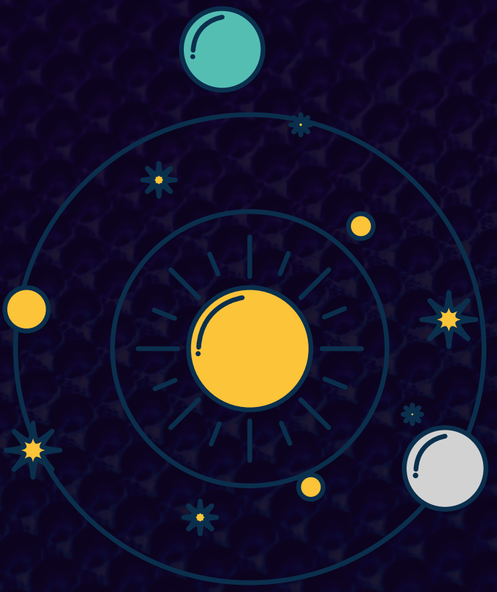
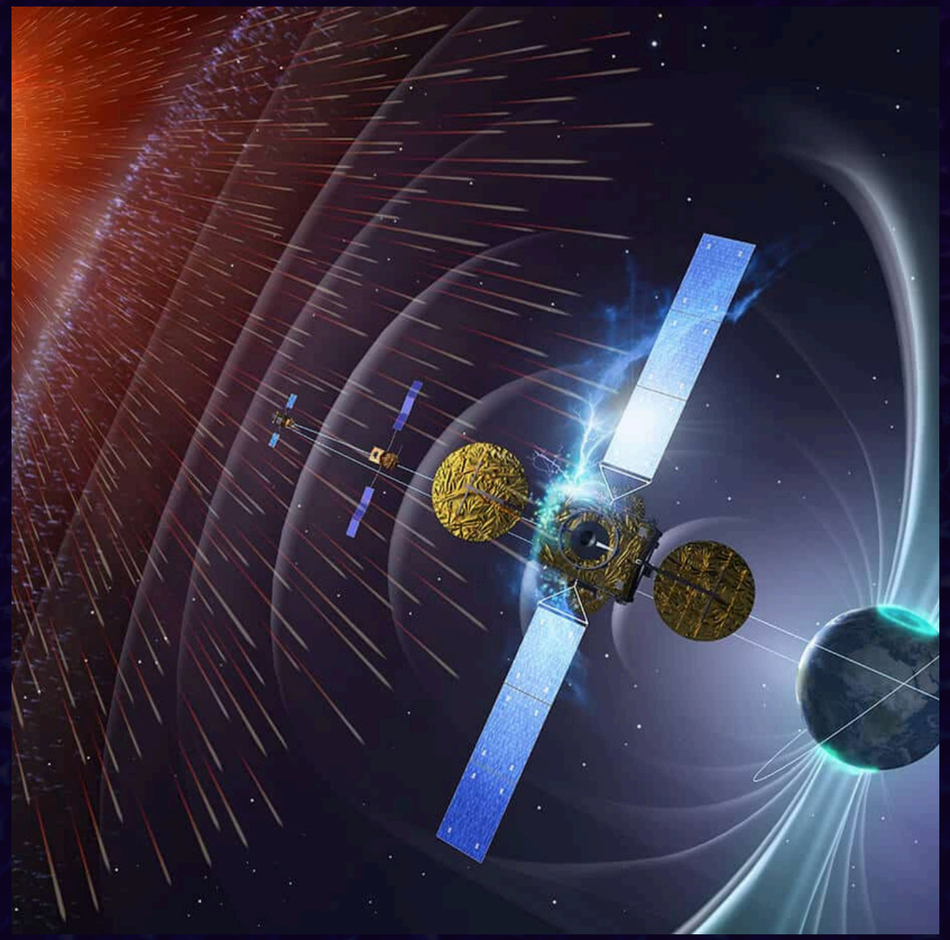


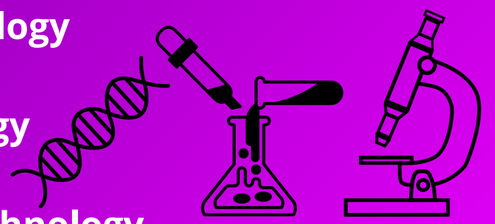
SCIENCE AND TECHNOLOGY

Er.Ashish Singh



SCIENCE & TECHNOLOGY UPSC SYLLABUS PRE+MAINS

- **Topic-1-Space Technology**
- **Topic-2-Energy-Nuclear Energy & Alternative Sources of Energy**
- **Topic-3-Defence Technology**
- **Topic-4-ICT(Information & Communication Technology)**
- **Topic-5-Nano Technology**
- **Topic-6-Robotics & AI**
- **Topic-7-Bio Technology**
- **Topic-8-IPR-Patent**
- **Topic-9-Science & Technology Policy,Achievements of Indians in field of Science & Technology**

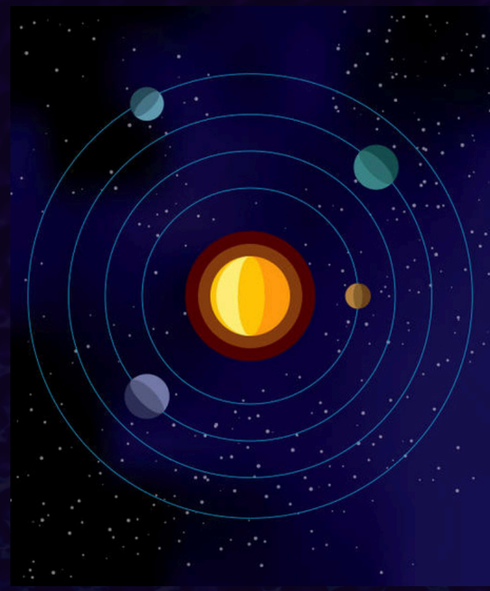


SPACE TECHNOLOGY

SUB TOPICS:

- Orbits & related concepts
- Indian Space Resarch Programme
- Launch Vehicle Technology
- Satellite System
- INSAT/GSAT
- IRSS/EOS
- Space Mission
- Navigation System
- Space Technology Organisations
- Space Laws

