

# APPOLO STUDY CENTRE



## FEB WEEKLY TEST - 4

11 <sup>th</sup> - Geography	Unit -2	The Solar System and the Earth
	Unit - 8	Natural Disasters Public Awareness for Disaster Risk Reduction
12 <sup>th</sup> - Geography	Unit - 8	Man- Made Disasters
11 <sup>th</sup> - Economics	Unit -11	Tamil Nadu Economy
12 <sup>th</sup> - Economics	Unit - 8	International Economic Organisations

### 11<sup>th</sup> - Geography Unit II The Solar System and the Earth

#### Introduction

Have you ever relaxed lying on the terrace of a building or in the front yard at a cloudless night? If yes, could you watch the night sky filled with glittering stars which appear to be growing in numbers? These glittering stars, which we see, are a part of the universe. Let us now discuss in detail about the Universe, stars, planets and other objects. The universe is a vast endless space which includes galaxies, stars, planets and other forms of matter and energy in it.

#### Theories of the Earth's origin

There are many theories supporting the origin of the earth. One of the earlier and popular arguments of the earth's origin was by a German professor Immanuel Kant. Mathematician Laplace revised it in 1796. It was known as Nebular Hypothesis. It considered that planets were formed out of a cloud of material associated with a youthful sun, which was slowly rotating. Lyttleton propounded the accretion theory of the earth's formation. According to this theory, approximately 4.6 billion years ago, the solar system was a cloud of dust and gas known as a solar nebula. As the solar nebula began to spin, the gravity collapsed the materials on itself and it formed the sun in the centre of the solar system. When the sun

formed, the remaining materials began to clump up. Small particles drew together, bound by the force of gravity, into larger particles. The solar wind swept away lighter elements, such as hydrogen and helium, from the closer regions. It left only heavy rocky materials to create planets like the Earth. But farther away, the solar winds had less impact on lighter elements, allowing them to coalesce into gas giants. In this way, planets, moons, asteroids, comets, etc., were created.

Voyager 2 travelling at the speed of more than 62,764.416 km/h will still take more than 296,000 years to pass Sirius, the brightest star in our night sky.

Earth's rocky core formed first when heavy elements collided and bound together. Dense materials sank to the center, while the lighter material created the crust. The planet's magnetic field probably formed around this time. Gravity captured some of the gases that made up the planet's early atmosphere.

### **Modern theories of the origin of the Universe**

The most popular argument regarding the origin of the universe is the Big Bang Theory. It is also called expanding universe hypothesis. In 1927, Abbe Georges Lemaitre, a Belgian astronomer was the first to propose, a theory on the origin of the universe. It was Edwin Hubble who provided the evidence that the universe is expanding. It was called, 'the Big Bang Theory'. According to it, the universe was formed during a period of inflation that began about 13.75 billion years ago.

Like a rapidly expanding balloon, it swelled from a size smaller than an electron to nearly its current size within a fraction of a second. Matter from the universe was thrown out with great force in all directions and started expanding outwards. From this matter, many groups of stars were formed which we call 'galaxies'. A galaxy is a system of billions of stars, stellar remnants, interstellar gas, dust, and dark matter. The word galaxy is derived from the Greek word Galaxias, literally "milky", a reference to the Milky Way (Figure 2.1). The Milky Way is the galaxy that contains our Solar System.

Galaxies are in three major forms:

1. **Spiral Galaxies:** It consists of a flat and rotating disk of stars, gases and dust. It has a central concentration of stars known as the 'bulge'. The Milky Way and the Andromeda are spiral galaxies.
2. **Elliptical Galaxies:** It contains older stars with fewer gases. Messier89 galaxy is an elliptical galaxy.
3. **Irregular Galaxies:** They are youthful galaxies with more dust and gases. This can make them very bright. Large Magellanic Cloud is an example of irregular galaxy.

Initially, the universe was saturated only by energy. Some of this energy set into particles, which assembled into light atoms like hydrogen and helium. These atoms grouped first into galaxies, then stars and all the other elements. This is generally agreed-upon concept of our universe's origin as estimated by scientists.

In fact, the stars, planets and galaxies that can be detected make up only 4 percent of the universe, according to astronomers. The other 96 percent of the substances in the universe cannot be seen or easily understandable.

The new measurement technique called gravitational lensing confirmed the age of the universe and the strength of dark energy. Dark energy is responsible for the accelerating expansion of the universe. Scientists used gravitational lensing to measure the distances light travelled from a bright, active galaxy to the earth and some details of its expansion.

Three scientists, Saul Perlmutter, Brian Schmidt and Adam Riess won the Nobel Prize in Physics (2011) for their discovery that the universe is just expanding and picking up speed.

### Star and Constellations

A star is type of astronomical object which has its own light and heat. The nearest star to earth is the Sun. Sirius is brighter star than the sun. 'Proxima Centaur?' is the closest star to the sun. Star is formed when enough dust and gas clump together because of the gravitational forces. Star changes its forms during its lifetime such as-red giant, white dwarf, neutron star and black hole.

**Constellation** (Figure 2.2) is a group of stars that forms a particular shape in the sky. In 1929, the International Astronomical Union (IAU) adopted official constellation boundaries that defined 88 official constellations that exist today. Earlier Ptolemy, in his book Almagest, listed 48 constellations.

Ursa Major (Figure 2.3) is a constellation that can be seen in the northern hemisphere and part of the southern hemisphere. Ursa Major means Great Bear in Latin.

### The Solar system

A solar system consists of a star (Figure 2.4) at the centre and the eight planets, moons, asteroids, comets and meteoroids that revolve it. The eight planets, namely the Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune, revolve around the sun in fixed elliptical paths known as 'orbits'. Most stars host their own planets. So there are billions of other solar systems in the Milky Way galaxy alone.

Solar systems can also have more than one star. These are called binary star systems if there are two stars or multi-star systems if there are three or more stars. Our solar system is located in an outer spiral arm of the vast Milky Way galaxy. Our solar system orbits the centre of the Milky Way Galaxy at about 828,000 km/h. Our solar system takes about 230 million years to complete one orbit around the galactic centre.

The solar system is believed to have been formed about 4.6 billion years ago. The solar system also includes the Kuiper Belt that lies past Neptune's orbit. This is a sparsely occupied ring of icy bodies. This is almost all smaller than the dwarf planet Pluto. Beyond the fringes of

the Kuiper belt (Figure 2.5) is the Oort cloud. This giant spherical shell surrounds our solar system. It has never been directly observed, by gravitational attraction, producing immense pressure and temperature at its core. There are three main layers in the Sun's interior: the core, the radioactive zone, and the convective zone (Figure 2.6). The core is at the centre. It is the hottest region, where the nuclear fusion reaction to give the sun power. Moving outward next come the radioactive (or radiation) zone. Its name is derived from the way energy is carried outward through this layer, carried by photons as thermal radiation. The third and final region of the solar interior is named the convective (or convection) zone. It is also named after the dominant mode of energy flow in this layer. The boundary between the Sun's interior and the solar atmosphere is called the photosphere. It is what we see as the visible 'surface' of the Sun.

Did you know that the Sun has an atmosphere? The lower region of the solar atmosphere is called the chromosphere. Its name is derived from the Greek word chroma (meaning colour), for it appears bright red when viewed during a solar eclipse. A thin transition region, where temperature rises sharply, separates the chromospheres from the vast corona above. The uppermost portion of the Sun's atmosphere is called the corona, and is surprisingly much hotter than the Sun's surface (photosphere) The upper corona gradually turns into the solar wind. Solar wind is a flow of plasma that moves outward through our solar system into interstellar space.

Therefore, the Sun has six regions: the core, the radioactive zone, and the convective zone in the interior; the photosphere; the chromospheres; and the corona. The temperature of the sun's surface is about 5,500 to 6,000 degrees Celsius.

At the core, the temperature is about 15 million degrees Celsius, which is sufficient to sustain thermonuclear fusion. This is a process in which atoms combine to form larger atoms and in this process, released, staggering amounts of energy. Specifically, in the Sun's core, hydrogen atoms fuse to make helium.

### **Size and Distance**

The sun has a radius of 695,508 kilometres. It is far more massive than earth and 3,32,946 Earths equal to the mass of the Sun. The Sun's volume would need 1.3 million Earths to fill it.

Venus is hotter than Mercury because Venus has an atmosphere which is thicker and made almost entirely of carbon dioxide

### **Orbit and Rotation**

The Milky Way has four main spiral arms: the Norma and Cygnus arm, Sagittarius, Scutum-Crux, and Perseus. The Sun is located in a minor arm, the Sagittarius arm. From there, the Sun orbits the centre of the Milky Way Galaxy, bringing the planets, asteroids, comets and other objects along with it. Our solar system is moving with an average velocity of 828,000 kilometres per hour. It takes about 230 million years to make one complete orbit around the Milky Way. The Sun's spin has an axial tilt of 7.25 degrees with respect to the plane of the

planets' orbits. Since the Sun is not a solid body, different parts of the Sun rotate at different rates. At the equator, the Sun spins around once about every 25 days, but at its poles the Sun rotates once on its axis every 36 Earth days. Most of the materials are pulled toward the centre to form our Sun. The Sun alone accounts for 99.8% of the mass of the entire solar system.

Like all stars, the Sun will someday run out of energy. When the Sun starts to die, it will swell so big that it will engulf Mercury and Venus and maybe even Earth. Scientists predict that the Sun is a little less than halfway through its lifetime and will last another 6.5 billion years before it shrinks down to be a white dwarf.

## The Planets

The word planet in Greek means 'wanderer'. Planet is the celestial body which does not have light or heat of its own. A planet should possess the following qualities:

- a. It should orbit around the sun.
- b. It should not be a satellite of any planet
- c. Due to its own mass and self-gravity, it should get a spherical shape and
- d. Any other celestial body should not cross in its orbit.

The planets are classified in order of their distance from the sun and based on their characteristics. They are:

1. The inner planets or terrestrial planets or rocky planets. Mercury, Venus, Earth and Mars are called inner or terrestrial planets.
2. The outer planets or gaseous planets or giant planets. Jupiter, Saturn, Uranus and Neptune are called outer or gaseous planets.
3. Each planet spins on its own axis. This movement is called rotation. One rotation makes one 'planet day'. The planets moving around the sun is called revolution or a 'planet-year'.

## Planets in the Solar System

Name of the Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Diameter (KM)	4,879	12,104	12,756	6,794	1,42,984	1,20,536	51,118	49,528
Density (kg/m <sup>3</sup> )	5,427	5,427	5,514	3,933	1,326	687	1,271	1,638
Rotation Period (hours)	1,407.6	- 5,832.5	23.9	24.6	9.9	10.7	17.2	16.1
Length of Day (hours)	4,222.6	2,802	24	24.7	9.9	10.7	17.2	16.1
The	57.9	108.2	149.6	227.9	778.6	1,433.5	2,872.5	4,495.1

Average distance from the sun( $10^6$ km)								
Orbital Period (days)	88	224.7	365.3	687	4331	10,747	30,589	59,800
Number of Satellites	0	0	1	2	67	53	27	13

### The Mercury

Mercury is the nearest planet to the sun and it is the smallest planet in the solar system. It does not have any satellite. It rotates on its own axis in 58.65 earth days while it takes 88 Earth days to complete one revolution around the sun. Mercury is 0.4 astronomical units away from the Sun. The sunlight takes 3.2 minutes to travel from the Sun to Mercury. Mercury is the second hottest planet though it is nearest to the sun.

### The Venus

'Venus' is the second nearest planet to the sun. It is also called as 'Earth's Sister' planet due to its similar size and mass as that of our Earth. It is the hottest planet in the solar system and experiences a mean surface temperature of  $462^{\circ}\text{C}$ . It is popularly known as "Morning star and Evening star" It is seen in the east sky before sunrise (dawn) in the morning and in the west sky after the sunset (twilight). It rotates clockwise i.e. east to west direction on its own axis. The rotation and orbit of the Venus are unusual in several ways. Venus is one of just two planets that rotate from east to west. Only Venus and Uranus have this 'backwards' rotation. It completes one rotation in 243 Earth days which is the longest day of any planet in our solar system. The Venus takes 224.7 Earth days to complete one revolution around the sun, and it has no natural satellites. Venus is 0.7 astronomical units away from the sun. The sunlight takes 6 minutes to travel from the sun to Venus.

### The Earth

Earth is the third nearest planet to the sun. It is the fifth largest planet in the solar system. The Earth's orbit lies between the orbits of Venus and Mars. It takes 23 hours 56 minutes and 4 seconds for the earth to complete one rotation on its own axis. The Earth takes 365.25 days (Table 2.1) to complete one revolution around the Sun. Earth's surface temperature varies from  $-88^{\circ}$  to  $58^{\circ}\text{C}$  and it is the densest planet in the solar system.

The Earth is a unique planet because of its distance from the sun, its motions, atmosphere with oxygen, presence of water and moderate temperature. The earth is neither too close nor too far from the sun. It is the only known planet to support life. It is also known

as the 'Blue Planet' because of the presence of water. Earth has only one natural satellite called the Moon. The sun light takes about 8.3 minutes to reach the earth.

### **The Mars**

Mars is the fourth nearest planet to the sun and it is the second smallest planet in the Solar system. It is also described as the "Red planet". It is reddish in colour due to the presence of iron oxide on its surface. The landmass of Mars and Earth are very similar. It takes 24 hours and 37 minutes to complete one rotation on its axis and it takes 687 days to complete one revolution around the Sun. The surface temperature of the Mars is ranging from  $-153^{\circ}$  to  $20^{\circ}\text{C}$ . With the exception of the Earth, Mars probably is the most hospitable to life. This planet has seasons, polar ice caps, volcanoes, canyons and weather. Mars has two satellites namely Phobos and Deimos.

### **The Jupiter**

Jupiter is the largest planet in the solar system. It is made primarily of gases and is therefore known as 'Giant Gas planet'. It takes 9 hours 55 minutes to complete one rotation on its axis and it takes 11.86 years to complete one revolution. Jupiter has the shortest day in the solar system. Jupiter has a faint ring system around it. They are mostly comprised of dust particles. Jupiter has 67 confirmed satellites orbiting the planet. Ganymede, the satellite of Jupiter, is the largest natural satellite in the solar system (even bigger than the planet Mercury).

### **The Saturn**

Saturn is the sixth planet from the sun and the second largest planet in the solar system. Saturn is called as the Ringed Planet. It is because of large, beautiful and extensive ring systems that encircle the planet. These rings are mostly made from the chunks of ice and carbonaceous dust. Saturn is the only planet in our solar system whose average density is less than water.

The Saturn has 30 rings and 53 confirmed natural satellites. The Saturn takes 10 hours 34 minutes to complete one rotation on its axis and it takes 29.4 years to complete one revolution around the sun.

### **The Uranus**

Uranus is the seventh planet from the sun and it is not visible to the naked eye. Like Venus, Uranus also rotates on its axis from east to west. Uranus is inclined on its axis at an angle of 98 degrees. The planet is almost lying on its side as it goes around the sun. The sunlight, thus, is received mostly in the polar areas. Hydrogen, helium and methane are the major gases of its atmosphere. It is very cold due to its great distance from the sun. Uranus is named after the ancient Greek god of the sky. It has a dense atmosphere primarily consisting of methane, which lends it a bluish-green appearance. Uranus also has rings and twenty-seven satellites.





## The Neptune

Neptune is the eighth planet from the sun. It takes 16 hours to complete one rotation on its own axis and it takes nearly 165 years to revolve around the sun. It has 13 natural satellites and 5 rings. It is the coldest planet in the Solar System because it is the farthest planet from the Sun. Neptune was the first planet located through mathematical calculations. Neptune is our solar system's windiest planet.

## Dwarf Planets

Dwarf planets are tiny planets in our solar system. Any celestial body orbiting around the sun, weighing for the self-gravity and nearly be round in shape is called 'Dwarf Planet'. It should not be a satellite of any planet. They are five in number Ceres, Pluto, Heumea, Makemake and Eris. As Pluto has not cleared the neighbourhood around its orbit, it is officially demoted in 2006 from its ninth position as a planet.

North Pole of the Uranus experiences 21 years of night time in winter, 21 years of daytime in summer and 42 years of day and night in the spring and fall.

## Satellites

The word 'Satellite' means companion. The moon was the only known satellite in the Solar System until 1610. Today, there are 163 known satellites in the Solar System. The satellites move around a planet from West to East. They do not have own light, but reflect the light of the Sun. They have no atmosphere and water.

## Moon: the Earth's Satellite

The moon is located at a distance of 8, 84,401 km from the earth (Figure 2.7). The moon revolves around the earth. The moon takes 27 days and 7 hours and 43 minutes for both its rotation and revolution around the earth.

