

ACHIEVEMENTS OF CONTEMPORARY BHARAT



सत्यमेव जयते

MINISTRY  
OF EDUCATION  
Government of India

# CHANDRAYAAN UTSAV

CODE  
1.3M



SPECIAL MODULE

विद्यया ऽ मृतमश्नुते



एन सी ई आर टी  
NCERT

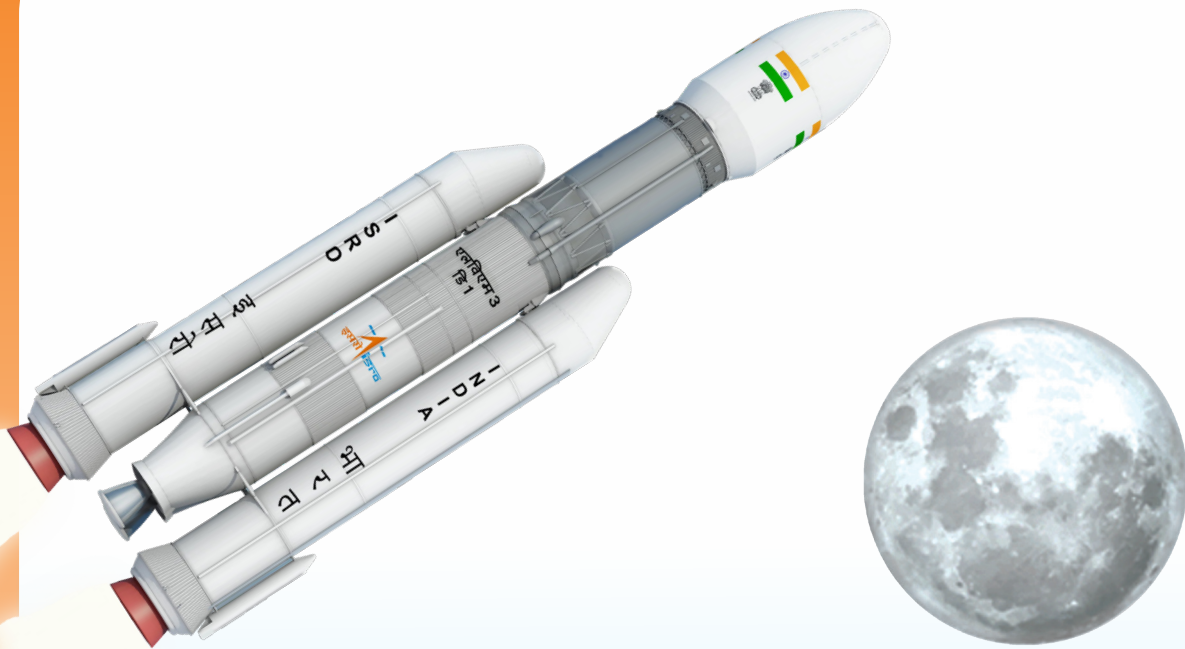
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# Chandrayaan Mission

Bharat's Expedition  
to the Moon

Middle Stage

## Introduction

Do you feel proud to know that Bharat is the fourth nation in the world to land on the Moon, and the first to successfully make a landing near to the South Pole of the lunar surface. August 23 2023, will go down in history as one of the proudest days for Bharat and the Bharatiya scientific community. It was on this day that our Hon'ble Prime Minister Shri Narendra Modi exclaimed, "Bharat is on the Moon, we have our national pride placed on the Moon".



He remarked that this success of our scientist is not a simple success, but also an achievement that heralds Bharat's scientific power in infinite space. You will be happy to know that the brilliant minds behind the success of Chandrayaan-3 are all made in Bharat. Hardly had their education from any of the overseas Universities, which seem to be a craze these days. With this achievement there will be some questions which will come up in your mind. Did this scientific achievement happen only now? Didn't it happen in the past? Didn't people in the past think about this? Literature tells us that it can be traced back through Vymaanika Shastra: 'Science of Aeronautics', which reveals that our country had the knowledge of flying vehicles in those days (This book has mind boggling details of construction, working of engines and the gyroscopic systems).

The Vedas, the oldest of Indian texts, makes a mention of various gods being transported on wheeled chariots pulled by animals, usually horses, but these chariots could also fly. The Rig Veda (verses 1.16.47-48) specifically mentions “mechanical birds.” There are various mentions of flying chariots (Rath) and flying vehicles (Vimaan) which were used in battles and wars. All gods had their own vehicle personified as an animal, which they used to travel from one place to another. These places included earth, heaven, planets and cosmic destinations called ‘Loks’. Such vehicles were said to travel effortlessly in space and without any noise. One such Vimaan is the legendary Pushpak Vimaan (literally the floral chariot) mentioned in Ramayana. It was created by Vishwakarma, the chief architect of god’s, out of the dust from the Sun for Brahma. Brahma gave it to Kuber. When Ravana took over Lanka from Kuber, it was used by Ravan as his personal vehicle.

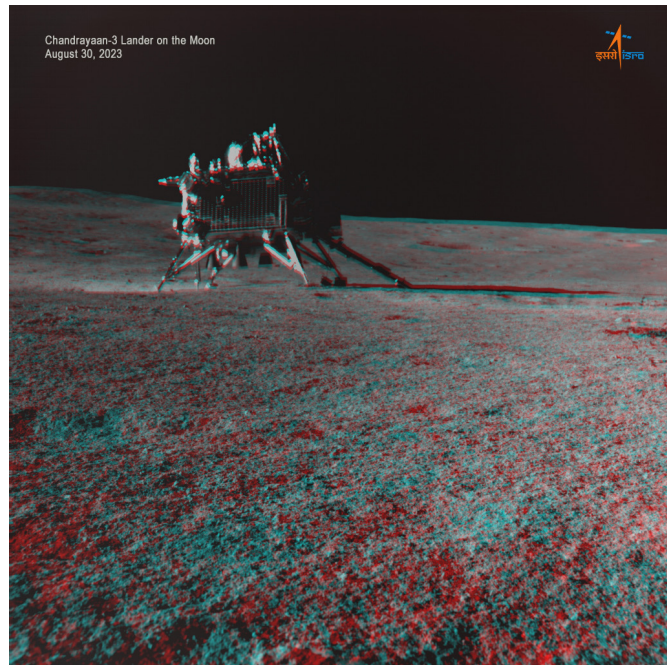


Literary inputs of nature stated above always gave Bharat, as a Nation, an advantage in understanding the significance of space science. In modern Bharat, the space research programme was ushered in by Dr. Vikram Sarabhai, who was instrumental in establishing present day Indian Space Research Organisation (ISRO).

Carrying forward the legacy of Bharat's Aeronautical Science today, Bharat has made remarkable advancement in Space Research. ISRO has made Bharat proud and created history. The highly ambitious Chandrayaan-3 mission successfully landed near the South Pole of the Moon on August 23 at 06:04 pm (IST), making Bharat the first country in the world to land near the South Pole.

Significance of the Chandrayaan-3 mission is of immense importance as outcome of the expedition will provide scientists with new understanding of the origin of Earth, how the Earth-Moon system and the Solar System formed and evolved, and the role of asteroid impacts in influencing Earth's

history and possibly future, Moon dynamism, etc. The Moon may provide economic benefits in the future based on the natural resources that can be found there, such as water, helium-3 and rare Earth elements. There is growing interest in the South Pole of the moon because it offers the greatest potential to find water ice, which could be used to support astronauts and to make them livable. The ice is believed to contain solid-state compounds that would normally melt under warmer conditions elsewhere on the Moon. The study of these compounds can provide insights into lunar, as well as, Earth, and Solar System history. It also has peaks that are in constant or near constant sunlight, which creates excellent opportunities for generating power to support lunar activities.



*View from Pragyan Rover of the Vikram Lander on the Moon Surface*

Success of Chandrayaan-3 Mission has definitely elevated Bharat's stature as a progressive nation in exponential terms. Marking the successful landing of Chandrayaan-3, August 23 will be celebrated as 'National Space Day' every year. Space has many things to offer for humanity and the World as a whole. The country needs this legacy to march ahead and lead the World in the future.

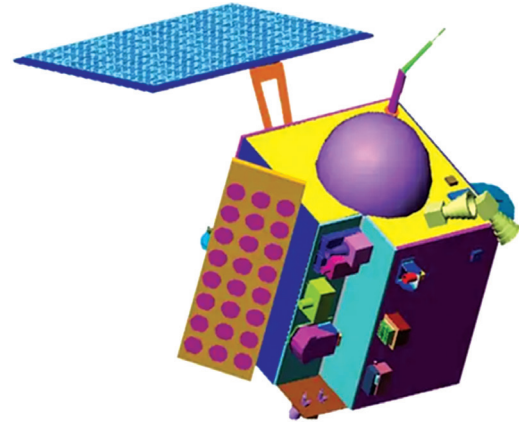
## **History of Bharat's Moon Missions**

Bharat's journey to the Moon has been a significant part of its space exploration efforts. The history of Bharat's Moon missions primarily revolves around the Chandrayaan program.

### **Chandrayaan-1 (2008)**

Chandrayaan-1 was Bharat's first Lunar Mission, launched on October 22 2008, by the Indian Space Research Organisation (ISRO). The spacecraft

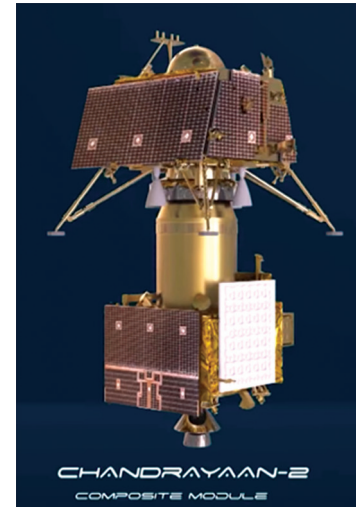
carried 11 scientific instruments, including an impact probe, and had the primary objective of conducting high resolution remote sensing of the lunar surface. Chandrayaan-1 made a significant discovery when it found evidence of water molecules on the moon's surface. Let's collect more information about Chandrayaan-1 from ISRO's website. Unfortunately, communication with Chandrayaan-1 was lost on 29th August 2009, and the mission was concluded.



*Chandrayaan 1 - Orbiter*

### **Chandrayaan-2 (2019)**

Chandrayaan-2 launched on July 22 2019, was Bharat's second Lunar Mission. Unlike Chandrayaan-1, which was primarily an orbiter, Chandrayaan-2 was designed to consist of three components: the Orbiter, the *Vikram* Lander, and the *Pragyan* Rover. The primary goal was to study the moon's South Polar region and conduct detailed research on lunar topography, mineralogy and exosphere. While the orbiter continues to send valuable data, the lander, *Vikram*, faced challenges during its descent and lost communication with ISRO. Consequently, the rover *Pragyan* could not be deployed on the lunar surface as planned.



#### **What did we learn from Chandrayaan-2?**

The mission failed in the final stages when *Vikram* Lander lost communication with the ground state just 2.1 km above the Moon. This failure doesn't mean that, just because we've failed to land a spacecraft on the Moon, that's the end of things. Scientists at ISRO learnt from this failure exactly what needs to be changed, and what works perfectly. Thus, proving 'Failure is the pillar of success'. An important life lesson for each one of us.

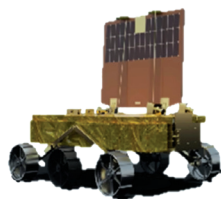


## Chandrayaan-3 (2023)

Chandrayaan-3 launched on 14 July 2023, was Bharat's third Lunar Mission. It was launched from Satish Dhawan Space Centre (SHAR), Sriharikota, Nellore, Andhra Pradesh. The mission consists of a Lunar Lander named 'Vikram' and a Lunar Rover named 'Pragyan', similar to those launched aboard Chandrayaan-2 in 2019. The spacecraft entered lunar orbit on 5th August, and the Lander touched down near the Lunar South Pole on 23 August at 06:04 p.m., making Bharat the fourth country to successfully land on the Moon, and the first to do so near the Lunar South Pole. After its safe landing, 'Pragyan', has traversed over 100 metres from the Lander 'Vikram' on the surface of the moon and completed its assignments. Let's locate Satish Dhawan Space Centre on the map of Bharat. The primary goal of the mission was to engineer and implement a lander to land safely and softly on the surface of the Moon and conduct experiments on the materials available on the lunar surface to better understand the composition of the Moon.

