ToppersNotes

IAS

GS PAPER-III

VOLUME-III

Sierra Innovations Pvt. Ltd.

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Awareness & Various Fields 1-205

Toppersnotes

Space Technology

(Communication + Defence + Information)

Satellite } – both are spacecraft.
Shuttle }

Spacecraft – all those which goes to space e.g. Chandrayan, Mangalyaan.

Rocket

Missile

Launch vehicle

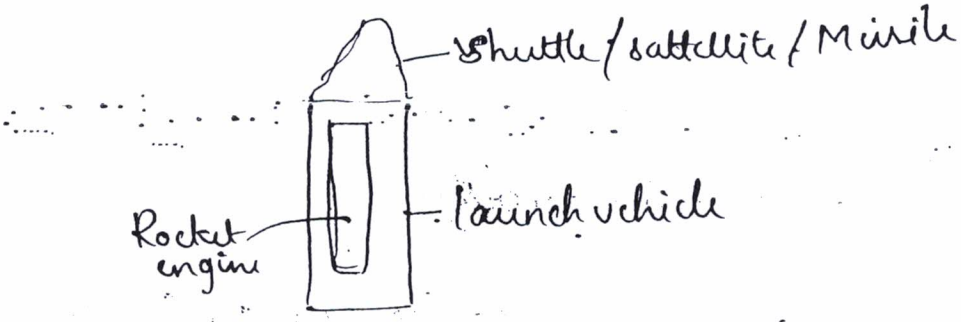
Satellite

- placed in earth orbit (attraction) gravity ≈ 36000 km
- Never comes back
- Multiple uses - comm^{n}, info^{n}, GPS, navigh etc.
- Never used to deliver anything in the space. (not used in space Transport System)

Shuttle

- placed anywhere if you want to
- delivers the objects in space (Space transport system)
- Reusable.
- Astronauts and Cosmonauts are same.

Rockets – engines or machines used in Shuttle, Missile and Launch vehicle or satellite



Missiles – used for destructive purpose.

Space Technology also known as Dual Technology – as it is used in Defence

Satellite
- Polar Satellite / Remote Sensing Satellite
- INSAT / GSAT
  Indian satellite / Geostationary Sat.

Launch Vehicle
- 1G – SLV (Satellite Launch Vehicle)
- 2G – ASLV (Augmented)
- 3G – PSLV (Polar)
- 4G – GSLV (Geostationary)

Toppersnotes

Remote Sensing Satellite

Aryabhatta (1975)
Bhaskara
Rohini
SROSS
IRS- 1A, 1B, 1C, 1D, 1E, 1F
CARTOSAT
OCEANSAT
RESOURCESAT
RISAT
Megha Tropics
SRM SAT
JUGNO

