UPSC 2021 Preparation
Types of Orbits

India's first Geo Imaging Satellite (GISAT) is to be placed in Geostationary Orbit (GEO) in April/May 2021. This has brought types of orbits to the news. IAS Exam aspirants must know what are all the types of orbits as the topic comes under Science and Technology subject.

To know the types of questions that have already been asked in the prelims from Science and Technology, candidates can check previous years' Science and Technology Questions in UPSC Prelims [2013-2020].

Types of Orbits for UPSC

The list of orbits is given below:

1. Geostationary Orbit (GEO)
2. Low Earth Orbit (LEO)
3. Medium Earth Orbit (MEO)
4. Sun Synchronous Orbit (SSO)
5. Geostationary Transfer Orbit (GTO)

The characteristics of the above-mentioned types of orbits are given below:

GEO – Geostationary Earth Orbit

- It is also called Geosynchronous Equatorial Orbit.
- It is a low inclination orbit.
- It makes satellites placed in it appear 'Stationary'. [Reason – They have an orbital period that is the same as the earth's rotation period. Hence, the satellite/spacecraft returns to the same point in the sky at the same time each day.]
- Communication satellites are often placed in GEO. [Reason – This makes it easy for Earth Antennas to track them without rotation]
- The GEO satellites are directly overhead at the Earth's equator. [To an observer who is near to the pole, these will appear lower in the sky.]
- ISRO's Indian National Satellite System [INSAT] is placed in GEO. [It is one of the largest domestic communication satellite systems in the Asia-Pacific region.]

Learn more about Indian Spacecrafts in the linked article.

Low Earth Orbit (LEO)

- It is relatively closer to the Earth's surface than other orbits.
- The altitude from the earth's surface could be between 160 Km to 1000 Km.
- The satellites placed in LEO can have a tilted plane.
- It is one of the commonly used orbits. [Reason – The satellites placed in it have more available routes as they don't have to follow a particular path around the Earth as the GEO]
- It is used for satellite imaging. [The images are of high resolution as the orbit is closer to the surface of the earth.]
- The International Space Station (ISS) uses LEO [It makes travel of astronauts easier]

- It is used by remote sensing satellites.

Medium Earth Orbit (MEO)

- The orbit, altitude of which is between LEO and GEO, is known as Medium Earth Orbit.
- It is also known as Intermediate Circular Orbit.
- It shares the similarity with LEO as the MEO satellites too do not have to track the path along the earth's equator.
- Navigation satellites and a number of artificial satellites are placed in MEO.
- Global Positioning System (GPS) is placed in MEO (20200 Km)
- Communication satellites too can be placed here. (Example – O3b MEO Satellite Constellation)

Polar Orbit & Sun-Synchronous Orbit (SSO)

- The SSO satellites travel past earth from north to south instead of west to east.
- These pass roughly over the earth's poles.
- The altitude can go as low as 200 Km however; mostly the satellites are placed between 600-800 km.
- As the name suggests, the SSO satellites are in synchrony with the sun. [Meaning – The position is 'fixed' relative to the sun.]
- SSO satellites always visit the same spot at the same local time as they are sun-synchronous.
- It is used for imaging, spy, and weather satellites.

Geostationary Transfer Orbit (GTO)

- The orbits are used by the satellites to travel from one orbit to another. It is a Hohmann Transfer Orbit between LEO and GSO.
- GTO provides satellites a halt [intermediate step] before they can be placed in their destination orbit. This way, it uses relatively less energy from built-in motors.
- The launchers do not have to directly place a satellite into GEO. Instead, it can first make use of GTO.
- It is a highly eccentric orbit. [Meaning – The path is elliptical]

How to approach this topic for UPSC Prelims?

In the UPSC Prelims of 2018, 2016, there were questions on Indian Regional Navigation Satellite System (IRNSS), ASTROSAT respectively. The questions expect candidates to know about orbits as well.

1. With reference to the Indian Regional Navigation Satellite System (IRNSS), consider the following statements: (Set-D)

(1) IRNSS has three satellites in geostationary and four satellites in geosynchronous orbits.

(2) IRNSS covers entire India and about 5500 sq. km beyond its borders.

(3) India will have its own satellite navigation system with full global coverage by the middle of 2019.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) None

2. With reference to `Astrosat', the astronomical observatory launched by India, which of the following statements is/are correct?

(1) Other than the USA and Russia, India is the only country to have launched a similar observatory into space.

(2) Astrosat is a 2000 kg satellite placed in an orbit at 1650 km above the surface of the Earth.

Select the correct answer using the code given below.

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Hence, knowledge of types of orbits for IAS Prelims can be a step in the right direction as questions are plausible to be designed around these too.

For the prelims examination, these facts are important; hence candidates should download the PDF given below for revision: