ooty and Coonoor are themajor hill stations located on this hills. Ithas more than 2,700 species of floweringplants and the state animal Nilgiri Tahr isfound in this hill. Much of the Nilgirisnatural montane grasslands and shrublandshave been disturbed or destroyed by extensivetea plantations and cattle grazing.

Anaimalai

Anaimalai is located in the borderof Tamil Nadu and Kerala. It is located tothe south of Palghat Gap. Anaimalai TigerReserve, Aliyar Reserved Forest, Valparaihill station, Kadamparai hydroelectric PowerPlant are located on this hills. Aliyar andTirumurthy dams are located at the foothillsof this range.

Palani Hills

Palani hills are the eastward extension ofthe Western Ghats. Except its western part,these hills are located in Dindigul district.Vandaravu (2,533 metres) is the highest peakin the Palani hills. Vembadi Shola (2,505metres) is its second highest peak. The hillstation of Kodaikanal (2,150 metres) lies inthe south central portion of the range.

Cardamom Hills

These hills are also known as Yela Malahills located in the southwestern part ofTamil Nadu. It acquires its name from thecardamom spice, which is commonly grownhere. Pepper and coffee are the other cropscultivated over the hills. They meet theAnaimalai hills in the northwest, the Palanihills in the northeast and Varusanadu andAndipatti hills in the southeast.

Peaks in Western Ghats	Height(m)
Doddabetta	2,637
Mukkuruthi	2,554
Vembadisolai	2,505
Perumalmalai	2,234
Kottaimtalai	2,019
Pagasura	1,918

Varusanadu and Andipatti Hills

Another eastward extension of WesternGhats is Varusanadu and Andipatti hills.Megamalai (the highway mountain),Kalugumalai, Kurangani hill station, and Suruliand Kumbakarai waterfalls are found on thesehills. Srivilliputhur Grizzled Squirrel Wild lifeSanctuary is located in the southern slope ofthese hills in Virudhunagar district. Vaigai riverand its tributaries originate in this region.

Pothigai Hills

Its major part lies in Tirunelveli districtwith its southern slope in the Kanyakumaridistrict. Pothigai hills are called with differentnames such as the Shiva Jothi Parvath,Agasthiyar hills and Southern Kailash.These hills feature richest biodiversity in theWestern Ghats. This area is known for itsrich evergreen forest, waterfalls and ancienttemples. Kalakkad Mundanthurai TigerReserve is located in this region.

Mahendragiri Hills

This continous range is situated along theborder of Kanyakumari and Tirunelveli districtsand is a part of the southern range of the WesternGhats. Its average height is 1,645 metres. ISRO
Propulsion Complex, a test facility for IndianSpace Research Organisation's launch vehiclesand satellite propulsion systems, is situated onthe lower slopes of this mountain.

The Eastern Ghats

Unlike Western Ghats, Eastern Ghats is adiscontinuous and irregular one. It is dissectedat many places by the rivers, which draininto the Bay of Bengal. Its height ranges from1,100 to 1,600 metres. These hills separate theplains from plateaus. Javadhu, Servarayan, the
Kalrayan, Kollimalai and Pachaimalai are themajor hills of the Eastern Ghats of Tamil Naduand are located in northern districts of the state.

Javadhu Hills

Javadhu hills are an extension of theEastern Ghats spread across parts of Velloreand Tiruvannamalai districts and separatesthese two districts. Many peaks with the heightof 1,100–1,150 metres are located in this range.Melpattu is its highest peak. The Vainu BappuObservatory (VBO) Kavalur, which beganoperations in 1967, is located on these hills.Many parts of this range are covered with bluishgrey granites. It is noted for its fruit bearingtrees, medicinal herbs and sandalwoods.Due to illegal logging, sandalwood trees aredisappeared now.

Kalvarayan Hills

The name 'Kalvarayan' comes from theword 'Karalar', the ancient name of the presenttribes. It is another major range of hills in theEastern Ghats of Tamil Nadu. This range,along with the Pachaimalai, Aralvaimalai,Javadhu and Servarayan hills, separates theriver basins of Cauvery and Palar. The heightof this hill ranges from 600 to 1,220 metres.These hills have two sections. The northernsection is referred as the Chinna Kalvarayanand the southern one the Periya Kalvarayan.The average height of Chinna Kalvarayanis 825 metres and the Periya Kalvarayan is1,220 metres.

Servarayan Hills

It is a mountain range located near theSalem city with the height ranging from 1,200to 1,620 metres. Th e name of the range comesfrom a local deity, Servarayan. Th e highestpeak in the southern part of the Eastern Ghatsis located in this range. Th e peak is Solaikaraduand its height is 1,620 metres. Th e hill stationYercaud, which is known as poor man's Ooty, islocated on this range. Servarayan temple is itshighest point (1623 metres).

Peaks in Eastern Ghats	Height(m)
Shervarayan temple	1,623
Mazhamalai	1,500
Urgamalai	1,486
Kuttirayan	1,395
Muganur	1,279
Valsamalai	1,034

Districts	Hills
Coimbatore	Maruthamalai, Velliangiriand Anaimalai
Dharmapuri	Th eertha malai, Chitteri andVathalmalai
Dindigul	Pazhamalai and Kodaikanal
Erode	Chenni hills and Sivan hills
Vellore	Javadhu, Yelagiri andRathinamalai hills
Namakkal	Kolli hills
Salem	Servarayan, Kanjamalai andChalk hills
Villupuram	Kalvarayan and Gingee hills
Perambalur	Pachaimalai
Kanyakumari	Marunthuvazhmalai
Tirunelveli	Mahendragiri andAgasthiyarmalai
Th e Nilgiris	Nilgiri hills

Kolli Hills

It is a small mountain range located inNamakkal district. It covers an area of about2,800 sq.km. It rises up to 1300 metres. This isa mountain range that runs almost parallel tothe east coast of South India. Arpaleeswarartemple located on this range is an importantpilgrim centre. It has the largest cover ofevergreen or shola forest when comparedto other parts of the Eastern Ghats. Severalcoffee plantations, fruits, flowers and silveroakestates are found in this region.

Why are mountain heightsmeasured from mean sea leveland not from ground level?

Pachaimalai

It is the lowest hill range, spreads overthe districts of Perambalur, Tiruchirapalli andSalem. In Tamil language, pachai means green.The vegetation in this range is greener thanthe vegetative cover of the other hills in thisregion. Hence it is named as 'Pachai malai'.Jackfruit is a popular seasonal agriculturalproduct of this hills.

1. Name the hill resorts ofWestern Ghats and EasternGhats in Tamil Nadu.
2. Is Ooty located on WesternGhats?
3. Name the hill stations located inWestern and Eastern Ghats of
4. Tamil Nadu.
5. Why is the Nilgiri hills called as BlueMountains?
6. 5. What is the kind of landform onwhich you live and what is its height?

Plateaus

Plateaus of Tamil Nadu are locatedbetween the Western Ghats and the EasternGhats. It is roughly triangular in shape andcovers an area of about 60,000 sq.km. Its heightincreases from east to west. Its height rangesbetween 150 and 600 metres. This plateau isbroader in the north and very narrow in thesouth. It has many subdivisions.

Bharamahal plateau is a part of theMysore plateau situated in the northwesternpart of Tamil Nadu. Its height ranges from 350to 710 metres. Dharmapuri and Krishnagiridistricts are located in this region.

Coimbatore plateau lies between theNilgiris and Dharmapuri districts. Its heightvaries from 150 to 450 metres. This regionincludes Salem, Coimbatore and Erodedistricts. The area of this plateau is bout2,560 sq.km. Its height varies from 352 to 710metres. Moyar river separates this plateaufrom the Mysore plateau.

Rivers like Bhavani, Noyyal andAmaravathi, which originate from WesternGhats, form valleys in this region. Manyintermontane plateaus are found in the regionof the Nilgiris. Sigur plateau is one such plateau.

Madurai plateau found in Maduraidistrict extends up to the foothills of theWestern Ghats. Vaigai and Thamirabaranibasins are located in this zone.

Plains

The plains of Tamil Nadu may be dividedinto two, namely inland plains and coastalplains. Inland plains are drained by the riversPalar, Ponnaiyar, Cauvery and Thamirabarani.Cauvery plains is one of the most importantfertile plains of the state. The plains of Cauveryis found in Salem, Erode, Karur, Tiruchirapalli,Pudukottai, Thanjavur, Tiruvarur andNagapattinam districts.

Coastal plains of Tamil Nadu are alsocalled Coromandel or Cholamandalam (landof Cholas) plain, which extends from Chennaito Kanyakumari. It is formed by the rivers thatflow towards east drain in the Bay of Bengal. Itis more than 80 kilometres wide at some places.Though it is an emerged coast, some partsare submerged into the sea. The sand dunesformed along the coast of Ramanathapuramand Thoothukudi districts are called Teri.Coral rocks are found at the head of Gulf ofMannar in the east coastal plain.

Beaches

The Coromandel Coast along the Bay ofBengal consists of many beautiful and exoticbeaches. The golden sands of Tamil Nadubeaches are scattered with palm and casuarinasgroves. Marina and Elliot beaches of Chennai,Kovalam and Silver beaches of Kanyakumariare some of the famous beaches in Tamil Nadu.

Drainage

Rivers of Tamil Nadu are its lifeline.Though it has many rivers, the rivers ofCauvery, Palar, Ponnaiyar, Vaigai andThamirabarani are the notable ones. Mostof the rivers of Tamil Nadu originate fromWestern Ghats and flow towards eastand drain into the Bay of Bengal. All therivers of the state are non-perennial exceptThamirabarani. It is perennial as it is fed byboth the southwest and northeast monsoons.

Cauvery

The river Cauvery originates at Talacauveryin the Brahmagiri hills of Kodagu(coorg)district of Karnataka in the Western Ghats.About 416 km of its course falls in Tamil Nadu.It serves as the boundary between Karnatakaand Tamil Nadu for a distance of 64 km. Itforms Hogenakkal waterfalls in Dharmapuridistrict. Mettur Dam, also called as theStanley Reservoir, is located across this riverin Salem district. A tributary called Bhavanijoins Cauvery on the right bank about 45km from the Mettur Reservoir. Thereafter, ittakes easterly course to enter into the plains ofTamil Nadu. Two more tributaries, Noyyal andAmaravathi, confluence the river on the rightbank at Thirumukkudal 10 km from Karur.The river is wider in this region, where it iscalled as 'Agandra Cauvery'.