Hence, the observers on the earth could see only one side of the moon. The moon is the fifth largest natural satellite in the solar system. The moon was likely to be formed after a Mars-sized body collided with Earth. There are many craters, high and steep mountains of different sizes which cast shadows on the Moon's surface. The light which is reflected by the Moon will reach the Earth in just one and a quarter seconds.

Apollo 11 was the first manned mission to land on the Moon sent by NASA. Two American Astronauts Neil Armstrong and Edwin Aldrin set foot on the moon's surface on the waterless Sea of Tranquillity on 20th July, 1969. They stayed there for 21 hours 38 minutes and 21 seconds on the moon. Michael Collins piloted Apollo 11.

Since the moon is smaller than the earth, it has  $1/6$  of the gravitational pull of the earth. So, man weighs 6 times less on the moon than the earth.

## Asteroids

Asteroids are small rocky celestial bodies that revolve around the Sun, like other planets. They are also called 'Minor Planets'. There are lots of asteroids in the solar system. Larger asteroids are called Planetoids. These are found in between the planets Mars and Jupiter. This belt is known as 'Asteroid belt'. The diameter of the asteroids varies from 100 km to a size of a pebble. The asteroids may be the fragments of a planet exploded in the past or some parts of comets. The new asteroids are being discovered continuously.

## Comets

Comets are the most exciting heavenly bodies and have ever been the objects of man's curiosity as well as fear. The word Comet (Figure 2.8) is derived from the Greek word Aster Kometes meaning 'Long Haired Star'. They are made up of small ice particles and meteoric fragments. They revolve around the Sun. But their orbits are irregular. Sometimes they get very close (Perihelion) to the sun and in other times they go far away (Aphelion) from the sun.

The best known Comet, Halley's Comet, appears once in every 76 years. The Halley's Comet was seen last in 1986 and it will be seen again on 28th July 2061.

### Titan - only moon with clouds and atmosphere

Titan is Saturn's largest moon and the second largest (after Ganymede of Jupiter) in the solar system. It is the only moon in the solar system with clouds and a dense, planet-like atmosphere.

Scientists believe that conditions on Titan are similar to Earth's early years (the main difference is that, because it is closer to the sun, Earth has always been warmer). According to NASA, "In many respects, Titan, is one of the most Earth-like worlds we have found to date".

Titan was discovered by Dutch astronomer Christiaan Huygens in 1655. The Huygens lander probe sent to the moon aboard NASA's Cassini spacecraft by the European Space Agency is named in his honour. Huygens was the first human-built object to land on Titan's surface. Diameter: 5,150 kilometres, about half the size of Earth and almost as large as Mars. Surface temperature: -179 degrees Celsius, which makes water as hard as rocks and allows methane to be found in its liquid form. Surface pressure. Earth's pressure at sea level is 1 bar while Titan's is 1.6 bars. Orbital period: 15;945 days. Titan's mass is composed mainly of water in the form of ice and rocky material. Titan has no magnetic field.

## Meteors

There is a bright streak of light flashing seen often in the sky during night for a few seconds. They are called as 'shooting stars'. They are the removed pieces of rocks mainly from the Asteroid belt. They are called Meteoroids before they enter into our atmosphere. They enter

into the atmosphere with great speed. But most of them are burnt when they enter into the atmosphere.

After entering into our atmosphere they are called as Meteors. Some pieces do not burn fully and they fall on the earth and make craters. The large unburned pieces of rocks that fall on the earth are called Meteorites.

Examples for Meteorite Fall: Meteor crater in Northern Arizona and Lake Lonar in Buldhana District of Maharashtra in India were created by meteor impacts.

### Shape and size of the Earth

It once was believed that the Earth was flat and that ships could sail over the edge. This view persisted even in the middle ages and was an issue in recruitment of Columbus.

Early Greek view was that the world was surrounded by the ocean (Oceanus), origin of all rivers. Anaximander (600 B.C) proposed that cylindrical earth was surrounded by celestial sphere. Pythagoras (582-507 B.C.) believed that the Earth was a sphere, which was considered the most harmonious geometric shape. Aristotle (384-322 B.C.) described observations that supported the theory that the Earth was a sphere. These included the fact that the shadow of the moon is circular in lunar eclipses and constellations were higher in the sky as one travelled south. Eratosthenes

(275-195 BCE) estimated size of earth from observations that the elevation of the sun varied with position on the Earth's surface in Egypt. Observations of the following suggested that the Earth is a sphere.

1. Mountain peaks lit by the Sun after sunset.
2. Ships disappear below the horizon as they sail across ocean.
3. The moon looks like a disc.
4. The Earth casts a circular shadow during lunar eclipses.

The Earth is an oblate spheroid, bulged at the equator and fattened at the poles. It is called 'Geoid' (Figure 2.9) meaning the earth is earth-shaped. The bulge at the equator is caused by the centrifugal force of the Earth's rotation. The gravitational pull of the earth is the strongest at the fattened poles and it is weaker towards the equator.

The Sun's gravitational pull differs in force at the poles. The North Pole points in the same direction to the North Star when it revolves about the Sun. If the Earth would not have been tilted on its axis, the days and nights would have been of same duration always.

### Motions of the earth

The earth has two basic movements: 1) Rotation and 2) Revolution.

**Galactic movement:**

This is the movement of the earth with the sun and the rest of the solar system in an orbit around the centre of the MilkyWay Galaxy. This, however, has little effect upon the changing environment of the earth.

### 1. Rotation:

The spinning of the earth around its axis is called the rotation of the earth. The axis is the imaginary line passing through the centre of the earth. The earth completes one rotation in 23 hours, 56 minutes and 4.09 seconds. It rotates in an eastward direction opposite to the apparent movement of the sun. The earth's axis is inclined at an angle of  $66\frac{1}{2}^\circ$  to the orbital plane as it moves around the sun. We can say, the earth's axis is tilted at an angle of  $23\frac{1}{2}^\circ$  (Figure 2.10) from a perpendicular to the elliptic plane. The velocity of earth's rotation varies depending on the distance of a given place from the equator. The rotational velocity at the poles is nearly zero. The greatest velocity of the rotation is found at the equator. The velocity of rotation at the equator is 1,670 km per hour.

Effects of earth's rotation: The rotation of the earth causes the following effects:

1. The apparent rising and setting of the sun is actually caused by the earth's rotation which results in the alternate occurrence of day and night everywhere on the earth's surface.
2. Rotation of the earth is also responsible for the difference in time between different places on the earth. A 24 hour period divided by 360 degrees gives a difference of 4 minutes for every degree of longitude that passes the sun. The hour (60 minutes) is thus  $\frac{1}{24}$  of a day.
3. When you observe through a moving train, trees, houses and fields on the other side of the track appear to move in the direction opposite to that of the speeding train. The apparent movement of the sun and the other heavenly bodies in relation to the rotating earth is similar. As the earth rotates from west to east, the sun, moon, planets and stars appear to rise in the east and set in the west.
4. Rotation causes the working of the Coriolis force which results in the deflection of the winds and the ocean currents from their normal path.
5. Tide is caused by the rotation of the earth apart from the gravitational pull of the sun and the moon.

Rotation causes a flattening of Earth at the two poles and bulging at the Equator. Hence, there is a difference in diameter at the poles and equator.

Circle of Illumination: The line around the earth separating the light and dark is known as the circle of illumination (Figure 2.11).

It passes through the poles and allows the entire earth to have an equal amount of time during the daylight and night time hours. This line can be seen from space, and the exact location of the line is dependent on the various seasons.

## Revolution of the Earth

The movement of the earth in its orbit around the sun in an anti-clockwise direction, that is, from west to east is called revolution of the earth. The earth revolves in an orbit at an average distance of 150 million km. The distance of the earth from sun varies time to time due to the elliptical shape of the orbit. About January 3rd the earth is closest to the sun and it is said to be at Perihelion ('peri' means close to and Helios means sun). At Perihelion, the distance is 147 million km.

Around July 4th the earth is farthest from the sun and it is said to be at Aphelion (Aph means away and Helios means sun). At Aphelion the distance of the earth is 152 million km away from the sun.

The period taken by the earth to complete one revolution around the sun is 365 days and 6 hours (5 hours, 48 minutes and 45 seconds) or  $365\frac{1}{4}$  days. The speed of the revolution is 1,07,000 km per hour. The speed is 30 km per second. The bullet from a gun travels with a speed of 9 km per second.

## Period of Revolution and Leap year

The period of time the earth takes to make one revolution around the sun determines the length of one year. The earth takes 365 days and 6 hours to complete one revolution. Earth takes 365.25 days to complete one trip around the Sun. That extra quarter of a day presents a challenge to our calendar system, which has one year as 365 days. To keep our yearly calendars consistent with our orbit around the Sun once in, every four years we add one day.

The extra day added to is called a leap day, and the year the extra day is added to is called a leap year. The extra day is added to the month of February which has 29 days in a leap year.

## Effects of revolution of the earth

The revolution of the earth around the sun results in the following

- Cycle of seasons,
- Variation in length of days and nights,
- Variation in distribution of solar energy over the earth and the temperature zones.

## Seasons

The seasons are caused due to the combined effect of the earth's revolution and the tilt of its axis in the same direction throughout the year. In general, spring, summer, autumn and winter are the four seasons (Figure 2.12). The latitude at which the sun appears directly overhead changes as the earth orbits the sun. The sun appears to follow a yearly pattern of northward and southward motion in the sky, known as the 'apparent movement of the sun'. It gives an impression that the sun is continuously swinging north and south of the equator. Actually it is the earth that is moving around the sun on its tilted axis. It varies when observed

on a daily and monthly basis, at different times of the year. On 21 March and 23 September the sun rises precisely in the east and sets exactly in the west.

### Equinoxes and solstices

You already knew that the sunrays are vertical at noon. The vertical rays fall on a small area, giving more heat.

### Equinoxes

Equinoxes occur when the earth reaches the points in its orbits where the equatorial and the orbital planes intersect, causing the sun to appear directly overhead at the equator. During the equinoxes the periods of day light and darkness are equal all over the world. On 21 March the sun is directly overhead at the equator. Throughout the world, on this day all the places experience almost equal hours of day and night. This position of the sun is called spring equinox. Again on 23 September the sun is directly overhead on the equator and it is called autumn equinox.

### Position of the earth on 21 March

Neither pole is inclined towards the sun. The rays of the sun fall vertically on the equator. All the places have equal days and nights as both the poles receive the rays of the sun. It is spring in the northern hemisphere and autumn in the southern hemisphere. This day (21 March) is known as spring equinox.

### Position of the earth on 23 September.

Neither pole of the earth is inclined towards the sun. The rays of the sun fall vertically on the equator. All the places have equal days and nights. It is autumn in the northern hemisphere and spring in the southern hemisphere. This day (23 September) when sun's rays fall vertically on the equator, is known as autumnal equinox (Figure 2.13).

### Position of the earth on 21 June

The North Pole is inclined or tilted towards the sun. It, therefore, experiences complete light for 24 hours. The South Pole is tilted away from the sun so it is in complete darkness for 24 hours. The rays of the sun fall vertically at the tropic of cancer ( $23\frac{1}{2}^{\circ}$  N). In the Northern hemisphere, the days are longer than the nights (Table 2.2). It is summer in the northern hemisphere and winter in the southern hemisphere. The day 21 June is known as summer solstice.

### Position of the earth on 22 December

Latitude	Summer Solstice	Winter Solstice	Equinoxes
0°	12hrs	12hrs	12hrs
10°	12hrs 35 min	11hrs 25 min	12hrs
20°	13hrs 12 min	10hrs 48 min	12hrs
30°	13hrs 56min	10hrs 4 min	12hrs

40°	14hrs52min	9hrs 8 min	12hrs
50°	16hrs18min	7hrs 8 min	12hrs
60°	18hrs27min	5hrs 42 min	12hrs
70°	24hrs (for 2 months)	0hrs00 min	12hrs
80°	24hrs (for 4 months)	0hrs00 min	12hrs
90°	24hrs (for 6 months)	0hrs00 min	12hrs

The South Pole is inclined towards the sun and the North Pole is away from it. The rays of the sun fall vertically at the tropic of Capricorn ( $23\frac{1}{2}^{\circ}$  S). The greater part of the southern hemisphere gets the direct rays of the sun so the days are long and the nights are short here. In the northern hemisphere the nights are longer than the days at this time. The southern hemisphere has summer. The northern hemisphere has winter. This day (22 December), when the sun's rays fall vertically on the Tropic of Capricorn, is known as winter solstice.

## Eclipses

Let us understand the effect of the revolution of the earth on the length of the days and the nights. The duration of the daylight varies with latitude and seasons.

An eclipse is a complete or partial obscuration of light from a celestial body and it passes through the shadow of another celestial body. The eclipses are of two types. They are:

### a) Solar Eclipse

It occurs on New Moon days, when the moon is between the Sun and the Earth. Thus it obscures a part of the Sun viewed from the Earth, but only from a small area of the world. It lasts only for a few minutes. A partial solar eclipse (Figure 2.14) happens when the moon partially covers the disc of the sun. An annular solar eclipse occurs when the moon passes centrally across the solar disc. During a total solar eclipse, the moon's shadow is short enough to cover the whole sun. The outer regions still glow and look bright as a ring. Such a phenomenon is called Diamond Ring

## Geo connects History

### Secret to Great Pyramid's Near Perfect Alignment Possibly Found!

The Great Pyramid of Giza, 4,500 years ago, is an ancient feat of engineering. Now an archaeologist has figured out how the Egyptians may have aligned the pyramid almost perfectly along the cardinal points, north-south-east-west. Egyptians may have used the autumn equinox. Methods used by the ancient Egyptians to align the pyramids along the cardinal points are accurate.

On the day of the fall equinox, a surveyor placed a rod into the ground and tracked its shadow throughout the day. The result was a line running almost perfectly east-

west. The Egyptians could have determined the day of the fall equinox by counting forward 91 days after the summer solstice.

Rotation	Revolution
Spinning of the earth from west to east on its axis	Movement of the earth around the sun in its elliptical orbit.
It takes 24 hours to complete a rotation (or a day)	It takes 365 $\frac{1}{4}$ days to complete on revolution (Or a year)
It is known as the daily or diurnal movement.	It is known as the annual movement of the earth.
Rotation causes days and nights to alternate, tides, deflection of winds and ocean currents and also gives the earth its shape.	Revolution results in the varying lengths of day and night,, changes in the altitude of the midday sun and change of seasons.

### b) Lunar Eclipse

It occurs on a Full Moon position when the earth is between the sun and the moon. The earth's shadow obscures the moon as viewed from the earth. A partial lunar eclipse can be observed when only a part of the moon's surface is obscured by earth's umbra (Figure 2.15). A penumbral lunar eclipse happens when the moon travels through the faint penumbral portion of the earth's shadow. A total lunar eclipse occurs when the earth umbra obscures the entire the moon's surface. Lunar eclipse can be seen from anywhere on the night side of the Earth. It lasts for a few hours due to the smaller size of the moon.

The changing angles between the earth, the sun and the moon determine the phases of the moon. Phases of the moon (Figure 2.16) start from the 'New Moon' every month. Then, only a part of the Moon is seen bright called 'Crescent', which develops into the 'first quarter'. With the increasing brightness it turns into three quarters known as 'Gibbous' and then it becomes a 'Full Moon'. These stages are the waxing moon. After the full moon, the moon starts waning or receding through the stages of Gibbous, last quarter, crescent, and finally becomes invisible as dark New Moon.

### The varying lengths of daylight in different latitudes

It is evident from the table that the duration of daylight is 12 hours throughout the year at the equator only. As one moves away from the equator, the seasonal variations in the duration of daylight increase. The seasonal variations in the duration of daylight are maximum at the polar region.

### Effects of the spherical shape of the earth

Variation in the amount of solar radiation received:



If the earth were a flat surface, oriented at right angle to the sun, all the places on the earth would have received the same amount of radiation. But the earth is spherical/ geoid. Hence the sunrays do not heat the higher latitudes of the earth as much as the tropics. On any given day only the places located at particular latitude receive vertical rays from the sun. As we move north or south of this location, the sun's rays strike at decreasing angles. The yearly fluctuations in the angle of the sun's rays and the length of the days change with the continual change of the earth's position in its orbit around the sun at an inclination of  $66\frac{1}{2}$  to the orbital plane.

