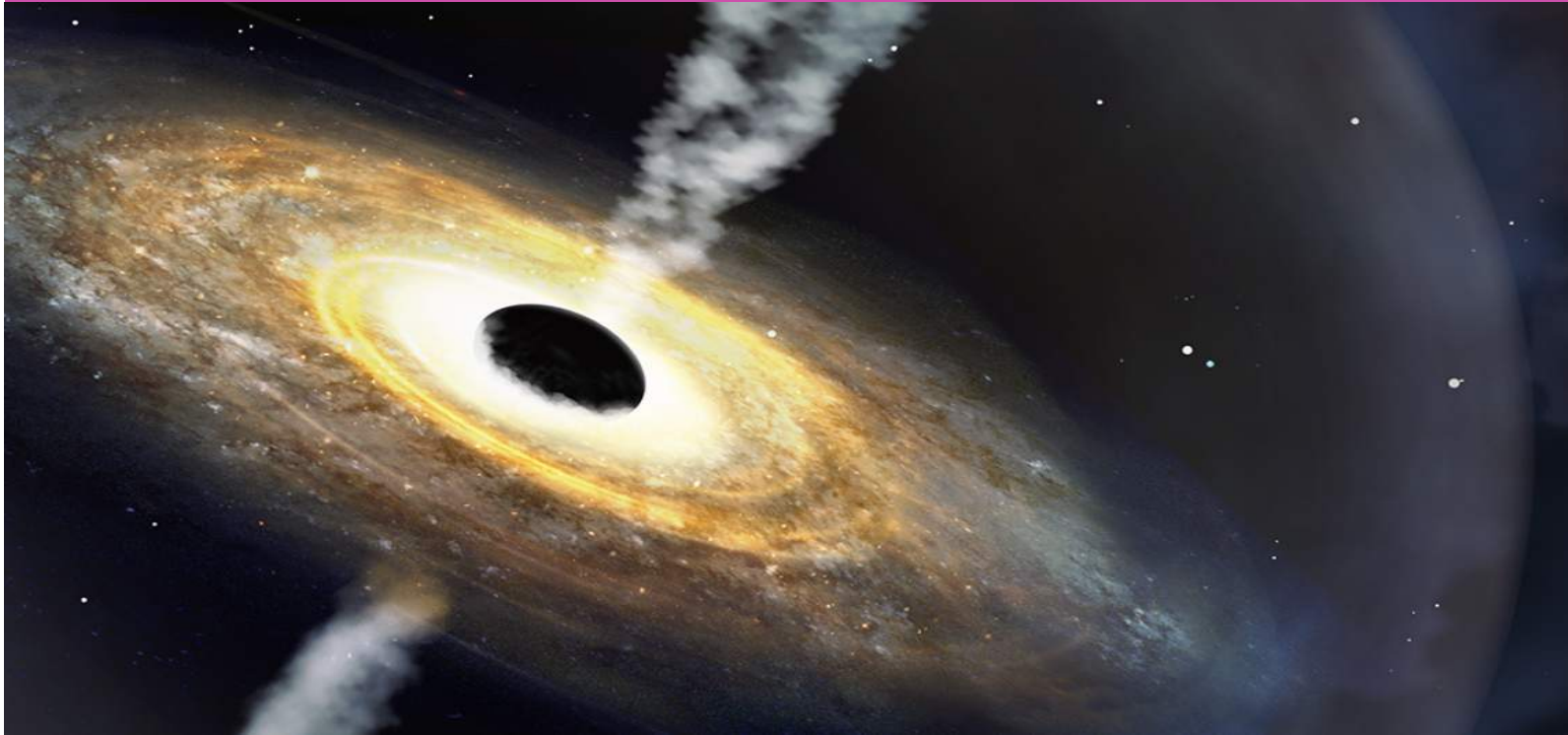


# **CENTRE FOR STEM & SPACE SCIENCE**

Nurturing Technocrats of Future



## **FOUNDATI💡N COURSES**

- **Basic Course in Astronomy**
- **Intermediate Course in Space Science**



## Basic Course in Astronomy

Eligibility	Astronomy Enthusiast ,Class 8th and above
Course Duration	25 Days / 2 hours per day
Mode of Study	Classroom / Online
Certificate Awarded By	Education Career Foundation
Structure of Course	Sessions of Theory, Experiments Sky Watch ,Examination

## Overview

Have you wondered about the objects in the night sky? Or about the laws that govern the working of the universe? The Basic Course in Astronomy is designed for students who want to gain the knowledge that will help them to unlock the mysteries of the universe. It is intended for anyone who wishes to develop and sharpen their interests in Astronomy and aid them in building a strong foundation that leads to fulfilling their education and career goals in Astronomy and Space Science.

## Course Highlights

- Getting a formal introduction to Astronomy and Space Science
- Study of celestial sphere and the basics of observing the sky.
- Knowing about scale of Universe, relative sizes of different objects in the universe
- Developing and fostering scientific and critical thinking
- Inducing independent thinking and creating aptitude for research.
- Learning about the progression of Astronomy from an observational to a scientific field.
- Training on handling and working of professional astronomical telescope.
- Learning about various tools and techniques used by astronomers for observations and research.
- Learning about the impact of Astronomy on daily life through technology transfer and applications.
- Providing a suitable foundation and guidance for further education and career in Astronomy.

## Learning Methods

- Streamlined curriculum theory and practical sessions by experts
- Extensive use of presentations, videos, graphics
- Lecture notes of each session
- Follow up questions and assignments for evaluation
- Continuous support from expert faculty

## Course Syllabus

### Unit 1: Overview of Astronomy

#### Introduction to Astronomy

Need of Astronomy, Origin of Astronomy, Famous astronomers, Developments in astronomy, Introduction to Astrophysics

#### Celestial Sphere

Introduction, Polar coordinate system, Right ascension – declination, Locating objects in the sky, Brightness of celestial bodies

#### Solar System

Ancient Theories about solar system, Origin of solar system, The Sun, Planets, Satellites, Comets, Location and motion of solar system

#### Stars

About stars, The Sun as a star, Formation and evolution of Sun, Formation of Stars, Life cycle of stars

#### Galaxies

About galaxies, Components of galaxies, Types of galaxies, Structure, Active Galactic Nuclei

#### Universe

What is the universe? Beginning, Evolution and Fate of the Universe, Multiverse

### Unit 2: Observational Astronomy

#### Sky Maps

About sky maps, History, Modern day sky maps, Stellarium

#### Optical Astronomy

Telescope, Principles of telescope, Types, Choosing the right telescope, Observatories, Space telescopes

### Unit 3: Satellites

About satellites, History, Launching, Orbits of satellite, GPS, Navigation, Communication satellites, Weather satellites

### Unit 4: Exoplanets

What are exoplanets? Detection of exoplanets, Detection Techniques, Significance

### Unit 5: Space Missions

About space missions, History of space missions, Purpose, Types, Some important space missions

### Unit 6: Scope, Importance & Future of Astronomy

Our place in the universe, Value of Astronomy and space technology, Contributions to modern society, Space agencies Future of space technology

## List of Practicals for Basic Course

- Study of celestial sphere – Part I
- Study of celestial sphere – Part II
- Measuring angular size of the Sun
- Parabolic Solar Oven
- Study of HR Diagram
- Reflection of Light and working of mirrors
- Refraction of light and working of lenses
- Working of telescope
- Reading Star Charts
- One Full Night Sky Observation

## Intermediate Course in Space Science

Eligibility	Astronomy Enthusiast ,Class 8th and above
Course Duration	25 Days / 2 hours per day
Mode of Study	Classroom / Online
Certificate Awarded By	Education Career Foundation
Structure of Course	Sessions of Theory, Experiments Sky Watch ,Examination

### Overview

This is the follow-up course of Basic course in Astronomy. This course intends to provide in-depth understanding of core concepts such as compact objects, propulsion systems, Space Exploration, Astrochemistry & Astrobiology, tools & techniques of Astronomy, Spectroscopy etc. At the end of the course students will be acquainted with higher educational and career opportunities in the field of Astronomy & Space Science.

### Course Highlights

- Study of advanced topics and technologies in Astronomy and Space Science.
- Developing and fostering scientific and critical thinking.
- Inducing independent thinking and creating aptitude for research.
- Exploring the life of stars and their inevitable death.
- Learning about the formation and properties of black holes and neutron stars.
- Understanding the concepts of dark matter and dark energy, along with the formation and eventual fate of the universe.
- Exploring the ingredients required for life and the possibility of extra-terrestrial life.
- Learning about rockets, spacecrafts and space propulsion.
- Training on handling and working of professional astronomical telescope and observation of deep sky objects like stars and nebulae.
- Providing a suitable foundation and guidance for taking the next step towards education and career in Astronomy and Space Science.

### Learning Methods

- Streamlined curriculum theory and practical sessions by experts
- Extensive use of presentations, videos, graphics
- Lecture notes of each session
- Follow up questions and assignments for evaluation
- Continuous support from expert faculty

## Course Syllabus

### Unit 1: Advanced Concepts in Astronomy

#### 1. Celestial Coordinate systems

Revision of celestial sphere, Ecliptic and Equatorial systems, Coordinate transformations, Galactic coordinates

#### 2. Earth & Moon

Earth as a planet, Formation of Earth and Moon, Earth's interior, Earth's Atmosphere, Seasons on Earth, Tides

#### 3. Stellar Physics

The Sun, Critical Mass, Birth of stars, Hydrostatic equilibrium, Nuclear fusion, Nova and Supernova

#### 4. Compact Objects

Death of stars, Stellar remnants, White dwarfs, Neutron stars, Black holes

#### 5. Galaxies and Intergalactic Medium

Structure and types of galaxies, Galactic rotation, Dark Matter, Galaxy clusters

#### 6. Cosmology

Redshift, Cosmic Microwave Background, Timeline of the universe, Cosmological models

#### 7. Life in the Universe

Astrobiology, Life, Chemistry of life, Necessary conditions for life, Exoplanets, Drake equation

### Unit 2: Space Science

#### 1. Space Propulsion

Rockets, Propulsion, Need, Rocket fuels, Rocket physics, History

#### 2. Physical Space Exploration

Space Exploration, Physical exploration, Purpose, Space missions, Future

#### 3. Satellites

Revision, Design of satellites, Satellites for space exploration, Orbiter missions

#### 4. Space Junk

Causes, Potential hazards, Proposed solutions

### Unit 3: Tools and techniques in Astronomy

#### 1. Non-optical astronomy

Electromagnetic spectrum, Atmospheric windows, Radio astronomy, Infrared astronomy, Ultraviolet and X-ray astronomy

#### 2. Data collection & analysis

Astronomical data, Optical image data, Radio data, UV and X-ray data

#### 3. Photo Detectors

About photo detectors, Need of photo detectors, CCD

#### 4. Spectroscopy

Spectrum, Types, Analysis, Doppler Shift, Applications

### Unit 4: Space Science as Career

### List of Practicals for Intermediate Course

- Study of celestial coordinate systems
- Calibration of spectrum
- Obtaining and studying spectra of various light sources
- Understanding temperature and colour of light sources
- Demonstration of working of Charge Coupled Device
- Demonstration of Satellite Communication
- Study of Solar Limb Darkening
- Analysing false colour images of galaxies
- Detecting asteroids and comets using Zooniverse
- Understanding standard candles in astronomy using streetlights

### References:

- 1.Our Solar System – A.W. Joshi & N. Rana – New Age Internationals
- 2.Astronomy: A Self-Teaching Guide – Dinah Moche – John Wiley and Sons
- 3.Fundamentals of Astronomy – Flavio Salvati – White Falcon Publishing
- 4.Stargazing – Royal Observatory Greenwich – Collins
- 5.A Companion to Astronomy & Astrophysics – Kenneth Lang - Springer
- 6.Introduction to Astronomy and Cosmology – Ian Morison – Wiley
- 7.Optics - Ajoy Ghatak – McGraw Hill Education
- 8.Satellite Basics for Everyone – C Robert Welti – iUniverse
- 9.Astrophysics of the Solar System – K.D. Abhyankar – Universities Press
- 10.Rocket Propulsion – Ramamurthy – Trinity

# LEARNING



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Basic Course in Astronomy  
+  
Intermediate Course in  
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+  
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