BASICS/ORBITS RELATED CONCEPTS



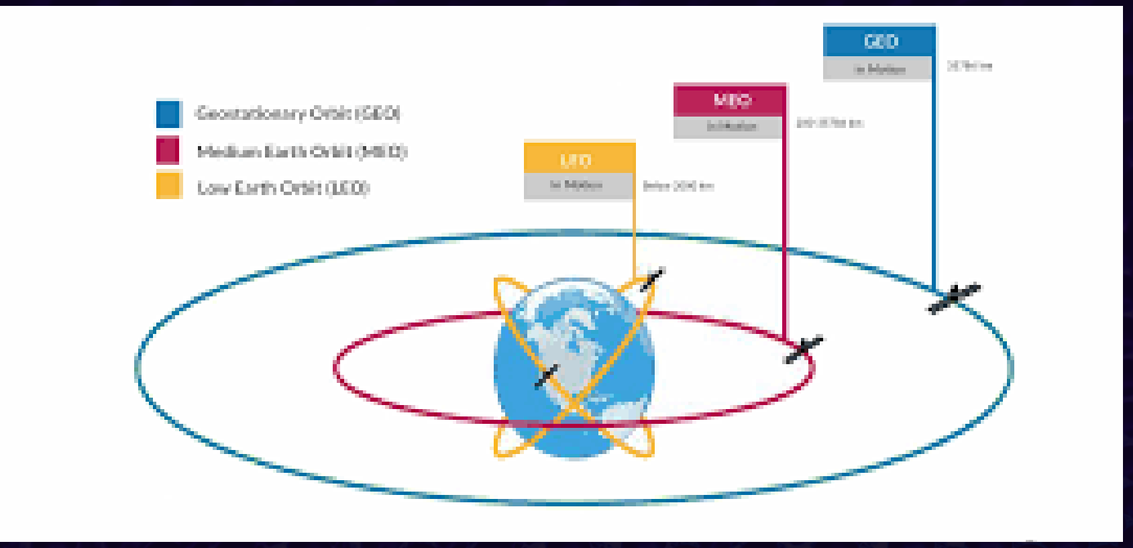
ORBIT :
PATH OF A SATTELITE

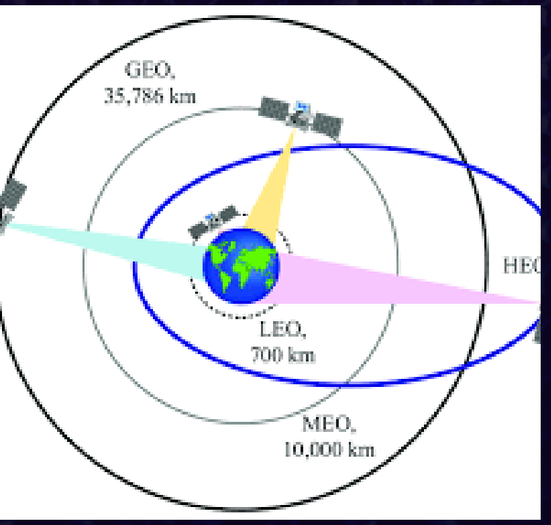
TYPES OF ORBITS

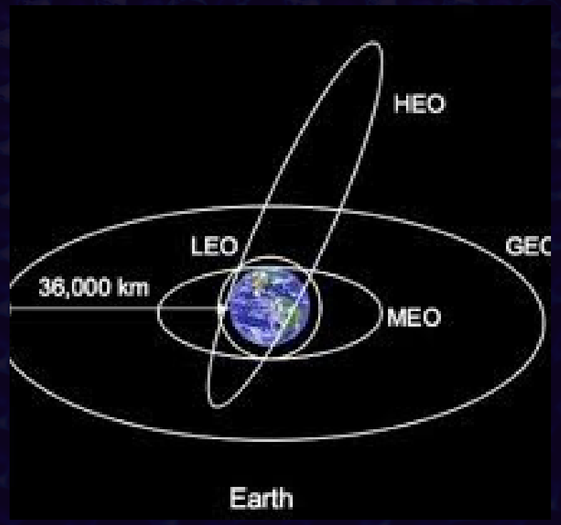
01 CIRCULAR ORBIT

02 ELLIPTICAL ORBIT

KINDS OF ORBITS AND ITS USAGE







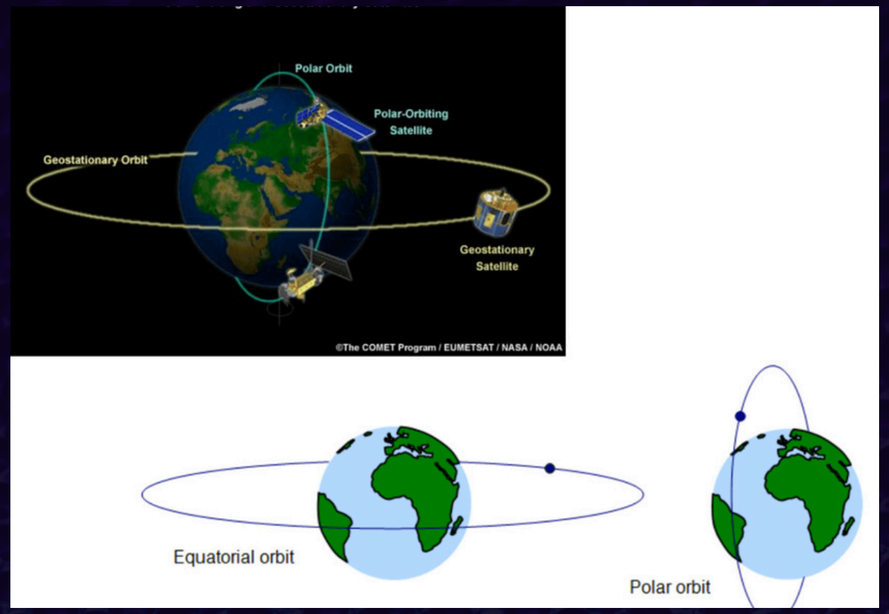
01 LEO : REMOTE SENSING APPLICATIONS

02 MEO : MAINLY NAVIGATION SYSTEM

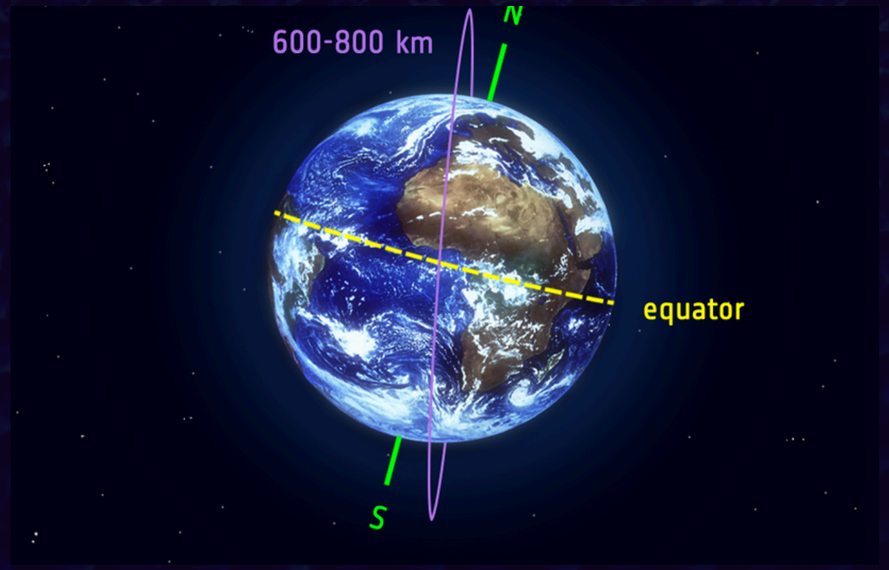
03 GEO : COMMUNICATION SYSTEM

04 HEO : RESEARCH STUDIES

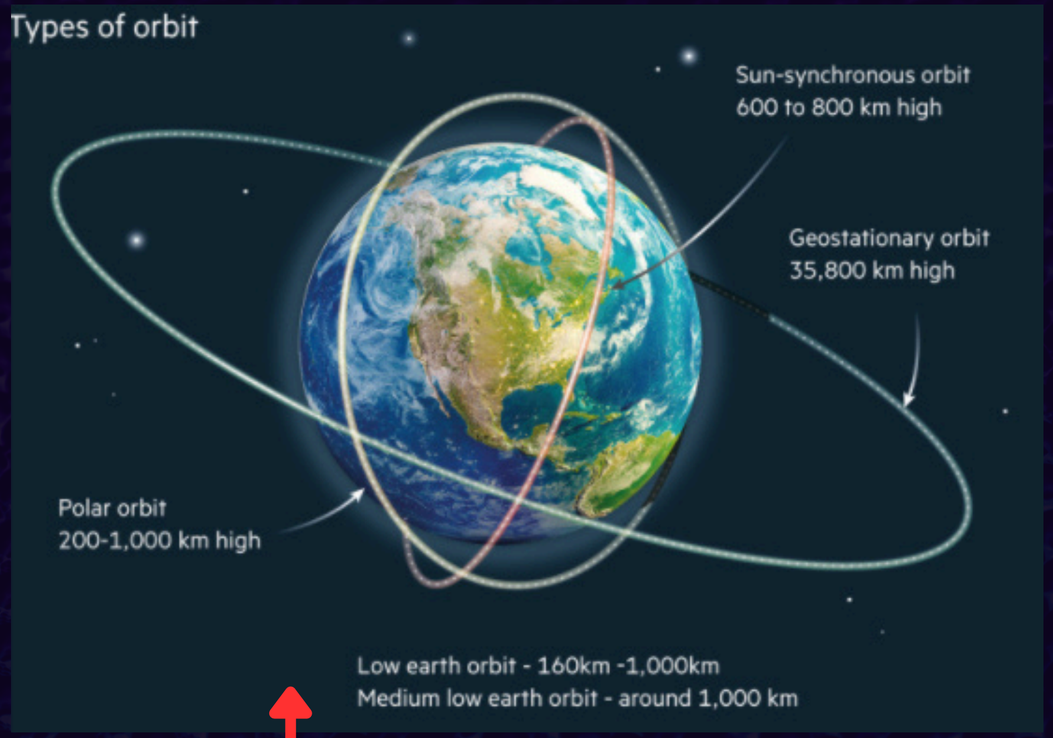
1. POLAR ORBIT



2.GEOSTATIONARY ORBIT

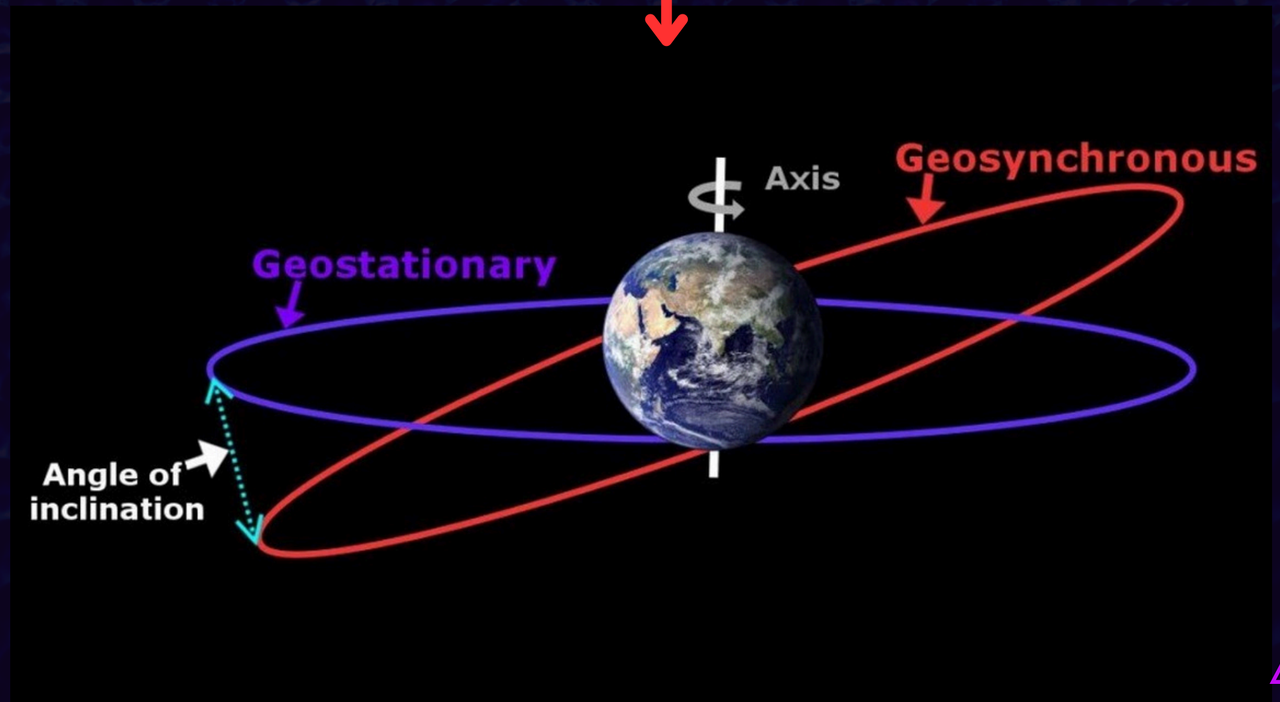


SYNCHRONOUS ORBIT CONCEPT



SUN SYNCHRONOUS ORBIT

GEO SYNCHRONOUS ORBIT



UPSC PRE 2011 QS

Q.Satellites used for telecommunication relay are kept in a geostationary orbit. A satellite is said to be in such an orbit when: (2011)

1. The orbit is geosynchronous.
2. The orbit is circular,
3. The orbit lies in the plane of the Earth’s equator.
4. The orbit is at an altitude of 22,236 km.