### **Difference in the angle of the sun's rays striking different parts of the earth.**

Away from the equator, the sun's rays strike the earth's surface at particular angle. The slanting rays are spread over a large area and do not heat with the same intensity as the direct rays. As we go pole wards, the rays spread over the regions beyond the Arctic and the Antarctic circles in an extremely slanting manner. This is how we get the various temperature zones.

Lower the degree of latitude; higher the temperature. Not only that, the rays striking at a low angle must travel through a greater thickness of the atmosphere than the rays striking at a higher angle. The rays striking at a lower angle are subject to greater depletion by reflection and absorption by the atmosphere.

### **Temperature zones**

The spherical shape of the earth along with its movement around the sun causes differences in the angles at which the sun's rays fall on the earth's surface. This causes a difference in the distribution of heat on the earth's surface.

As a result, the world has been divided into three distinct heat zones or temperature zones. They are the Torrid zone, Temperate zone and Frigid zone. You will learn more about it under the unit atmosphere.

### **Time Zones of the World**

People during the medieval period were using sundials and water clocks to observe the Sun's meridian passing at noon. In 17th century, the people started using pendulum clock which did not show accurate time while travelling in the sea. Later chronometer was invented in 1764. Chronometer measures time accurately and the mariners widely used this during the 19th century. But in many towns and cities clocks were set based on sunset and sunrise. The use of local solar time hindered the development of railways and telecommunications. A time zone is a region on the earth where uniform standard time should be maintained for transport, commercial and social purposes. For example, if different time zones were followed, the trains coming from different regions, sharing single track may meet with accidents.

The world time zone (Figure 2.17) was formed, relating longitude and the rotation of the earth. The Prime Meridian is the centre of time zone extending from  $7\frac{1}{2}^{\circ}\text{W}$  and  $7\frac{1}{2}^{\circ}\text{E}$

longitudes. The 24 hours time zone system had been developed so that all the time zones should be referred with respect to Greenwich Mean Time. Earth was divided into 24 time zones, each one zone for one hour of the day. It is because earth rotates  $15^\circ$  of longitude in one hour ( $360^\circ$  divided by 24 hours). The time when solar noon occurs at the Prime Meridian is fixed as noon for all places between  $7\frac{1}{2}^\circ$  E and  $7\frac{1}{2}^\circ$  W.

### Daylight Saving Time

In the mid latitude countries of Europe, North America, Australia and South America, the day time are longer in summer than the night. In spite of employing daylight duration, the clocks are adjusted 1 hour forward in spring and 1 hour backward in autumn. This time is generally known as 'the Daylight Saving Time' (DST).

### Time Zones

On its axis, the earth rotates 360 degrees every 24 hours. You can look at it as it takes one day to complete a full circle. Divided up into an hourly rate, the earth rotates 15 degrees every hour ( $360/24$ ). This number plays an important role in determining time zones. You have already learned about the latitudes and longitudes and their importance in the lower classes.

An important factor in determining time zones is the lines of latitude and longitude, imaginary lines known as latitudes and longitudes dividing the earth. Latitude lines are drawn east - west and they measure the location in northern and southern hemisphere. The line starts at the equator and measure distance from 0 degrees to 90 degrees north and also 0 degrees to 90 degrees south. They also become shorter farther away from the equator. On the other hand, longitude lines are drawn north - south and they measure eastern and western hemisphere. They start at the Prime Meridian (or 0 degree) and measure from 0 degrees to 180 degrees east and 180 degrees west. Unlike lines of latitude, these lines are fairly equal in length. The origin of this spherical coordinate system is at 0 degree latitude and 0 degree longitude. This spot can be found in the Atlantic Ocean just south west of Africa. Also, the two lines connect at 180 degrees or at the International Date Line (Figure 2.18). This too helps to determining different time zones of the world.

Together all of the above information can be used to calculate the difference of time between two locations.

1. First, we need to know what longitudes the two places are located.
2. Next, you would need to find the differences in longitude (in degrees) between the two places. If both places are located on the same side of the Prime Meridian, then the numbers are just simply subtracted to find the difference. If they are on the opposite side of the Prime Meridian then the two numbers should be added together to find the difference.
3. Third, we need to divide the difference (measured in degrees) by 15 since there are 15 degrees in every hour. This will give us the difference in time between the two

locations. So if you know what time it is in one location, and the longitude of another location, then just simple addition or subtraction problem will give us the time in a different time zone. Let's look at another way we may have to calculate the difference between times of two locations.

Another calculation you may have to make is over the International Date Line. This line is strategically placed in the Pacific Ocean so that no two neighbouring cities are one day apart in time. It can be difficult to calculate though the International Date Line when trying to determine the amount of time difference between locations on either side. This calculation is very similar to the situation with the Prime Meridian. We must start by finding the difference in longitude (or degrees) of the two places. We do this by adding the two numbers. Then, divide by the 15 degrees that occurs in one hour and this will give you the time difference between two locations through the International Date Line. And again, just add or subtract that difference from the time that we already know to come up with the new time in the new time zone.

### Example of Time Calculations

To review, to find the difference between the two longitudes and divide by 15, this gives you the difference in hours between the two locations. Second, add or subtract the number of hours from the time of day that was already known, we will need to add the numbers if we are going east, and subtract if we are going west. Here are some examples of how we may need to calculate the difference of time zones.

If you are in London at 12:00, and want to know what time it is in Japan, you would need to first figure out that London is 0 degrees (right on the prime meridian), and Japan is 135 degrees East. So the difference is 135 degrees (135-0), divided by 15 which equals 9. It means there is a 9-hour difference between London and Japan. Since Japan is further east than London is, you would add 9 hours to 12:00. The answer is at 12:00 noon London time, it is 9:00pm in Japan.

Now we suppose imagine that we are going through the International Date Line. Pretend you are in Japan, which is 135 degrees east and you wanted to know what time it is in Hawaii, which is 150 West. Well, there is 45 (180-135) degrees difference between Japan and the IDL. Also there is 30 (180-150) degrees difference between the IDL and Hawaii. Therefore the difference in time is  $(45 + 30/15 = 5)$  5 hours. Now the tricky part is that Japan and Hawaii are on different days. It is one day ahead on the left side of the IDL compared to the right side. If it is 3:00pm in Japan on Thursday that means it is  $3:00 + 5$  hours = 8:00pm in Hawaii. However notice that when crossing the IDL we subtract a day going east. So, in Hawaii it is 8:00pm on Wednesday.

Now note that Latitudinal lines are imaginary horizontal lines over the Earth's globe.  $0^\circ$  longitudinal line is Equator. Earth completes one rotation on its axis in 24 hours and in the process turns a complete circle of  $360^\circ$ . This means Earth rotates  $360^\circ/24 = 15^\circ$  in one hour. Every gain or loss of  $1^\circ$  longitude stands for 4 minutes.

$360^\circ = 24 \text{ hours} = 1440 \text{ min}$

Difference of time for  $15^\circ$  longitude = one hour.

Difference of time for  $1^\circ$  longitude = 4 minutes.

### Longitude Calculations Procedures

- First locate the two places involved
- find the longitude difference
- Convert the longitude difference to time and,
- Adjust the time according to the direction of movement, (west or east).

### Example 1

Ponni starts her journey at longitude  $0^\circ$  at 12 noon and she's moving towards eastward of longitude  $10^\circ$ . Calculate the time that Ponni will arrive at her destination.

### Solution

Initial time = 12 noon

Destination =  $10^\circ\text{E}$

Conversion of degree to time  $1 \text{ hour} = 15^\circ$

and 4 minutes =  $1^\circ$

Hence  $10^\circ = (4 \times 10) \text{ minutes}$

= 40 minutes

Destination time = Initial time + calculated time

= 12 noon + 40 minutes

= 12:40pm

### Example 2

If the time at village A (long  $75^\circ\text{W}$ ) is 5:00 pm on Friday. Calculate the time and day at village B (long  $120^\circ\text{E}$ )

### Solution

$360^\circ = 24 \text{ hrs}$

$15^\circ = 1 \text{ hour}$

$1^\circ = 4 \text{ minutes}$

Village A =  $75^\circ\text{W}$

Village B =  $120^\circ\text{E}$

We will add (west and east)

$(75 + 120)^\circ = 195^\circ$

195 divided by  $15^\circ = 13 \text{ hrs}$

Destination time = initial + calculated time

= 5:00 + 13 hrs

= 18:00

18:00 = 6:00

**Answer = 6:00am on Saturday**

### Example 3

Calculate the local time in New York (USA) longitude 75°W, when it is 10am in Nigeria of longitude 15°E

### Solution

Initial time = 10:00am

New York = 75°W

Nigeria = 15° E We will add (west and east)

$(75 + 15)^\circ = 90^\circ$

$90^\circ$  divided by  $15^\circ = 6$  hrs

Destination time = initial + calculated time

= 10:00am + 6hrs

= 14:00pm

14:00pm = 4:00pm

**Answer = 4:00pm**

### Glossary

1. **Dark energy:** A theoretical form of energy postulated to act in opposition to gravity and to occupy the entire universe, accounting for most of the energy in it and causing its expansion to accelerate.
2. **Magnetic field:** A force field that is created by moving electric charges and magnetic dipoles, and exerts a force on other nearby moving charges and magnetic dipoles.
3. **Penumbra:** The partially shaded outer region of the shadow cast by an opaque object.
4. **Asteroids:** Small rocky celestial bodies that revolve around the Sun, like other planets.
5. **Standard time:** A uniform time for places in approximately the same longitude, established in a country or region by law or custom.
6. **Galactic movement:** This is the movement of the earth with the sun and the rest of the solar system in an orbit around the centre of the MilkyWay Galaxy
7. **Equinox:** Time when the apparent movement of the sun is overhead the equator.
8. **Gibbous:** Third quarter of moon's phase is known as Gibbous.

## 11<sup>th</sup> - Geography Unit 8

### Natural Disasters Public Awareness for Disaster Risk Reduction

#### Introduction

On an average, 232 million people are affected by different types of disasters every year. In recent years disaster risks have been on the rise due to factors such as population growth, unplanned urbanization, environmental degradation, conflicts and competition for scarce resources, climate change, disease epidemics, poverty and pressure from development within high-risk zones. Hence, disaster risk reduction is the need of hour.

Recognizing the importance of Disaster Risk Reduction in 2005, 168 governments and all leading development and humanitarian actors signed the Hyogo Framework for Action (HFA), committing themselves to a ten-year multi-stakeholder and multi-sector plan to invest in disaster risk reduction as a means to building disaster-resilient societies.

Public awareness campaigns can be started modestly and tailored to meet the needs of specific populations and target groups. These approaches can be integrated into almost all existing initiatives, whenever and wherever they take place. They can build on and support existing volunteer mobilisation and peer-to-peer communications. To support this, it requires strong and unified disaster reduction messages and clear and targeted information, education and communication materials.

#### Public awareness for disaster risk reduction

There are four key approaches to public awareness for disaster risk reduction: Campaigns, participatory learning, informal education, and formal school-based interventions. Let's take formal school based interventions to learn in detail.

#### Formal school-based interventions:

The focus of formal school-based interventions cover two areas: school disaster management and disaster risk reduction in school curricula. These are considered to be formal because accountability and responsibility for school safety and curricula belong exclusively to education authorities, so they require support for long-term planning and capacity building.

#### School disaster management:

The primary goals of school disaster management are to ensure the safety of students and staff. Sustained school disaster management requires the familiar participatory and on-going process of identification of hazards and risks, mitigation and reduction of risks, and developing response capacity.

A school disaster management plan, developed at the school level, should be the living document that expresses the awareness of public for disaster risk reduction. Every school has to setup the following school disaster committees:

1. Coordination Committees
2. Awareness generation Team
3. Search Rescue and Evacuation Team
4. Site safety Team
5. First Aid Team
6. Warning and Information Team
7. Bus safety Team
8. Water / Food Arrangement Team.

All the teams should participate in the mock drill.

**Mock drills** form a vital part of the school disaster management process, and provide an intensive learning experience. They should be followed by reflection and assessment by all members of the school community. Lessons learned are incorporated into the school disaster management plan, and goals set for improvement next time. Depending on hazards faced, there are several major types of drills that can be practiced:

## Disasters and Rules of actions during disasters

### Earthquake

An earthquake is sudden, rapid shaking of the ground caused by the shifting of rocks beneath the earth's surface. Earthquakes strike suddenly without warning and can occur at any-time. The impacts of the earthquakes include deaths, injuries and damage of property. You have learned about occurrence of the earthquake and other related information in the earlier part of the book.

#### Nepal - India Earthquake

The April 2015 Nepal Earthquake (also known as the Gorkha Earthquake) killed nearly 9,000 people and injured nearly 22,000. It occurred on 25 April, with a magnitude of 8.1 Richter scale. Its epicentre was east of Gorkha District at Barpak. It was the worst natural disaster to strike Nepal since 1934 Nepal-Bihar earthquake. The earthquake triggered an avalanche on Mount Everest, killing 21 people making April 25, 2015 the deadliest day on Nepal's history. The earthquake triggered another huge avalanche in the Langtang Valley, where 250 people were reported missing.

#### Mock drill: Earthquake

In case we are inside the class when earthquake occurs, instruct loudly "earth quake position - drop, cover, and hold on". Drop down on your knee. Cover your head, neck and face. Go under a table to protect your head.

#### Rules of actions during an earthquake:

1. Stay calm, do not panic.

2. If you are in a building, sit down on the floor under a table or any other furniture and firmly hold on to it until the earthquake has stopped.
3. If there is no table nearby, cover your face and head with your hands and sit on the floor in a corner of the room.
4. Keep away from glass windows, glass doors and things that can fall down.
5. Do not try to leave the building quickly; during earthquakes people mostly die because they try to run out of the building and become trapped under ruins if the building is destroyed.
6. Do not go to the staircase, a balcony or an elevator.
7. If you are in the street, keep away from buildings; try to get into an open space and avoid power transmission lines.
8. If you are at home, turn off electrical equipment and gas quickly.
9. If you are in chemistry class or a laboratory where chemicals are stored, try to leave the room because chemicals may cause injuries;

### **After earthquake:**

1. First check if you have any injuries, and then check the condition of the surrounding people. If you cannot do this, wait for the rescue team;
2. After the earthquake when you leave the shelter, do not return for 2-3 hours because the quakes may repeat (an aftershock).
3. Check if there is fire; in case of a mild one try to extinguish it.
4. Be cautious about the possibility of gas leakage and damage caused to electrical wiring.
5. Be careful while opening wardrobe doors to take necessary items;
6. Use only lanterns; do not use an oil lamp or a candle.
7. Listen to the radio to receive information about the earthquake.

### **Landslide**

A landslide is defined as the movement of a mass of rock debris down a slope. Landslides are caused by the direct influence of gravity. Landslides can be caused by rainfall, snowmelt, stream erosion, and flood, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors. Landslides cause property damage, injury and death and adversely affect a variety of resources. For example, water supplies, fisheries, sewage disposal systems, forests, dams and roadways can be affected.

### **During a Landslide**

1. Listen for any unusual sounds that might indicate moving debris, such as trees cracking or boulders knocking together.
2. If you are near a river, be alert for any sudden increase or decrease in water flow and for a change from clear to muddy water. Such changes may indicate landslide activity upstream, so be prepared to move quickly.
3. Be alert especially when driving. Embankments along roadsides are particularly susceptible to landslides.
4. Disconnect the power supply in the areas of landslide.



## After the Landslide

1. Stay away from the slide area. There may be danger of additional slides
2. Check for injured and trapped persons near the slide, without entering the direct slide area.
3. Direct rescuers to their locations.
4. Listen to local radio or television for the latest emergency information
5. Watch for flooding, which may occur after a landslide or debris flow.

## Cyclone

The major natural disaster that affects the coastal regions of India is cyclone and as India has a coastline of about 7516 km; it is exposed to nearly 10 percent of the world's tropical cyclones. About 71 percent of flood prone areas are in ten states (Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Pondicherry, Andhra Pradesh, Orissa and West Bengal). The islands of Andaman, Nicobar and Lakshadweep are also prone to cyclones.

Districts in Tamil Nadu which are frequently affected by cyclones: All the 13 coastal Districts of Tamil Nadu are affected by cyclonic storms which occur during May-June and in October-November months. These Districts are: Tiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, Nagapattinam, Tiruvarur, Tanjavur, Pudukkottai, Ramanathapuram, Tuticorin, Tirunelveli and Kanniyakumari.

On an average, about five or six tropical cyclones form in the Bay of Bengal and Arabian sea and hit the coast every year. Out of these, two or three are severe. When a cyclone approaches to the coast, a risk of serious loss or damage occurs from severe winds, heavy rainfall, storm surges and river floods. The effect of a storm surge is most pronounced in wide and shallow bays exposed to cyclones such as in the northern part of Bay of Bengal. Most cyclones occur in the Bay of Bengal followed by those in the Arabian Sea and the ratio is approximately 4:1. During the cyclonic of cyclonic storms, wind speed is between 65 km/h and 117 km/h.

## Rules of action before a cyclone

1. Go to high-lying places from low-lying areas
2. Those residing in old buildings should temporarily relocate to safer buildings; Jewels and documents should be kept in safe custody.
3. Battery-operated radio, plastic torchlight, lamp, kerosene, match-box should be kept safely for future use.
4. Keep in ready all the first-aid kit and material available with you.
5. Keep in stock foodstuffs, material, fuel, drinking water and life-saving drugs needed for the next week.
6. It is also important to take cattle and other pets to safer places.
7. It is important to know that if we see quickly approaching storm clouds it is possible to predict strong winds several minutes in advance.

## During a cyclone

1. If you are in a building during a strong gust, it is necessary to close and fasten windows and doors. It is better to stay in the rooms.
2. Turn off all electrical devices.
3. Protect yourself with your hands or a scarf. Protect the eyes, nose and mouth from dust.
4. If you are in a wildlife area, try to find a place protected from the wind. If there is no such place nearby, lie down on the ground.
5. If you are in a car it is better to stay there and close the windows. Do not park the car under unstable objects that can break down and fall on the car.

## After cyclone

1. Turn off electricity, gas and water and unplug all electric appliances.
2. Beware of snakes and other animals immediately after the cyclone.
3. Do not go for sightseeing.
4. Stay away from damaged power lines, falling trees and flood water.
5. Boil and purify water before drinking.

## Flood

Flood destructions have always brought miseries to numerous people, especially in rural areas. Flood results in the outbreak of serious epidemics, specially malaria and cholera. Simultaneously, scarcity of water also arises. It has a drastic effect on agricultural produce. Sometimes, water remains standing over large areas for long span of time hampering the Rabi crops.

India is one of the most flood prone countries in the world. The principal reasons for flood lie in the very nature of natural ecological systems in this country, namely, the monsoon, the highly silted river systems and the steep highly erodible mountains, particularly those of the Himalayan ranges. The average rainfall in India is 1,150 mm with significant variation across the country. The annual rainfall along the western coast and the Western Ghats, Khasi hills and over most of the Brahmaputra valley amounts to more than 2,500 mm. Twenty-three of the states (29) and union territories (6) in the country are subject to floods and 40 million hectares of land, roughly one-eighth of the country's geographical area, is prone to floods. The National Flood Control Program was launched in the country in 1954.

Mock Drill means Practicing of something that can happen in future so that it can be easily dealt with in.

- Tropical Cyclone Vardha hit Chennai on 12 December, 2016. National Disaster Management Authority (NDMA) reports that at least 10 people have died in Tamil Nadu.
- Maximum sustained wind speeds of over 130 km/h were recorded, and the storm has caused severe damage to parts of the city of Chennai. Over 4,000

trees have been uprooted, power lines downed and buildings damaged.

### **Do's before flood**

1. Keep furniture and electrical appliances on beds and tables
2. Put sandbags in the toilet bowl and cover all drain holes to prevent sewage back flow.
3. Keep your mobile charged
4. Listen to radio or watch television for the latest weather bulletin and flood warnings.
5. Keep strong ropes, a lantern, battery operated torches, extra batteries ready.
6. Keep umbrellas and bamboo sticks with you for protection from snakes.

### **Drought**

The above map shows most the acute shortage of water in Tamil Nadu in 10 years. (2017) Drought is a period of time (months or years) during which a part of the land has shortage of rain, causing severe damage to the soil, crops, animals, and people. It sometimes causes even death. During drought high temperature is experienced. Such conditions may affect our health.

The primary cause of drought is deficiency of rainfall and in particular, the timing, distribution and intensity. In India around 68 percent of the country is prone to drought. Of the entire area 35 percent receives rain falls between 750 mm and 1,125 mm which is considered drought prone while 33 percent areas receive rainfalls less than 750 mm is considered to be chronically drought prone.

### **Rules of action before, during and after Drought**

#### **Before drought:**

1. Rainwater harvesting should be followed.
2. Sewage water should be recycled and used for domestic purpose.
3. Building canals or redirecting rivers for irrigation.
4. Utilise water economically.

#### **During drought:**

1. Wear cotton clothing and a hat.
2. In case of overheating, immediately move to a shady area.
3. Consume adequate amounts of water stay.

#### **After drought:**

1. If anyone faints after sunstroke, emergency medical measures should be taken.
2. Contact local government agencies to receive information about disaster and assistance for the population.

## Lightning

Lightning is an atmospheric electrostatic discharge (spark) accompanied by thunder, which typically occurs during thunderstorms, and sometimes during volcanic eruptions or dust storms. Lightning generates 10-20 ampere current and it is therefore fatal. It is especially dangerous for people in an open area.

- You can hear thunder from about 16 km of its starting point.
- Lightning bolts travel at the speed of up to 80,000 km / second.
- The average length of a single lightning bolt is 3-4km.

Lightning strikes often have fatal consequences. On an average, 2000 people die from lightning in the world every year. Lightning mostly strikes tall things, such as trees that break down and catch fire or it may strike power transmission lines and antennas fastened on roofs and buildings which causing fire. The air temperature, when lightning occurs, is as hot as 9982.2 °C.

Thunder is the sound caused by lightning. A charged, superheated lightning bolt creates a “resonating tube” as it travels. The air in the tube rapidly expands and contracts causing vibrations that we hear as the rumble of thunder. Lightning strikes can explode a tree. Imagine 15 million volts of electricity hitting a tree branch. The heat travels through the tree, vaporizing its sap and creating steam that causes the trunk to explode.

### Before lightning

1. If you are planning to go to the countryside, check the weather forecast.
2. If a thunderstorm is expected it is better to postpone the trip.
3. It is good if you can estimate the distance to the front line of a thunderstorm. In order to do this you must check the time interval from the moment you see the lightning until you hear thunder. Lightning always precedes thunder. We know that the sound speed travels on average about 1km every 3 seconds. Reduction of the time interval between the sight of lightning and the resulting thunder means that the danger is approaching and protective measures must be taken. If there is no interval between lightning and thunder means, it means that the cloud is already over your head.

### During Lightning:

1. If you are in a building it is necessary to close windows, doors, ventilation pipes and chimneys.
2. It is necessary to turn off the telephone, TV set, and other electrical equipment because lightning may strike electrical cables and pass through wiring.
3. Do not take a shower because both water and metal conduct electricity.
4. Do not light the fireplace because the heat coming from the chimney may attract lightning.
5. It is better to stay away from electric wires, lightning rods, water pipes, antennas and windows.

6. If you are in an open area during a thunderstorm, do not stand under a tall tree. Lightning is most damaging for tall trees. It is better to stay 30-40 meters away from them. Avoid trees that are standing separately. Remember that lightning does not strike bushes.
7. If the area is open, it is better to find a lower place or a cavity and squat there. It is dangerous to stand or lie down on the ground, because this increases the exposure area.
8. It is necessary to get rid of metal items such as a bicycle, coins etc.
9. Do not stand under an umbrella.
10. Do not run during the occurrence of lightning; move slowly towards a shelter because the air flow may attract lightning;
11. If you are in a car, do not get out. It is better to close the windows and turn off the antenna. Do not park your car under tall trees or any structures that may fall down and hit you.
12. If there is an injured person next to you, remember that the victim may lose consciousness. It is necessary to provide first aid.
13. Cover your mouth with a wet cloth in order to protect your lungs.

## Glossary

1. **Disaster:** A serious disruption of the functioning of a society involving human, and material, and impacts that exceed the ability of the affected society to cope using its own resources.
  2. **Disaster risk reduction:** The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters.
  3. **Mitigation :** The lessening of the adverse impacts of hazards and related disasters
  4. **Preparedness:** The capacity developed by organizations, to effectively anticipate, respond to, and recovers from the impacts of disaster events.
  5. **Prevention:** The outright avoidance of adverse impacts of hazards and related disasters.
  6. **Public awareness:** The extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken, to reduce vulnerability to hazards.
  7. **Resilience:** The ability of a society exposed to hazards to resist, absorb, adapt to and recover from the effects of a disaster.
  8. **Hyogo Framework for Action-** A global blueprint for disaster risk reduction efforts between 2005 and 2015 - by providing specific operational guidance for promoting disaster risk reduction.
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12<sup>th</sup> - Geography  
8. MAN- MADE DISASTERS

**Introduction**

**"Mumbai railway station stampede kills at least 22"**

"Rush-hour crush on footbridge connecting two stations was triggered by falling concrete that caused panic!" At least 22 people have been killed and more than 30 injured during a rush-hour stampede on a bridge between two railway stations in Mumbai. The crush occurred on a narrow footbridge connecting Prabhadevi station, formerly Elphinstone, and Parel station during the Friday, September 29, 2017 morning commuter rush and amid heavy rain. "There was a huge crowd on the foot over bridge. Everybody tried to leave at once and it appeared one of them slipped and fell, triggering the stampede," said an Indian Railways spokesman. Another spokesman said the number of people on the bridge was higher than usual because people were using the station to shelter from the rain. The above incident throws some lights on how to be aware of the accidents we encounter in our daily walk of life. Let us try to answer the following questions:

1. Which is more important life or the scheduled journey to be completed?
2. Why rushing in anything may be disastrous?
3. Why timely communication is more important to avoid accident?

The root of the word disaster ("bad star" in Greek and Latin) comes from an astrological theme in which ancients used to refer to the destruction of a star as a disaster.

**Terms to know:**

1. Hazard is a potentially damaging physical event or human activity which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.
2. Disaster is a serious disruption of a society functioning, causing widespread human, material losses which exceed the ability of the affected society to cope using its own resources.
3. Disaster risk management is a set of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of disaster.
4. Capacity - the assets, resources and skills available within a community that can be used to reduce the risks or effects of a disaster.
5. Disaster risk reduction includes activities that will minimize disaster-related losses of life and property.

Disaster is a serious disruption, causing damage or injury to people, buildings, roads, livelihoods, or the environment, which exceed the community's ability to cope.

The magnitude and impact of disasters are increasing and disasters have disrupted social, economic and environmental community activities worldwide. International data

shows that disasters have taken, over the last 10 years, more than 478,000 lives. It has affected 2.5 billion people and caused direct economic losses in the amount of 690 billion US dollars worldwide.

Recent financial studies underline the urgent need for a shift from sole disaster response to disaster risk reduction. Therefore, efforts should be made to ensure that disaster risk reduction is an important aspect of poverty reduction and general development initiatives in the coming years.

### **Community-Based Disaster Risk Reduction**

Community is a group of people living in the same place having homogenous characteristics. It includes shared experiences, locality, culture, language and social interests. Community-based disaster risk reduction is a process within a community and for the community. Reducing risk in communities should address the root causes of risks and address it through local knowledge and expertise. Performance and the arts provide a variety of creative opportunities to communicate. Important messages through live experiences. Examples include: Street theatre, dramatic readings, skits and plays, puppet shows, poetry reading.

Dance, flash mob activities in large urban settings (a group of people who assemble suddenly in a public place, perform an unusual act and then disperse), tapping into oral traditions such as story-telling, music and sing-along, mural-making and other hands-on art and design activities. All of these can involve volunteers and community members, as performers and audiences. Skilled performers find creative ways to engage their audience.

### **Man - made Disasters**

Disasters induced by human beings are man-made disasters. It includes fire accident, transport accident, structure failure, mining accidents, explosions, stampede etc. In this lesson, we study about some of the man-made disasters.

### **Stampede**

The term stampede is a sudden rush of a crowd of people, usually resulting in injuries and death from suffocation and trampling. In stampede, the term mob or crowd is used to refer to a congregated, active, polarized aggregate of people, which is basically heterogeneous and complex. Its most salient features include homogeneity of thought and action among its participants and their impulsive and irrational actions.

### **Causes of stampede**

Incidents of stampedes can occur in numerous socio-cultural situations. These stampede incidents can be categorized into the following types: Entertainment events, escalator and moving walkways, food distribution, processions, natural disasters, power failure, religious events, fire incidents during religious/ other events, riots, sports events and weather related events.

Large religious gatherings are a particular stampede danger in the developing world. A 2013 paper out of India, for example, found that 79 percent of stampedes in that country have taken place at religious events, as opposed to political or entertainment-related events.

## Stampede Management

Crowd management is defined as the systematic planning and supervision of the orderly movement and assembly of people. Crowd control is the restriction or limitation of group behavior.

### The rules of action for stampede

**1. Notice Alternate Exit:** First thing to know in such situations is the route out. If you are attending an event, one of the things you can do in preparation is to try and know the topography of the place. This will help you find the exits. So, when struck in a stampede, try to identify these exits.

**2. Keep Your Hands by Your Chest:** Your hands must be up by your chest like they would be in a boxing position. This makes it easy to move. It also stops your ribs from getting crushed by the crowd on both sides. When the crowd pushes you from front and back, your lungs will be affected. You will suffer of suffocation.

**3. How to move when on your feet:** In the middle of a moving crowd, do not resist the flow by standing still or sitting down. The force is too much to fight. Like in a wave, there is force and in crowd situation. Keep moving diagonally between the pockets of people whenever there is a lull. Try to move towards the exits but not towards walls or fences where you might be cornered. Keep moving with the crowd to avoid falling.

**4. How to move if you fall:** If you fall and get back on your feet, cover your head with your hands and hurl up in a fetal position. Basically, avoid exposing your lungs to the crowd. Keep trying to find an opportunity to get up.

**5. Communicate smartly:** When trapped in the crowd, use sign language such as waving your hands up one side after another so that you will not get exhausted.

**6. Conserve energy:** Keep calm and do not try to scream. That only increases panic.

**7. Set a meeting place:** Arrange a meeting place, in case you get separated, one inside and another one outside.

If someone extends his/her hand for help, grab hold to keep them up.

**Child safety Tips:** Take a second, take a photo.

Before taking children out to any event, pull out your phone and take a photo of each child individually a selfie. That way you have a picture of how they looked that day. The photo can be sent to police to aid in locating the child in case the child is lost in a crowd.

## Drowning

Drowning is the 3rd leading cause of unintentional injury death worldwide, accounting for 7% of all injury-related deaths. There are an estimated 3,72,000 annual drowning deaths worldwide. Children, males and individuals with increased access to water are most at risk of



drowning. Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid; outcomes are classified as death, morbidity and no morbidity.

### Fact File

It is one of our most visceral fears; thrashing in the deep, far below the water's surface, lungs burning for oxygen. Drowning claims hundreds of thousands of lives every year, a great many of whom are young children. Of course, exposure to water is a key factor in drowning, but there is a strong economic correlation as well. Those in poorer countries are far more likely to be drowning. In Bangladesh, 17,000 children drown annually that's 46 a day.

Below are 10 facts about drowning; from a lake that never surrenders its victims to a party for lifeguards that ended in deadly irony.

### Fresh Water and Salt Water Drown You Differently.

Males are especially at risk of drowning, with twice the overall mortality rate of females. Studies suggest that the higher drowning rates among males are due to increased exposure to water and riskier behavior such as swimming alone, drinking alcohol before swimming alone and boating. Drowning accounts for 75% of deaths in flood disasters.

### Prevention

There are many actions to prevent drowning. Installing barriers (e.g. covering wells, using doorway barriers and playpens, fencing swimming pools etc.) to control access to water hazards, or removing water hazards entirely greatly reduces water hazard exposure and risk. Community-based, supervised child care for pre-school children can reduce drowning risk and has other proven health benefits. Teaching school-age children basic swimming, water safety and safe rescue skills is another approach. Setting and enforcing safe boating, shipping and ferry regulations is an important part of improving safety on the water and preventing drowning. Building resilience to flooding and managing flood risks through better disaster preparedness planning, land use planning, and early warning systems can prevent drowning during flood disasters.

### Fire Accident

Massive forest fires may start in hot and droughty weather as a result of lightning, and human carelessness or from other causal factors. Fires can lead to the destruction of buildings, wooden bridges and poles, power, transmission and telecommunication lines, warehouses of containing oil products and other fuel. It causes injury to people and animals.

### Students' activity Mock Drill:

To escape a fire, **stop, drop, and roll**. In case your clothes burn, stop running, drop on the floor and roll to stop fire spreading.

During droughts or windy weather, fire may destroy low vegetation and trees. The spreading speed of low fire is 1-3 m/sec and high fire may reach up to 100m/sec.