In Tiruchirappalli district, the riverbranches into two parts. The northernbranch is called Coleroon or Kollidam andthe southern branch remains Cauvery. Fromhere, the Cauvery delta begins. After flowingfor about 16 km, the two branches join againto form the 'Srirangam Island'. The GrandAnaicut, also called as Kallanai was built acrossthe river Cauvery. After Kallanai, the riverbreaks into a large number of distributariesand forms a network all over the delta. Thenetwork of distributaries within the delta ofCauvery in the coast is called as the 'Gardenof Southern India'. It merges into Bay ofBengal to the south of Cuddalore.

Pamban, Hare, Krusadai,Nallathanni Theevu, Pullivasal,Srirangam, Upputanni,Island Grounds, KattupalliIsland, Quibble Island andVivekananda Rock Memorial are somemajor islands of Tamil Nadu

Palar

The Palar river rises beyond Talagavaravillage in the Kolar district of Karnataka.The Palar drains an area of 17,871 sq.km,out of which nearly 57% lies in Tamil Naduand the rest in the states of Karnataka andAndhra Pradesh. Ponnai, Goundinya Nadhi,Malattar, Cheyyar and Kiliyar are its majortributaries. Its total length is 348 km, outof which 222 km of its course falls in TamilNadu. It flows through the districts of Velloreand Kancheepuram before entering into Bayof Bengal near Kuvattur.

Then Pennaiyar/Then Ponnaiyar

It originates from the eastern slope ofNandi Durga hills in eastern Karnataka. Itdrains an area of 16,019 sq.km, of which nearly
77% lies in Tamil Nadu. It flows for a distanceof 247 km in the southeasterly direction in thedistricts of Krishnagiri, Dharmapuri, Vellore,Tiruvannamalai, Cuddalore and Villupuram.It branches into two, viz. Gadilam and thePonnaiyar near Tirukoilur Anaicut. Gadilamjoins the Bay of Bengal near Cuddaloreand Ponnaiyar near the Union Territory ofPuducherry. Chinnar, Markandanadhi, Vaniarand Pambar are its tributaries. Heavy rain atthe river's source cause sudden but short-livedfloods. The river is extensively dammed forirrigation, especially in Tamil Nadu. There arereservoirs at Krishnagiri and Sathanur

acrossthis river. The Ponnaiyar is considered sacredby Hindus and festivals are held during theTamil month of Thai (January–February).

Vaigai

Vaigai river rises from the eastern slopes ofthe Varusanadu hills of Western Ghats of TamilNadu. It drains an area of 7,741 sq.km, whichlies entirely in the state of Tamil Nadu. It flowsthrough the districts of Madurai, Sivagangaand Ramanathapuram. Its length is 258 km. Itdischarges its water into the Ramnad Big Tankand some other small tanks. The surplus waterfrom the tanks is finally discharged into PalkStrait near Ramanathapuram.

Thamirabarani

The name is interpreted as Thamiram(copper) and Varuni (streams of river). Thewater of this river gives a copper like appearancedue to the presence of dissolved suspended redsoil. It originates from a peak in Pothigai hillson the Western Ghats above Papanasam in theAmbasamudram taluk. The origin of the river isassociated with Sage Agasthiyar. It courses throughthe districts of Tirunelveli and Thoothukudiand finally flow into the Bay of Bangal nearPunnaikayal in Thoothukudi district. Karaiyar,Servalar, Manimuthar, Gadananathi, Pachaiyar,Chittar and Ramanathi are its main tributaries.

District	Waterfalls
Dharmapuri	Hogenakkal
Thirunelveli	Kalyanatheertham,Courtallam
Theni	Kumbakkarai and Suruli
Namakkal	Agayagangai
Th e Nilgiri	Catherine and Pykara
Salem	Kiliyur
Virudhunagar	Ayyanar
Coimbatore	Vaideki, Sengupathi,Siruvani and Kovaikutralam
Tiruppur	Tirumurthy
Madurai	Kutladampatti
Kanyakumari	Tirparappu, Kaalikesam, Ulakkai and Vattaparai

Climate

You have already learnt that the Tropic ofCancer divides India roughly into two equalparts and the state Tamil Nadu lies to the southof Tropic of Cancer, which is near the Equator.As it receives vertical sunrays, the temperatureof the state is relatively high throughout theyear. Though the state falls within the hotclimatic zone, the east coast of Tamil Naduenjoys tropical maritime climate. TheBay ofBengal and Indian Ocean infl uence the climateof the coastal regions. Th e annual temperatureranges from 18o to 43o and the annual rain fallis 958.5 mm.

While the east coast experiences tropicalmaritime climate, the western region of the stateenjoys the mountainous climate. The is climateprevails over the Blue Mountains, Anaimalaiand the Kodaikanal hills. Thick forests and highaltitude make the climate of these areas cooland pleasant. The us stations in this region attractthousands of people during the summer season.Low altitude and distance from the sea are thereasons for high temperature and dry conditionsin the central part of Tamil Nadu. The migrationof vertical sun's rays leads to the formation ofdifferent seasons in Tamil Nadu as follows.

Seasons of Tamil Nadu	
Season	**Period**
Winter Season	January-February
Summer Season	March- May
Southwest Monsoon	June-September
Northeast Monsoon	October –December

Winter Season

During January and February, thevertical rays of the sun fall between the Tropicof Capricorn and the Equator. Hence, TamilNadu and India on the whole receive slantingrays from the sun. So, the weather is slightlycooler during these months. The differencebetween summer and winter temperature isnot very high. Winter temperature in TamilNadu varies from 15°C to 25°C. However,in the hill stations, the winter temperaturedrops below 5°C occasionally. Some valleysin the Nilgiris record even 0°C. This drop intemperature leads to the formation of thickmist and frost. This season is practically dry.

Summer Season

The apparent migration of the suntowards north during March, April and Mayresults in the reception of vertical sun's raysby South India. Thus there is a steady rise intemperature from the equator. Hence, TamilNadu located to the south of Tropic of Cancer,experiences high temperature. Generally thetemperature varies from 30°C to more than40°C. During this season particularly in themonth of May, southern part of the statereceives some rainfall from pre-monsoonshowers (Mango/Blossom showers) and someparts experience convectional rainfall.

1. What is Agni Nakshatram?
2. Group the districts of TamilNadu into low, moderateand heavy rainfall regions.

Southwest Monsoon

The intense heating of the landmass of thenorth by the sun during March to May createsa well-developed low pressure in North India,which draws wind from the Indian Ocean.This results in the formation of southwestmonsoon. During this season, Tamil Nadu islocated in the rain shadow region for the wind,which blows from the Arabian Sea.

As a result,Tamil Nadu receives only a meagre rainfallfrom this monsoon. Rainfall during this seasondecreases from west to east. Coimbatore plateaureceives an average of 50 cm rainfall. However,the southern districts like Kanyakumari,Tirunelveli and The Nilgiris record 50–100cm rainfall during this period. The rainfall isscanty in the eastern part of the state.

Coriolis Force:
An apparent force acts as aresult of the earth's rotation defl ects movingobjects (such as projectiles or air currents)to the right in the northern hemisphere andto the left in the southern hemisphere.

Northeast Monsoon

The northeast monsoon seasoncommences from the month of October andlasts till mid-December. The high pressurecreated over Central Asia and northern partof India becomes the source for the northeastmonsoon winds. The apparent migration ofthe sun from Tropic of Cancer to the Tropicof Capricorn causes a change in receivingtemperature and air pressure during thisseason. It makes the wind to blow towards Bayof Bengal from North India. After reaching Bayof Bengal, the wind gets deflected by Coriolisforce and takes the northeast direction. Henceit is known as northeast monsoon. As thenortheast monsoon is a part of returning ofsouthwest monsoon wind, it is also called asthe retreating monsoon. This is the main rainyseason for Tamil Nadu, accounting for its 48%of annual rainfall. Coastal districts of the stateget nearly 60% of their annual rainfall andthe interior districts get about 40–50% of theannual rainfall during this season.

Tropical cyclones are common during thisseason. Cyclone originating from the Bay ofBengal bring heavy rainfall to the east coastalregions of Tamil Nadu. More than 50% of thestate's rainfall is received from tropical cyclonesduring this period and east coastal regionreceives 100 to 200 cm of rainfall. The rainfallreceived by the central and northwestern partsis 50–100 cm. The cyclones sometimes disturbthe cultivation of crops and cause severedamage to life and property.

Chinnakallar near Valparaiis the 3rd wettest place inIndia and the wettest place inTamil Nadu.

Soils of Tamil Nadu

Soil is the loose material mainly formed bythe weathering and erosion of rocks. It forms animportant element of agriculture. It providesessential minerals and nutrients for the growthof vegetation. Soil is one of the importantnon-renewable resources in the world. It takes300–1,000 years to form two inches of soil.The soil of a place depends on the factors likeclimate, parent rocks and vegetative cover ofthe respective places. The soils in Tamil Naduare broadly classified into five types accordingto their characteristics. They are alluvial, black,red, laterite and saline soils.

Alluvial Soil

Alluvial soils are formed by the depositionof silt by the rivers. Alluvial soils are generallyfertile as they are rich in minerals such as
lime, potassium, magnesium, nitrogen andphosphoric acid. It is deficient in nitrogen andhumus. It is porous and loamy. Paddy, sugarcane,banana and turmeric are cultivated in this soil.It is found in the river valley regions and thecoastal plains of Tamil Nadu. Generally thistype of soil is found in the districts of Thanjavur,Tiruvarur, Nagapattinam, Villupuram,Cuddalore, Tirunelveli and Kanyakumari. Itis also found to a small extent along the rivervalleys in few interior districts.

Black Soil

Black soils are formed by the weatheringof igneous rocks. It is also known as regur soil.As cotton grows well in this soil, it is also calledas black cotton soil. This soil is developed overthe Deccan lava granite region under semiaridconditions. It is fine textured and clayey innature. It is poor in phosphoric acid, nitrogenand organic matter. Chief minerals found in thissoil are calcium, magnesium, carbonates, potashand lime. Cotton, sorghum, cumbu and foddercrops are the major crops cultivated in theblack soil regions of Tamil Nadu. Black soils arefound extensively in the districts of Coimbatore,Madurai, Virudhunagar, Tirunelveli andThoothukudi.