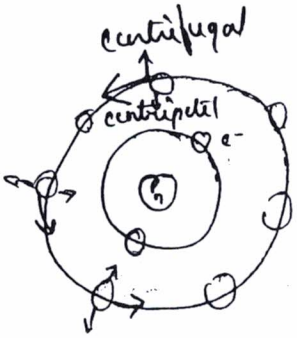
Orbit

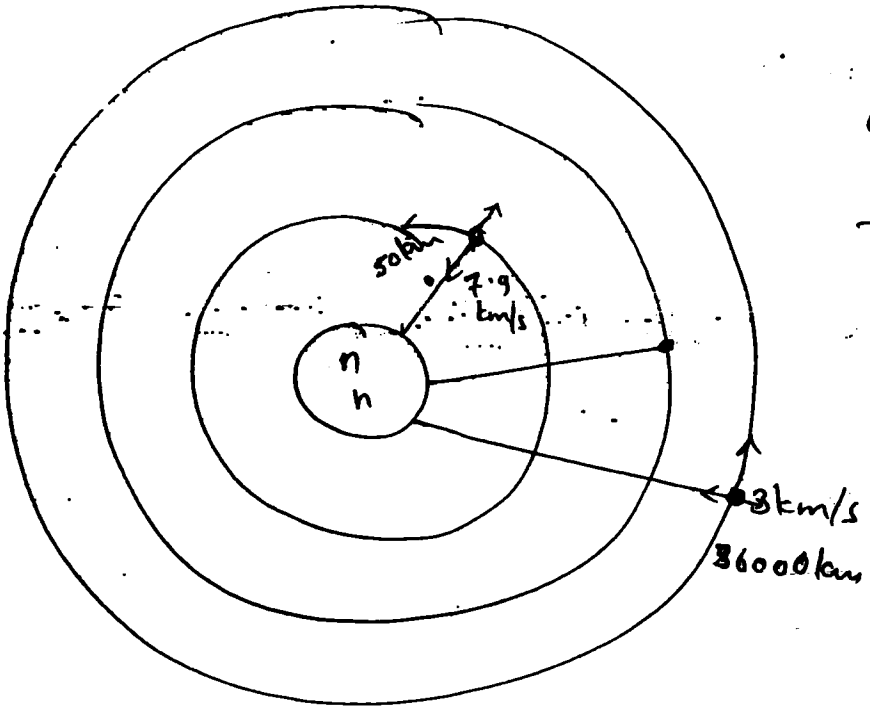
on basis of distance

LEO i) Low Earth Orbit (50 km - 2000 km)
MEO ii) Medium " " (5000 km - 12000 km) ≃ 20000 " "
HEO iii) High (≃ 36000 km)

Position

→ i) Polar Orbit
→ ii) Inclined / Transitional
→ iii) Equatorial





acceleration is maintained to balance the centripetal and centrifugal forces. ∴ The satellite does not fall.

for equatorial = 7.9 km/s

for polar = 7.9 km/s.

Types of Satellite –

Polar Orbit
Polar Synchronous orbit
Navigation
2011(P) → Geostationary Satellite
Geosynchronous satellite.

Polar orbit

— used for mapping purpose
- resources
- melting of ice (in polar areas)
- afforestation, deforestation
- productivity of crop / loss
- attack of locust / insect
- water table
- Disaster Mng.
- weather forecasting
- spy purpose

50km → 95 min

1500km → 120m.

Geostationary orbit

- perpendicular to equator with some inclination acc. to countries.
- remains at same position.

satellite revol^{n} = earth rotation

only $\omega \rightarrow E$ (24 hrs)

* Through IRS-1A, 1D 15 types of agricultural climatic zone in India found through remote sensing satellite. (polar satellite)

IRS – placed in (Tot. 11) polar sun-synchronous orbit.

Polar Sun synchronous Orbit

- at 800km
- 98.6° inclination angle

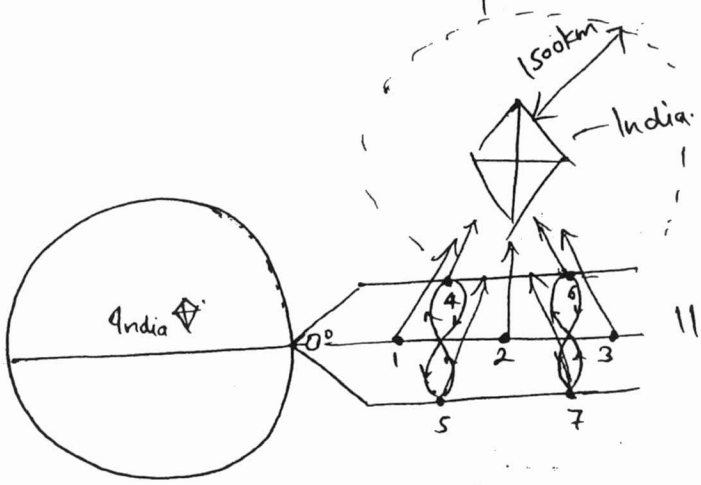
Geosynchronous orbit

Geo - earth
Synch - together
Chro - time
ous - both.

$\omega \rightarrow E$
$E \rightarrow \omega$
} in 24 hrs.