### Rule of actions for Fire Accident-Do's

1. When Fire accident occurs, warning should be given by shouting or ringing bell.
2. Extinguish the fire using sand and other fire extinguishers.
3. Main switch should be switched off immediately.
4. If clothes started burning, the victim should roll on the ground to extinguish the fire.
5. The combustible materials found near the fire accident place, have to be discarded so that the fire does not spread to them.
6. If fire breaks out with smoke spreading, cover the nose, crawl and move out.
7. Think that life is more valuable than belongings.
8. Move from the fire accident place to a safe place.

### Preventive Measures

1. Create a safe zone between the house and flammable plants.
2. Cut off all the branches of trees with below three meter height standing near your house.
3. Remove moss and dry branches from plants standing near the house.
4. Clean ditches and pits from dry branches, leaves and cones.
5. Keep flammable materials in the checked safe containers.
6. Ask your relative or friend living in a different location to be your contact person.
7. Have a fire extinguisher and know how to use it.

### Do you know?

A natural gas vent in Iraq known as The Eternal Fire of Baba Gurgur, meaning 'Father of Fire' has been burning continuously for over 4,000 years, and it has been mentioned by Herodotus, and Plutarch.

### During fire accident

1. When water cannot be used (because the equipment is plugged-in) or there is no water and the fire is not strong, you can use cooking soda or calcite soda, washing powder, sand, soil.
2. Keep your head no higher than 30 cm above the floor; above this height accumulation of heavy poisonous gases is possible.
3. If there is no opportunity to leave the room, move towards a window, and try to get the attention of people by giving signals.
4. If your clothing has caught fire do not run because this will intensify burning. Take the clothes off, throw them in a safe place and put out the fire.
5. If you are near a fire in a forest and cannot extinguish the fire by yourself, immediately inform people who are nearby about the necessity to leave the hazard zone.

### Things that must never be done during a fire

1. Never pour water on burning electrical equipment if it is switched on. If a TV set, a refrigerator is burning, turn off the electricity from the main switch.
2. Do not jump from windows of upper floors.
3. Do not panic.
4. Do not try to extinguish the fire by yourself.

## Industrial Disasters

Industrial hazards consist of four principle hazards. The hazards encountered are fire, explosion, toxic release and environmental damage. This is because industries employ many different processes involving a wide range of different raw materials, waste products and final products. Danger originates from technological or industrial accidents, dangerous procedures, infrastructure failures or certain human activities. It may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

**Fire:** This is the most frequent hazard. Fire can also produce toxic fumes like Acrolein, Carbon monoxide and Cyanides. Physical structures can be damaged either by the intensity of the heat or combustion. It may also have an effect on essential services like power and instrumentation.

**Explosion:** Explosions is the result of a shock wave. This overpressure can kill people but usually the indirect effects of collapsing buildings, flying glass and debris causes far more loss of life and severe injuries. There are different types of explosions which include gas explosions and dust explosions. Gas explosions occur when a flammable gas mixes with air. Dust explosions occur when flammable solids, especially metals, in the form of fine powders are intensively mixed with air and ignited.

**Chemical release:** Sudden release of toxic vapors has the potential to cause death and severe injuries several kilometers from the release point. They are carried by water and air. Their release into public sewage systems, rivers, canals and other water courses, either directly or through contaminated water used in firefighting can result in serious threat to public. The number of casualties depends on the weather conditions, population density in the path of the cloud and the effectiveness of the emergency arrangements.

**Environmental Damage:** Release of other substances, not directly toxic to humans can cause major pollution problems. It is becoming increasingly recognized that damage to natural resources such as plant and animal life can have serious long term consequences. E.g. destruction of trees is increasing the effect of global warming and extinction of animals are severely disrupting food webs and causing an increase in pests.

### Means of reducing the industrial hazards

**Process Safety Management:** Reliability assessment of process equipment, incorporating safety tips, scrubbing system, etc, should be done before effecting major process changes.

**Safety Audits:** Periodical assessment of safety procedures, performance of safety systems and gadgets along with follow up measures should be carried out.

**Emergency Planning:** A comprehensive risk analysis indicating the impact of consequences and practiced emergency procedures should be done. This can be done by communities as well as national or regional corporation authorities.

**Training:** Proper training of employees and protective services should be done.

### **Road accident**

It is estimated that 1.34 million people are killed in the road accidents every year. Road accident is the 8th leading cause of death globally. Every year, up to 50 million people suffer serious, life-altering injuries which, in many low- and middle-income countries, directly contribute to the poverty cycle.

Primary road safety risk factors in low and middle-income countries include:

1. Speeding
2. Drink-driving
3. Non-use, or improper use of helmets, and
4. Non-use, or improper use of seatbelts

Strengthening the capability of the road traffic police to enforce traffic laws is fundamental to deterring road users from violating the laws, to reduce harm and to reduce inappropriate and unsafe behaviors on the roads.

### **Basic road safety rules for students:**

#### **1. Aware of the road signals**

Assist students to learn the traffic lights and signs. Check out the relevance of each color:

- Green light is an indication for “go”- Whenever the signal turns green, the vehicle can move ahead.
- Red light is an indication “to stop”- All the vehicles have to stop, when the red light is on.
- Yellow light is an indication “to slow down”- When the yellow light turns on, you should slow down your vehicle and prepare to stop.
- “Walking man” signal at intersections are constructed for the pedestrians. Recall the fact that you will be authorized to cross the road only when the signal turns green. Ensure that there are no vehicles, both on the left and right side of the road.
- Never attempt to cross the road, if the signboard signifies “Don’t walk” message or the walking symbol turns red.

#### **2. Stop, look, and cross**

In fact, students will either walk to school or to the bus stop for waiting their respective school bus. The only task of students is to cross the road prudently, right after the school bus drops them off. Hence, we should undertake the responsibility to provide adequate guidance for crossing the road cautiously.

We teach them to be aware of various road signs and recommend them to utilize the zebra crossing while crossing the road. If there are no markings or signs, the following procedures can be worthwhile:

- Check the right side, after that to the left side of the road for the incoming vehicles.

- If you notice a vehicle is approaching, wait for the vehicle to pass and then safely cross the road.
- Do not cross the road at the turns, it is unsafe.
- Never cross the road between the stopped vehicles.

However, accompaniment is required for the children aged below 6 years and you should compulsorily hold their hands while crossing the road.

### **3. Listen**

Educate the child to be extra vigilant while they cross the road at the turns. As a consequence, listening can only aid them. For this reason, instruct your child to listen and ensure whether a vehicle is approaching or not. Ordinarily, vehicles apply horns at turns and at unmanned intersections to provide a warning to other road users. Meanwhile, you can interpret the following instances to students:

- If a horn is heard, stop and cross only after ensuring that no vehicle approaches you from left or right side of the road.

### **4. Don't rush on roads**

Students will not be tolerant and have a tendency to dash across the road to reach the other side. In addition, they become absent-minded when they are having fun and henceforth bound across or along the road. Therefore, teach them to remain placid while they are near the road.

### **5. Relevance of Sidewalks**

Persuade students to avail the service of sidewalks whenever they walk on the road. Demonstrate them how to cross the road safely. Motivate them to avail the sidewalks even though it is not a busy street.

### **6. Crossroads and pedestrian crossings**

Students will have a tendency to scoot across the street. This will become particularly perilous since vehicles will never slow down unless there is a cross road or relevant signal. Notify your students to cross only at intersections and avail the pedestrian crossings. If there is no crossroad or pedestrian crossing, you can admonish students to comply the rules mentioned above.

### **7. Place the hands inside the vehicle**

A multitude of students have the habit of placing their hands outside the vehicle while it is moving. They will lay their head out and wave with exhilaration. This is a familiar sight among the school bus students. Nevertheless, these behaviors can have significant consequences. Due to carelessness, they will be injured by vehicles, which advance from the opposite direction.

### **8. Never cross road at bends**

Bends are evidently the blind spot for motorists. When you attempt to cross at bends, the driver will be unable to recognize you and stop the car at the right time. As a result, students will be hurt while crossing at bends.

### **9. Remain safe on a bicycle**

If students ride bicycle to reach the school, ensure that they adhere to the following cycling rules:

- Utilize the bicycle lane. If such a lane does not exist, ride the bike either on the extreme left or right side of the road and glide along with the traffic.
- Never permit your students to ride on congested streets without your supervision.

#### **10. Staying safe in a moving vehicle**

In a moving vehicle, you can ensure the student's safety with the assistance of a seat belt. Let them practice the following safety rules in your absence:

- Never stand, stroll or sprint inside a moving vehicle.
- Remain seated and hold the rails on the seats until the school bus halts.
- Do not put your hands outside the moving vehicle.

#### **11. Get off the vehicle at the curb side**

Ask your students to memorize the following safety tips and conform to the rules while they get down from the school bus:

- Ensure that you reach the bus stop prior to the scheduled bus timing in order to avert the circumstance of running behind the school bus.
  - Form a queue to board or descend the school bus.
  - Disembark the school bus at the curbside in order to evade unnecessary endangerment and hindrance to other vehicles.
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## 11<sup>th</sup> - Economics

### 11. Tamil Nadu Economy

#### Introduction

The economic and social development of states in India are not uniform. Wide regional disparities exist. The western region and southern regions are better of than the other regions. Tamil Nadu is geographically eleventh largest and population wise third largest. Tamil Nadu fares well with many achievements. It stands to second in terms of contribution to GDP, third highest in terms of per capita income, investment, Foreign Direct Investment (FDI) and industrial output. It has been ranked as the most economically free state by the Economic Freedom.

In the social and health sector also Tamil Nadu's performance is better than many other states and better than national average in terms of health, higher education, IMR and MMR.

#### Highlights of Tamil Nadu Economy

- Growth of SGDP in Tamil Nadu has been among the fastest in India since 2005.
- Poverty reduction in Tamil Nadu has been faster than that in many other States.
- Tamil Nadu contains a smaller proportion of India's poor population.
- Tamil Nadu is the second largest contributor to India's GDP.
- Tamil Nadu ranks 3rd in Human Development Index (source: UNDP-2015)
- Tamil Nadu ranks 3rd in terms of invested capital (Rs.2.92 lakh crore) and value of total industrial output (Rs.6.19 lakh crore).
- Tamil Nadu ranks first among the states in terms of number of factories with 17% share and industrial workers (16% share) of the country.
- Tamil Nadu is placed third in health index as per the NITI AAYOG report.
- Tamil Nadu has a highest Gross Enrolment Ratio in higher education.
- Tamil Nadu has the largest number of engineering colleges
- Tamil Nadu has emerged as a major hub for renewable energy.
- Tamil Nadu has highest credit Deposit Ratio in commercial and Cooperative banks.
- has highest ranks first on investment proposals filed by MSMEs.

#### Performance of Tamil Nadu Economy

Some of the States like Gujarat and Maharashtra seem to perform well in some of the economic indicators. Kerala tops in literacy IMR and MMR. In recent years Tamil Nadu's performance is outstanding and far ahead of all other states in the spheres of health, higher education, growth of MSMEs, poverty alleviation and employment generation.

#### Tamil Nadu is placed third in health index

The Tamil Nadu state has come third after Kerala and Punjab in a health index report. The neo natal mortality rate is 14 lower than that of many other states and that the under 5 mortality has dropped from 21 in 2014 to 20 in 2015

- Healthy States, Progressive India Report, (2018) -NITI AAYOG The reasons for the relative success of Tamil Nadu lie in extending social policies to cover most of the population. For instance the Public Distribution System, midday meals and public health infrastructure have near universal coverage.

## Natural Resource

### Water Resources

Tamil Nadu is not endowed with rich natural resources compared to other States. It accounts for three per cent of water sources, four per cent of land area against six per cent of population. North East monsoon is the major source of rainfall followed by South West monsoon. There are 17 river basins in Tamil Nadu. The main rivers are Palar, Cheyyar, Ponnaiyar, Cauvery, Bhavani, Vaigai, Chittar, Tamiraparani, Vellar, NoyyalSiruvani, Gundar, Vaipar, Valparai etc. Wells are the largest source of irrigation in Tamil Nadu (56%).

Water Resources	
Source of Irrigation	Numbers
Reservoirs	81
Canals	2239
Tanks	41262
Tube Wells	3,20,707
Open Wells	14,92,359

Source: Tamil Nadu Government Season & Crop Report 2012-13

### Mineral Resources

Tamil Nadu has a few mining projects based on Titanium, Lignite, Magnesite, Graphite, Limestone, Granite and Bauxite. The first one is the Neyveli Lignite Corporation that has led development of large industrial complex around Neyveli in Cuddalore district with Thermal power plants, Fertilizer and Carbonisation plants. Magnesite mining is at Salem from which mining of Bauxite ores are carried out at Yercaud and this region is also rich in Iron Ore at Kanjamalai. Molybdenum is found in Dharmapuri, and is the only source in the country.

Table 11.2

Mineral Resources		
Mineral	Reserve(Tonnes)	National Share
Lignite	30,275,000	87%
Vermiculite	2,000,000	66%
Garnet	23,000,000	42%
Zircon	8,000,000	38%
Graphite	2,000,000	33%
Ilmenite	98,000,000	28%
Rutile	5,000,000	27%
Monazite	2,000,000	25%
Magnesite	73,000,000	17%

(Source: Department. of Geology and Mining)



## Population

Tamil Nadu stands sixth in population with 7.21 crore against India's 121 crore as per 2011 census. However, Tamil Nadu's population is higher than that of several countries according to UN Report.

Table 11.3 Population

State / Country	Population(in Crore)
Tamil Nadu	7.2
U.K.	6.5
France	6.5
Italy	5.9
South Africa	5.6
Spain	4.7
Sri Lanka	2.1

(Source: Projections published by the United Nations in the 2017 Revision of World Population Prospects.)

## Density

The density of population which measures population per sq.km is 555 (2011) against 480 (2001). Tamil Nadu ranks 12th in density among the Indian States and overall it is 382 for India.

## Urbanisation

Tamil Nadu is the most urbanized state with 48.4% of urban population against 31.5% for India as a whole. The State accounts for 9.61% of total urbanites in India against 6% share of total population.

## Sex ratio (Number of female per 1000 males)

Balanced sex ratio implies improvement in quality of life of female population. The sexratio in Tamil Nadu is nearing balance with 995 which is far better compared to most of the States and all India level. Tamil Nadu stands third next only to Kerala state and Puduchery Union Territory in sex ratio.

Table 11.4 Sex Ratio

S. No	Indicator	Tamil Nadu	India
1.	IMR	17	34
2.	MMR	79	159
3.	Life Expectancy		
	Total	70.6	67.9
	Male	68.6	66.4
	Female	72.7	69.6

4.	Literacy Rate		
	Total	80.33%	74.04 %
	Male	86.81%	82.14 %
	Female	73.86%	65.46 %
5.	Sex Ratio	995	940

### Infant Mortality Rate (mortality before completing 1 year)

Tamil Nadu is well ahead of national average and other states in IMR. According to NITI AAYOG, the IMR is 17 (per 1000) for Tamil Nadu which is just half of national average of 34 as on 2016.

### Maternal Mortality Rate (MMR) (Mother's death at the time of delivery per 1 lakh)

Tamil Nadu has a good record of controlling MMR, ranking third with 79 (Kerala 61, Maharashtra 67) against national average of 159 again half of the national average [NITI AAYOG].

### Life Expectancy at birth

The average period that a person may expect to live is called life expectancy. However, life expectancy in India still falls short of most developed and developing nations.

### Literacy

The literacy rate of Tamil Nadu is Is higher than in many States

### Gross State Domestic Product (GSDP)

Just like GDP, the Gross State Domestic Product refers to the total money value of all the goods and services produced annually in the State.

Tamil Nadu is the second largest economy in India with a GSDP of \$ 207.8 billion in 2016-17 according to the Directorate of Economics and Statistics, Tamil Nadu. The GSDP of Tamil Nadu is equal to the GDP of Kuwait on nominal term and GDP of UAE on PPP terms.

The GSDP of Tamil Nadu is far higher compared to many countries as shown below. This is mainly due to population effect. Per capita GSDP would be better for intercountry or interstate comparisons. Tamil Nadu may go below if per capita GSDP is considered for comparison.

### Gross State Domestic Product

State / Country	GSDP /GDP (Billion)
Tamil Nadu-GSDP	\$ 207.8
Iraq-GDP	\$ 171
New Zealand-GDP	\$ 184

Sri Lanka-GDP	\$ 81
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(Source: IMF Outlook, April 2017)

### Sectoral Contribution

The tertiary sector (service sector) is the major contributor to Tamil Nadu's GSDP at 63.70%. The secondary sector (Industry) contribution is gradually on the rise and now it is 28.5%. Agriculture occupies a prominent position in occupation but its contribution to GSDP is declining and now it is just 7.76%. This means that the tertiary and secondary sectors have grown faster, the agricultural sector has grown slow. Agriculture sector provides employment and food to larger proportion of Indians and Tamils. But, the same sector is growing slowly means it is not good. With this trend sustainable development may not be possible.