Select the correct answer using the codes given below:

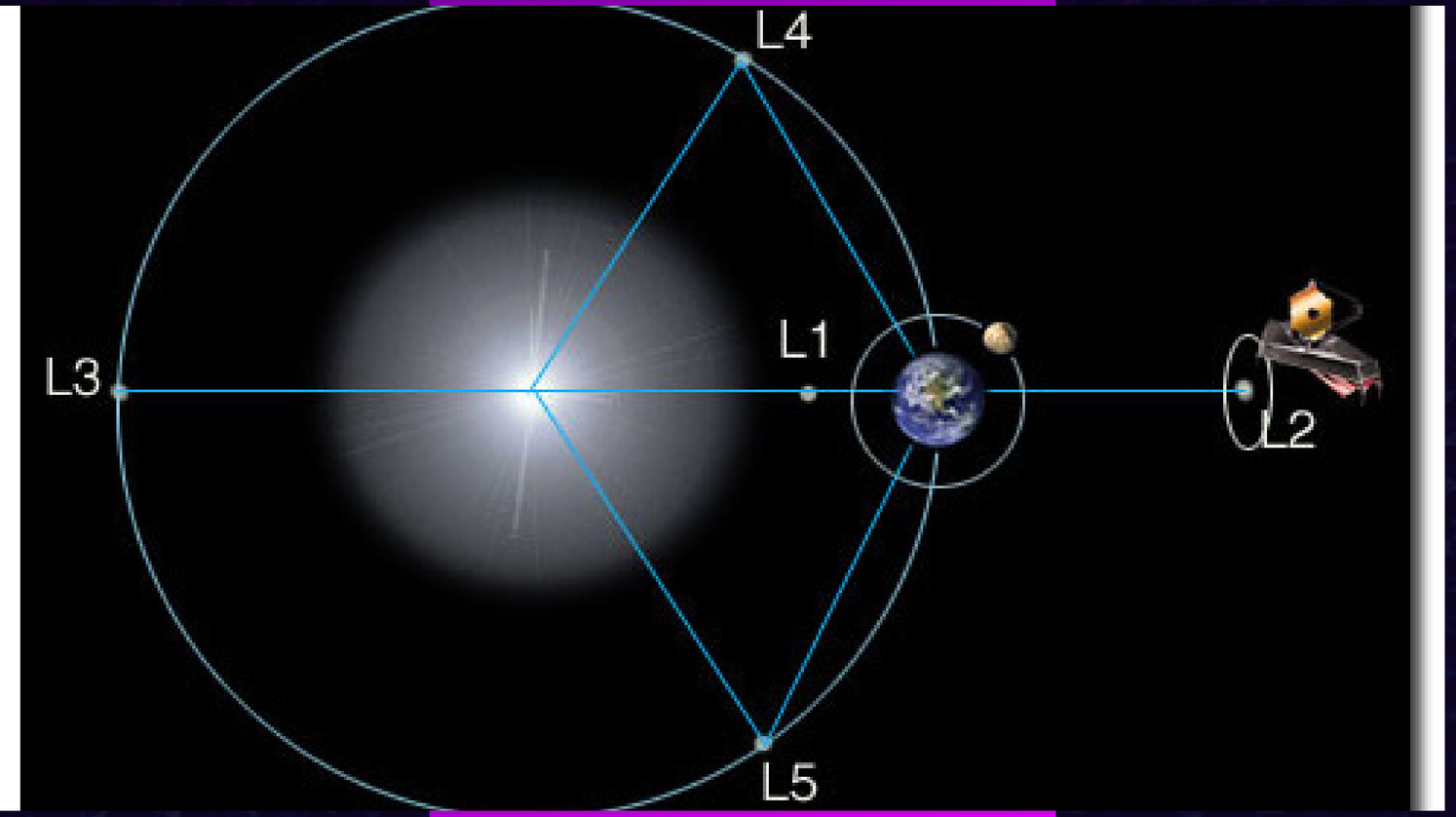
(a.) 1, 2 and 3 only

(b.) 1, 3 and 4 only

(c.) 2 and 4 only

(d.) 1, 2,3 and 4

HALO ORBIT



LAGRANGES POINTS

Lagrange points (also Lagrangian points, L-points, or libration points) are points near two large orbiting bodies. Normally, the two objects exert an unbalanced gravitational force at a point, altering the orbit of whatever is at that point. At the Lagrange points, the gravitational forces of the two large bodies and the centrifugal force balance each other

OTHER ORBITS

1. PROGRADE ORBIT
2. RETROGRADE ORBIT 3.INCLINED ORBIT
   - NON-INCLINED ORBIT
   - HIGHLY INCLINED ORBIT
4. ‘MOLINIYA’ ORBIT
5. EXO ORBIT
6. JUNK ORBIT/DISPOSAL ORBIT/GRAVEYARD ORBIT

INDIAN SPACE RESEARCH PROGRAMME

- LAUNCH VEHICLE TECHNOLOGY
- INSAT/GSAT
- IRSS
- SPACE MISSION

LAUNCH VEHICLE TECHNOLOGY

SLV-3

Height : 22.7m
Lift-off weight : 17 t
Propulsion : All Solid
Payload mass : 40 kg
Orbit : Low Earth Orbit

ASLV

Height : 23.5m
Lift-off weight : 39 t
Propulsion : All Solid
Payload mass : 150 kg
Orbit : Low Earth Orbit

PSLV-XL

Height : 44m
Lift-off weight : 320 t
Propulsion : Solid & Liquid
Payload mass : 1860 kg
Orbit : 475 km Sun Synchronous Polar Orbit (1300 kg in Geosynchronous Transfer Orbit)

GSLV Mk II

Height : 49m
Lift-off weight : 414 t
Propulsion : Solid, Liquid & Cryogenic
Payload mass : 2200 kg
Orbit : Geosynchronous Transfer Orbit

GSLV Mk III

Height : 43.43 m
Lift-off weight : 640 t
Propulsion : Solid, Liquid & Cryogenic
Payload mass : 4000 kg
Orbit : Geosynchronous Transfer Orbit

UPSC PRE 2018 QS-LAUNCH VEHICLE TECHNOLOGY

Q.With reference to India's satellite launch vehicles, consider the following statements:

1.PSLVs launch the satellites useful for Earth resources monitoring whereas GSLVs are designed mainly to launch communication satellites.

2.Satellites launched by PSLV appear to remain permanently fixed in the same position in the sky, as viewed from a particular location on Earth.

3.GSLV Mk III is a four-staged launch vehicle with the first and third stages using solid rocket motors; and the second and fourth stages using liquid rocket engines.

Which of the statements given above is/are correct?

(a) 1 only

(b) 2 and 3

(c) 1 and 2

(d) 3 only

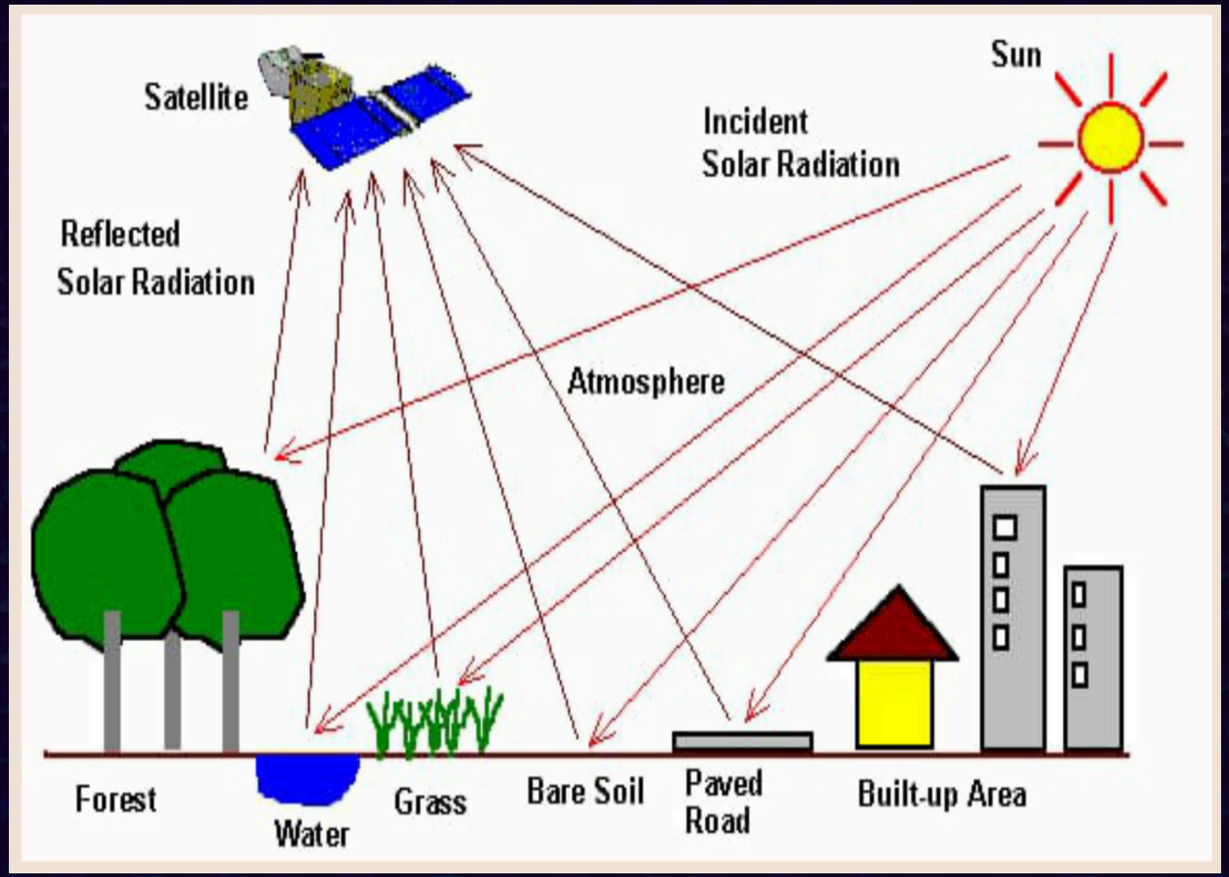
- Remote Sensing refers to the use of satellite- or to observe Earth.It includes the surface and the atmosphere and oceans, based on electromagnetic radiation.
- It mainly works in two way:

1.Active remote sensing

In this a signal is emitted by a satellite or aircraft to the object and its reflection is detected by the sensor).

2.Passive remote sensing

In this the reflection of sunlight is detected by the sensor



- India's remote sensing program was developed with the idea of applying space technologies for socio economic development of the country.
- The program involves designing, building and launching satellites to a Sun-synchronous orbit,to establish and operate ground stations for spacecraft control, data transfer along with data processing and to use the data obtained for various applications on the ground.

- Applications of Remote Sensing:

Agriculture and Soils
Renewable Energy
Forest & Environment
Land Resources
Ocean Science
Rural Development
Urban Development
Water Resources
Weather and Climate

▪ UPSC Pre 2024 Qs-Remote Sensing Satellite System

Q.Consider the following activities:

1. Identification of narcotics on passengers at airports or in aircraft
2. Monitoring of precipitation
3. Tracking the migration of animals

In how many of the above activities can the radars be used?

(a) Only one

(b) Only two

(c) All three

(d) None

UPSC Pre 2019 Qs-Remote Sensing Satellite System

Q.For the measurement/estimation of which of the following are satellite images/remote sensing data used?

1.Chlorophyll content in the vegetation of a specific location

2.Greenhouse gas emissions from rice paddies
of a specific location

3.Land surface temperatures of a specific location

Select the correct answer using the code given below.

(a) 1 Only

(b) 2 and 3 only

(c) 3 only

(d) 1, 2 and 3

UPSC Pre 2015 Qs-Remote Sensing Satellite System

Q.In which of the following activities Indain Remote Sensing Satellites (IRS) used?

1.Assesment of Crop productivity

2.Locating Groundwater resources

3.Mineral Exploration

4.Telecommunication

5.Traffic Studies

Select the correct answer using the codes given below:

(a) 1 ,2 and 3

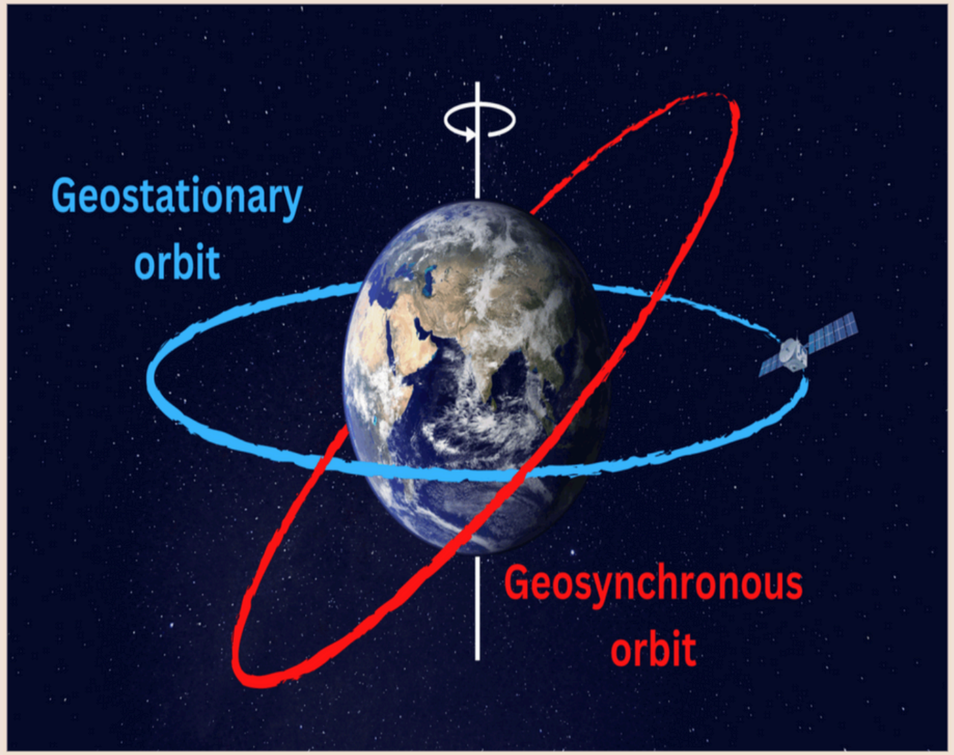
(b) 4 and 5 only

(c) 1 and 2

(d)1,2,3,4 and 5

INSAT

- Indian National Satellite System or INSAT, is a series of multipurpose geostationary satellites launched by the Indian Space Research Organisation (ISRO) for applications like telecommunications, broadcasting, meteorology, and search and rescue operations.
- It was commissioned in 1983, INSAT is the largest domestic communication system in the Indo-Pacific Region.
- It is a joint venture of the Department of Space, Department of Telecommunications, India Meteorological Department, All India Radio and Doordarshan

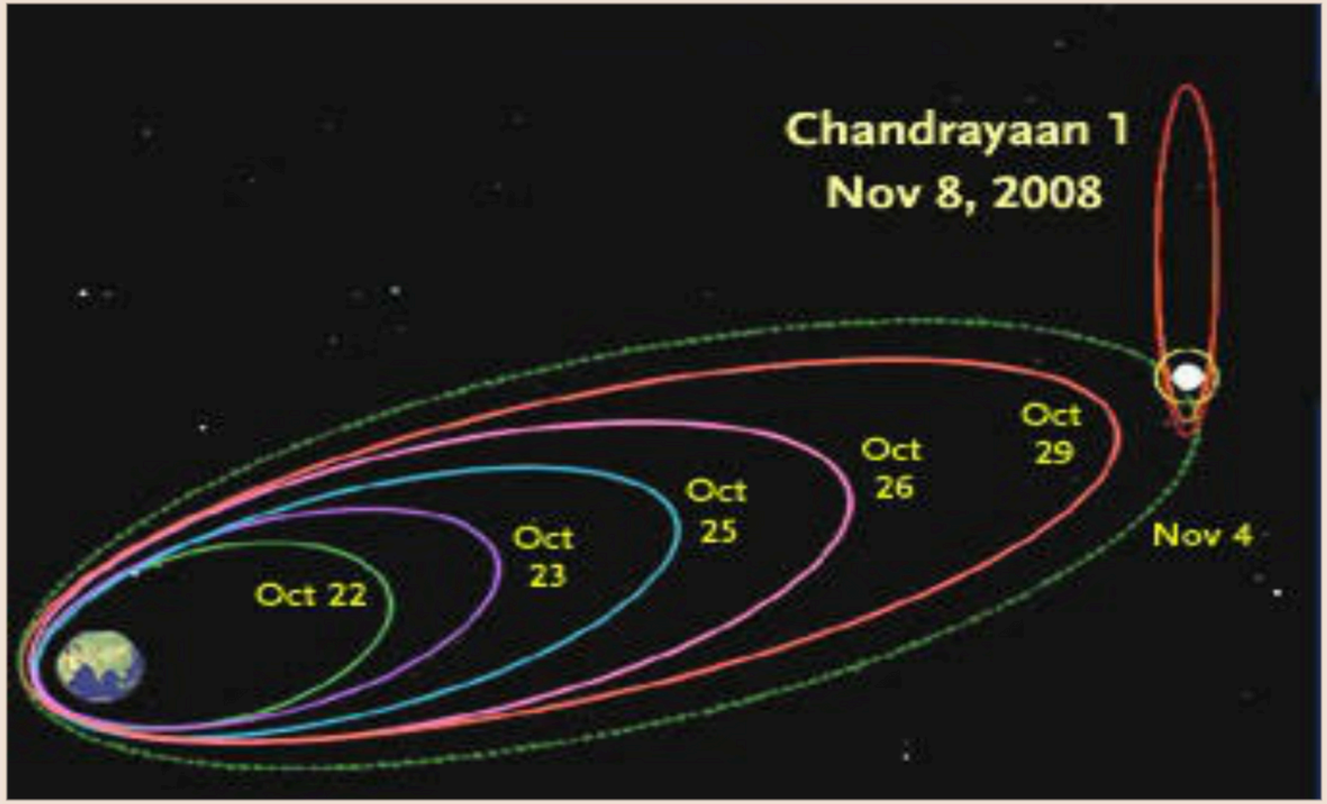


Applications:

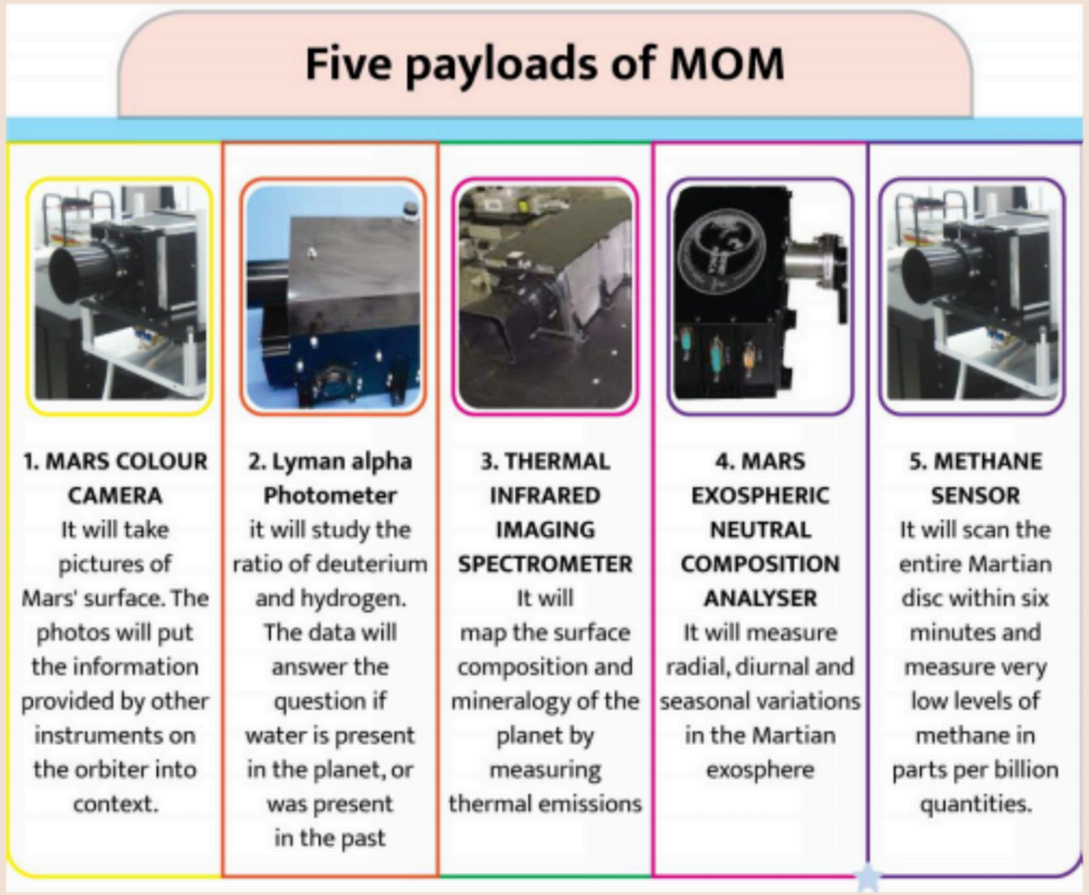
Satellite Communication
Telecommunication
Tele-Medicine
Tele-Education
Mobile Satellite Services
Radio Networking
Village Resource Centre
Satellite Aided Search and Rescue
Satellite Navigation Programme
Satellite News Gathering and Dissemination
Standard Time and Frequency Signal Dissemination Services
Television

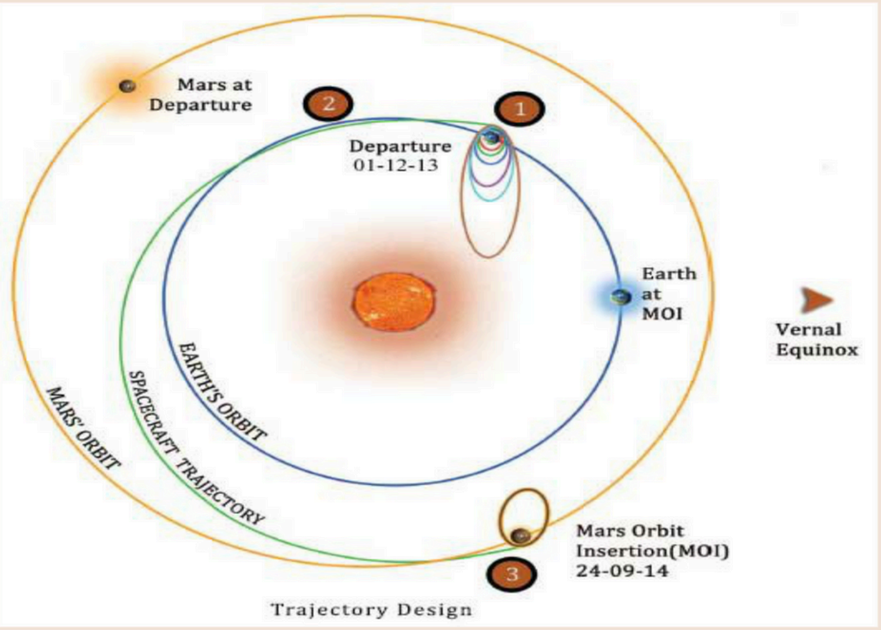
INDIAN SPACE MISSION:

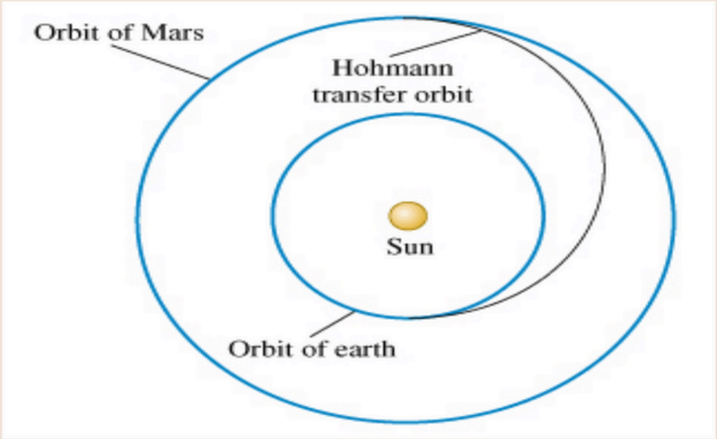
- **Chandrayaan 1**



- **MOM (Mars Orbiter Mission)/Mangalyaan**



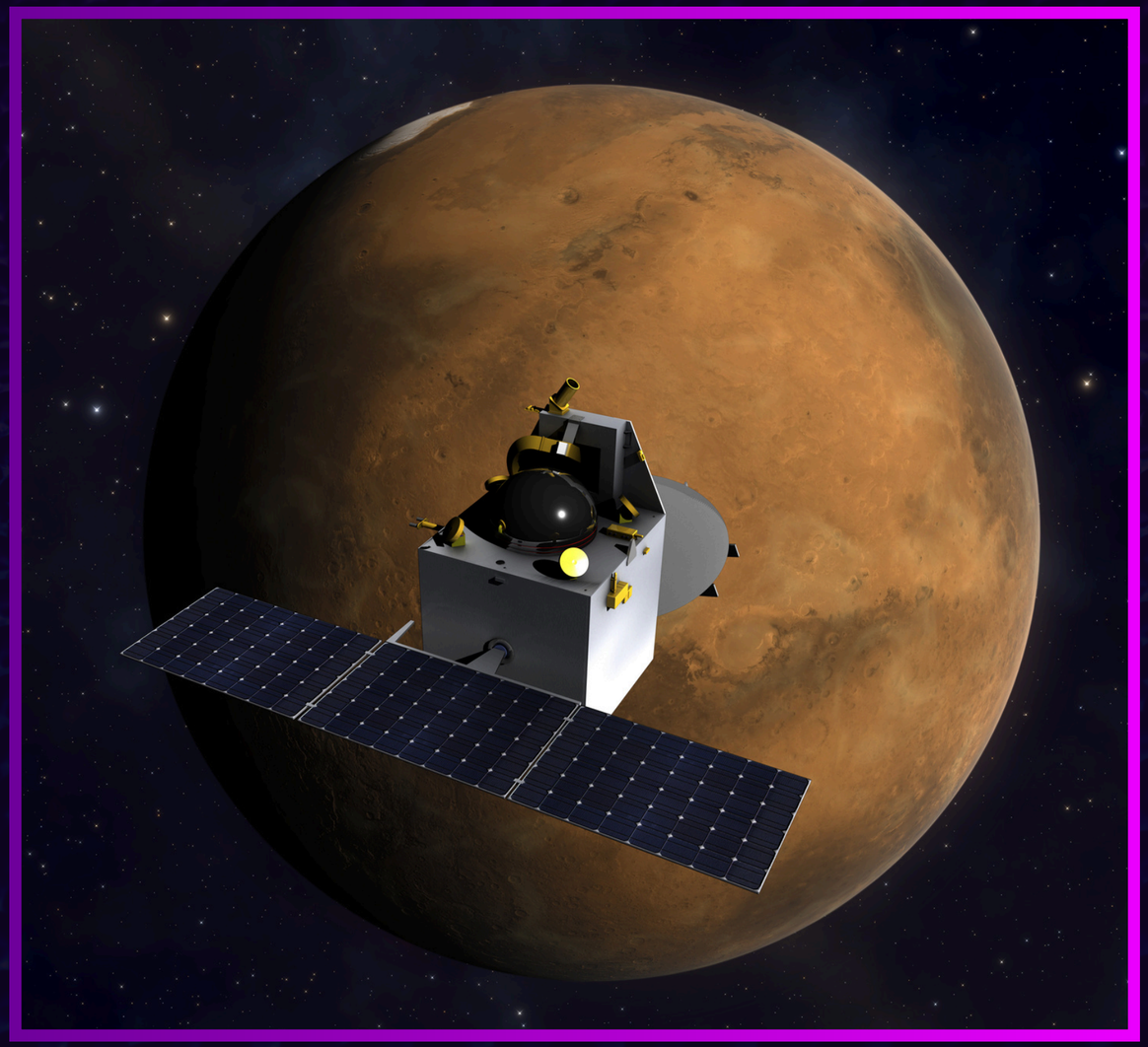




▪ UPSC Pre 2016 Qs-Mangalyaan

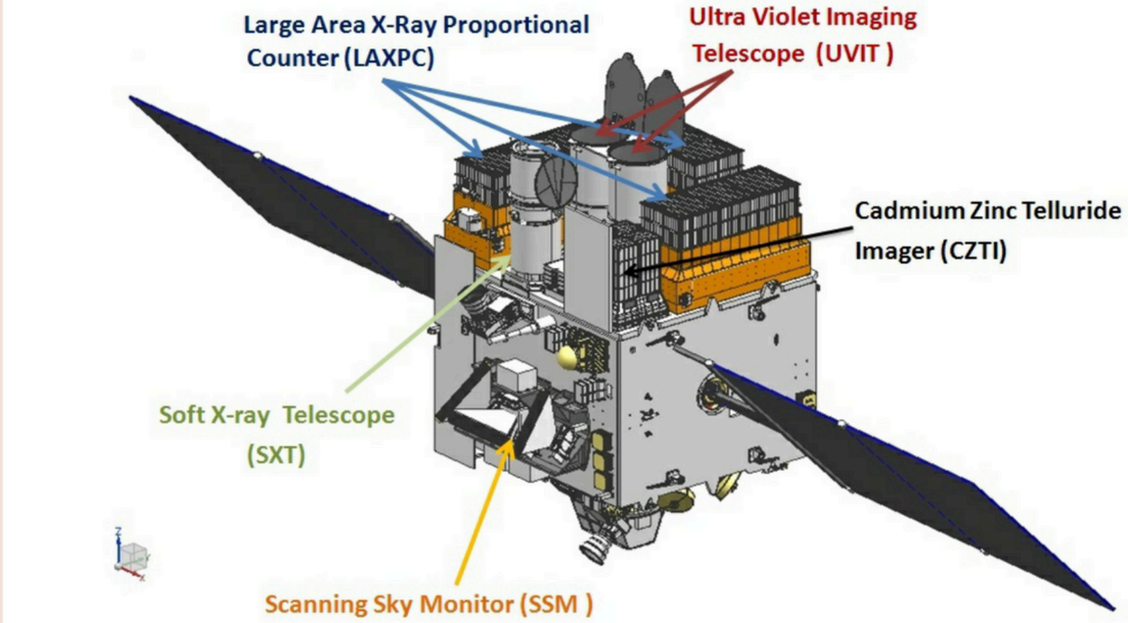
1.The Mangalyaan launched by ISRO
1.is also called the Mars Orbiter Mission
2.made India the second country to have a spacecraft orbit the Mars after USA.
3.made India the only country to be successful in making its spacecraft orbit the Mars in its very first attempt.
Which of the following statements given above is/are correct?

a.1 only
b.2 and 3 only
c.1 and 3 only
d.1, 2 and 3



• Astrosat


India's first Multiwavelength Space Observatory
ASTROSAT
The 5 telescopes of the Astrosat
1. Large Area X-ray Proportional Counter (LAXPC)
2. Soft X-ray Telecope (SXT)
3. Cadmium-Zinc-Telluride Imager (CZTI)
4. Scanning Sky Monitor (SSM)
5. Ultra Violet Imaging Telescope (UVIT)


Large Area X-Ray Proportional Counter (LAXPC)
Ultra Violet Imaging Telescope (UVIT)
Cadmium Zinc Telluride Imager (CZTI)
Soft X-ray Telescope (SXT)
Scanning Sky Monitor (SSM)

UPSC Pre 2016 Qs-ASTROSAT

Q.With reference to ‘Astrosat’, the astronomical observatory launched by India, which of the following statements is/are correct?

1.Other than 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.