### Do you know how the Chandrayaan-3 was ejected to space and directed to its destination?

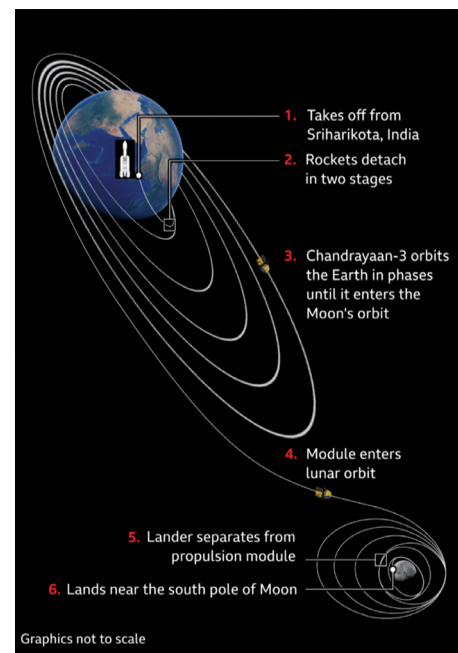
Chandrayaan-3 comprises of three main components: a propulsion module, lander, and rover. Our launch vehicle (LVM3) has put Chandrayaan-3 on the precise orbit around the Earth.



### Activity 1

"The cost of the Chandrayaan-3 Mission was less than that of certain Bollywood movies."

- (A) List out the indigenous materials used in making Chandrayaan-3 a budget-friendly mission.
- (B) Find out the expenditure incurred by US, Russia and China in their expedition to Moon, and then make a comparison with the expenses incurred in our Chandrayaan-3 Mission.



Source: Indian Space Research Organisation





Explanation Video Link: [https://youtu.be/8uCMhryzH3s?si=\\_Ot6z3BxNdXxME\\_N](https://youtu.be/8uCMhryzH3s?si=_Ot6z3BxNdXxME_N)

Source: *Lets GrowUp*

Do you know what scientific instruments were carried by the spacecraft to space in Chandrayaan-3 Mission?

A spacecraft carries payloads or scientific instruments in space. When it revolves around the Earth or a celestial body, it is called a satellite—an artificial one. Chandrayaan-3 (CH-3) consists of a Lander (Vikram), designed to gently touch down on the moon's surface, and a Rover (Pragyan), ready to explore the lunar terrain after landing. To propel the Lander and Rover towards the moon, CH-3 relies on a Propulsion Module (PM).

### **Payloads and their Scientific Outcome**

Chandrayaan-3 houses a total of seven scientific instruments. The lander carries four instruments, namely,

- i. ILSA: a Seismometer, developed by LEOS
- ii. RAMBHA-LP: A Langmuir probe—designed, realised, and delivered by Space Physics Laboratory SPL/VSSC.
- iii. CHASTE: A Thermal probe—designed, realised, and delivered by SPL/VSSC.
- iv. LRA: A Retroreflector from NASA.

The rover has two instruments, viz.,

- i. APXS: an X-ray spectrometer, provided by Physical Research Laboratory (PRL)
- ii. LIBS: a laser-based spectrometer, provided by LEOS.

The propulsion module has SHAPE (a spectro-polarimeter) instrument, developed by URSC.



Can you find out what does the following abbreviation mean in space?

Acronyms	Full Form
ISRO	
LVM3	
ILSA	
LEOS	
RAMBHA-LP	
SPL/VSSC	
CHASTE	
LRA	
NASA	
APXS	
PRL	
LIBS	
SHAPE	
URSC	

**Major scientific experiments planned on the Moon included studying the—**

- vibrations on the lunar surface due to seismic events, and/or due to the impact of meteorites, rover movement, etc.;
- near-surface plasma environment;
- temperature and thermal conductivity up to the depth of 10 cm;
- elemental composition in and around the landing site; and
- spectral signatures of Earth from lunar orbit.