### Per capita Income

The Per capita GSDP of Tamil Nadu also (\$ 2,200) which is higher than that of many other States in India. Per capita GSDP of Tamil Nadu is nearly 1.75 times higher than the national average, as per 2018 data. In term of ₹ the per capita income in Tamil Nadu was ₹ 1,03,600 in 2010-11 and it has increased to ₹1,88,492 in 2017-18 as per the Budget figures 2018.

### Per capita income

State / Country	Per capita Income (in USD)
Tamil Nadu	2200
India	1670
Nigeria	2175
Nicaragua	2151
Pakistan	1443
Bangladesh	1358
Zimbabwe	1029
Nepal	729

(Source: World Bank National Accounts data, and OECD National Accounts data files. - <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>)

The Per capita income of Tamil Nadu among the southern States is given below:

**Table Per capita Income (2015-16)**

State	PI
Tamil Nadu	1,57,116
Kerala	1,55,516
Karnataka	1,46,416
Telangana	1,58,360
Andhra Pradesh	1,37,000

(Source: Reserve Bank of India, New Delhi. February 2017.)

## Agriculture

Tamil Nadu, with seven agro climatic zones and varied soil types is better suited for the production of fruits, vegetables, spices, plantation crops, flowers and medicinal plants. The State is the largest producer of loose flowers and the third largest producer of fruits. Tamil Nadu has historically been an agricultural State. At present, Tamil Nadu is the India's second biggest producer of rice, next only to West Bengal. The state is one of the major producers of turmeric. It is also the leading producer of Kambu, Corn, Groundnut, Oil seeds and Sugarcane. It ranks first in production of plantation crops and banana and coconut, second in rubber and cashew nut, third in pepper and fourth in sugarcane.

The gross cropped area under all crops was 58.97 lakh hectares in the year 2013-14. The area under food crops account for 72.9% and that of non-foodcrops is 27.1%. Among the food crops paddy takes a major share. Among the non-food crops, groundnut and coconut take a major share.

Net sown area has been gradually declining; and, rural land, labour and capital are moving towards urban projects. As a result, villages are emptied and cities are over-crowded and congested, leading to spatially unbalanced bulging.

### Foodgrain Production

Rice production dominates among food grain production with 79.49 lakh tones on 2014-15 followed by millets at 40.79 lakh tons. There is significant jump in pulses production from 3.59 lakhs ton in 2011-12 to 7.67 lakh ton in 2014-15. There may be changes in these statistics. Hence updation is unavoidable.

### Productivity Position of Tamil Nadu and India

The Government of Tamil Nadu lays emphasis on agricultural production and productivity. As a result, Tamil Nadu tops in productivity, in food crops as well as non-food crops, among the States in India.

### Productivity Position of Tamil Nadu

Crop	Position of Tamil Nadu at National Level
Maize	1
Cumbu	1
Total Oilseeds	1
Cotton	1
Coconut	2
Rice	2
Sugarcane	3
Sunflower	3
Jowar	3

Coarse cereals	4
Total Pulses	8

(Source: Tamil Nadu Agriculture Department Policy Note 2017-18)

Tamil Nadu ranks first in maize cumbu, groundnut, oil seeds and cotton second in rice and coconut, third in sugarcane, sunflower and jowar.

## Industry

Chennai is sometimes referred to as the Health Capital of India or the Banking Capital of India, having attracted investments from International finance Corporation and the World Bank. It is also called as Detroit of Asia.

Tamil Nadu has a network of about 110 industrial parks/estates that offer developed plots with supporting infrastructure. Also the Government is promoting other industrial parks like Rubber Park, TICEL Park for Biotechnology, Siruseri IT Park and Agro Export Zones.

The heavy engineering manufacturing companies are centered around the suburbs of Chennai. Chennai boasts of global car manufacturing giants as well as home grown companies.

Karur is known for its bus body building which contributes 80% of South Indian bus body building. TNPL is the Asia's largest eco-friendly paper mill. Salem is called as steel city and has many sago producing units and mineral wealth. Sivakasi is the leader in printing, fireworks, safety matches production in India. It contributes to 80% of India's total safety matches production and 90% of India's total fireworks production. Thoothukudi is the gateway of Tamil Nadu. It is a major chemical producer next only to Chennai.

## Textiles

Tamil Nadu is the largest textile hub of India. Tamil Nadu is known as the "Yarn Bowl" of the country accounting for 41% of India's cotton yarn production. The textile industry plays a significant role in the Indian economy by providing direct employment to an estimated 35 million people, and thereby contributing 4% of GDP and 35% of gross export earnings. The textile sector contributes to 14% of the manufacturing sector. From spinning to garment manufacturing, entire textile production chain facilities are in Tamil Nadu. About half of India's total spinning mill capacity is in Tamil Nadu. The western part of Tamil Nadu comprising Coimbatore, Tirupur, Erode, Dindigul and Karur has the majority of spinning mills manufacturing cotton/polyester/blended yarn and silk yarn used by garment units in Tamil Nadu, Maharashtra etc. Yarn is also exported to China, Bangladesh etc. Tirupur known as "Knitting City" is the exporter of garments worth USD 3 Billion. Karur is the major home for textile manufacturing (Curtain cloth, bed linens, kitchen linens, toilet linens, table linens, wall hangings etc.) and export hub in India. Erode is the main cloth market in South India for both retail and wholesale ready-mades.

## **Leather**

Tamil Nadu accounts for 30 per cent of leather exports and about 70 per cent of leather production in the country. Hundreds of leather and tannery industries are located around Vellore, Dindigul and Erode. Every year the State hosts the India International Leather Fair in Chennai.

## **Electronics**

Chennai has emerged as EMS Hub of India. Many multi - national companies have chosen Chennai as their South Asian manufacturing hub.

## **Auto motives**

Chennai nicknamed as “The Detroit of Asia” is home to a large number of auto component industries. Tamil Nadu has 28% share each in automotive and auto components industries, 19% in the trucks segment and 18% each in passenger cars and two wheelers.

## **Cement Industry**

Tamil Nadu ranks third in cement production in India (First Andhra Pradesh, Second Rajasthan). Among 10 largest cement companies in India as on 2018, Ramco Cement and India Cement find prominent place. And also Tamil Nadu stands second in number of cement plants with 21 units against 35 units in Andhra Pradesh.

## **Fire works**

The town of Sivakasi is a leader in the areas of printing, fireworks, and safety matches. It was fondly called as “Little Japan” by Jawaharlal Nehru. It contributes to 80% of India’s fireworks production. Sivakasi provides over 60% of India’s total offset printing solutions.

## **Other Industries**

One of the global electrical equipment public sector companies viz BHEL has manufacturing plants at Tiruchirappalli and Ranipet. The Tamil Nadu State Government owns the Tamil Nadu Newsprint and Papers (TNPL), the world’s biggest bagasse-based paper mill in Karur. Tamil Nadu is a leading producer of cement in India and with manufacturing units located at Ariyalur, Virudhunagar, Coimbatore and Tirunelveli. The region around Salem is rich in mineral ores. The country’s largest steel public sector undertaking, SAIL has a steel plant in Salem.

Coimbatore is also referred to as “the Pump City” as it supplies two thirds of India’s requirements of motors and pumps. The city is one of the largest exporters of jewellery, wet grinders and auto components and the term “Coimbatore Wet Grinder” has been given a Geographical indication. Thoothukudi is known as “Gateway of Tamil Nadu”. Thoothukudi is

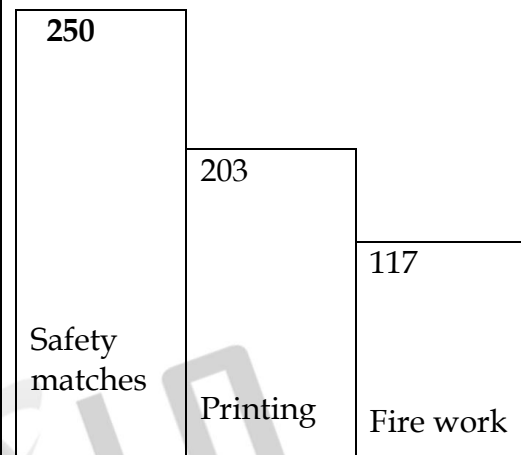
the major chemical producer in the state. It produces the 70 per cent of the total salt production in the State and 30 per cent in the country.

### Sivakasi-A fireworks manufacturing hub

- Sivakasi is a town in Virudhunagar District of Tamil Nadu
- World renowned for firework Production
- Accounts for USD 50 Million exports of safety Matches, printing and Firework in 2013-14

90% India's Fire Work Production	450 Firework factories
0.5 Million direct employment	0.2Million indirect employment
60% of safety match Production	4500 match units

### Production in 2012 - 13 (USD Million)



### MSMEs

The Micro, Small and Medium Enterprises are defined under the MSMED Act 2006. The enterprises are classified as Manufacturing and Service enterprises based on the investment in plant and machinery and equipment (excluding land and building) the classification of Micro, Small and Medium Enterprises is given in Table- 11.11.

Tamil Nadu accounts of 15.07% Micro, Small and Medium Enterprises (MSMEs) in the country( the highest among all States) with 6.89 lakhs registered MSMEs. Producing over 8000 varieties of product for a total investment of more than Rs.32,008crore.

MSMEs produce a wide variety of products in almost all sectors. Te prominent among them are the engineering, electrical, chemicals, plastics, steel paper, matches, textiles, hosiery and garments sector. Around 15.61 lakh entrepreneurs have registered, providing employment opportunities to about 99.7 lakhs persons with total investment of Rs. 1,68,331 crore.

### Energy

Tamil Nadu tops in power generation among the southern States as seen in following table.Installed capacity of power utilities in States in southern region

Table 11.11 Energy

State	Units	Ranks
Tamil Nadu	26,865 MW	I

Karnataka	18,641 MW	II
Andhra Pradesh	17,289 MW	III
Telungana	12,691 MW	IV
Kerala	4,141 MW	V
	<b>79,627 MW</b>	

(Source: Central Electricity Authority, Ministry of Power, Government of India. Retrieved Jan.2017.)

Tamil Nadu is in the forefront of all other Indian States in installed capacity. Muppandal wind farm is a renewable energy source, supplying the villagers with electricity for work. Wind farms were built in Nagercoil and Tuticorin apart from already existing ones around Coimbatore, Pollachi, Dharapuram and Udumalaipettai. These areas generate about half of India's 2,000 megawatts of wind energy or two percent of the total power output of India.

### Nuclear Energy

The Kalpakkam Nuclear Power Plant and the Koodankulam Nuclear Power Plant are the major nuclear energy plants for the energy grid.

Table 11.12 Nuclear Energy

Units	Existing Installed capacity (2018)
Kudankulam	1834 MW (2 x 917)
Kalpakkam	470 MW (2 x 235)

### Thermal Power

In Tamil Nadu the share of thermal power in total energy sources is very high and the thermal power plants are at Athippattu (North Chennai) Ennore, Mettur, Neyveli and Thoothukudi. The generation of power under various sources is given below.

Table 11.13 Thermal Power

Source	Million Units	%
Thermal	13304	49.52
Hydel	2203	8.20
Nuclear	986	3.67
Others (Wind Solar)	10372	38.61
<b>Total</b>	<b>26865</b>	<b>100.00</b>

(Source: Central Electricity Authority, Ministry of Power, Government of India. Retrieved 15 Jan.2017.)

### Hydel Energy

There are about 20 hydroelectric units in Tamil Nadu. The prominent units are Hundah, Mettur, Periyar, Maravakandy, Parson Valley etc.



## Solar Energy

Tamil Nadu tops in solar power generation in India as seen in following table. Southern Tamil Nadu is considered as one of the most suitable regions in the country for developing solar power projects.

### Solar Energy

Ranking	States	Total capacity(MW) 2017
1	Tamil Nadu	1590.97
2	Rajasthan	1317.64
3	Gujarat	1159.76
4	Telangana	1073.41
5	Andhra Pradesh	979.65

(Source: Data From MNRE)

## Wind Energy

Tamil Nadu has the highest installed wind energy capacity in India. The State has very high quality of shore wind energy potential of the Tirunelveli coast and southern Toothukudi and Rameswaram coast.

## SERVICES

Banking, insurance, energy, transport and communication fall under tertiary sector i.e., services.

### Banking

In Tamil Nadu, Nationalised banks account for 52% with 5,337 branches, Private Commercial Banks 30% (3,060) branches, State Bank of India and its associates 13% (1,364), Regional Rural Banks 5% (537) branches and the remaining 22 foreign bank branches.

Total deposits of the banks in Tamil Nadu registered an year-on-year increase of 14.32% by March 2017 and touched Rs. 6,65,068.59 crores. Total credit of the banks in Tamil Nadu registered a year-on-year increase of 13.50% by March 2017 and touched Rs. 6,95,500.31 crores. The share of Priority Sector Advances stands at 45.54% as against the national average of 40%. The percentage of Agricultural advances to total advances as at the end of March 2017 works out to 19.81% as against the national average of 18%. Banks in Tamil Nadu have maintained one of the highest Credit Deposit Ratio of 119.15% in the country whereas this ratio is 77.5% at the national level.

## Education

### a. School Education

Tamil Nadu is grouped among high Gross Enrolment Ratio (GER) States. It ranks third next only to Kerala (81%) and Himachal Pradesh (74%). The all India average is 43% and the world average is 59%.

Gross Enrolment Ratio is 118.8% for primary level(class 1-5); 112.3% for upper primary level (class 6-8), 62.7% for secondary level (class 9-10), 49.26% at Higher Secondary level (class 11-12). This has been possible mainly due to the supply of free food, cloth, foot-wear, scholarship, laptop etc.

### Tamil Nadu's primary education statistics 2016-17

Number of schools	Primary	35,414
	Middle	9,708
	High and HigherSecondary	12,911

(Source: Tamil Nadu State portal, State interim Budget 2016-17)

### b. Higher Education

In Gross Enrolment Ratio under higher education (Tertiary level) Tamil Nadu continues to be at the top level well ahead of other states. The GER is 46.9% in Tamil Nadu which is far higher against national average and all other States This higher GER is thanks to the distribution of free food, cloth, footwear, laptop and scholarship.

Table 11.16 Gross Enrolment Rate %

State	2016-17
Tamil Nadu	46.9
Maharashtra	30.2
Uttar Pradesh	24.9
Odisha	21.0
Bihar	14.4
All India	25.2

(Source: All India Survey on Higher Education (AISHE) released by the Ministry of Human Resource Development- January 2018)

Tamil Nadu has 59 Universities, 40 Medical colleges, 517 Engineering colleges, 2,260 Arts and Science colleges, 447 Polytechnics and 20 dental colleges. Tamil Nadu produces nearly four lakh engineering and polytechnic students every year, the highest in the country.

### Educational Loans

As far as educational loans disbursed by Public Sector Banks under priority sector are concerned, 20.8% of the total amount was disbursed in Tamil Nadu between 2013-14 and 2015-16. Andhra Pradesh was second with 11.2% of the total loan amount followed by Maharashtra (10.2%).

Of the total amount of educational loans disbursed by Private Banks during the same period, Kerala accounted for 37.8% followed by Tamil Nadu with 24.8%. Both Karnataka

& Kerala together accounted for more than 60% of the total educational loan amount by Private Banks.

## Health

Tamil Nadu has a three – tier health infrastructure comprising hospitals, primary health centres, health units, community health centres and sub-centres. As of March 2015, the State had 34 district hospitals, 229 sub-divisional hospitals, 1,254 primary health centres, 7,555 Sub-centres and 313 community health centres.

## Communication

Maharashtra has the highest number of internet subscribers in the country at 29.47 million, followed by States like Tamil Nadu, Andhra Pradesh and Karnataka. According to government data, India had a total of 342.65 million internet subscribers at the end of March, 2016. Tamil Nadu had 28.01 million subscribers, while its neighbor's Andhra Pradesh and Karnataka had 24.87 million and 22.63 million, respectively.

## Transport

Tamil Nadu has a well-established transportation system that connects all parts of the State. This is partly responsible for the investment in the State. Tamil Nadu is served by an extensive road network in terms of its spread and quality, providing links between urban centres, agricultural market-places and rural habitations in the countryside. However, there is scope for improvement.

