Geography Class 04

REVISION OF THE PREVIOUS CLASS (9: 05 AM):

- Seasons are observed on the earth because the earth revolves around the sun with a tilted axis of rotation whose angle of inclination is always constant.
- The change of seasons on the surface of the earth is mainly due to variation in the length of day and night, and the variation in the intensity of sunlight.
- Regions that are receiving higher intensity of sunlight for a longer duration of time experience summer and those receiving lower power of the sun for a shorter duration of time experience winter

Equinox:

 It is the position of the earth where the earth's axis of rotation is neither tilted towards the sun nor away from the sun.

Summer solstice:

- 21 June- Sunrays fall vertically at 23.5 degrees north and decrease towards the north pole.
- All the places to the north of the equator receive higher sunlight intensity.
- The length of the day and night is 12 hours at the equator.
- The length of the day increases from the equator to the north pole.

Winter Solstice:

- 22nd December- Sunrays fall vertically at 23.5 degrees south and decrease to the south poles.
- All the places to the north of the equator receive sunlight at a lower intensity.
- The length of the day is 12 hours along the equator and it decreases from the equator towards the north pole.

Equinox:

- During the equinox, the sun's rays fall vertically at the equator.
- All the latitudes towards the north and south of the equator receive an equal duration of day and night.
- The Spring equinox is on the 21st of March and the Autumn equinox is on the 23rd of September.
- Sun rays fall vertically on the Equator. All the latitudes experience an equal duration of day and night.

Overhead sun:

- The position of the overhead sun varies between the Tropic of Cancer and the Tropic of Capricorn.
- Every place located in the tropics receives 90 degrees of sunlight for two days a year.
- And those which are located exactly in the tropics receive 90 degrees of sunlight for 1 day a year.

Time zones in different countries:

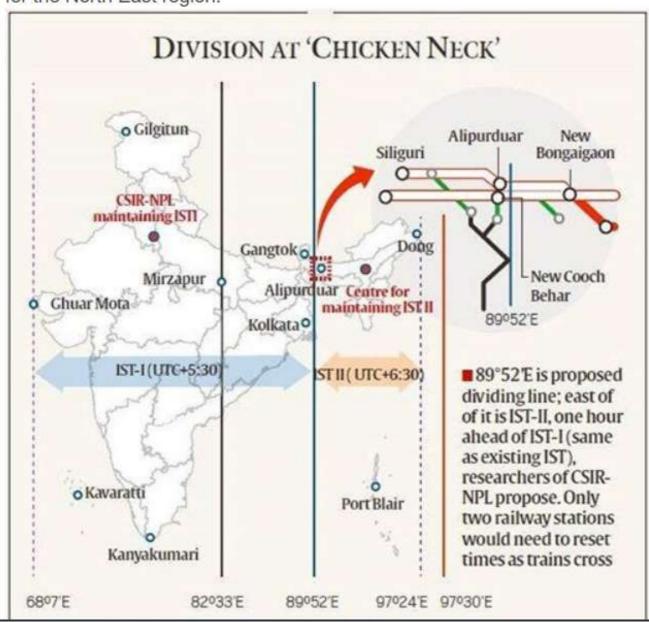
- Any country generally prefers to stay in a single time zone for administrative and technical convenience.
- France has the highest number of time zones- 12.
- USA and Russia have 11 time zones.

Indian Standard Meridian:

- The Indian Standard Meridian passes through 82.5 degrees east- Mirzapur, Uttar Pradesh.
- The longitudinal extent of India is about 30 degrees from east to west- 2933 kilometers, which sums up to around two hours of time.
- Considering the longitudinal extent, India should have more than one time zone to maximize the solar daytime.

India and different time zones:

- India used to have three time zones till 1906- Bombay, Madras, and Calcutta time zones.
- India also had a local Chai Bagan Time in Assam.
- In 1906, India adopted 82.5 degrees East longitude as its standard meridian.
- Local times of Calcutta and Bombay continued till 1955.
- Even the National Physical Laboratory has recommended a separate time zone for the North East region.



ISSUES WITH MULTIPLE TIME ZONES (9:30 AM):

- · Issues with economic integration through banking trade stock markets etc.
- Issues in synchronization of transportation such as railways.
- Administrative convenience- timings of government offices, schools, and offices, etc.
- · Security issues- better communication.