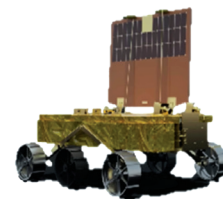
## What did the *Pragyan* Rover find on the Lunar surface?

The Chandrayaan-3's rover, *Pragyan*, till date has traversed over 100 metres from the lander *Vikram* on the surface of the moon. The lander and the rover, with a mission life of one Lunar Day (14 Earth days), have scientific payloads to carry out experiments on the lunar surface. According to the Indian Space Research Organisation (ISRO) the Laser-Induced Breakdown Spectroscopy (LIBS) instrument on the *Pragyan* rover has discovered the presence of aluminium, sulphur, calcium, iron, chromium, titanium, manganese, silicon and oxygen on the moon. But one of the major goals of Chandrayaan-3 was to hunt for water. Scientists say the huge craters in the South Pole region, which are permanently in shadow hold ice which could support human habitation on the Moon in future. The various tests conducted on the lunar surface detected moon quakes, movement of heat through the lunar surface, and helped to understand the plasma environment around the moon and the gravitational interaction between the Moon and the Earth.

### Did you know?

Hon'ble Prime Minister, Shri Narendra Modi, named the Chandrayaan-3 landing site as *Shiva Shakti*. *Shiva Shakti* derives its name from Hindu mythology.

Discuss with your parents/elders and find out the significance of the word *Shiva Shakti*.



## Know the Heroes who Made the Mission Successful (The scientific community behind the success)

ISRO has made Bharat proud and created history. The highly ambitious Chandrayaan-3 Mission successfully landed near the South Pole of the Moon on August 23 at 06:03 pm, making Bharat the first country in the world to land on the South Pole. Bharat is not only the fourth nation in the world to land on the Moon, but it is also the first to successfully make a landing on the South Pole of the lunar surface. August 23 will go down in history as one of the proudest days for Bharat and the scientific community.

## The Brilliant Minds Behind the Success of Chandrayaan-3

Source: <https://www.jagranjosh.com/general-knowledge/scientists-behind-chandrayaan-3-success-1692796298-1>



1. **S. Somanath, *Chairman, ISRO***

Shri S. Somanath has a B. Tech in Mechanical Engineering from TKM College of Engineering, Kollam, and a Master's degree (M. Tech.) in Aerospace Engineering from IIS (Indian Institute of Science) in Bengaluru.



2. **P Veeramuthuvel, *Overall Project Director of Chandrayaan-3***

Shri P. Veeramuthuvel is the main scientist behind the Chandrayaan-3 Mission. He has a degree from the Indian Institute of Technology Madras (IIT-M).



3. **S Unnikrishnan Nair, *Director, Vikram Sarabhai Space Centre***

Shri Nair has a B.Tech. degree in Mechanical Engineering from Mar Athanasius College of Engineering affiliated with Kerala University; a Master's in Aerospace Engineering from IISc, Bengaluru, and a Ph.D in Mechanical Engineering, from IIT Madras, Chennai.



4. **B N Ramakrishna, *Director, ISTRAC***

Shri Ramakrishna has a Master's Degree in Science. He is an expert in the areas of navigation and orbit determination of spacecraft.



5. **S Mohana Kumar, *Mission Director for Chandrayaan-3***

Shri S. Mohana Kumar is a senior scientist at the Vikram Sarabhai Space Centre (VSSC) in Thiruvananthapuram, Kerala. Mr. Kumar is a graduate from Indian Institute of Technology (IIT), Madras, and holds a Ph.D in Aerospace Engineering from the Indian Institute of Science (IISc), Bengaluru.



6. **M Sankaran, *Director, U R Rao Satellite Centre***

Shri Sankaran holds a Master's Degree in Physics from Bharathidasan University, Tiruchirappalli, Tamil Nadu.



7. **Dr V Narayanan**

Dr. V Narayanan, Distinguished Scientist is currently the Director of Liquid Propulsion Systems Centre (LPSC), one of the major Centres of the Indian Space Research Organisation (ISRO).



8. **Kalpana Kalahasti, *Deputy Project Director of Chandrayan-3, ISRO***

Smt. Kalpana Kalahasti graduated in Electronics and Communication Engineering from Madras University. She was second-in-command, paying extra attention to the minute details of the project.



