



University of Kerala

Discipline	PHYSICS				
Course Code	UK3DSEPHY203				
Course Title	FUNDAMENTALS OF ASTROPHYSICS				
Type of Course	DSE				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 Hrs	-	-	4 Hrs
Pre-requisites	1. Laws of motion, Familiarity with optics and light propagation 2. Knowledge of trigonometric functions and identities				
Course Summary	The course aims to give a fundamental concept of astronomy and astrophysics. This includes formation and evolution of stars and galaxies, basics of observational astronomy. On completion of the course, the student will get a comprehensive understanding of the fundamental principles and latest developments in astronomy and astrophysics.				

BOOKS FOR STUDY:

1. An Introduction to Astrophysics, Baidyanath Basu, PHI Learning Private Limited (2010)
2. Fundamentals of Astrophysics. Stan Owocki, Cambridge University Press, 2021
3. Astronomy, Andrew Fraknoi, David Morrison, and Sidney C. Wolff, XanEdu Publishing Inc; Second edition (2022)
4. Astronomy for Beginners, The introduction Guide to Space Cosmos Galaxies and Celestial Bodies, Sally R Ball ,Bluesource and Friends, 2019
5. Introduction to astronomy and cosmology, Ian Morison, Wiley
6. Introduction to Astronomy and Astrophysics, Pankaj Jain, CRC Press 2016

BOOKS FOR REFERENCE:

1. Astrophysics: Stars and Galaxies, K.D. Abhyankar, Universities Press (India) Limited (2001)
2. An Introduction to Modern Astrophysics, Bradley Carroll & Dale Ostlie Pearson Addison-Wesley, 2007
3. Modern Physics- R. Murugesan, Kiruthika Sivaprasath (2007), S.Chand & Company Ltd
4. Introduction to Space Science – Robert C Hymes (1971), John Wiley & Sons Inc.
5. Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]:

1. A Beginner’s Guide to Working with Astronomical Data, Markus Possel ([1905.13189v2.pdf](https://arxiv.org/abs/1905.13189v2) (arxiv.org))
2. <https://www.secretsoftheuniverse.in/basics-of-astrophysics-sou/>

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Introduction to Astronomy & Astrophysics (Book 3: Chapter 2 & 3)		12	
	1	Ptolemy’s model of Universe – Copernican and Galilean contributions, Branches of Astronomy	3	1
	2	Laws of planetary motion: Tycho Brahe’s observations, Kepler’s laws	5	1
	3	Cosmology: Expansion of the Universe - redshifts , The Big Bang and the expanding universe; dark matter and dark energy, Hubble’s law	4	1
II	Stellar Astrophysics (Book 2: Part 3)		12	
	4	Celestial coordinates, Astronomical distances- Parallaxes and Parsec, Electro-magnetic spectrum, Magnitude & Types, Color, Luminosity, Color-Magnitude Diagram,	3	2
	5	Formation of stars, Estimation of Star Formation Rate	3	2
	6	Stellar evolution, White dwarfs, Supernova explosion, Neutron stars, Chandrasekhar limit, Black holes	3	2
	7	Spectral classification of stars: The Harvard classification, Yerkes Classification, M-K classification, Hertzsprung Russel diagram	3	2

III	Galaxies (Book 2: Part 4)		12	
	8	Galaxy types: Spiral, Elliptical, Dwarf, Galaxy formation	4	3
	9	Our Galaxy- Galactic structure- Galactic rotation	4	3
	10	Cepheid variables as standard candle for distances to external Galaxies, Role of Galaxy Collisions, Galactic redshift and Hubble's law	4	3
IV	Solar system (Book 1: Chapter 5)		12	
	11	Formation of solar system: Nebular hypothesis, Evolution of protoplanetary disks	4	4
	12	Growth of solid bodies, Formation of Terrestrial and Giant planets	3	4
	13	Physical characteristics of planets in solar system	2	4
	14	Familiarization of solar system objects: Satellites, Asteroid belt, Kuiper belt, Comets and Meteorites, Search for extrasolar planets	3	4
V*	Observational Techniques in Astronomy (Book 1: Chapter 1, E-content - 1)		12	
	15	Imaging techniques: photography, CCD imaging	3	5
	16	Data Acquisition in optical, infrared, radio, x-rays, ultra-violet regions, Neutrinos and cosmic rays	2	5
	17	Telescopes and Detectors - Measuring the signal: telescope characteristics	2	5
	18	Chandra X- ray observatory, Hubble space telescope, James web Telescope, Ultra-violet Imaging telescope	2	5
	19	Familiarisation of software for data analysis - DS9, Topcat, Laxpc, Astropy, IRAF	3	5

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recall the historical development of astronomy and astrophysics	R	3

CO-2	Identify the key concepts in astronomy and astrophysics and develop basic observational skills to identify celestial objects	R, U	3
CO-3	Differentiate between different types of galaxies and understand the structure of galaxies	U, R	3
CO-4	Describe the structure and composition of the solar system	U	3
CO-5	Explain use of telescopes and observational tools to collect and analyze astronomical data	U, Ap	3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FUNDAMENTALS OF ASTROPHYSICS

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Understand the historical development of astronomy and astrophysics	PO 1/ PSO 3	R	F, C	L	-
CO-2	Learn the key concepts in astronomy and astrophysics and Develop basic observational skills to identify celestial objects	PO 1/ PSO 3	U	F,C	L	-
CO-3	Differentiate between different types of galaxies and understand the structure of galaxies	PO 1/ PSO 3	U	F,C	L	-
CO-4	Gain knowledge about the structure and composition	PO 1/ PSO 3	U	F,C	L	-

	of the solar system					
CO-5	Understand the use of telescopes and observational tools to collect and analyse astronomical data	PO 2/ PSO 3	U	F,C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
CO-2	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
CO-3	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
CO-4	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
CO-5	-	-	3	-	-	-	-	-	2	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	✓	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	✓	✓	-	-