

COURSE CODE	COURSE TITLE	L	T	P	C
1154AE103	INTRODUCTION TO ASTRONOMY AND ASTROPHYSICS	3	0	0	3

**Course Category:**

University Elective

**a. Preamble :**

This course provides fundamental concepts of Astronomy and astrophysics with emphasis on exploring universe, galaxies and interstellar. This course also introduce the observatory techniques and life in universe.

**b. Prerequisite Courses:**

Physics

**c. Related Courses:**

- Space Mechanics

**d. Course Educational Objectives :**

- To understand the structure, scale and components of Solar system, galaxies and universe.
- To familiarize observatory techniques and stars
- To impart knowledge on life on universe

**e. Course Outcomes :**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Describe the scale and contents of universe	K2
CO2	Describe the interstellar, Galaxies & Star formation	K2
CO3	Explain the cosmology	K3
CO4	Explain observation and properties of star	K4
CO5	Explain life in Universe	K5

**f. Correlation of COs with POs :**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		H	H			M	H				
CO2	H		H	H			M	H				
CO3	H		H	H			M	H				
CO4	H		H	H			M	H				
CO5	H		H	H			M	H		H		

H- High; M-Medium; L-Low

**g. Course Content :**

**UNIT I Introduction to Solar system and Universe**

Introduction - Components and structure of Solar system - Sun - Planets - Comets - Asteroids - Components and structure of Milky way galaxy - Components and structure of Universe -

Newton Cosmology preliminary concepts - Einstein cosmology - Coordinate system and basic gravitational laws - Motion of planets and natural satellites - tides and waves - astronomical events

## **UNIT II Interstellar and Galaxies**

Interstellar medium and star formation - Interstellar dust - Interstellar gas - Star formation - Jeans length and mass - Protostars- Cluster of stars - Milky Way - Rotation curve of the Milky way - Black hole at the Galactic center - Normal and active galaxies - Equations of stellar structure - Mass continuity and hydrostatic equilibrium - Gas and radiation pressure - Virial theorem - Stability of stars - Lifetime on the Main-Sequence - Stability of stars .

## **UNIT III Cosmology**

Universe on large scales - Problems of a static, Newtonian Universe - Einstein's cosmological principle- Basic ideas of special relativity - Time dilation – Black holes - Basic properties of gravitation- Schwarzschild metric - Gravitational radiation from pulsars - Thermodynamics and evaporation of black holes - Energy and momentum- Doppler effect-Gravitational Waves - Expansion of the Universe: Hubble's law - Cosmological models for an homogeneous, isotropic universe - Early universe

## **UNIT IV Observatory and Properties of star**

The electromagnetic spectrum - geometrical optics - diffraction - telescopes -Neutrinos - Gravitational waves - Properties of stars: brightness's & colours - spectral lines - Hertzsprung-Russell diagram; the main sequence - distances to stars (parallax, standard candles, P-L relationships, m-s fitting etc); positions of stars

## **UNIT V Life in the Universe : The night sky**

Astronomical telescopes and observing procedures, coordinate systems and celestial motions, types and physical nature of astronomical objects - Directions & Time using star position - Life on earth - Life on jovian moons & Mars - search life in solar system - Extra-terrestrial Intelligence - Interstellar Travel & Fermi Paradox - Exoplanets life

**Total: 45 Periods**

### **h. Learning Resources**

#### **i. Text Books :**

1. Intelligent Life in the Universe” by I. S. Shklovskii& C. Sagan © 1998 Emerson-Adams
2. “An Introduction to Astrobiology” edited by D.A. Rothery, I. Gilmour and M.A. Sephton 2003 edition Cambridge University Press
3. Carroll, B.W. &Ostlie, D.A., An Introduction to Modern Astrophysics (Pearson)
3. Green, S.F. & Jones, M.H., An Introduction to the Sun and Stars (Cambridge University
4. Jones, M.H. &Lambourne, R.J.A., An Introduction to Galaxies & cosmology (Cambridge University Press)
5. Shu, F.H., The Physical Universe, An Introduction to Astronomy, (University Science Books)

6. Zeilik & Gregory, *Introductory Astronomy & Astrophysics*, 4th ed (Saunders College Publishing)