Calculating time at different places:

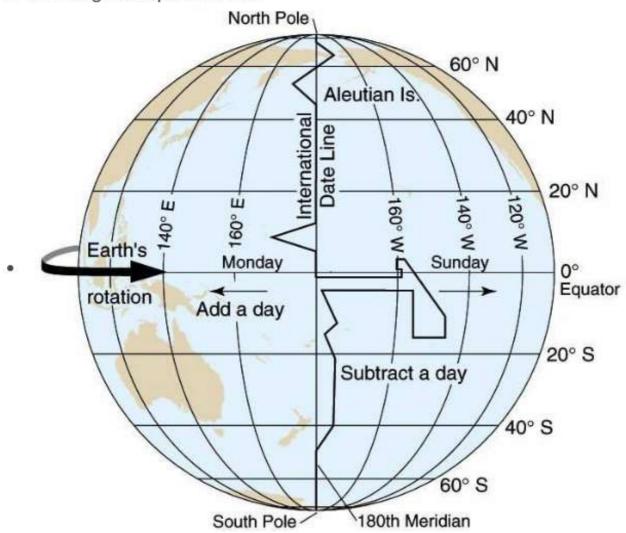
- If the time in Mirzapur is 6 PM, what is the present time at Toronto at 77.5 degrees west longitude?
- · Approach:
- We need to first find the difference in latitudes.
- Mirzapur(82.5 degrees east) and Toronto(77.5 degrees west) are 160 degrees apart.
- The 1-degree difference is of around 4 minutes.
- 160 degrees will give us a difference of 10 hours & 40 minutes(640 minutes).
- We need to go back in time by 10 hours 40 minutes because we are moving from East to West.
- Hence we will get 7:20 AM.

International Date Line(IDL):

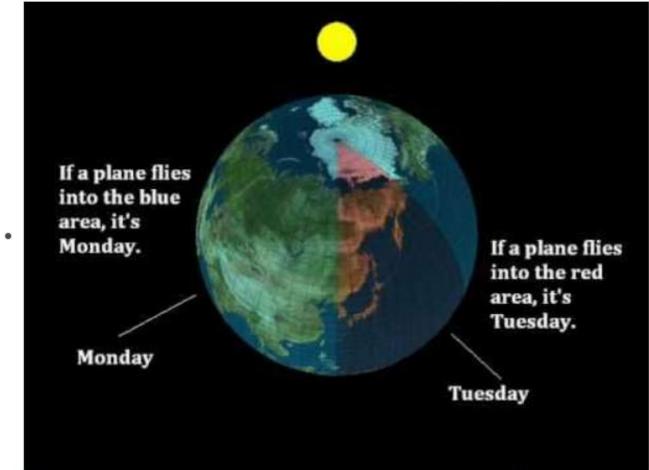
- It is an imaginary line of demarcation running from the North Pole to the South Pole.
- · It demarcates the change of calendar day.
- · It was agreed upon in 1884.

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- The IDL roughly follows 180 Degrees East /180 Degrees West longitude.
- It is not a straight line and it follows a slightly zig-zag path to accommodate the islands in the Pacific Ocean.
- A linear IDL would have meant that there would have been two different dates for the same island.
- It is the line where the date changes exactly by one day when crossed.
- When a traveler crosses it from East to West, a day is lost.
- When a traveler crosses it from West to East, a day is gained.

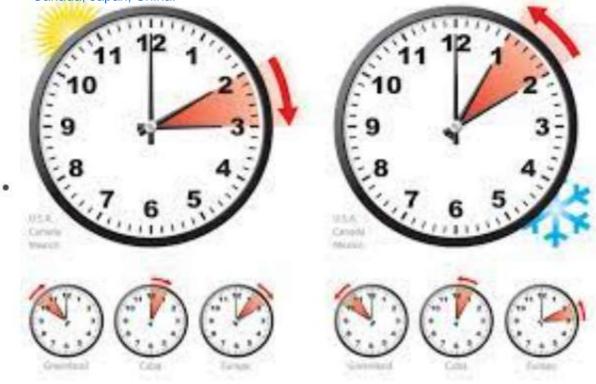


The east, and west used above is with references to the IDL only.

