Course Type	Course Code	Name of Course	L	T	P	Credit
DE	**NPHD517**	Astrophysics And Cosmology	3	0	0	3

Prerequisites: Theory of Relativity, Thermodynamics.

Course Objective

The objective of the course is

- To provide a glimpse of the ever mysterious and stirring world of space and related phenomena to the beginners or to the curious students of any discipline other than physics;
- To motivate students to choose a career in related areas of physics;
- To prepare a base for an ambitious physics student who wants to go to advanced studies or research in relevant fields.

Learning Outcomes

Upon successful completion of this course, students will:

- Able to understand various astrophysical phenomenon.
- Eligible for higher studies in astronomy, astrophysics and cosmology
- Will be well versed with the cosmological structure and evolution of the universe

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	**Fundamentals:** Overview of major contents of universe, The scale of the universe: Mass, length and time scales in astrophysics, Celestial coordinates, Magnitude Scale, Sources of Astronomical information, Basics of astronomy.	7	This unit provides a broad knowledge of major celestial contents and basics of astronomical measurement and astronomy.
2.	**Stellar Astrophysics**: Properties of Ordinary stars: Stellar colors, Stellar distances, basic knowledge of stellar atmospheres, Spectral types, Hertzprung-Russel Diagram. Radiative Transfer, Binaries, variable stars. Stellar Evolution, White dwarfs, Supernovae, Neutron Stars, Blackholes, Pulsars.	10	This unit will help student in understanding Stellar Properties and classification.
3.	**Galaxy:** Shape, size and contents of our galaxy, Types of Galaxies, Normal and active galaxies.	4	Helps student in understanding Stellar formation and evolution, and be able to apply current basic models.
4.	**Cosmology and Cosmological principles:** observational tests, the early universe, thermal history, the microwave background, principles of homogeneity and isotropy; Newtonian cosmology, Relation between distance, red-shift and scale factor, Hubble's law	10	This unit will help student to understand basics of cosmological observations, the thermal history of the universe, the basic principles and models leading to the current cosmological models of the universe. Also they will be able to apply basic cosmological models to predict the age and structure of the universe
5.	**Relativistic Cosmology:** The Friedmann-Robertson-Walker metric, forms of energy and momentum, different solutions, open, closed and flat universes.	5	Students will learn the basic cosmological model, and the different possible solutions to the Einstein's equations in the context of cosmology.
6.	**Standard Model of Cosmology:** The Lambda CDM model, dark matter and dark energy	3	The current and observationally most viable cosmological model will be discussed, the meaning of dark energy, dark matter and inflation will be taught.
7.	**Perturbation Theory:** Introduction to cosmological linear perturbation theory, formation of structures	3	Students will be given preliminary introduction to linear perturbation theory that leads to structure formation.
	Total	**42**	

Textbooks:

1. Theoretical Astrophysics, Padmanabhan T., Vols.1-3, Cambridge University Press, 2005.
2.Astrophysics for Physicists, Arnab Rai Choudhuri, Cambridge University Press
3. An Introduction to Cosmology, 3rd Edition, Narlikar, Cambridge University Press, 1993.
4. Modern Cosmology by Scott Dodelson, Academic Press, 2003.

Reference Books:

1.The Physical Universe, F. Shu, University of California, 1982.
2.Astrophysical Concepts, M. Harwit, 3rd edition, Springer-Verlag, 2006.
3.The Classical Theory of Fields, 2nd ed., Landau, L.D. and Lifshitz, E.M., Pergamon Press, 1995.
4. Physical Cosmology, Peebles, P. J. E., Princeton University Press, 1993.