### a. Road

There are 28 national highways in the State, covering a total distance of 5,036 km. The State has a total road length of 167,000 km, of which 60,628 km are maintained by Highways Department. It ranks second in India with a share of over 20% in total road projects under operation in the public-private partnership (PPP) model.

### b. Rail

Tamil Nadu has a well-developed rail network as part of Southern Railway, Headquartered at Chennai. The present Southern Railway network extends over a large area of India's Southern Peninsula, covering the States of Tamil Nadu, Kerala, Puducherry, minor portions of Karnataka and Andhra Pradesh. Tamil Nadu has a total railway track length of 6,693 km and there are 690 railway stations in the State. The system connects it with most major cities in India. Main rail junctions in the State include Chennai, Coimbatore, Erode, Madurai, Salem, Tiruchirapalli and Tirunelveli. Chennai has a well-established Suburban Railway network, a Mass Rapid Transport System and is currently developing a Metro system, with its first underground stretch operational since May 2017.

**c. Air**

Tamil Nadu has four major international airports. Chennai International Airport is currently the third largest airport in India after Mumbai and Delhi. Other international airports in Tamil Nadu include Coimbatore International Airport, Madurai International Airport and Tiruchirapalli International Airport. It also has domestic airports at Tuticorin, Salem, and Madurai. which connect several parts of the country. Increased industrial activity has given rise to an increase in passenger traffic as well as freight movement which has been growing at over 18 per cent per year.

**d. Ports**

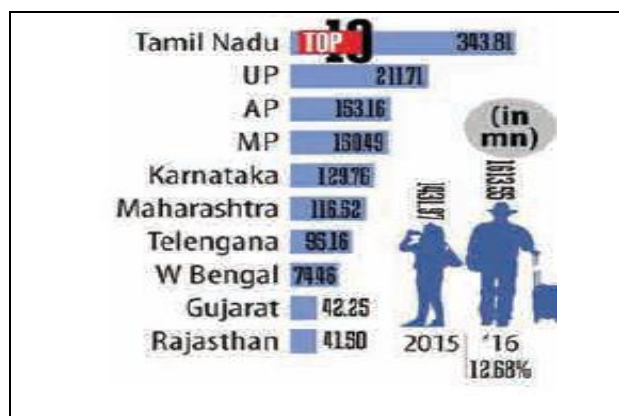
Tamil Nadu has three major ports; one each at Chennai, Ennore, and Tuticorin, as well as one intermediate port in Nagapattinam, and 23 minor ports. The ports are currently capable of handling over 73 million metric tonnes of cargo annually (24 per cent share of India). All the minor ports are managed by the Tamil Nadu Maritime Board, Chennai Port. This is an artificial harbour and the second principal port in the country for handling containers. It is currently being upgraded to have a dedicated terminal for cars capable of handling 4,00,000 vehicles. Ennore Port was recently converted from an intermediate port to a major port and handles all the coal and ore traffic in Tamil Nadu.

**Tourism**

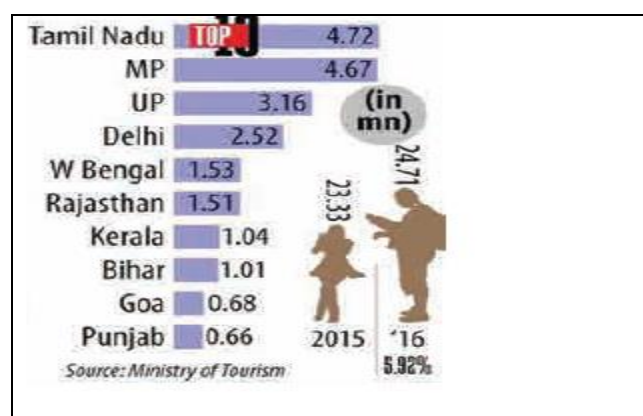
Tamil Nadu has since ancient past been a hub for tourism. In recent years, the state has emerged as one of the leading tourist destinations for both domestic and foreign tourists. Tourism in Tamil Nadu is promoted by Tamil Nadu Tourism Development Corporation (TTDC), a Government of Tamil Nadu undertaking. The State currently ranks the highest among Indian States with about 25 crore arrivals (in 2013). The annual growth rate of this industry stood at 16 per cent. Approximately 28 lakh foreign and 11 crore domestic tourists visit the State.

**Tourist arrivals in India 2016**

**Domestic tourist visits to States /UTs**



**Foreign tourist visits to States /UTs**



## Unemployment and Poverty

National average of unemployment rate stands at 50 and Tamil Nadu ranks 22nd with unemployment rate of 42 per 1000. There are different kinds of unemployment with different economic implications. All those aspects need to be studied to fully understand the employment situation.

Tamil Nadu is one of India's richest states. Since 1994, the state has seen a steady decline in poverty. Today, Tamil Nadu has lower levels of poverty than most other States in the country. After 2005, Tamil Nadu was among India's fastest growing states, with growth being driven mainly by services.

## Conclusion

The Tamil Nadu economy which is not rich in natural resources has good record of agricultural growth, industrial progress, infrastructural development and good record of robust growth of service sector especially banking, education, transport and tourism. It occupies top three ranks in health index, education, development of MSMEs. It has a good record of poverty alleviation and employment generation. However, India in general and Tamil Nadu in particular need to work more to eliminate female foeticide, reduce the population living in slums, sleeping on roadsides, beggars and rag pickers. Development is meaningless as long as the above eyesore continues.

<b>Population Growth in Tamil Nadu: At a Glance (2011 Census)</b>	
Total Population	72138958
Male	36158871
Female	35980087
Crude birth rate (per thousand)	15.7
Crude death rate (per thousand)	7.4
Growth Rate (per thousand)	8.3
Districts with Highest Population	(Chennai, Kancheepuram, Vellore and Thiruvallur)
Districts with Lowest Population	(Perambalur, The Nilgiris, Ariyalur and Theni)
Population Density (per sq km)	555 (2011), 480 (2001)
Maximum Density	Chennai (26903); Kanyakumari (1106)
Minimum Density	The Nilgiris (288); Thiruchirappalli (602)
Sex Ratio (per 1000 males)	995 females (2011) 987 females (2001)
District with Highest Sex Ratio	The Nilgiris (1041 females) Thanjavur (1031 females) Nagapattinam (1025 females)
District with Lowest Sex Ratio	Theni (900 females) Dharmapuri (946 females)

Child Sex Ratio (0-6 age group)	946 female children (2011) 942 female children (2001)
District with Highest Child Sex Ratio	The Nilgiris (985), Kanyakumari (964)
District with Lowest Child Sex Ratio	Cuddalore (896); Ariyalur (897)
Literacy Rate	80.33% (2011) 73.45% (2001)
Male Literacy	86.81% (2011) 82.33% (2001)
Female Literacy	73.86% (2011) 64.55% (2001)
District with Highest Literacy	Kanyakumari (92.14%); Chennai 90.33%)
District with Lowest Literacy	Dharmapuri(64.71%) Ariyalur (71.99%)

## Glossary

**Per capita Income** - In come per head (GSDP / Population)

**GSDP** -Money value of all goods and services produced annually in the State

**Neo natal Mortality**- Death of kids soon after delivery

**Infant Mortality Rate** -Death of children before completing one year after birth.

**Child Mortality Rate** - Death of child before the age of five

**C-D Ratio** - Ratio of Bank advances to deposits

**Bio-diesel** - Extraction of oil from plants like jatropha

**MSMEs** - Micro, Small and Medium Enterprises

**Micro Enterprise** - Enterprise with a capital investment, not exceeding 25 lakhs (These many change)

**Small Enterprise** - Unit with investment on plant and machinery above 25 lakhs but below 10 cr. (These many change)

**12<sup>th</sup> - Economics**  
**8. International Economic Organizations**

“Foreign capital infinitely prefers situations where the upside potential is vast, if risks must be taken to get in”.

- Rudi Dornbusch

**Introduction**

In the previous chapter, we have studied the basis of trade, gains from trade, terms of trade, BoP and foreign exchange. When trade takes place among countries, the developed countries always stand to gain and the LDCs suffer from adverse terms of trade as well as balance of payments and they affect their exchange rates. The Great Depression of 1930s and World War II led to purely nationalistic policies in which almost every country imposed trade restrictions, exchange controls and exchange depreciation so as to boost exports and to restrict imports considerably.

The Brettonwoods Conference proposed IMF, World Bank and International Trade Organisation (ITO) in 1944. The IMF and World Bank were started in 1945. Instead of ITO, an interim arrangement was made and named GATT (General Agreement on Tariff and Trade). The GATT was transformed into WTO (World Trade Organisation) from 1995. The IMF, IBRD and WTO headquarters are presented in the table.

Institution	Headquarters	Year of Establishment
International Monetary Fund	Washington D.C	1945
World Bank	Washington D.C	1945
World Trade Organisation	Geneva	1995

**International Monetary Fund**

The purpose of International Monetary Fund is to secure and promote economic and financial cooperation among member countries. The IMF was established to assist the member nations to tide over the Balance of Payments disequilibrium in the short term. At present, the IMF has 189 member countries with Republic of Nauru joined in 2016.

**Objectives Of IMF**

- i) To promote international monetary cooperation among the member nations.
- ii) To facilitate faster and balanced growth of international trade.
- iii) To ensure exchange rate stability by curbing competitive exchange depreciations.
- iv) To eliminate or reduce exchange controls imposed by member nations.
- v) To establish multilateral trade and payment system in respect of current transactions instead of bilateral trade agreements.
- vi) To promote the flow of capital from developed to developing nations.
- vii) To solve the problem of international liquidity.

## Functions of IMF

### i) Bringing stability in exchange rate

The IMF is maintaining exchange rate stability and emphasising devaluation criteria, restricting members to go in for multiple exchange rates and also to buy or sell gold at prices other than declared par value.

### ii) Correcting BOP Disequilibrium

The IMF is helping the member countries in eliminating or minimizing the short-period disequilibrium in their balance of payments either by selling or lending foreign currencies to the member nation.

### iii) Determining par values

IMF enforces the system of determination of par values of the currencies of the member countries. According to the Articles of Agreement of the IMF, every member nation should declare the par value of its currency in terms of gold or US dollars. Under this article, IMF ensures smooth working of the international monetary system, in favour of some developed countries.

### iv) Balancing demand and supply of currencies

IMF is entrusted with the important function of maintaining balance between demand and supply of various currencies. The Fund (IMF) can declare a currency as scarce currency which is in great demand and can increase its supply by borrowing it from the country concerned or by purchasing the same currency in exchange of gold.

### v) Reducing trade restrictions

The Fund also aims at reducing tariffs and other trade barriers imposed by the member countries with the purpose of removing restrictions on remittance of funds or to avoid discriminating practices.

### vi) Providing credit facilities

IMF is providing different borrowing and credit facilities with the objective of helping the member countries. These credit facilities offered by it include basic credit facility, extended fund facility for a period of three years, compensatory financing facility and structural adjustment facility.

The functions of the IMF are grouped under three heads.

1. Financial – Assistance to correct short and medium term deficit in BOP;
2. Regulatory – Code of conduct and
3. Consultative - Counseling and technical consultancy.

## Facilities offered by IMF

The Fund has created several new credit facilities for its members. Chief among them are:



### **(i) Basic Credit Facility:**

The IMF provides financial assistance to its member nations to overcome their temporary difficulties relating to balance of payments. A member nation can purchase from the Fund other currencies or SDRs, in exchange for its own currency, to finance payment deficits. The loan is repaid when the member repurchases its own currency with other currencies or SDRs. A member can unconditionally borrow from the Fund in a year equal to 25% of its quota. This unconditional borrowing right is called the reserve tranche.

### **Special Drawing Rights (SDRs)**

The Fund has succeeded in establishing a scheme of Special Drawing Rights (SDRs) which is otherwise called 'Paper Gold'. They are a form of international reserves created by the IMF in 1969 to solve the problem of international liquidity. They are allocated to the IMF members in proportion to their Fund quotas. SDRs are used as a means of payment by Fund members to meet balance of payments deficits and their total reserve position with the Fund. Thus SDRs act both as an international unit of account and a means of payment. All transactions by the Fund in the form of loans and their repayments, its liquid reserves, its capital, etc., are expressed in the SDR.

The achievements of the fund can be summed up in the words of Haien that 'Fund is like an International Reserve Bank.'

### **(ii) Extended Fund Facility**

Under this arrangement, the IMF provides additional borrowing facility up to 140% of the member's quota, over and above the basic credit facility. The extended facility is limited for a period up to 3 years and the rate of interest is low.

### **(iii) Compensatory Financing Facility**

In 1963, IMF established compensatory financing facility to provide additional financial assistance to the member countries, particularly primary producing countries facing shortfall in export earnings. In 1981, the coverage of the compensatory financing facility was extended to payment problem caused by the fluctuations in the cost of cereal inputs.

### **(iv) Buffer Stock Facility**

The buffer stock financing facility was started in 1969. The purpose of this scheme was to help the primary goods (food grains) producing countries to finance contributions to buffer stock arrangements for the stabilisation of primary product prices.

### **(v) Supplementary Financing Facility**

Under the supplementary financing facility, the IMF makes temporary arrangements to provide supplementary financial assistance to member countries facing payments problems relating to their present quota sizes.

### **(vi) Structural Adjustment Facility**

The IMF established Structural Adjustment Facility (SAF) in March 1986 to provide additional balance of payments assistance on concessional terms to the poorer member countries. In December 1987, the Enhanced Structural Adjustment Facility (ESAF) was set up to augment the availability of concessional resources to low income countries. The purpose of SAF and ESAF is to force the poor countries to undertake strong macroeconomic and structural programmes to improve their balance of payments positions and promote economic growth.

### **Achievements Of IMF**

The main achievements of International Monetary Fund are as follows:

#### **i) Establishment of monetary reserve fund**

The Fund has played a major role in achieving the sizeable stock of the national currencies of different countries. To meet the foreign exchange requirements of the member nations, IMF uses its stock to help the member nations to meet foreign exchange requirements.

#### **ii) Monetary discipline and cooperation**

The IMF has shown keen interest in maintaining monetary discipline and cooperation among the member countries. To achieve this objective, it has provided assistance only to those countries which make sincere efforts to solve their problems.

#### **iii) Special interest in the problems of UDCs**

The notable success of the Fund is the maintenance of special interest in the acute problems of developing countries. The Fund has provided financial assistance to solve the balance of payment problem of UDCs. However, many UDCs continue to be UDCs, while the developed countries have achieved substantial growth.

### **India and IMF**

Till 1970, India stood fifth in the Fund and it had the power to appoint a permanent Executive Director. India has been one of the major beneficiaries of the Fund assistance. It has been getting aid from the various Fund Agencies from time to time and has been regularly repaying its debt. India's current quota in the IMF is SDRs (Special Drawing Rights) 5,821.5 million, making it the 13th largest quota holding country at IMF with shareholdings of 2.44%.

Besides receiving loans to meet deficit in its balance of payments, India has benefited in certain other respects from the membership of the Fund.

### **International Bank For Reconstruction And Development (IBRD) or World Bank**

The International Bank for Reconstruction and Development (IBRD), otherwise called the World Bank(WB) was established in 1945 under the Bretton Woods Conference in 1944. The purpose is to bring about a smooth transition from a war-time to peace-time economy. It is known as a sister institution along with the International Monetary Fund. The membership in International Monetary Fund is a prerequisite to become a member of IBRD. The IBRD was established to provide long term financial assistance to member countries.



### **Objectives of IBRD**

#### **Objectives of the World Bank**

1. Reconstruction and Development
2. Encouragement to Capital Investment
3. Encouragement to International Trade
4. Establishment of Peace-time Economy
5. Environmental Protection

The following are the objectives of the World Bank:

1. To help member countries for economic reconstruction and development.
2. To stimulate long-run capital investment for restoring Balance of Payments (BoP) equilibrium and thereby ensure balanced development of international trade among the member nations.
3. To provide guarantees for loans meant for infrastructural and industrial projects of member nations.
4. To help war ravaged economies transform into peace economies.
5. To supplement foreign private investment by direct loans out of its own funds for productive purposes.

#### **World Bank's Lending Procedure:**

The Bank advances loans to members in three ways

- i) Loans out of its own fund,
- ii) Loans out of borrowed capital and

iii) Loans through Bank's guarantee.

The Bank(WB) has changed its development loan strategy and lays more emphasis on financing schemes which directly influence the well being of poor masses of the member countries, especially the developing countries. The amount of agricultural loans has increased more rapidly than in any other sector. The bank now also takes interest in the activities of the development of rural areas such as:

- a) spread of education among the rural people
- b) development of roads in rural areas and
- c) electrification of the villages.