Red Soil

Red soils cover over two-thirds of thetotal area of Tamil Nadu. They are foundparticularly in the central districts of thestate. This soil is sandy and loamy in texture.However, the characteristic features of the redsoil vary according to its formation and climaticcondition under which the soil was formed.Red soil is porous, friable and non-retentiveof moisture. The colour of the soil is due to thepresence of high content of iron oxides. Thissoil is poor in nitrogen, phosphorus, acids andhumus. paddy, ragi, tobacco and vegetablesare the chief crops grown in this soil. Almostall types of crops can be grown in this soilwith the application of manure and irrigationfacilities. It is dominantly found in Sivagangaiand Ramanathapuram districts.

Laterite Soil

This soil is formed by the process ofintense leaching. Laterite soils are found insome parts of Kancheepuram, Tiruvallur andThanjavur districts and some patches overthe mountainous region in the Nilgiris. Cropsgrown in this soil are paddy, ginger, pepper andplantains. It is also suitable for the cultivationof tea and coffee plants.

Saline Soil

Saline soils in Tamil Nadu are confinedto the Coromandel coast. Vedaranyam has apocket of saline soil. However, the tsunamiwaves on December 26, 2004 brought a lotof

sand and deposited it all along the eastcoast of Tamil Nadu. The tsunami made thecoastal areas unsuitable for cultivation to aconsiderable extent.

Soil Erosion

Soil is a non-renewable resource. It is verydifficult to replace the soil once it gets degraded.Deforestation, overgrazing, urbanisation andheavy rain are responsible for soil erosion inTamil Nadu. Soil erosion reduces the fertilityof soils, which in turn reduces agriculturalproductivity. So, it is necessary to take intensivecare to conserve the soil resources.

Desertification is oneof the major problems ofTamil Nadu. Accordingto the desertification atlasprepared by the ISRO. About12% of the total geographical area is underdesertification and land degradation. Theni,the Nilgiris and Kanyakumari are the worstaffected districts. About 12,000 hectares (120Sq.km) were affected by sand deposition inTheni and Rajapalayam.

Natural Vegetation

Natural vegetation refers to the forestcover. Landforms, nature of soil, temperatureand rainfall are the major factors that controlthe distribution of natural vegetation. As perNational Forest Policy, 1988, a minimum ofone-third of the total geographical area mustbe under forest cover. The total forest cover ofTamil Nadu is far lower than this. Accordingto the Tamil Nadu State of Forest Report – 2017assessment, the area under forest in the stateis 26,281 sq.km, which constitutes 20.21% ofthe total area. Tamil Nadu constitutes 2.99%of India's forest cover. The forest types inthe state varies from wet evergreen to scrubforests. The Western Ghats, the longest hillrange in the state, is one of the 25 globalhotspots of bio-diversity and one of the threemega centres of endemism in India. Thefollowing table shows the categories of forestand their areal extent classified under theprovision of Indian Forest Act.

Forest Type	Area(sq.km)
Reserved Forest	19,459
Protected Forest	1,782
Unclassified Forest	1,266
Total	22,507
Source: Tamil Nadu stastistical Handbook – 2016---	

Forest Types

The forest in the state is broadly dividedinto five types as follows

Tropical Evergreen Forest

This forest type is found in the regionsthat receive heavy rainfall. It is a dense, multi-layered forest. It is found in the upper slopes ofWestern Ghats of Tirunelveli,

Kanyakumari,the Nilgiris and Coimbatore districts. Themajor tree species of this forest are cinnamon,Malabar ironwood, panasa, java plum/jamun,jack, kindal, ayani and crape myrtle. The semievergreentype of forest in the state is foundover the regions of sub-tropical climate overthe Eastern Ghats. The prominent regionsare Servarayan, Kollimalai and Pachaimalai.

Species of Indian mahogany, monkey teak,woolly cassia, jack and mango trees arecommon in this region.

Montane Temperate Forest

It is found in sheltered valleys ofAnaimalai, Nilgiris and Palani hills over a1000 metres altitude. They are known as'Sholas'. The trees in this forest are evergreenand usually short. Nilgiri champa, wights litsea and rose apple are the common treesfound in this forest.

Tropical Deciduous Forest

This type of forest lies in the margin ofsemi-evergreen and evergreen forests. Thetrees in this forest shed their leaves duringthe dry season. The trees reach up to a heightof 30 metres. Some trees of this forest are silkcotton, kapok, kadamba, dog teak, woman'stounge, axlewood and siris. Bamboos are alsocommon in this type of forests. Some trees ofthis forest are economically important.

Mangroves

This type of forest is found in the coastalareas, river deltas, tails of islands and oversea faces where accretion is in progress. Thevegetation is typically evergreen, moderatein height and has leathery leaves. Thevegetation of this forest is adapted to survivein tidal mud and salt water. Asiatic mangrove,white mangrove, wild jasmine/Indian pivotetc. are some of the notable trees of thisforest. Pichavaram, Vedaranyam, Muthupet,Chatram and Thoothukudi are the placesin Tamil Nadu where the mangrove forest isfound to a considerable extent.

Role of Mangroves in Coastal Zone Management.Mangroves helps in the prevention of coastalerosion from waves and storms. It alsoprotects coral reefs and sea grass meadowsfrom being smothered in sediments.

Pichavaram mangroveforest is located nearChidambaram, Cuddaloredistrict. This is the secondlargest mangrove forest inthe world covering about 1,100 hectares(11 sq.km) of area. It is separated from theBay of Bengal by a sandbar. It consists ofspecies like Avicennia and Rhizophora. Italso supports the existence of rare varietiesof shell and fin fishes.

Tropical Thorn Forest

Thorn forest in Tamil Nadu is found wherethere is a little rainfall. These forests are foundfrom plains up to 400 meters altitude. Thecommon trees of this forest are rusty

acacia,wheel, neem and palm. Shrubs are commonvegetation in this type of forest. This type offorest is found in the districts of Dharmapuri,Ramanathapuram, Virudhunagar and someparts of interior districts.

Districts with prominent forest cover in Tamil Nadu	
District	**Area (sq km)**
Dharmapuri	3,280
Coimbatore	2,627
Erode	2,427
Vellore	1,857
The Nilgiris	1,583
Dindigul	1,662

Wild life

Animals and birds live in forestsconstitute the wild life. Tamil Nadu has avariety of wild animals, birds and reptiles.hills are an ideal refuge for elephants, bisons,tigers, deer and monkeys.Several Wildlife sanctuaries and NationalParks have been set up to protect the animallife in the state. The hills of the state providean ideal condition for a variety of animals andplants life. The list of Wild lifeSanctuaries,National parks and Biosphere Reserves ofTamil Nadu are listed in the following tables.

S. No	Wildlife Sanctuaries in Tamil Nadu	District	Year of Establishment
1	Mudumalai Wildlife Sanctuary	The Nilgiris	1940
2	Mundanthurai Wildlife Sanctuary	Tirunelveli	1962
3	Point Calimere Wildlife Sanctuary	Nagapattinam	1967
4	Indira Gandhi Wildlife Sanctuary	Coimbatore	1976
5	Kalakad Wildlife Sanctuary	Tirunelveli	1976
6	Vallanadu Black Buck Sanctuary	Thoothukudi	1987
7	Grizzled Giant Squirrel Wildlife Sanctuary	Virudhunagar	1988
8	Kanyakumari Wildlife Sanctuary	Kanyakumari	2007
9	Sathyamangalam Wildlife Sanctuary	Erode	2008
10	Megamalai Wildlife Sanctuary	Theni and Madurai	2009
11	Point Calimere Wildlife Sanctuary - Block A and Block B	Thanjavur and TiruvarurNagapattinam	2013
12	Kodaikanal Wildlife Sanctuary	Dindigul and Theni	2013
13	Gangaikondan Spotted Deer Sanctuary	Tirunelveli	2013
14	Cauvery North Wildlife Sanctuary	Dharmapuri and	2014

		rishnagiri	
15	Nellai Wildlife Sanctuary	Tirunelveli	2015

S. No	**Bird Sanctuaries in Tamil Nadu**	**District**	**Year of Establishment**
1	Vettangudi Birds Sanctuary	Sivaganga	1977
2	Pulicat Lake Birds Sanctuary	Tiruvallur	1980
3	Karikili Birds Sanctuary	Kancheepuram	1989
4	Kanjirankulam Birds Sanctuary	Ramanathapuram	1989
5	Chitrangudi Birds Sanctuary	Ramanathapuram	1989
6	Koonthankulam-Kadankulam Birds Sanctuary	Tirunelveli	1994
7	Vellode Birds Sanctuary	Erode	1997
8	Vedanthangal Birds Sanctuary	Kancheepuram	1998
9	Udayamarthandapuram Birds Sanctuary	Tiruvarur	1998
10	Melaselvanur-Keelselvanur Birds Sanctuary	Ramanathapuram	1998
11	Vaduvoor Birds Sanctuary	Tiruvarur	1999
12	Karaivetti Birds Sanctuary	Ariyalur	2000
13	Theerthangal Bird Sanctury	Ramanathapuram	2010
14	Sakkarakottai Tank Birds Sanctuary	Ramanathapuram	2012
15	Oussudu Lake Birds Sanctuary	Villupuram	2015

S. No	Biosphere Reserves in Tamil Nadu
1	Nilgiri Biosphere Reserve
2	Gulf of Mannar Biosphere Reserve
3	Agasthiyarmalai Biosphere Reserve

Tamil Nadu is a state with varied climate,landforms and resources. This makes ourstate a distinct one among the Indian states.In Tamil Nadu, If the available resources areutilised rationally, it may continue to be at topin the country. So, it is the duty of the everyindividual to strive towards achieving this goal.

Natural Disasters in Tamil Nadu

A sudden natural catastrophe thatcauses great damage or loss to lives andproperties is called as disaster. The alterationof natural environment by the technologyand developmental activities increase thefrequency of disasters all over the world.So, it is necessary to aware the measures tobe adopted during different types of naturaldisasters to reduce the risk caused by them.

According to United Nations officefor Disaster Risk Reduction, Disaster RiskReduction(UNDRR) is the concept and practiceof reducing disaster risks through

systematicefforts to analyse and reduce the causal factorsof disasters. This includes reducing exposure tohazards, lessening the vulnerability of peopleand property, wise management of land andenvironment, and improving preparedness andearly warning for adverse events.

Here we will discuss about the naturaldisasters in Tamil Nadu and the measures to beadopted before, during and after different disasters.