DAYLIGHT SAVING TIME (10:10 AM):

- The clocks are forwarded in summer for better use of natural light and conservation of energy, particularly during the evening.
- It is mainly practiced in temperate countries with a sufficient variation of day length between summer and winter.
- Normally in winter daylight period is much shorter, and the night is much longer.
- Whereas in summer, the daylight period is much longer, and nights are shorter.

• Temperate Countries:- Which are in between the latitude from 23.5 degree and 66.5 degree . ex:- North America, Canada, Japan, China.



Example of Daylight Saving Time:

- Our aim remains that the office employees spend the day in the office, while it is still daytime, as the productivity gets higher.
- We assume that the office timings will remain same all round the year.
- Assume that the common office timings are 10 AM-6 PM, and the average times of sunrise and sunset are 5 AM and 6 PM.
- During winter, in the northeast, the sun will rise at 6 AM and it may set at 5 PM.
- So if the office timing is still 10
 AM-6 PM, the workers will work
 for one hour (5 PM-6 PM) when it
 will be night, and their
 productivity will be less.
- But if we set the watches of northeast backward by one hour, it will show 6 PM there, even when actually it would be 5 PM as per Indian standard time.
- So even that one hour would be utilized, and people will work in the office while still there is still day.

MILANKOVITCH CYCLES (10:30 AM):

- The cyclical changes observed during the earth's circumnavigation around the sun are called Milankovitch cycles.
- · It involves variations in:
- I. Eccentricity: Shape of the earth's robot around the sun.
- It is visible after around 1 lakh years.
- . II. Obliquity: Inclination of the earth's axis.
- It is visible after around 41 thousand years.
- III. Precession: Earth's slow wobble during its spinning motion.
- It is visible after around 26 thousand years.

CHANGES IN AXIAL PROCESSION (WOBBLE) IN A 26,000-YEAR CYCLE

CHANGES IN ECCENTRICITY (ORBIT SHAPE) IN A 100,000-YEAR CYCLE

CHANGES IN OBLIQUITY (TILT) IN A 41,000-YEAR CYCLE

CYCLE

Impact of these cycles:

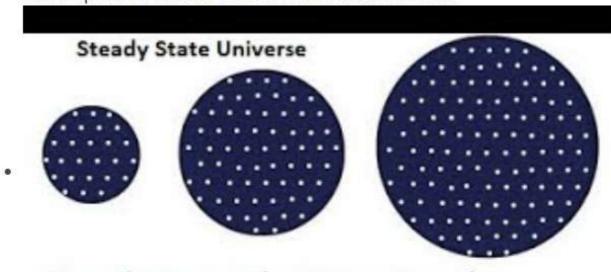
- The severity of seasons changes due to variations in the amount of sunlight received on the earth.
- Long-term climatic changes.

UNIVERSE (11:00 AM):

- The universe is the limitless expanse of all of space, and all the matter around us.
- It consists of the solar system, stars, galaxies, dark matter, dark energy, etc.
- There are estimated 100-400 billion galaxies, and each galaxy has around 100-400 billion stars.
- Proxima Centauri is the second nearest star in our galaxy which is 4.2 light years away.
- It could take around 25000 years to reach Proxima Centauri.
- · There have been various theories regarding the origin of the universe:

Steady State Theory:

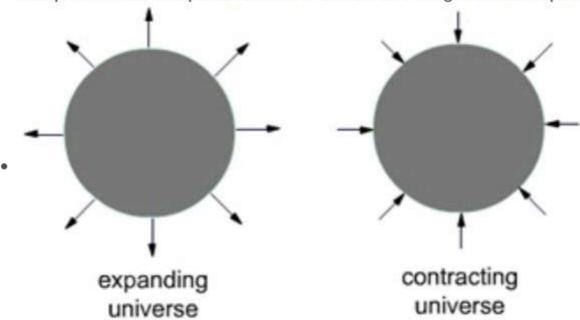
- It was proposed by Fred Hoyle.
- The theory says that the overall size and mass of the universe remain constant at any point in time.
- · The universe has no beginning and no end.
- In this Universe model, matter is always created to form galaxies and stars at the same speed as the old ones become unobservable.