IKONA → first Remote sensing satellite by USA for spy purpose

Geostationary Orbit	Geosynchronous Orbit
(i) $\omega \rightarrow E$ in 24 hrs	$\omega \rightarrow E$ $E \rightarrow \omega$ can move in both direction
∴ it appears stationary in comparison to the Earth.	(used $E-\omega-E$ since it's easy
∴ Its a kind of Geosynchronous orbit.	
(ii) inclination angle is fixed.	inclination angle is varying (bubbling)
	∴ Bubbling is & changing of position of geosynchronous satellite.



eg. INSS

1, 2, 3 – geostationary
4, 5, 6, 7 – geosynchronous

Toppersnotes

* Polar satellite never used for navigation / communication
* Geostationary also we cannot use " (it cannot be used beyond 60-70°) but used for communication ☺

ISAC at Bangla

Navigation (GPS)

for navigation purpose (24-36) satellites are used in an inclined orbit.

(India has not sent any satellite in inclined orbit).

Group of 4 satellite.

Launching Station

i) Kourou (French Guyana)

ii) Cape canavaral (florida)

India always use French Guyana.

Why French Guyana is a launching station of India?

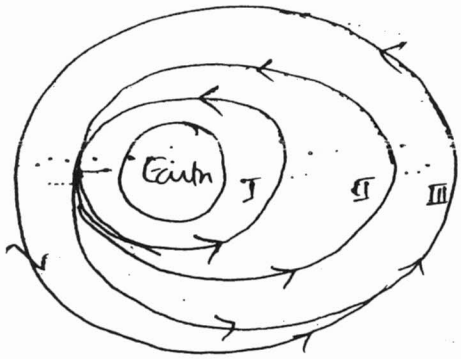
(i) Location of French Guyana —

a) near to equator (earth's gravity is less)

b) towards the eastern coast. ↓ at the time of uplift it is easy to use.

c) safe for people and property.

Toppersnotes



I - Transfer orbit

II - intermediate orbit

III - circular orbit

Institutional Setup

1962 - GOI set up a committee for Space Research

1969 - On the recommendation of this committee ISRO was formed.

1972 - DOS established (Dept. of Space) and ISRO was brought under it.

ISRO has various regional centres -

(i) ISAC - ISRO Satellite Application Centre in Banglore.
- Here we ~~were~~ develop our satellite.

(ii) VSSC - Vikram Sarabhai Space Centre in Tiruvananthpuram.
- Launch vehicle development centre.

(iii) SDSC - Satish Dhawan Space Centre in Sriharikota (AP)
- Launching station of India.
- old name was SHAR

iv) SAC – Satellite Application Centre in Ahemdabad

- Data acquisition centre (all satellite based data are stored here)

Satellite

(i) Remote Sensing Satellite or Polar Satellite

i) Payload : LISS camera (Linear imaging self scanning)
WFS camera (Wide field Sensor)
Panchromatic camera

Payloads are those devices installed in the satellite for any purpose.

ii) Functions

1st Remote sensing satellite was placed in 1975 – Aryabhatta.

Note – 1 July – 7 June
↓
Study of satellite

(2). INSAT / GSAT Satellite -

- INSAT satellites are multipurpose satellite.

a) for communication and info^{n}

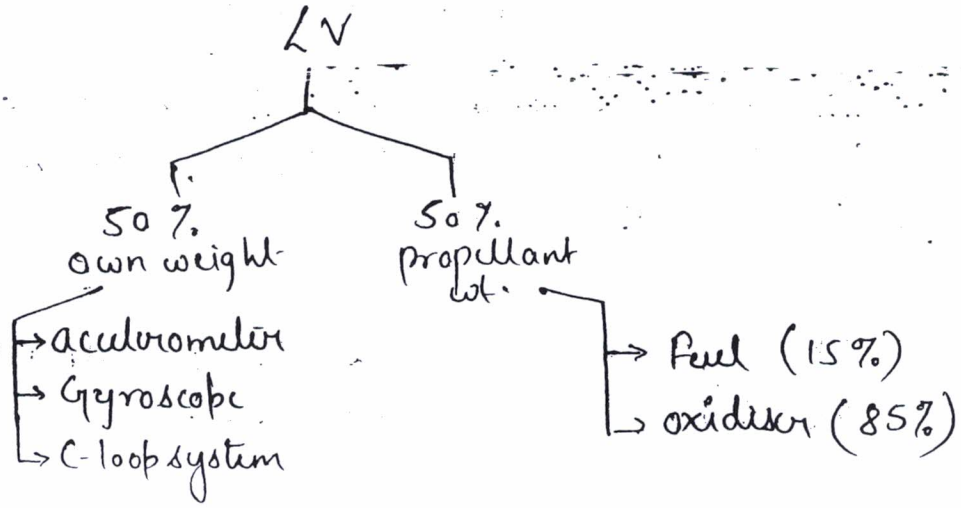
[telecomm^{n}, satellite news gathering, business networking, internet, DTH, etc, search and rescue operation.]

b) In regional GPS system, these satellite also help. (e.g. GAGAN, IRNSS)

payload of INSAT satellite we will discuss in Communication Tech. Chapter.

- 1st successful INSAT satellite was INSAT 1B (earlier name was INSAT and now GSAT)

Launch Vehicle Technology



- accelerometer used for acceleration of LV
- Gyroscope provides specific direction to LV
- C-loop sys. is overall programme of LV.

Solid fuel = HTPB (Hydroxyl terminated Polybutadiene

Liquid " = UDMH (unsymmetrical dimethyl) hydrazine

O = N_2O_4 (Nitrogen Tetraoxide)

Stages of Launch Vehicle

Solid liqui

1G – SLV — 4 stage { S S S S

2G – ASLV — 5 stage { S S S S S

3G – PSLV – 4 stage { S L S L

4G – GSLV – 3 stage { S L Cryogenic stage

SLV —

- it can carry 50 kg wt. of satellite in low earth orbit.
- Now its not in use.
- 1st launch vehicle used by India was SLV-III under leadership of API Kalam (it was successful) (1979)

Note : Antrix work under ISRO for commercial purpose.

ASLV

- carrying capacity 150 kg in LEO (Low Earth orbit)
- retired.
- some of ASLV has been changed under the development of certain missiles.

PSLV

Polar satellite launch vehicle.

Variants –

- PSLV
- PSLV-CA
- PSLV-XL

} developed

- PSLV-HP
- PSLV-3S

} developing

1st PSLV — in 1993 - PSLV-D1 IRS-1E Fail

variants of PSLV — 1994 - PSLV D2 IRS-P2 succuful

D3

C1

!

!

variant of PSLV CA - 2008 - PSLV-C9 it sucusfully carried max. no of satellite in one periodic

right now 2nd rank

22 Oct 2008 PSLV-C11 — Chandrayan-I

Variant of PSLV XL

PSLV-C25 — Mangalyan
(5 Nov 2013)

Currents Only

GSLV

- First two stage of PSLV are very similar to GSLV because same propellants used there. But 3rd stage is completely different. i.e. Cryogenic stage.
- Cryogenic is a low temperature based technology. In cryogenic propellants liquid hydrogen used as a fuel at -253°C and liquid oxygen as oxidiser at -183°C temperature.
- Earlier, we got cryogenic engine from Russia but from 2007 onwards we started to develop our own C.E at LPSC (Liquid Propulsion System Centre), Mahendragiri (TN).

Toppersnotes

Indian Russian deal for CE in 1996.

When India got C.E from Russia so got a prob of MTCR (Missile Technology Control Regime) India is now member of MTCR, recently

Variants of GSLV

GSLV MK-I
- I(a) – 1500kg (carry)
- I(b) – 1900kg
- I(c) – 15000kg

GSLV MK II – 2500kg

↓

earlier we used Russian cryogen engine, now Indian.

	variant of			
(i)	I(a)	Apr 2001	GSLV D1	GSAT-1 – ~~fail~~ (success)
(ii)	I(a)	2003	GSLV D2	GSAT-2 – succesful.
			F01	
			F02	
			F04	
			D3	
			F06	
		Jan, 2014	GSLV-D5	GSAT14 (Indigenous cryogenic 2nd time used and was succesful for 1st time
		27 Aug, 2015	D6	– GSAT-6