Landslide

A collapse of a mass of earth or rock froma mountain or cliff is called landslide. Wateris the most common trigger of a landslide.Nilgiris in Tamil Nadu is identified as one ofthe most vulnerable districts in the country andlandslides pose a major threat in this area. Theother regions which are prone to land slides areCoimbatore and palani hill of Dindigul districtwhere Kodaikanal hill station is located.

Risk Reduction Measures

Before: Create awareness; stay alert and awake;monitor the news updates; make evacuationplan; listen for any unusual sounds that mightindicate moving debris such as trees cracking,boulders knocking and consider leaving theplace of landslide if it is safe to do so.

During

If indoors: Find cover in the section ofthe building that is farthest away from theapproaching landslide; take shelter under astrong table or bench. Hold on firmly andstay until all movement has ceased.

If outdoors

Move quickly away from its likely path,keeping clear of embankments, trees, powerlines and poles; avoid crossing roads andbridges and stay away from the landslidebecause the slope may experience additionalfailures for hours to days afterwards.

After- Stay away from the slide area; listen tolocal radio or television stations for the latestemergency information; watch for flooding,which may occur after a landslide or debrisflow; check for injured and trapped personsnear the slide, without entering the directslide area.

Flood

Flood is a common one in the coastaldistricts of Tamil Nadu during northeastmonsoon. The recent flood occurred in thestate was in 2015. The 2015 South Indianfloods resulted from heavy rainfall generatedby the annual northeast monsoon inNovember–December 2015. They affected theCoromandel Coast region of the South Indianstates of Tamil Nadu and Andhra Pradesh.More than 500 people were killed and

over1.8 million people were displaced. With theestimates of damages and losses ranging fromnearly 200 billion, the floods were the costliestnatural disasters of the year 2015. Tamil Naduwas the worst affected state by this flood.Generally the districts of Kancheepuram,Tiruvallur, Cuddalore, Villupuram,Thanjavur, Tiruvarur, Nagapattinam,Pudukkottai, Ramanathapuram, Tirunelveli
and Kanyakumari are the most flood pronedistricts of the state.

Risk Reduction Measures

Before: Know about relief centres andevacuation routes; keep emergency phonenumbers and important information; foldand roll up things on to higher ground.During: Be quick, keep safe and ensure thatchildren and elderly are safe by leaving thehouse to a higher ground; turn off all electricalappliances and gas; leave the area before itsget too late; do not drive through the water;stay away from power lines or broken powertransmission cables and try to keep awayfrom flood water.

After: Make sure to get back inside yourhouse, keep all power and electrical appliancesoff before it is okay to put them on and wearappropriate dress before cleaning house whichis necessary to clean the contamination.

Cyclone

The coastal regions of Tamil Nadu are oftenhit by the tropical cyclones formed in Bay ofBengal during northeast monsoon. Occurrenceof flood, losses to lives and properties are therecurring one in the state. Based on the cyclonehit areas, the state of Tamil Nadu can be dividedinto five zones namely very high, high, medium,low and very low cyclone prone zones. Southernpart of Chennai, eastern part of kancheepuram,eastern part of Villupuram, northeastern part ofCuddalore and Union Territory of Puducherryfall under the very high cyclone prone zone.Nagapattinam, Tiruvallur, Tiruvarur (exceptnorthwestern part), southern part of Thanjavur,eastern part of Pudukkottai, eastern part ofCuddalore, middle portion of Villupuram,eastern part of Tiruvannamalai, western part ofkancheepuram, northeastern part of Vellore andnorthern part of Chennai districts are includedin the high cyclone prone zone.

Risk Reduction Measures

Before: Ignore rumours, stay calm, don't bepanic; Keep your mobile phones charged toensure connectivity; use sms; listen to radio;watch TV; read newspapers for weatherupdates. Keep your documents and valuables inwater proof containers; prepare an emergencykits with essential items for survival; secureyour house; carry out repairs; don't leave sharpobjects loose; untie cattle/animals for theirsafety. Fishermen should keep a radio set withextra batteries handy; keep boats and rafts tiedup safely and don't venture out in the sea.

During: Take care of the old and young, keepall family members inside the house; switchof all electrical appliances, stay in an emptyroom, movable items should be kept securelytied; try to help your neighbours but, don't goout during cyclone.

After: Those who shifted to the cyclonecentre must remain there till instructions arereceived; strictly avoid loose electrical wiresafter the cyclone; beware of snakes and otheranimals immediately after the cyclone; cleardebris and carcasses from/near the premiseafter the cyclone and report losses truthfullyand accurately to the authorities.

Drought

Tamil Nadu is water deficit state. It isalmost a regular one and not a seasonal one.It depends mostly on northeast monsoon forits rain. Its failure ends in disastrous. The totalassessed water resources in the state amount to1,587 TMC (Thousand million cubic feet) whilethe state government's demand estimate is1,894 TMC. Demand exceeds supply by 19.3%,this happens when rainfall is "normal".

The government classifies groundwaterblocks into different categories. Only 145of 385 such blocks are classified safe. Theothers are in various stages of depletion:over-exploited, critical and semi-critical.About 2% of the blocks are already saline.About 64% of the total area of the state isdrought prone. Coimbatore, Dharmapuri,Kanyakumari, Madurai, Ramanathapuram,Salem, Tirunelveli, and Tiruchirappalli arethe districts which are more drought prone.

According to the desertification atlasprepared by the ISRO, about 12 percent of thetotal geographical area is under desertificationand land degradation. Theni, Virudhunagar,the Niligris and Kanyakumari are the worstaffected districts. To manage the water deficit,rain water harvesting and water conservationmethods have to be implemented strictly.

Some methods of water conservation are:

Protection of water from pollution;redistribution of water; rational useof groundwater; population control;renovation of traditional water sources; useof modern irrigation methods; increasingforest cover; changing crop pattern; floodmanagement and use of geothermal waterare some of the major water conservationmethods.

Forest Fire

Tamil Nadu is a tropicalstate. The high temperatureduring summer leads tooccasional forest fire indeciduous and thorn forests.
The recent fire accidentin the state took place in 2018. The tragedyhappened on March 11 when 37 people fromChennai and Erode regions were returningafter a trekking trip to the Kurangani hills in

Theni district. The groups were struck in themiddle of a forest fire, which ultimately killed23 people. In the aftermath of the Kuranganiforest fire, Tamil Nadu government hasbanned trekking in the state for two monthsevery year (February15 to April 15).

Risk Reduction Measures

Before: Create defensible space to separateyour home from flammable vegetationand materials (30 feet); follow all localfire and building codes; keep all trees andshrubs trimmed. Use approved fire resistantmaterials; make evacuation plans with familymembers which include several options withan outside meeting place.

During: Listen to radio; watch tv; readnewspapers for updates; if adequate water areavailable fill buckets with water. turn a lighton a room in case of smoke; turn off gas andelectrical appliances and be ready to evacuateall family members.

After: Check with fire officials beforeattempting to return to your home; usecaution when re-entering a burned area -flare ups can occur; check grounds for hotspots and check the roof and exterior areasfor sparks and embers.

Tsunami

Though Tsunami is not a common onein India, its incident in 2004 alerted Indiaand the state of Tamil Nadu on this aspect.Almost all the countries situated around theBay of Bengal were affected by the tsunamiwaves in the morning hours of 26 December2004 (between 09:00 and 10:30 hrs IST). Thekiller waves were triggered by an earthquakemeasuring 8.9 on the Richter scale that hadan epicentre near the west coast of Sumatrain Indonesia. Waves rose up to 6-10 metresand the impact was felt up to the East Africancoast affecting Somalia, Tanzania and Kenya.

Tremors and Tidal Waves in South India

Tremors and Tidal waves hit South Indiaand Large Scale devastation was reported. Overa thousand people have been killed in tidal wavesin Tamil Nadu, Andhra Pradesh, and Andamanand Nicobar Islands. Tamil Nadu was the "worstaffected" state of India in this incident.

More than 1,500 people have been killedin the state. Casualties reported were veryhigh in Nagapattinam (700), Kanyakumari(250) and Cuddalore (200) districts. Around125 deaths have been recorded in the statecapital of chennai. Earlier, the tsunami wasreported in India in 1881 and 1941.

Risk Reduction Measures

Before: if you live in a coastal area, knowabout tsunami risk and local warningarrangements; develop household emergencyplan; know where the nearest high ground isand how you will reach it.

During: Take your get away kit, don't travelareas at risk; move immediately nearest highground; if you can't escape tsunami, go to anupper storey of the building or climb onto a roofor tree or grab a floating objects; never go to theshore to watch tsunami and listen to local radiostations as emergency management.

After: Continue to listen to the radio; don'treturn to the evacuation zone until authoritieshave given all clear; check yourself for injuriesand get first aid and help others.

Earthquakes

India is a vast country whichexperiences many earthquakes at differentperiods. Generally high risk zones of thecountry are located in the north and centralparts. The state of Tamil Nadu is located inthe moderately low risk zone.

Earthquakes in Tamil Nadu

26 September 2001: A moderate quakeoccurred in the Bay of Bengal, off the coast ofthe Union Territory of Puducherry, resultingin three deaths and minor damage to propertyin Puducherry and coastal Tamil Nadu. It hada magnitude of 5.6 on Richter scale.

7 June 2008: A mild earthquake occurred inthe Palar Valley region in Tamil Nadu. It hada magnitude of 3.8 on Richter scale and wasfelt in many parts of Vellore district.

12 August 2011: A mild earthquake occurredin the Cauvery basin in Ariyalur district. Ithad a magnitude of 3.5 on Richter scale andwas felt in several districts in southern TamilNadu. It resulted in one death and causedminor damages in the districts of Cuddalore,
Villupuram, Perambalur and Tiruchirappalli.

In 2012, Chennai experienced a mild tremorwith its epicentre in the Indian Ocean.

Risk Reduction Measures

During: Take cover under a strong table orany other piece of furniture and remain undercover until the shaking stops.

After: Proceed cautiously once the earthquakehas stopped and always avoid roads, bridges thatmight have been damaged by the earthquake.

Unit – 7

Human Geography of Tamil Nadu

Introduction

Human geography refers to the study ofways of development of human societies andtheir operation in relation to their physicalenvironment. This chapter focuses on thedistribution, characteristics and utilisation ofdifferent resources in Tamil Nadu. We havestudied earlier that the earth is endowedwith a variety of natural resources such aslandforms, rivers, soil, natural vegetation,water and wildlife. These resources are usefulonly when they are utilised. Human beingsuse these resources using their intelligenceand skill. Thus, the human beings are themost significant resource on the earth surface.They turn all these natural resources intouseful products with their skills and abilities.