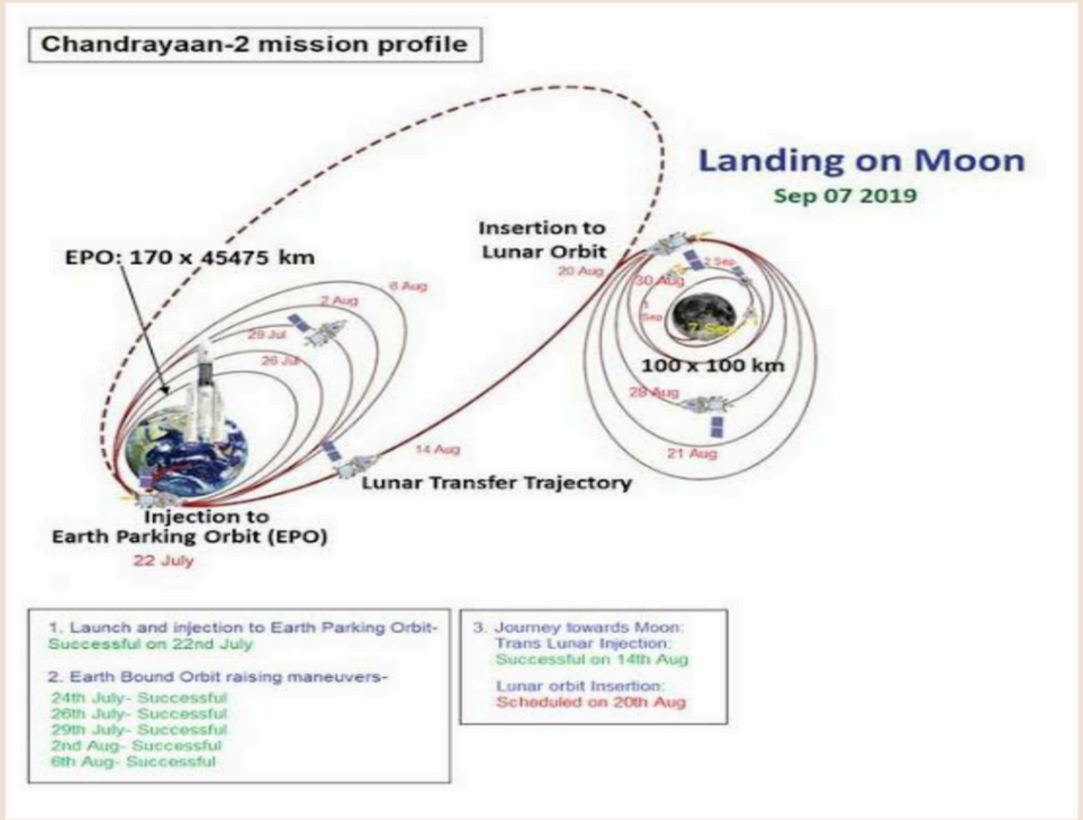
a.1 only

b.2 only

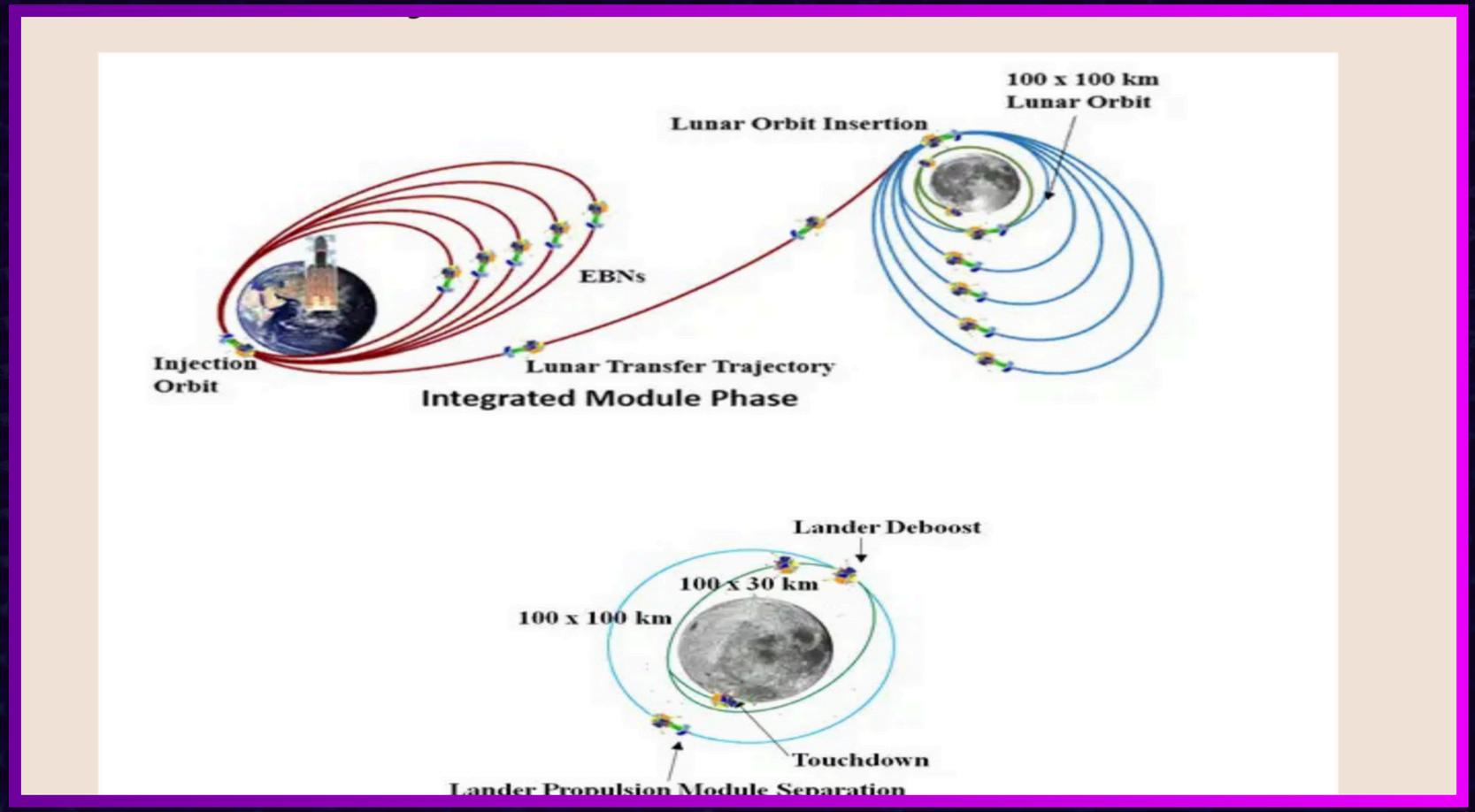
c.Both 1 and 2

d.Neither 1 nor 2

• Chandrayaan 2



• Chandrayaan 3



• Aditya-L1

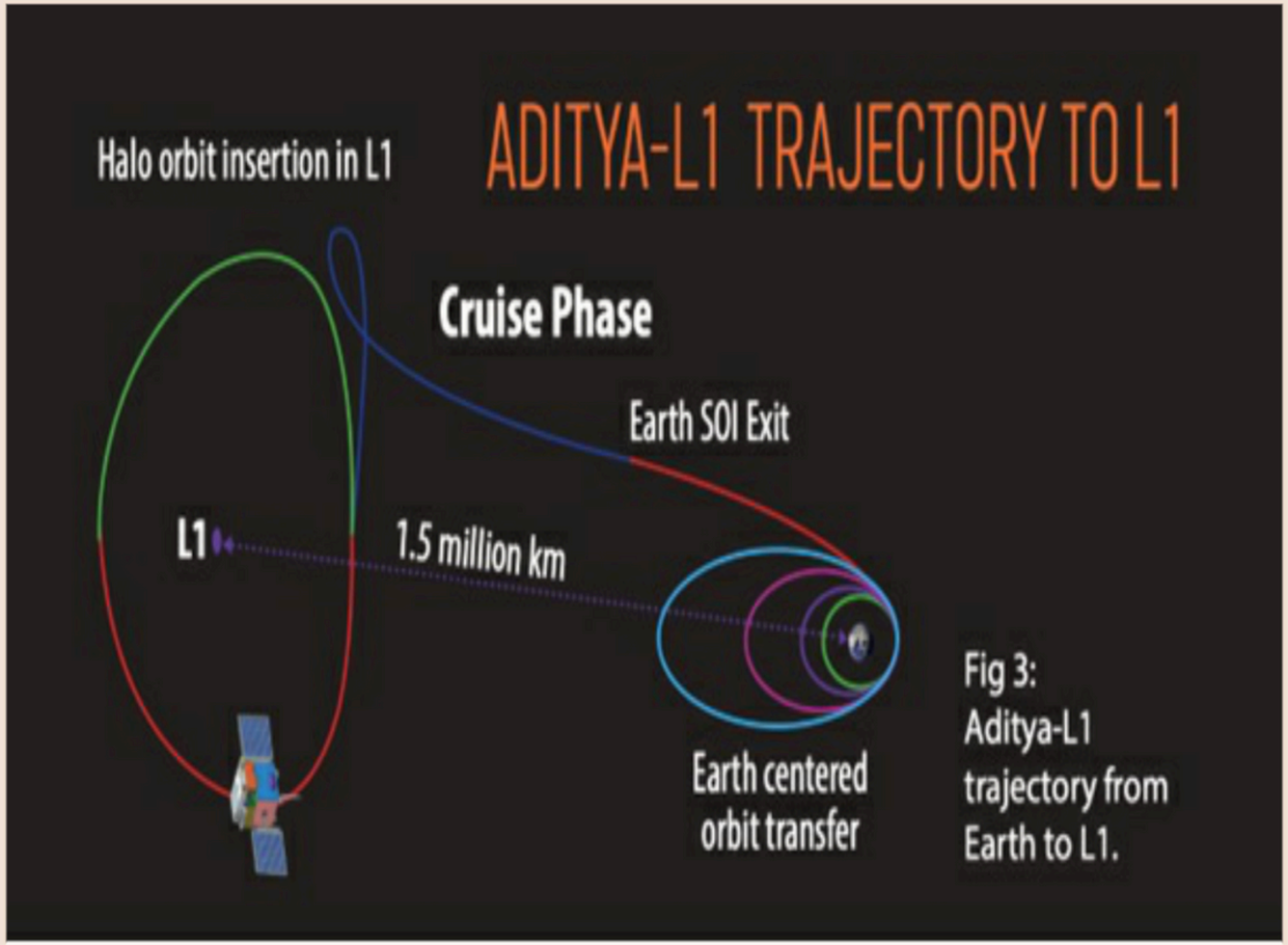
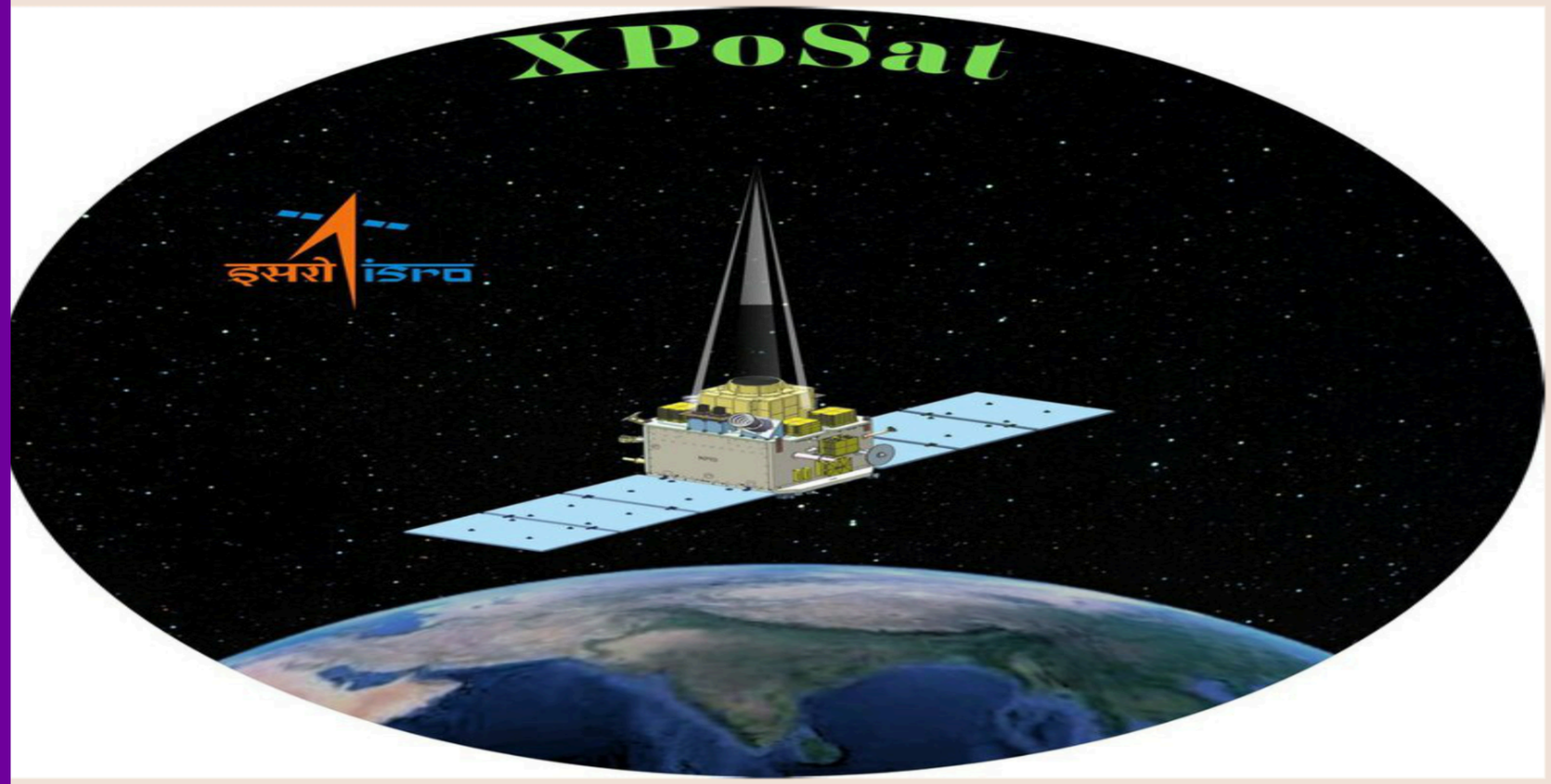
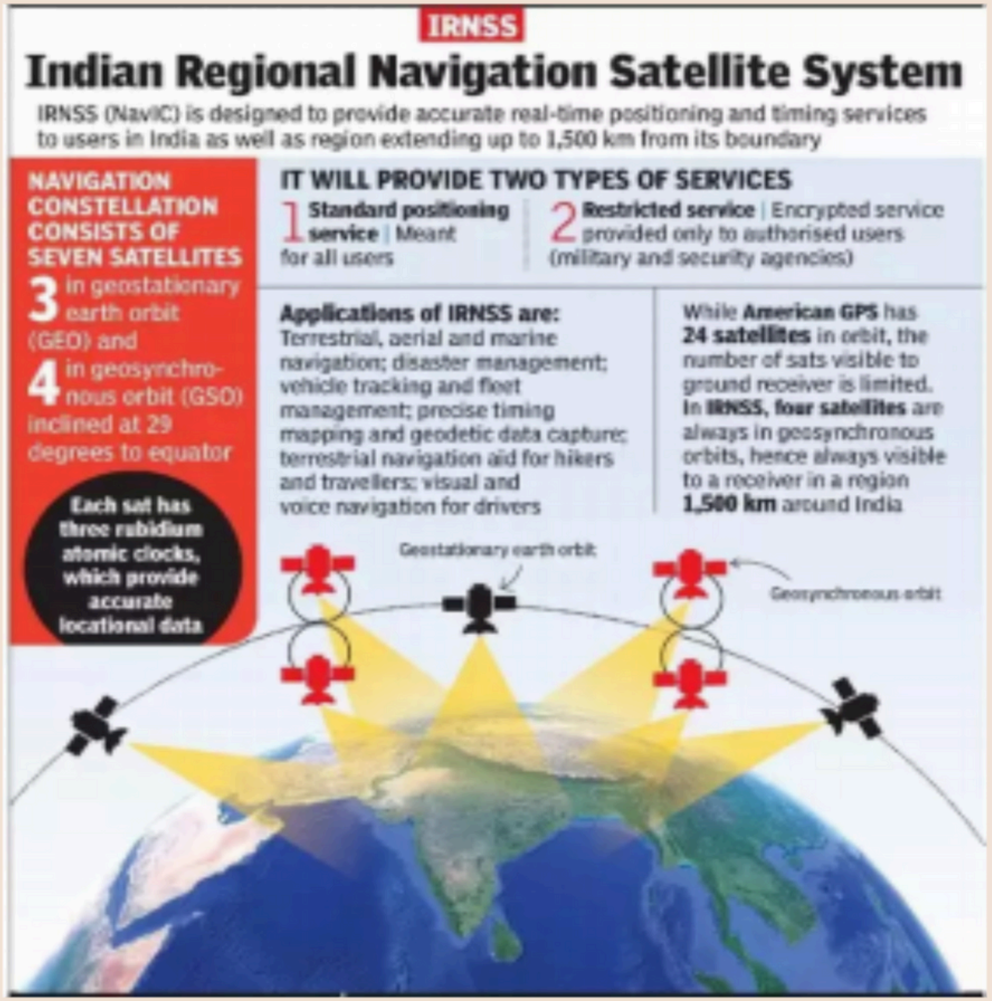


Fig 3: Aditya-L1 trajectory from Earth to L1.

• XPosat



Navigation System/Positioning System



UPSC Pre 2018 Qs-Navigation System

Q.With reference to the Indian Regional Navigation Satellite System (IRNSS), consider the following statements:

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

UPSC Pre 2023 Qs-Navigation System

Q.Which one of the following countries has its own Satellite Navigation System?

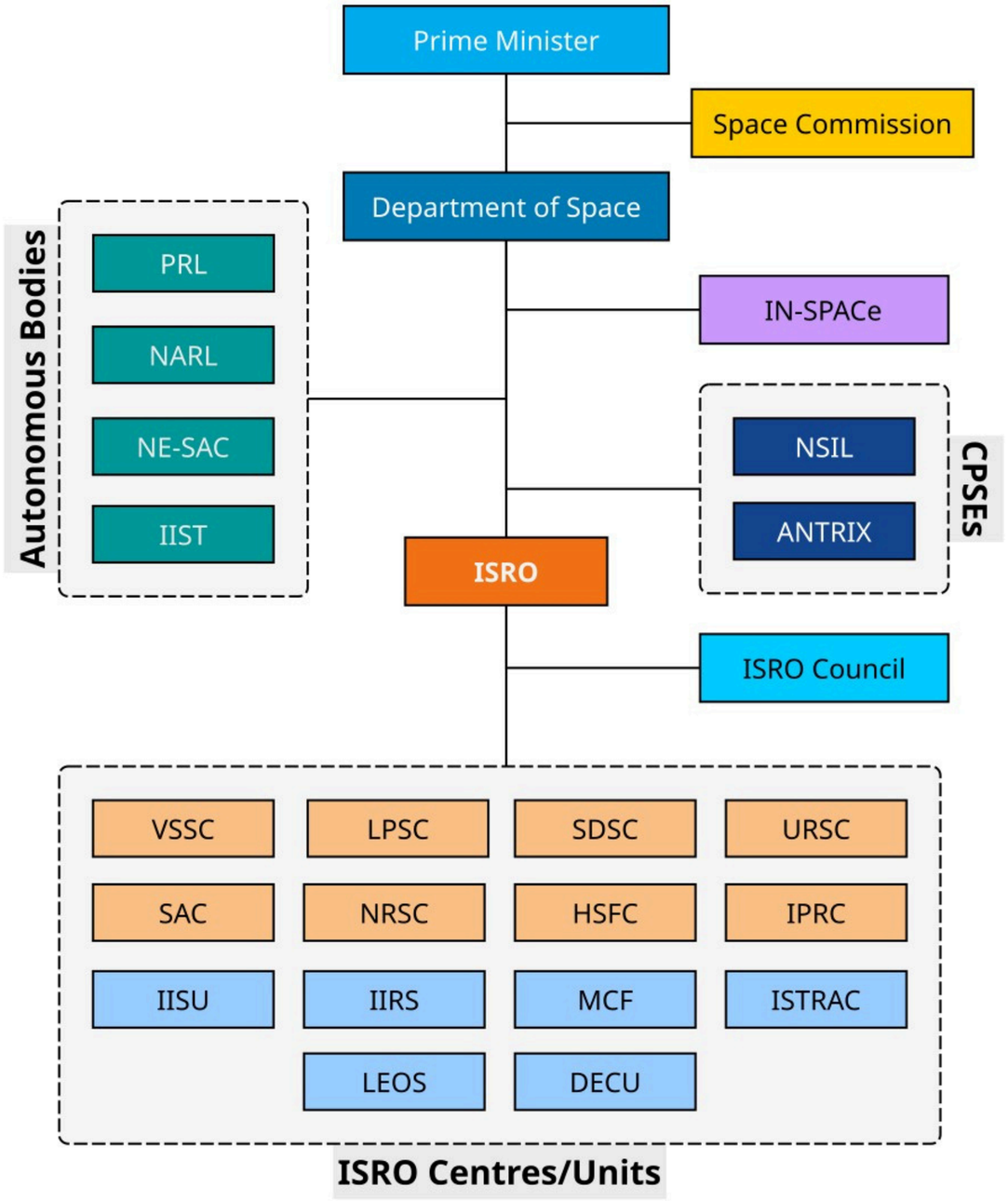
a.Australia

b.Canada

c.Israel

d.Japan

Organisation Structure



List of Abbreviations/Acronyms

ANTRIX: Antrix Corporation Limited

DECU: Development and Educational Communication Unit

HSFC: Human Space Flight Centre

IIRS: Indian Institute of Remote Sensing

IISU: ISRO Inertial Systems Unit

IIST: Indian Institute of Space Science and Technology

IN-SPACe: Indian National Space Promotion and Authorization Centre

IPRC: ISRO Propulsion Complex

ISTRAC: ISRO Telemetry Tracking and Command Network

LEOS: Laboratory for Electro-Optical Systems

LPSC: Liquid Propulsions System Centre

MCF: Master Control Facility

NARL: National Atmospheric Research Laboratory

NE-SAC: North Eastern Space Applications Centre

NRSC: National Remote Sensing Centre

NSIL: NewSpace India Limited

PRL: Physical Research Laboratory

SAC: Space Applications Centre

SDSC: Shatish Dhawan Space Centre

URSC: U R Rao Satellite Centre

VSSC: Vikram Sarabhai Space Centre

▪ Space Laws

▪ Space law is the body of law governing space-related activities like space exploration, liability for damage, weapons use, rescue efforts, environmental preservation, information sharing, new technologies, and ethics.

International treaties

▪ Outer Space Treaty,1967
Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies

▪ Rescue Agreement,1968
Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space
Caused by Space Objects

▪ Registration Convention,1976

Convention on Registration of Objects Launched into Outer Space

▪ Moon Treaty,1984
Agreement Governing the Activities of States on the Moon and Other Celestial Bodies

THANK YOU