New galaxies created as Universe Expands

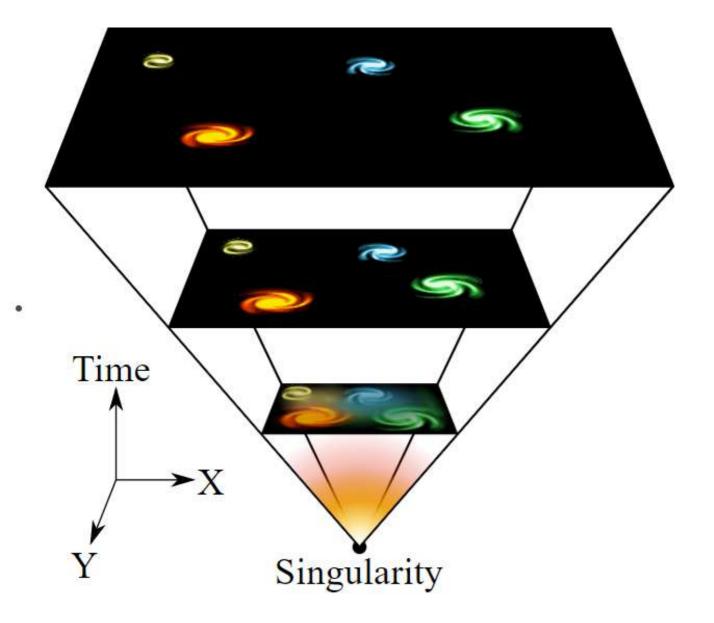
Pulsating Theory:

- It was proposed by Arthur Eddington.
- Even this theory suggests that the universe has no beginning and no end.
- The theory suggests that the universe expands and contracts alternatively.
- · It expands due to explosion and it contracts due to gravitational pull.



BIG BANG THEORY (11:30 AM):

- It was first proposed by Georges Lemaitre in 1927.
- · The universe started as a very hot and dense point known as the singularity.
- There was no other space and time.
- 13.7 billion years ago, a cosmic explosion called the big bang happened.
- The name "Big Bang" was coined by Fred Hoyle.
- Fred Hoyle's steady state theory was actually given by him in opposition to the big bang theory.



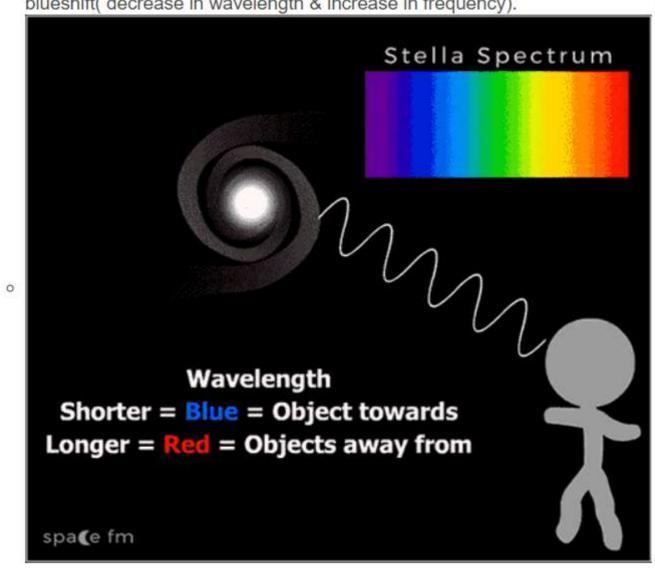




- · Evidence for the theory was given by Hubble.
- For the evidence, the concept of the Doppler effect in light was used.

Doppler Effect in light:

- This refers to the change in the observed frequency of light caused by the relative movement between the emitter of the light and the observer of the light.
- This can be seen through the red shift and blue shift.
- When an object is moving away from us, the light from the object gives us a redshift(increase in wavelength & decrease in frequency).
- When an object is moving towards us, the light from the object gives us a blueshift(decrease in wavelength & increase in frequency).



- After the big bang, the universe started to expand and is still continuing today.
- The expansion subsequently led to the forces of physics, elementary particles, atoms, molecules, gaseous clouds, stars, and galaxies.
- Hubble in 1929 proposed that all observable stars and galaxies are moving away from the Earth.
- This was observed through the redshift observed from faraway stars
- The rate of expansion of the universe is not constant, and it is called **Hubble's** constant.

Cosmic Microwave Background:

- It is the evidence supporting the big bang theory.
- It refers to faint uniform radiation that permeates the entire universe and originated after the big bang.
- As the universe expands, this radiation has undergone a redshift to a microwave range.

The topics for the next class are Stars, Galaxies & Solar systems