### **Functions of IBRD**

The World Bank performs the major role of providing loans for development works to member countries, especially to underdeveloped countries. The World Bank provides long-term loans for various development projects. Article 1 of the Agreement states the functions performed by the world bank as follows.

#### **1. Investment for productive purposes**

The World Bank performs the function of assisting in the reconstruction and development of territories of member nations through facility of investment for productive purposes. It also encourages the development of productive facilities and resources in less developed countries.

#### **2. Balanced growth of international trade**

Promoting the long range balanced growth of trade at international level and the maintaining equilibrium in BOPs of member nations by encouraging international investment.

#### **3. Provision of loans and guarantees**

Arranging the loans or providing guarantees on loans by various other channels so as to execute important projects.

#### **4. Promotion of foreign private investment**

The promotion of private foreign investment by means of guarantees on loans and other investment made by private investors. The Bank supplements private investment by providing finance for productive purpose out of its own resources or from borrowed funds.

#### **5. Technical services**

The World Bank facilitates different kinds of technical services to the member countries through Staff College and experts.

## Achievements of World Bank

The World Bank is said to be successful in achieving its primary objective of reconstruction and development of war ravaged nations. It helped greatly in the reconstruction of Europe after the World War II. It has been providing the developed and developing countries the same treatment in the process of growth.

- i. It is noted that the Bank's membership has increased from the initial number of 30 countries to 68 countries in 1960 and to 151 countries in 1988. The IBRD has 189 member countries.
- ii. The Bank grants medium and long-term loans (i.e., payable over a period of 15-20 years) for reconstruction and development purposes to the member countries. The actual term of a loan depends upon the estimated useful life of the equipment or plant financed.
- iii. Initially the World Bank's loans were mainly directed at the European countries for financing their programmes of reconstruction. Later it changed its development loan strategy and lays more emphasis of financing schemes for the poor masses of the developing countries.
- iv. The World Bank grants loans to member countries only for productive purposes particularly for agriculture, irrigation, power and transport. In other words, the Bank strengthens infrastructure needed for further development.
- v. The International Development Association (IDA), the Soft Loan Window of the Bank provides loans to UDCs at very low rate of interest. However, the economic inequality among the member-countries goes on increasing. Many African countries are yet to improve their economic status.

## India and World Bank:

The name "International Bank for Reconstruction and Development" was first suggested by India to the drafting committee. Since then the two have developed close relationship with each other from framing the policies of economic development in India to financing the implementation of these policies. The World Bank has given large financial assistance to India for economic development. Special mention may be made of the assistance World Bank has given to India in the development of infrastructure such as electric power, transport, communication, irrigation projects and steel industry.

The World Bank has assisted a number of projects in India. The IFC has identified five priority areas, namely, capital market development, direct foreign investment, access to foreign markets, equity investments in new and expanding companies and infrastructure. The World Bank has also assisted India in accelerating programmes of poverty alleviation and economic development. Until China became the member of World Bank in 1980, India was the largest beneficiary of the World Bank assistance.

- INDIA & IBRD : A Sustainable Relationship
  - India is a member of four of the five constituents of the World Bank Group.
  - International Bank for Reconstruction and Development (IBRD, 1945)

- International Development Association (IDA, 1960)
- International Finance Corporation (IFC, 1956)
- Multilateral Investment Guarantee Agency (MIGA, 1958)
- International Centre for Settlement of Investment Disputes (ICSID, 1966)
- [India is not its member]
- India is one of the founder members of IBRD, IDA and IFC. World Bank assistance in India started from 1948 when a funding for Agricultural Machinery Project was approved.
- First investment of IFC in India took place in 1959 with US\$ 1.5 million.
- India became a member of MIGA in January 1994.
- India has an Executive Director, in the Board of Directors of IBRD / IFC / IDA/ MIGA.

## World Trade Organization

The WTO was established in 1995 as a successor to the GATT. It is a new international organization set up as a permanent body and is designed to play the role of watch dog in the spheres of trade in goods and services, foreign investment and intellectual property rights. The Dunkel Draft, formulated by Arthur Dunkel, its Secretary General became the base for WTO.

Every two years, the member countries' Commerce Ministers Conference are being organized to discuss and settle the important issues and trade related matters. The first WTO conference was held at Singapore in 1996. The recent conference was held at Argentina in 2017. It was planned to organize 12th ministerial conference at Kazakhstan in 2020.

## Objectives of WTO

The basic aim is to expand international trade and bring about economic prosperity by liberalizing trade restrictions.

- To ensure reduction of tariff and other barriers.
- To eliminate discrimination in trade.
- To facilitate higher standard of living.
- To facilitate optimal use of world's resources.
- To enable the LDCs to secure fair share in the growth of international trade.
- To ensure linkages between trade policies, environmental policies and sustainable development.

## WTO Agreements

### Agreement on Trade Related Intellectual Property Rights (TRIPs)

Intellectual Property Rights include copy right, trade marks, patents, geographical indications, trade secrets, industrial designs, etc. TRIPS Agreement provides for granting product patents instead of process patents. The period of protection will be 20 years for patents, 50 years for copy rights, 7 years for trade marks and 10 years for layout designs. As a result of TRIPS, the dependence of LDCs on advanced countries for seeds, drugs, fertilizers and pesticides has increased. Farmers are depending on the industrial firm for their seeds.

## **Agreement on Trade Related Investment Measures (TRIMs)**

TRIMs are related to conditions or restrictions in respect of foreign investment in the country. It calls for introducing equal treatment for foreign companies on par with national companies. TRIMs were widely employed by developing countries. Restrictions on foreign investment on following grounds are to be removed.

- No restriction on area of investment.
- No binding on use of local material.
- No mandatory exports.
- No restriction on repatriation of royalty, dividend and interest.
- No trade balancing requirement,
- i.e. imports not exceeding exports.

## **General Agreement on Trade in Services (GATS)**

GATS is the first multilateral set of rules covering trade in services like banking, insurance, transportation, communication, etc., All member countries are supposed to extend MFN (Most Favoured Nation) status to all other countries without any discrimination. Transparency should be maintained by publishing all relevant laws and regulations over services.

## **Phasing out of Multi Fibre Agreement (MFA)**

The multi fibre agreement governed the world trade in textiles and garments since 1974. It imposed quotas on export of textiles by developing nations to the developed countries. This quota system was to be phased out over a period of ten years. This was beneficial to India.

## **Agreement on Agriculture (AoA)**

Agriculture was included for the first time under GATT. The important aspects of the agreement are Tariffication, Tariff cuts and Subsidy reduction.

## **Dispute Settlement Body**

The Disputes Settlement Body puts an end to procedural delays. It is mandatory to settle any dispute within 18 months. The disputes are resolved through multilateral trading system. However, India has lost a huge export earnings because of the conditions laid out by the Body.

## **Functions of WTO**

**The following are the functions of the WTO**

- i. It facilitates the implementation, administration and operation of the objectives of the Agreement and of the Multilateral Trade Agreements.

- ii. It provides the forum for negotiations among its members, concerning their multilateral trade relations in matters relating to the agreements.
- iii. It administers the Understanding on Rules and Procedures governing the Settlement of Disputes.
- iv. It cooperates with the IMF and the World Bank and its affiliated agencies with a view to achieving greater coherence in global economic policy making.

### **Major WTO Functions**

- ❖ Administering WTO trade agreements
- ❖ Forum for trade negotiations
- ❖ Handling trade disputes
- ❖ Monitoring national trade policies
- ❖ Technical assistance and training for developing countries
- ❖ Cooperation with other international organizations

### **Achievements of WTO**

**The major achievements of WTO are as follows**

1. Use of restrictive measures for BoP problems has declined markedly;
2. Services trade has been brought into the multilateral system and many countries, as in goods, are opening their markets for trade and investment;
3. The trade policy review mechanism has created a process of continuous monitoring of trade policy developments.

### **WTO and India**

India is the founding member of the WTO. India favours multilateral trade approach. It enjoys MFN status and allows the same status to all other trading partners. India benefited from WTO on following grounds:

1. By reducing tariff rates on raw materials, components and capital goods, it was able to import more for meeting her developmental requirements. India's imports go on increasing.
2. India gets market access in several countries without any bilateral trade agreements.
3. Advanced technology has been obtained at cheaper cost.
4. India is in a better position to get quick redressal from the trade disputes.
5. The Indian exporters benefited from wider market information.

### **Trade Blocks**

- ❖ Some countries create business opportunities for themselves by integrating their economies in order to avoid unnecessary competition among them. Trade blocks cover different kinds of arrangements between or among countries for mutual benefit. Economic integration takes the form of Free Trade Area, Customs Union, Common Market and Economic Union.



- ❖ A free trade area is the region encompassing a trade bloc whose member countries have signed a free-trade agreement (FTA). Such agreements involve cooperation between at least two countries to reduce trade barriers. e.g. SAFTA, EFTA.
- ❖ A customs union is defined as a type of trade block which is composed of a free trade area with no tariff among members and (zero tariffs among members) with a common external tariff. e.g. BENELUX (Belgium, Netherland and Luxumbuang).
- ❖ Common market is established through trade pacts. A group formed by countries within a geographical area to promote duty free trade and free movement of labour and capital among its members. e.g. European Common Market (ECM)
- ❖ An economic union is composed of a common market with a customs union. The participant countries have both common policies on product regulation, freedom of movement of goods, services and the factors of production and a common external trade policy. (e.g. European Economic Union)

Institution	Headquarters	Year of Establishment
South Asian Association for Regional Cooperation (SAARC)	Kathmandu	1985
ASEAN	Bangkok	1967
BRICS	Shangai	2001

### South Asian Association For Regional Co-Operation (SAARC)

The South Asian Association for Regional Co-operation (SAARC) is an organisation of South Asian nations, which was established on 8 December 1985 for the promotion of economic and social progress, cultural development within the South Asia region and also for friendship and co-operation with other developing countries. The SAARC Group (SAARC) comprises of Bangladesh, Bhutan, India, The Maldives, Nepal, Pakistan and Sri Lanka. In April 2007, Afghanistan became its eighth member. The basic aim of the organisation is to accelerate the process of economic and social development of member states through joint action in the agreed areas of cooperation. The SAARC Secretariat was established in Kathmandu (Nepal) on 16th January 1987. The first SAARC summit was held at Dhaka in the year 1985. SAARC meets once in two years. Recently, the 20th SAARC summit was hosted by Srilanka in 2018.

### Objectives of SAARC

According to Article I of the Charter of the SAARC, the objectives of the Association are as follows:

- i. To promote the welfare of the people of South Asia and improve their quality of life;
- ii. To accelerate economic growth, social progress and cultural development in the region;
- iii. To promote and strengthen collective self-reliance among the countries of South Asia;
- iv. To contribute to mutual trust, understanding and appreciation of one another's problems;
- v. To promote active collaboration and mutual assistance in the economic, social, cultural, technical and scientific fields;
- vi. To strengthen co-operation with other developing countries;

- vii. To strengthen cooperation among themselves in international forums on matters of common interest;
- viii. To cooperate with international and regional organisations with similar aims and purposes.

### **Functions of SAARC**

The main functions of SAARC are as follows.

1. Maintenance of the co operation in the region
2. Prevention of common problems associated with the member nations.
3. Ensuring strong relationship among the member nations.
4. Removal of the poverty through various packages of programmes.
5. Prevention of terrorism in the region.

### **Achievements of SAARC**

1. The establishment of SAARC Preferential Trading Agreement (SAPTA) and reduction in tariff and non-tariff barriers on imports.
2. The setting up of Technical Committees for economic cooperation among SAARC countries relating to agriculture, communications, education, health and population, rural development, science and technology, tourism, etc.
3. SAARC has established a three-tier mechanism for exchanging information on poverty reduction programmes which is passed on to member countries.
4. SAARC Agricultural Information Centre (SAIC) in 1988 works as a central information institution for agriculture related resources like fisheries, forestry, etc.
5. South Asian Development Fund (SADF) for development projects, human resource development and infrastructural development projects. With all these tall claims, the inter-SAARC Trade has not gone beyond three percent in the last 30 years.

### **Association of South East Asian Nations (ASEAN)**

ASEAN was established on 8 August 1967 in Bangkok by the five original member countries: Indonesia, Malaysia, Philippines, Singapore and Thailand. Later Brunei Darussalam, Vietnam, Laos and Myanmar and Cambodia joined. Besides ten members of the ASEAN, there are six “dialogue partners” which have been participating in its deliberations. They are China, Japan, India, South Korea, New Zealand and Australia. The ASEAN nations are expected to benefit from the FTA as it will reduce tariff and non-tariff barriers. The common historical and cultural background made the member countries to maintain their unity and solidarity by establishing a trade block. Foreign trade is the life blood of the ASEAN countries following globalization and prudent macroeconomic policies. The ASEAN Summit of the Heads of Governments of member countries is the highest forum for ASEAN cooperation. Its meetings are held once in three years. The ASEAN \ministerial meeting of Foreign Ministers is the next highest decision-making body.

India's relationship with ASEAN started in 1992 when India became a "sectoral dialogue partner" of ASEAN. The geographic proximity of ASEAN countries to India facilitates faster exports and lower freight costs.

## Objectives of ASEAN

The ASEAN Declaration states the aims and purposes of the Association as:

- i. To accelerate the economic growth, social progress and cultural development in the region;
- ii. To promote regional peace and stability and adherence to the principles of the United Nations Charter;
- iii. To promote cooperation among the members of ASEAN through the exchange of knowledge and experience in the field of public sector auditing.
- iv. To provide a conducive environment and facilities for research, training, and education among the members
- v. To serve as a centre of information and as an ASEAN link with other international organizations.

## Functions of the ASEAN

- i. It facilitates free movement of goods, services and investments within ASEAN by creating a single regional market like the European Union.
- ii. It provides free access to the marketers of one member country to the markets of all other member countries, thus fostering growth in the region.
- iii. It improves business competitiveness between businesses from different countries and also narrow developmental gaps between member countries.
- iv. It paves way for market and investment opportunities for the member nations.
- v. It fosters co-operations in many areas including industry and trade.

All the ASEAN economies experienced a great economic crisis in the year 1997.

## BRICS

BRICS is the acronym for an association of five major emerging national economies: Brazil, Russia, India, China and South Africa. Originally the first four were grouped as "BRIC" before the induction of South Africa in 2010. The term 'BRIC' was coined in 2001. The BRICS members are known for their significant influence on regional affairs. Since 2009, the BRICS nations have met annually at formal summits. South Africa hosted the 10th BRICS summit in July 2018. The agenda for BRICS summit 2018 includes Inclusive growth, Trade issues, Global governance, Shared Prosperity, International peace and security.

It's headquarters is at Shanghai, China. The New Development Bank (NDB) formerly referred to as the BRICS Development Bank was established by BRICS States. The first BRICS summit was held at Moscow and South Africa hosted the Tenth Conference at Johannesburg in

July 2018. India had an opportunity of hosting fourth and Eighth summits in 2012 and 2016 respectively.

### **Objectives of BRICS**

1. To increase trade co-operation by making an exclusive trade block.
2. To use currency other than US Dollar. Since Dollar is a dominant currency and US can control the flow of dollar, BRICS helps in the countries operating with alternative currencies. How far have they succeeded in this respect? Not much.
3. To increase regional co-operation.
4. To create a separate trade block made for developing countries for trade co-operation.

### **Functions of BRICS**

1. It acts as a promoter of more legitimate international system and also advocating reform of the UN Security Council.
2. This group of nations is especially meant for South-South framework for cooperation.
3. It performs as an agent to bridge the increasing gap between developed and developing countries. For instance, in the WTO, the BRICS countries are emphasizing to promote a fair order regarding agricultural policies.
4. It performs a commendable contribution for assisting developing countries in gaining in areas such as an advantage in trade and climate change negotiations.
5. It disseminates information and exchange platform beyond economic cooperation.
6. It acts as a catalytic in protecting the interests of middle powers on global forum.

### **Achievements of BRICS**

**Following are some of the major achievements of BRICS.**

- The establishment of the Contingent Reserve Arrangement (CRA) has further deepened and consolidated the partnership of its members in the economic-financial area.
- In the sixth BRICS summit in Brazil, the member countries, signed an agreement to create a development bank (New Development Bank) with headquarters at Shanghai, China in 2015 on the lines of Asian Development Bank and the World Bank.
- The economic potential and demographic development are putting the BRICS countries, increasingly in a leading position in setting the global agenda and having a greater say in the global governance.

It has to be remembered that BRICS share 43% of world population, but only 21% of the global GDP.

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