9. **Muthayya Vanitha, *Deputy Director, UR Rao Satellite Center***

Smt. Muthayya Vanitha is an electronics system engineer, a graduate from College of Engineering, Guindy, Chennai. She is the first female project director at ISRO, and also the first woman to lead an interplanetary mission.



10. **M. Srikanth**

He is the Mission Director, CH-3 and Aditya-L1 MPAD/MDA, U R Rao Satellite Center, ISRO Bengaluru. He has been working in ISRO for 19 years.



11. **Nandini Harinath**

She is the Deputy Director, Spacecraft Operations Area ISRO Telemetry Tracking and Command Network, ISRO, Bengaluru. Having held key positions in more than 20 satellite missions she is specialised in Mission Design and Spacecraft Operations.

The above personalities played a pertinent role in etching Bharat's name globally in Space research with the historical success of Chandrayaan-3.

## Contribution of Women in the Mission (*Nari Shakti*)

Women scientists/engineers have been contributing to each of the ISRO Programmes. The country's Nari Shakti (over 100 women staff) have played a significant role in conceptualising, designing, realising, testing and execution of Chandrayaan-3. They have taken lead roles in—

- overall spacecraft configuration, realisation of Chandrayaan-3 and team management;
- assembly, integration and testing of the spacecraft;
- establishment and execution of ground segment for Chandrayaan-3 mission operations;
- carrying out lander navigation guidance and control simulations, to assure the capability of the lander for autonomous safe and soft landing; and
- development and delivery of crucial sensors like Laser Altimeter, Laser Doppler Velocimeter and Lander Horizontal Velocity Camera that play a key role in navigation during the critical Lander Power descent phase, etc.

The ancient *Bharatiya* texts and discourses contain treasures of scientific knowledge on various disciplines including aeronautics (that can make the younger generation feel proud of the legacy inherited by them and take this knowledge system further for new uses). Bharat has made remarkable advancement in Space Research; thanks to highly successful and cost-effective endeavours made by the ISRO.



### Activity 2

Prepare a model for Chandrayaan-3



### Activity 3

Prepare a photo album on Chandrayaan-3

Ask the learners to collect pictures of the Chandrayaan-3 Mission and prepare an album stage wise. Each photograph should have a detailed caption. The best album may be selected, and a e-flip book may be prepared and uploaded in the school website.

You may prepare a small video by capturing the reactions of people, or how Indians have developed a sense of pride from the technological advancements made in Space Science through an android phone.

The success of Bharat's expedition to the Moon has brought new hopes, aspirations and national pride to the centre stage. Bharat has reclaimed its scientific knowledge domination, as in ancient Bharat, signaling the end of the dominance of space by the US, China and Russia. The success of Chandrayaan-3 Mission helped the *Bharatiya* scientists to conduct experiments on the materials available on the lunar surface, to better understand the composition of the Moon, and explore the possibilities of economic benefits in future based on the natural resources that can be found there. These endeavours help in understanding the differentiation of the universe.