Agriculture

The word "agriculture" is derived from theLatin words "ager and cultura", which meansfield and growing. Agriculture is a practice offarming that includes the cultivation of crops,rearing of animals, birds, forestry, fisheriesand other related activities. Agriculture is themajor occupation in Tamil Nadu. Agriculturehas been the mainstay of the state's economysince independence with more than 65% of thepopulation depends upon this sector for theirliving. Agriculture provides employment forrural people on a large scale. There is a stronglink between agriculture and economic growth.Agriculture constitutes about 21% of the state'seconomy. However, it fluctuates from one yearto another. Paddy, millets and pulses are theprincipal food crops of the state. Sugarcane,cotton, sunflower, coconut, cashew, chillies,gingelly, groundnut, tea, coffee, cardamom andrubber are the major commercial crops.

Geographical determinants of Agriculture

Landform, climate, soil and irrigationare the factors that determine the growth ofagriculture.

Landform

Tamil Nadu is a land of diverse landscapecomprising of hills, plateaus and plains.Among them the plains are most suitablefor agriculture. The plains with alluvial soilenhances agricultural productivity. Example:Plains of cauvery. Agriculture in the plateau ismoderate and is poor on the hills.

Climate

Tamil Nadu is situated in the tropicalzone, which is nearer to the equator. The stateexperiences a tropical climate. Hence, thetemperature in Tamil Nadu is relatively highalmost throughout the year. So, only the tropicalcrops are cultivated. Water is another limitingfactor of agriculture. Northeast monsoon isthe major source of rainfall for Tamil Nadu.Therefore, the major cropping season beginswith this season. The rainfall in this season andthe irrigation facilities affect agriculture to alarge extent.

Soil

Soil is one of the most essential elementsof agriculture. It provides essential minerals ornutrients for the growth of crops and vegetation.The regions of river valleys and the coastal plainsare the most agriculturally productive regions of thestate as they are covered with fertile alluvial soil.

Types and regions of Agriculture Practices in Tamil Nadu

Farming type	**Area practiced**
Subsistenceintensiveagriculture	Practiced all overTamil Nadu with fewexceptions.
PlantationAgriculture	Hill slopes of Easternand Western Ghats.
Mixed farming	Banks of RiverCauvery andThenpennai.

Irrigation

Monsoon rainfall in the state is highlyirregular. Further it is seasonal. Hence,irrigation becomes necessary for successfulcultivation of crops in the state. In the dryregions, rain-fed crops are cultivated.

The Tamil Nadu RiceResearch Institute (TRRI) is anIndian research institute workingin the field of rice under TamilNadu Agricultural University(TNAU).It is situated at Aduthurai, in Thanjavurdistrict, it was established in April, 1985 in TNAUto meet the research requirements of the regionwith the help of existing Agricultural Collegesand Research centres and perform lead functionfor rice and rice based cropping system research.

Cropping Seasons in Tamil Nadu

Farmers select different crops fordifferent seasons of cultivation. It is based onthe temperature and availability of moisturein the soil. Accordingly, the state has thefollowing cropping seasons.

Name	**Sowing**	**Harvesting**	**Major crops**
Sornavari (chittirai pattam)	April-May	August-September	Millets and cotton

Samba (Adipattam)	July-August	January-February	Paddy and sugarcane
Navarai	November - December	February-March	Fruits, vegetables, cucumber and watermelon

Distribution of major crops in Tamil Nadu

Paddy

Paddy is the most important staple foodcrop of Tamil Nadu. Ponni and kichadi sambaare the major varieties of paddy grown inTamil Nadu. About 3 million hectares of thestate is under rice cultivation. Though it iscultivated all over Tamil Nadu, its cultivationis highly concentrated in Thanjavur, Tiruvarur,Tiruvallur, Kancheepuram, Villupuram,Cuddalore and Tirunelveli districts. It ranksthird in the production of rice among the statesof India. The deltaic region of river cauvery(the undivided Thanjavur district) is the majorrice-producing region of Tamil Nadu. So, thisregion is rightly called as the "Granary ofTamil Nadu."

Millets

Millets form staple food of nearly onethirdof human population of Tamil Nadu.Sorghum/jowar (cholam), ragi (kezhvaragu)and bajra (kambu) are the major millets. Theseare grown not only in drier areas but also inthe coastal plains. Sorghum is grown in theCoimbatore plateau and Kambam valley. Ragi isgrown in Coimbatore, Dharmapuri, Vellore andCuddalore districts. Bajra is mostly cultivatedin Ramanathapuram, Tirunelveli, Karur,Perambalur and Salem districts.

India observed 2018 asnational year of millets. FAOhas decided to observe 2023 asthe International year of millets.

Pulses

Pulses are the major source of protein.Bengal gram, black gram, green gram, cowpeaand horse gram are the important pulses grownin Tamil Nadu. Pulses are grown in a wide rangeof climatic conditions mostly in drier regionswith or without irrigation. Mild cool climateand a low to moderate rainfall are best suitedfor these crops. Pulses serve as excellent fodder.Pulses are grown in almost all districts in thestate except Chennai, Nilgiris and Kanyakumari.Coimbatore leads in the production of Bengalgram. Vellore and Kanyakumari districtsproduce red gram.

To promote organicfarming a central scheme named'National Project on OrganicFarming' was launched Apartfrom general things (creatingawareness, promoting organic fertilizers,training, capacity building etc.), the schemeprovides financial assistance through CapitalInvestment Subsidy Scheme for agro-wastecompost production units, bio-fertilizers/bio-pesticides production units,

developmentand implementation of quality controlregime, human resource development etc.

Tiruvarur, Nagapattinam and Thoothukudidistricts are the principal producers of greengram and black gram. Horse gram is widelycultivated in Dharmapuri and Krishnagiridistricts.

Oil Seeds

Groundnut, gingelly castor, coconut,sunflower and mustard are some of the oilseedsthat are grown in Tamil Nadu. Apart from itsuse in food preparation, it is used in industriesas a lubricant, in the manufacture of varnish,soaps, candles, cosmetics and pharmaceuticals.Groundnut is the major oilseed of the state. Thecultivation of groundnut is mostly concentratedin Vellore, Tiruvannamalai, Villupuram, Salemand Pudukottai districts. It is also grown to someextent in Dharmapuri, Cuddalore, Perambalurand Madurai. Erode, Ramanathapuram,Sivagangai and Virudhunagar districts areits minor producers. Coconut is grown inCoimbatore, Thanjavur and Kanyakumaridistricts.

Sugarcane

It is one of the major cash crops of thestate. It is an annual crop. It requires hightemperature and heavy rainfall. It grows well inthe tropical region. Major sugarcane-producingdistricts are Tiruvallur, Kancheepuram, Vellore,Cuddalore, Tiruchirapalli, Coimbatore, Erodeand Tirunelveli.

Cotton

Cotton is a fibre and cash crop. It requiresblack soil, long frost-free condition and warmand humid weather for its cultivation. Humidweather in the early stages and hot, dry weatherduring harvest period is suitable for this crop.It is predominantly cultivated in Coimbatoreplateau and Vaigai-Vaippar river basins. It isalso cultivated in Madurai, Ramanathapuram,Virudhunagar, Tirunelveli, Thoothukudi,Salem and Dharmapuri districts.

Plantation crops

Tea, coffee, cashew, rubber and cinchonaare the major plantation crops of the state.Tamil Nadu ranks second in area andproduction of tea in India next to Assam. Teaplantations are found in the hills of the Nilgirisand Coimbatore. The Nilgiris is the notableregions for tea plantations. Coffee plants aregrown in the hills of Western Ghats as wellas Eastern Ghats. It is also found in the hillyslopes of Dindigul, Madurai, Theni and Salemdistricts. Yercaud, Kolli Hills and Kodaikanalare notable for coffee plantations. Tamil Nadustands second in area and production ofcoffee next to Karnataka. Rubber plantationsare significant in Kanyakumari. Pepper isconfined to the warm and wet slopes of Easternand Western Ghats of Tamil Nadu. Cashew isextensively cultivated in Cuddalore district.

Cinchona is planted at heights varyingfrom 1060 to 1280 metres in Anaimalai hills.Cardamom estates are located at few places inthe hills of Madurai region at an elevation of915 to 1525 metres.

TANTEA (TANTEATamilNadu Tea PlantationCorporation Limited) isone of the Biggest Black TeaProducers in India with highquality clonal tea. Its plantation spreadsover nearly 4500 hec.Tamil Nadu Dairy DevelopmentCorporation Ltd. was transformed into thenewly registered Tamil Nadu Co-operativeMilk Producers Federation LimitedPopularly known as "Aavin".

Livestock/Animal Husbandry

Livestock has remained an integral partof socio-economic fabric of rural people.The number of cattle found in Tamil Nadu is88,92,473. There are 47,86,680 sheep, 81,43,341goats and 11,73,48,894 poultry animals.

Goat

Goat is also known as 'poor man's cow'in India. It forms a very important componentin dry land farming system. In the marginal orundulating lands unsuitable for rearing of othertypes of cattle like cow or buffalo, goat is the bestalternative. With very low investments, goatrearing can be made into a profitable venturefor small and marginal farmers.

Sheep

Sheep is used for multiple purposes likewool, meat, milk, skins and manure, andforms an important component of the ruraleconomy, particularly in the arid, semi-aridand mountainous areas of Tamil Nadu. Itprovides a dependable source of income tothe shepherds through the sale of wool andanimals.

A variety of cattle breeds are reared in thestate for the milk and forms a major componentof the rural economy. The poultry hub of
Tamil Nadu are Namakkal, Salem, Erode andCoimbatore districts.

Fishing

Since Tamil Nadu is a coastal state, fishingis one of the major occupations in the state.With widespread reservoirs and rivers, inlandfishing also is also seen to a considerableextent. There are about 2500 species of fishesfound in different aquatic environments.

Marine Fishing

The length of the coastline of TamilNadu is 1076 km (13% of the country'scoastline). The coastal region of the statecovers an area of 0.19 million sq.km. Anarea of 41,412 sq.km

of continental shelvesof the state favours coastal fishing and TamilNadu is one of the leading states in marinefish production. Marine fishing is also calledinshore fish or neritic fishing, carried out inoceans and seas. Large mechanised boats areused for fishing. In ocean or seawaters, fishingwithin few kilometres from the shoreline iscalled inshore fishing and the fishing far fromthe shore typically 20–30 miles out in waterhundreds and thousands of feet deep is calledoff-shore fishing. The fish varieties caughtare sharks, flying fish, counch, catfish, silverbellies, and crabs. Chennai, Kanyakumari,Tirunelveli, Nagapattinam, Thanjavur andRamanathapuram districts contribute about40% to marine fish production in the state.Their coastal location favours fishing in theseregions. The state has three major fishingharbours, three medium fishing harboursand 363 fish landing centres. The export ofmarine products from the state during 2007–08 accounted for 72,644 metric tons.

Inland Fishing

Inland fishing is carried out in lakes,rivers, ponds, estuaries, backwaters andswamps. Oysters and prawns are culturedin original nurseries. Catamaran, dieselboats and floating nets are used in fishing.Tamil Nadu Fisheries Department hasintroduced several programmes forthe betterment of fishing. The majorprogrammes are aquaculture in farmponds and irrigation tanks, fish seed bank,fish seed rearing, ornamental fish cultureand the establishment of Fish FarmerDevelopment Agency. Vellore district leadsin the production of inland fish productionwith 10% of state's production. Cuddalore, Sivagangai and Virudhunagar districts standsecond with 9% of inland fish catch each.Fishing sector contributes 1.25% of state'seconomy.

Second Green Revolution (Eco-Farming or Organic Farming)
In organic farming synthetic fertilizers,pesticides, growth regulator and livestockfeed additives are not used. This type offarming rely on crop rotation, crop residues,animal manure, off-farm organic wastesand biological pest control to maintain soilproductivity. This farming method is beingadopted by very few farmers in the state. Ithas to be increased in number.

Water Resource

Water is the preciousgift of nature to humankindand millions of other speciesliving on the earth.

Tamil Nadu constitutes4% of India's land area and is inhabited by6% of India's population, but has only 2.5%percent of India's water resources. More than95% of the surface water and 80% of theground water have already been put into use.Major uses of water include human/animalconsumption, irrigation and industrial use.The state is heavily dependent on monsoonrains. The annual average rainfall is around930 mm (47% during the northeast monsoon,35% during the southwest monsoon, 14% insummer and 4% in winter).

Surface Water Resources	Numbers
River Basin	17
Reservoirs	81
Tanks	41,127
Tube wells and other wells	4,98,644
Open wells	15,06,919
Total (Million Cubic metres)	2046788 MCM
Source: Statistical handbook of Tamil Nadu – 2017	

Multipurpose River Valley Projects

Multipurpose river valley projects arebasically designed for the development ofirrigation for agriculture and hydropowergeneration. However, they are used for manyother purposes as well.

Mettur Dam

The Mettur Dam was constructed ina gorge, where river Cauvery enters theplains. It is one of the oldest dam in India.It provides irrigation to Salem, Erode, Karur,Tiruchirappalli, Thanjavur, Tiruvarur andNagapattinam districts for about 2,71,000acres of farmland. The dam, park, majorhydroelectric power stations and hills on allsides make this dam an important touristspot.

Bhavani Sagar Dam

The Bhavani Sagar Dam is located 80 kmaway from Coimbatore city in the district ofErode. It has been constructed across the riverBhavani. This dam is one of the biggest earthendams in the country.

Amaravathi Dam

The Amaravathi dam is situated 25 kmaway from Udumalpet in Tirupur district. Thedam has been constructed across the riverAmaravathi, a tributary of Cauvery. The damwas built primarily for irrigation and floodcontrol. A small hydropower station has alsobeen installed recently. This reservoir is notablefor the significant population of muggercrocodiles. It is also a familiar tourist spot.

Krishnagiri Dam

Krishnagiri dam is situated at a distance of7 km from Krishnagiri towards Dharmapuri.This dam drains an area of 5428 sq.km. This isa famous tourist spot too. This dam is floodedwith tourists during the weekends.

Sathanur Dam

Sathanur Dam was constructed acrossthe river Thenpennai in Chengam taluk. It isin the midst of Chennakesava hills. The waterholdingcapacity of the dam is 7321 millioncubic feet (full level: 119 feet). About 7183hectares of land is drained by the left bank canaland 905 hectares by the right bank canal of thisdam. It irrigates the land in Thandrampet andTiruvannamalai blocks. There is also a largecrocodile farm and a fish grotto. Parks aremaintained inside the dam for tourists and thegardens are used by the film industry.

Mullaiperiyar Dam

Mullaiperiyar dam was built by theBritish administration in 1895. It has beenconstructed on the Periyar river, whichoriginates from Thekkady hills of Kerala. Thedam was built mainly for watering the farmingland of Tamil Nadu, which is perenniallydrought-prone. Though the dam is located inthe state of Kerala, most of its water is usedto irrigate Tamil Nadu. The dam is 175 feet inheight and 1200 feet in length.

Vaigai Dam

This dam built across the river Vaigainear Andipatti. The dam with a height of 111feet can store water up to 71 feet. It is located 7km from Andipatti and 70 km from Madurai.This dam was opened on 21 January, 1959.The dam has a unique garden that deservesthe surname 'Little Brindavan'. It is a popularpicnic spot in Theni district.

Manimuthar Dam

Manimuthar dam is located about 47km from Tirunelveli. The gorgeous garden ofthe dam is located about 5 km from the damand is accessible through a zig-zag ghat road.Pleasure boating and waterfalls are additionaltourist attractions near the dam.

The Papanasam Dam

It is also known as Karaiyar dam and islocated about 49 km away from Tirunelveli.The dam is used to irrigate 34,861 hectares ofland in Tirunelveli and Thoothukudi districts.It generates 28 MW of hydro power.

Parampikulam Aliyar Project

It is a joint venture of Tamil Nadu andKerala states. It envisages the construction ofseven interconnected reservoirs by harnessingthe water of seven rivers, which include majorrivers of Parambikulam and Aliyar.

Parappalar project is located nearOttanchatram. Its storage capacity is 167million cubic feet of water. It is about 75 kmfrom Madurai and is in Palani taluk.

Surface water Resources

The total surface water potential of thestate is about 24,864 mcm (million cubicmetre). There are 17 major river basins inthe state with 81 reservoirs and about 41,262tanks. Most of the surface water has alreadybeen tapped, primarily for irrigation, wherewater use is largest. An area of 24 lakhhectares of the land are irrigated by surfacewater through major, medium and minorschemes.

Ground Water Resources

The utilizable groundwater resource ofthe state is 22,423 mcm. The current levelof utilization of water is about 13,558 mcmwhich is about 60 percent of the availablerecharge, while about 8875 mcm (40 percent)is the balance available for use.

Water Resource Management

Water resource management is theactivity of planning, developing, distributingand managing the optimum use of waterresources. The demand for water in TamilNadu is increasing at a fast rate both due toincreasing population and also due to largerper capita needs triggered by economicgrowth. The per capita availability of waterresources is just 900 cubic metres whencompared to the national average of 2,200cubic metres. Agriculture is the largestconsumer of water in the state using 75% ofthe state's water resources. Demands fromother sectors such as domestic and industrieshave been growing significantly. The state isheavily dependent on monsoon rains. Sincethe state is entirely dependent on rains forrecharging its water resources, monsoonfailures lead to acute water scarcity and severedroughts. So, it is important to save water forus and the future generation.

Mineral Resources

Tamil Nadu is the leading holder ofcountry's resources of vermiculite, magnetite,dunite, rutile, garnet, molybdenum andilmenite. The state accounts for the country's55.3% of lignite, 75% of vermiculite, 69% ofdunite, 59% of garnet, 52% of molybdenumand 30% of titanium mineral resources.

Important minerals are found inthe state are as follows: Neyveli has largelignite resources. Coal is also availableinRamanathapuram. Oil and gas are found inthe Cauvery basin. Iron deposits are found in Kanjamalairegion in Salem district and Kalrayan Malairegion of Tiruvannamalai district. Magnesiteores are available near Salem. Bauxite is foundin Servarayan Hills, Kotagiri, Udagamandalam,Palani and Kollimalai areas. Gypsum is obtainedin Tiruchirappalli, Tirunelveli, Thoothukudiand Virudhunagar districts. Ilmenite andrutile are found in the sands of Kanyakumaribeach. Limestone is available in Coimbatore,Cuddalore, Dindigul, Kancheepuram, Karur,Madurai, Nagapattinam, Namakkal, Perambalur,Ramanathapuram, Salem and Tiruvallurdistricts. Magnesite is obtained in Coimbatore,Dharmapuri, Karur, Namakkal, the Nilgiris,Salem,

Tiruchirapalli, Tirunelveli and Velloredistricts. Feldspar, quartz, copper and lead arealso found in some parts of the state.

Industries

Industries use rawmaterials and convert theminto usable product or goods.Textiles, sugar, paper, leather,cement, electrical equipment,automobiles, informationtechnology and tourism arethe major industries of Tamil Nadu.

Textile Industry

Textile industry is one of the traditionallywell-developed industries in Tamil Nadu. Thetextile mills are concentrated in Coimbatore,Tirupur, Salem, Palladam, Karur, Dindigul,Virudhunagar, Tirunelveli, Thoothukudi,Madurai and Erode. Tamil Nadu has about3,50,000 power looms manufacturing cottonfabrics and accounts for 30% of India's exportsof textiles products. Erode in Tamil Nadu iswell known for marketing of handloom, powerloom and readymade garments. Coimbatore isalso known as the 'Manchester of Tamil Nadu'.Coimbatore, Tirupur and Erode contributea major share to the state's economy throughtextiles. So, this region is referred as 'TextileValley of Tamil Nadu'. Karur is known as 'TheTextile capital of Tamil Nadu'.

Silk Textiles

Tamil Nadu occupies fourth position inthe country in silk production. Kancheepuramsilk is unique in its quality and is known for itstraditional value all over the world. The annualsilk production in Tamil Nadu is around1200 metric tons. Kancheepuram, Arani,Kumbakonam, Salem, Coimbatore, Maduraiand Tirunelveli are the important silk-weavingcentres in Tamil Nadu. Ramanathapuram hassome specialised areas for the manufacturingof synthetic silk clothes.

Leather Industry

Tamil Nadu accounts for 60% of leathertanning processes of India and 38% of all leatherfootwear, garments and components. Hundredsof leather tanneries are located around Velloreand nearby towns, such as Ranipet, Ambur andVaniyambadi. The Vellore district is the topexporter of finished leather goods in the country.Vellore leather accounts for more than 37%of the country's export of leather and leatherrelatedproducts (such as finished leathers, shoes,garments and gloves). Central Leather ResearchInstitute (CLRI), a CSIR research laboratory, islocated in Chennai.

GI Tag

GI(Geographical Indication)is a name orsign used on products which corresponds toa specific geographical location. It providesrights and protection of holders.

Some important GI Tags of Tamil Nadu are:

Place	Products
Aranl	Silk

Kancheepuram	Silk
Coimbatore	Wet Grinder and Coracotton
Thanjavur	Paintings, Art plate,Doll and veenai
Nagercoil	Temple Jewellery
Erode	Turmeric
Salem	Venpattu(salem silk)
Bhavani	Jamakkalam
Madurai	Sungudi
Swamimalai	Bronze Icons
Nachiarkovil	Kuthuvilakku
Pattamadai	Mat
Nilgiri	Orthodox Embroidery
Mahabalipuram	Stone sculpture
Sirumalai	Hill banana
Eathomozhi	Coconut

Paper Industry

Many paper industries are located inthe state. Tamil Nadu Newsprint and PapersLimited (TNPL) is a government of TamilNadu enterprise producing newsprint andprinting and writing paper at its mill locatedat Kagithapuram in Karur district. It wasstarted in 1979 with an installed capacity of2.45 lakh MT of production per annum. TNPLis one of the most accomplished mills in theworld, producing different varieties paper ofacceptable quality primarily from bagasse andpulpwood. Other paper mills of the state arefound in Pukkathurai of Kancheepuram district,Bhavanisagar, Pallipalayam, Paramathi Vellore,Coimbatore, Udamalaipet, Thoppampatti,Nilakkotai and Cheranmahadevi.

Cement Industry

Cement production and consumptioncontinue to grow despite the general recession inthe economy. India is one of the largest cementproducers and ranked second in the world withan annual production capacity of 181 milliontons. Tamil Nadu Cements Corporation Limited(TANCEM) is one among the major cementproducers in Tamil Nadu operating two cementunits: one at Ariyalur and another at Alangulam.Asbestos cement sheet plant at Alangulam andstoneware pipe unit at Virudhachalam are theother units of TANCEM. Sankar Cement, ZuariCement, Ultratech Cement, Madras Cementand Dalmia Cement are the major privatecement brands produced in Tamil Nadu.

Information Technology

According to National Association ofSoftware and Services Companies (NASSCOM),the southern states continue to account formore than half of the country's total exportof software. Tamil Nadu and Andhra Pradeshtogether account for 59.6% of India's totalsoftware exports. Tamil Nadu is the secondlargest software exporter in the country next toKarnataka.

A special economic zone (SEZ) is anarea in which the business and trade laws aredifferent from the rest of the country. SEZs arelocated within a country's national borders,and their aims include increased tradebalance, employment, increased investment,job creation and effective administration.

Special Economic Zones

Special economic zones (SEZs) providean internationally competitive and hasslefreeenvironment for exports. Units in SEZmanufacture goods and provide a range of services.SEZs are located in Nanguneri, Ennore, Hosurand Perambalur. IT & ITES SEZ named TIDEL-IIand TIDEL-III and Bio-Pharmaceuticals SEZ arelocated in Chennai and Coimbatore SEZ calledthe TIDEL Park–IV is located in the city.

The list of IT parks in Tamil Nadu

Tidel Park, Ascendas, Mahindra worldcity 4 IT & ITES SEZ TIDEL-II, IT & ITESSEZ TIDEL-III, Coimbatore SEZ - Tidel Park

Manufacturing & Engineering Industry

The manufacturing industry is one ofthe vibrant sectors of the state economy andcontributes significantly to the industrial output.
The manufacturing industry broadly coversmanufacture of machinery and equipment,motor vehicles, basic metal and alloy industries,metal products and repair of capital goods.Tamil Nadu's share of the industrial outputis around 11–12% of the country's output and15% of the country's exports excluding software.Tamil Nadu accounts for about 17% of India'ssoftware exports.

Automobile Industries

The share of Tamil Nadu in all-Indiaproduction of automobiles and heavy vehicles israther significant. Automobile industry plays acrucial role in the state's economy and has beenone of the key driving factors. Contributing8 percent to state GDP and giving directemployment to 2,20,000 people.

Tamil Nadu accounts for about 21% ofpassenger cars, 33% of commercial vehiclesand 35% of automobile components producedin India. Major automobile manufacturerslike Ford, Hyundai, HM-Mitsubishi, AshokLeyland, and TAFE have their manufacturingbase in Tamil Nadu.

Chemical & Plastic Industry

The chemical industry is one of the fastestgrowing sectors of industry and the economy.The sector contributes 13% to the state's GDPand constitutes 8% of the total exports of thecountry.

Handlooms and Powerlooms

The handloom sector in the state is thesingle largest cottage industry providinglivelihood to a large number of ruralpeople and promoting export earnings. Thehandloom sector and its related economicactivities generate gainful employment formore than 4.29 lakh weaver householdsand 11.64 lakh weavers in the state. Thesesocieties mainly produce the cloth requiredfor the scheme of 'Free Supply of Uniformsto School Children and Free Distribution ofSarees and Dhotis Scheme'.

Sugar Industry

Sugar industry in Tamil Nadu is animportant agro-based industry. It plays avital role in the economic development ofthe state, particularly in rural areas. Thesugar industry provides large-scale directemployment to several thousands and indirectemployment to several lakhs of farmers andagricultural labourers in the rural areas whoare involved in cultivation of sugarcane,harvesting, transporting and other services.There are 34 sugar mills in Tamil Nadu, inwhich 16 are in the cooperative sector and18 in the private sector.

Tourism Industry

Tourism is considered as an industrybecause of its enormous potential in creatingemployment for a large number of people.In recent years, the state has emerged asone of the leading tourist destinations forboth domestic and foreign tourists. Tourismin Tamil Nadu is promoted by Tamil NaduTourism Development Corporation (TTDC).The state currently ranks the highest amongIndian states with about 25 crore arrivals(in 2013). The annual growth rate of thisindustry stood at 16%. Approximately 28 lakhforeign and 11 crore domestic tourists visitour state annually. The presence of ancientmonuments, pilgrim centres, hill stations, avariety of natural landscapes, long coastline,along with rich culture and heritage make
Tamil Nadu the best destination for tourists.

Activity

Plan a visit to a manufacturing unit inyour city. Find out how raw materials areconverted into finished products. Talk to theworkers and manager to know more aboutthe industry.

Plan a field visit with your social scienceteacher to visit a variety of geographicalfeatures, pilgrim centres, monuments, hillstations and prepare a field visit report.

Population

The term 'population'refers to the number ofpeople living in a definedarea. The statistical studyof the characteristics ofhuman population is calleddemography. Demographersmake a deep and detailed study of thepopulation. The rapid increase of

populationmay be responsible for retarding economicgrowth. Hence, overpopulation is one of themajor problems confronting our nation with allits evil effects.

Growth of Population in Tamil Nadu

The total population of Tamil Nadu is72,140,703 or 7.21 crores as per 2011 Census. Itspopulation was 6.24 crore in 2001 and registereda growth of nearly 1 crore population in a decade.The male and female population of the state in2011 is 36,137,975 and 36,009,055 respectivelyand it was 31,400,909 and 31,004,770 in 2001.It shows that the population of the state is sharedalmost 50% each by male and female. The growthrate of population in the decade 2001–2011was 15.61% while in the previous decade it was11.19%. The population of Tamil Nadu forms5.96% of country's total population as per 2011Census. In 2001, it was 6.07%.

Distribution of Population

Based on the actual size of population,Tamil Nadu is divided into the following regions.

Regions of High Population

Chennai has the highest urban populationwith 4.219 million people, but the city rankssecond in the district-wise count, next toCoimbatore district, which had 4.224 millionpeople as per 2011 Census. Coimbatore,Chennai, Tiruvallur, Kancheepuram,Villupuram, Dharmapuri, Salem, Madurai andTirunelveli are the most populous districts in thestate. Agriculture and industrial developmentare the main causes of high concentration ofpopulation of these districts.

Regions of Moderate Population

Tiruvannamalai, Cuddalore, Tiruchirapalliand Thanjavur districts have a population 30–35 lakh. Vellore, Dindugal, Virudhunagar andThoothukudi districts each have a population of15–20 lakh. Other than agriculture, small-scaleindustries and fishing along the coastal areas arethe major occupations of people in these districts.

Regions of Sparse Population

The coastal districts Nagapattinam,Tiruvarur, Pudukottai, Ramanathapuramand Sivagangai have a less than 15 lakh. TheNilgiris district has a population of less than10 lakh (764,826) population and it is the leastpopulated district as per 2011 Census.

Population Density

The density of population in Tamil Nadu is555 per sq.km as per the 2011 Census, while itwas 480 per sq.km in 2001. The state ranks 12thamong the Indian states in population density.The national average density of populationas per the 2011 Census is 382. Chennai is thedensest district with 26,903 persons per sq.kmfollowed by Kanyakumari (1106), Tiruvallur(1049), Kancheepuram (927), Madurai (823),Coimbatore (748), Cuddalore (702), Thanjavur(691), Nagapattinam (668), Salem (663), Vellore(646) and Tiruchirappalli (602). These are theregions with high density of population. Theleast density of population is recorded in theNilgiris (288 per sq.km) and the other districtshave moderate density of population.

Religion

Hinduism, Christianity and Islam arethe major religions in the state. The Hindusconstitute 87.58% of the population, followedby Christians (6.12%) and Muslims (5.86%).Jainism (0.12%), Sikhism (0.02%) and Buddhism(0.02%) also have a presence in the state.

People of other religions constitute 0.01%and the percentage of people with unstatedreligion is 0.26%.

Urban and Rural Population

As per 2011 Census, the urban populationof Tamil Nadu is 3,49,17,440, which constitutes48.40% of the total population of the state. Therural population of the state is 3,72,29,590, whichconstitutes 51.60% of the state population.

Sex Ratio

The sex ratio represents the number offemales per 1000 males. The sex ratio of thestate increased from 987 in 2001 to 995 in 2011.
The sex ratio in India is 940 in 2011 as against933 in 2001. It shows that the sex ratio is morefavourable in the state than the country.

As per 2011 Census, 15 out of 32 districtshave recorded the sex ratio of more than 1000and a similar trend was noticed in the 2001Census also. Only Sivagangai has recordedthe sex ratio of exactly 1000. It is noted that12 districts have the sex ratio of less than1000 and it ranges between 980 and 1000.The highest sex ratio is found in the Nilgirisdistrict (1041) followed by Thanjavur district(1031). The lowest sex ratio is reported inDharmapuri district (946) followed by Salemdistrict (954).

Literacy Rate

The literacy rate of Tamil Nadu as per the2011 Census is 80.33%. It was 73.45% in 2001.The male literacy rate is 86.81% and the femaleliteracy rate is 73.86%. The

correspondingrates in 2001 were 82.42% for males and64.43% for females. It may be observed thatmore than three-fourths of the population isliterate among males in all the districts (exceptDharmapuri), while more than two-thirdsof the population is literate among femalesin all but eight districts. The districts areDharmapuri (60.03%), Krishnagiri (64.86%),Tiruvannamalai (65.71%), Villupuram(63.51%), Salem (65.43%), Erode (65.07%),Perambalur (66.11%) and Ariyalur (62.22%).

The literacy rate for India as per 2011census is 74.04, of which the male literacyrate is 82.14 and the female literacy rateis 65.46. In 2001, the literacy rate of Indiastood at 64.8. It was 75.3 and 53.7 for malesand females, respectively. The district ofKanyakumari has reported the highest literacyrate (92.14%) while Dharmapuri district hasthe lowest rate (64.71%). A high level ofliteracy rate is also seen in Chennai (90.33%),Thoothukudi (86.52%), the Nilgiris (85.65%)and Kancheepuram (85.29%) districts.

Transport and Communication

Roadways

The State has a totalroad length of 167,000km, In which 60,628kmare maintained by stateHighways Department. Itranks second in India with a share of over 20%in total road projects under operation in thePublic-Private Partnership (PPP) model.

Types of the Roads	Length (Km)
National Highways	4994
State Highways	57291
Corporation & Municipalities Road	23350
Panchayat Union	147543
Village Panchayat Union	21049
Others(Forest Roads)	3348
Commercial	12.13
Non commercial	20.341 Lakhs
Source: Statistical handbook of Tamil Nadu -2017	

Railways

Tamil Nadu has a well-developed rail networkas part of Southern Railway, headquarteredat Chennai. The present Southern Railwaynetwork extends over a large area of India'ssouthern peninsula, covering Tamil Nadu, Kerala,Puducherry, minor portions of Karnataka andAndhra Pradesh. Tamil Nadu has a total railwaytrack length of 6,693 km with 690 railway stationsin the state. The system connects it with most of themajor cities in India. Main rail junctions in the stateinclude Chennai, Coimbatore, Erode, Madurai,Salem, Tiruchirappalli and Tirunelveli. Chennaihas a well-established suburban railway network,a mass rapid transport system(MRTS) and iscurrently developing a Metro system, with its firstunderground stretch in operation since May 2017.

Airways

Tamil Nadu has four major internationalairports. Chennai International Airport iscurrently the third largest airport in Indiaafter Mumbai and Delhi. Other internationalairports in Tamil Nadu include Coimbatore,Madurai and Tiruchirapalli airports. It alsohas domestic airports at Tuticorin and Salemconnecting several parts of the country.Increased industrial activity has given riseto an increase in passenger traffic as well asfreight movement, which has been growing atover 18% per year.

NH - 44 is the longest national highway in Tamil Nadu which runs from Hosur to Kanniyakumari (627.2 km) Via Dharmapuri-Salem-Karur- Dindigul-Madurai-Tirunelveli.
NH - 785 is the shortest nationalhighway in Tamil Nadu which runs fromMadurai to Natham (38 km).

Waterways

Tamil Nadu has three major ports. Theyare in Chennai, Ennore and Tuticorin. It hasan intermediate port at Nagapattinam and15 minor ports. The ports are currently capableof handling over 73 million metric tonnes ofcargo annually (24% share of India). All theminor ports are managed by the Tamil NaduMaritime Board, Chennai Port. This is anartificial harbour and the second principal portin the country for handling containers. It iscurrently being upgraded to have a dedicatedterminal for cars capable of handling 4,00,000vehicles. Ennore intermediate port was recentlyconverted as a major port and handles the majorcoal and ore traffic in Tamil Nadu.

Communication

Communication is derived from the Latinword communicare, meaning 'to share'. Theact of conveying or exchanging information iscalled means of communication. They are masscommunication and personal communication.

Postal Districts and Headquarters in Tamil Nadu

Zone /districts	**Head quarters**
Chennai	Chennai
Western	Coimbatore
Central	Thiruchirapalli
Southern	Madurai

Trade

Export and import are the twocomponents of trade. Export means goodsand services sold for foreign currency. TamilNadu contributes 12.2% to the country'sexports. Import refers to goods and servicesare brought from overseas producers. TamilNadu

imports many goods from outside. Thedifference between the values of export andimport is called the balance of trade.

Major Exports of Tamil Nadu	
(i) Agricultural Products	tobacco, cereals, cotton, sugarcane, paddy, groundnut, spices and vegetables.
(ii) Leather Products	wallets, purses, pouches, handbags, belts, footwear and gloves
(iii) Gems and Jewellery	pearls, precious stones, gold jewellery, decorations and antiques
(iv) Chemicals and related products	paper, chemicals, rubber and glass.

Imports of Tamil Nadu

Machineries like transport equipment,machine tools, non-electrical machinery,electrical machinery, pharmaceuticalproducts, petroleum, fertilizers and newsprintare its major imports. The state contributes10.94% to the country's trade through majorports.

The above discussion shows that TamilNadu is an important state of India in termsof size, population, resources and economicdevelopment. People in the state are wellsecured. The new schemes introduced by thestate government periodically have enablednotable progress in various fields.

Man made Disasters in Tamil Nadu
Definition

A disastrous events caused directlyor indirectly by human actions are calledas manmade disaster. Man-made disastercan include hazardous material spills, fires,groundwater contamination, transportationaccidents, structure failures, mining accidents,explosions and acts of terrorism.

Industrial Disaster

Disasters caused by industrialcompanies either by accident, negligence, orincompetence fall under industrial disasters.Electrical faults seem to be the major reasonfor industrial disasters in the country.Overheating, aging of the material and useof sub-standared quality of electrical gadgetshave been the main factors contributing tothe increasing fire accidents in industries.Electricity is not just a life line; It can also takeaway life when handled improperly', Apartfrom these, explosions, leaking of poisonousgases, injuries and deaths caused by machinesare the other causes of industrial disasters.

Sivakasi, is considered the "fireworkscapital"of India. Series of industrial accidentscausing deaths are reporting frequently in theregions of Virudhunagar and Sivakasi wherea number of fireworks and match units arein operation. An explosion occurred on 5September, 2012 in a private firework company.In this incident 40 workers

were killed and morethan 70 workers were injured. Various measuresare being taken by the Government to reduce thefire accidents and casualties caused by industries.In another industrial accident which took placeat Coimbatore on 2nd February 2016 in a tyremelting unit, six migrant workers were criticallyinjured.

Stampede

A situation in which a large numberof animals or people running in the samedirection in an uncontrolled way causinginjuries and deaths is called stampingOn 21st April, 2019 seven people werekilled and 10 injured in a stampede during alocal festival at a temple near Thuraiyur in TamilNadu. The incident took place when hundredsof devotees gathered at the Karuppasamy templein Muthiampalayam village for the 'padikasu'(temple coin) distribution ceremony.

Mitigation

Hazard mitigation refers to any sustainedaction taken to reduce or eliminate the longtermrisk to human life and property fromhazardous conditions.

- Regular maintenance of machines andwires may reduce the frequency ofaccidents,
- Creating awareness and training theworkers to be cautious during work hoursmay help them to reduce risk duringdisasters.
- Wearing specially designed dresses andother safety materials would help theworkers to protect themselves from anyserious injuries.
- Conducting periodical medical campswould help them to assess their healthstatus. The Provision of having lifeinsurance policies will secure their future.
- Besides these, the administration shouldbe employees friendly and ready toextend their help in case of any untowardincidents.
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Disaster emergency contact number 1077 - Control room of District Collector/Magistrate.

Road Accidents

The road accidents in India is on veryhigh level. Tamil Nadu leads in the number ofroad accidents in the country. Increase in roadtraffic, high speed of vehicles and violation oftraffic rules are the causes of major of accidents.In 2013, 14504 accidents had taken place in thestate which resulted in 15563 deaths. In the tenyears from 2002-2012, Tamil Nadu tops the listin number of road accidents among the statesof India. It is reported that about 15 percent ofaccidents of the country takes place in TamilNadu. The figure of 2017 also puts Tamil Naduon top with recording of 16157 deaths out of147913 deaths recorded in the country. Deathtoll came down rapidly in 2018 to 12213 deaths,a decline of 24.5 percent.

Risk Reduction Measures

Before: Avoid Speeding, Drunk and driving,use helmets and seat belts and follow trafficrules

After: Call police or ambulance; seek medicalattention; make an accurate record andexchange information.

KNOW - RISK...!
NO - RISK...!

Basic Road Safety Rules

- Aware of the road signals
- Stop, look and cross
- Listen and ensure whether a vehicle isapproaching;
- Don't rush on roads;
- Cross roads in pedestrian crossings;
- Don't stretch hands while driving vehicles;
- Never cross road at bends and stay safe ina moving vehicle.

Accelerated changes in demographic andeconomic trends disturb the balance whichleads to increased frequency and the negativeimpact of disaster. At present the society facea challenging mix of demographic, ecologicaland technological condition which makepopulation more vulnerable to the impact ofthe calamities. Though the number of naturaldisasters are in decline than they were in thepast, the increasing level of magnitude posesa threat. Besides the various measures takenby the government and the public, educationon awareness regarding the disasters mayhelp in the reduction of risks during disasters.

For the management of disastersin the state, the following forces andorganizations are in service.

I. State Disaster Management Authority(Chairman-Chief Minister)
II. Relief/ Disaster ManagementDepartment
III. Police
IV. Forest Department
V. Fire and Civil Defence Services
VI. Health Services
VII. Transport Department
VIII. Public Works Department
IX. Veterinary Services
X. Food & Civil Supplied Department.
XI.

The Organizations at District Level

(i) District Magistrate (Chairman-District Collector)
(ii) Revenue Department
(iii) Civil Administration,
(iv) Local Police,
(v) Civil Defence,
(vi) Fire & Emergency Services,
(vii) Home Guards (also LocalCommunity, Non-GovernmentalOrganisations, VoluntaryAgencies) etc.