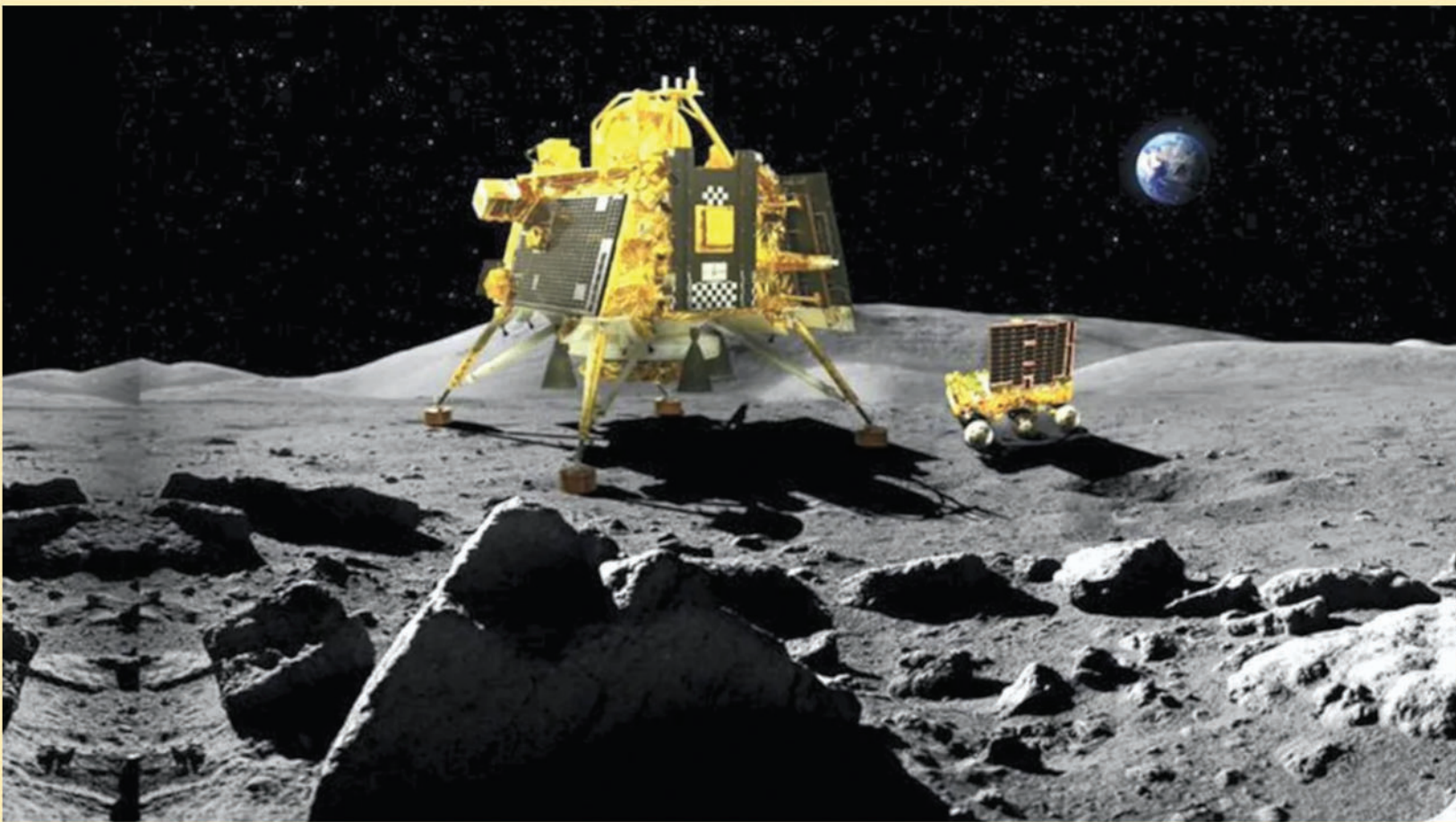
## Theme 1.0 Chandrayaan Utsav

- |      |    |  |
|------|----|--|
| 1.1  | F  | हमारा चंद्रयान<br>Our Chandrayaan                    |
| 1.2  | P  | <i>Mera Pyara Chanda: Rani ki Khoj</i>               |
| 1.3  | M  | Chandrayaan Mission: Bharat's Expedition to the Moon |
| 1.4  | S  | Chandrayaan: Journey Towards the Moon                |
| 1.5  | S  | Exploring the Moon Mission of Bharat                 |
| 1.6  | S  | Towards Moon and Beyond                              |
| 1.7  | S  | Exploring Chandrayaan-3: Bharat's Lunar Mission      |
| 1.8  | HS | Bharat on the Moon                                   |
| 1.9  | HS | Bharat Space Mission: The Chandrayaan Mission        |
| 1.10 | HS | Physics of Chandrayaan-3                             |

For participation in the activities related to Apna Chandrayaan:  
Visit : [www.bharatonthemoon.ncert.gov.in](http://www.bharatonthemoon.ncert.gov.in)

For more information:  
Email: [dceta.ncert@nic.in](mailto:dceta.ncert@nic.in)  
PMeVIDYA IVRS: 8800440559





An image of Rover *Pragyan* with Lander *Vikram*

विद्यया ऽ मृतमश्नुते



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राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्  
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING