Subject: Physics
Semester: Six
Course Name: Astronomy and Astrophysics
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY353
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit –I: Fundamentals of astronomy	Basic components of the universe – stars, planets and galaxies; celestial sphere and celestial coordinates system - altitude-azimuth (Alt-Az) and right ascension-declination (RA-DEC); Introduction to constellations through sky observation and Stellarium; concept of time – universal time, solar and mean solar time, sidereal time, local sidereal time, Julian day; flux and luminosity of celestial objects; stellar magnitude scale – apparent and absolute magnitude; measurement of stellar distances – trigonometric parallax; introduction to HIPPARCOS and GAIA.	8	Credit - 4
Unit- II: Astronomical techniques	Telescopes –size and light gathering power; resolving power; different types of optical telescopes (reflecting and refracting); space telescopes; concept of virtual observatory; virtual observatory tools in astronomy – SIMBAD, Aladin; SDSS, AAVSO, Sky-View; introduction to photometry; CCD –an introduction; spectroscopy and polarimetry.	7	
Unit – III: Stellar astrophysics	Star formation from interstellar medium (introduction only); properties of stars – mass, luminosity, radius and effective surface temperature; mass-luminosity, mass-radius and luminosity-radiustemperature relation; variable stars-cepheids; star clusters – open and globular, their ages (introduction only). Gravity and thermodynamics – hydrostatic equilibrium of stars; virial theorem; internal temperature and pressure of stars; spectral classification –	13	

	HR diagram; stellar evolution- idea of nucleosynthesis in main sequence phase- pp and CNO cycle; evolution of Sun-like stars off the main sequence -red giants and white dwarfs- Chandrasekhar mass limit (introduction only); evolution of massive stars – neutron stars and black holes (introduction only).		
Unit-IV: The solar system	(Lectures 5) The Sun; properties of photosphere, chromospheres and corona; Formation of the solar system – Kant-Laplace nebular hypothesis; asteroid belt and meteorites; Distances and atmospheres of planets; Pluto and dwarf planets; comets – Kuiper belt and Oort cloud; extra-solar planets – transit method of detection (introduction only).	5	
Unit- V: Galaxies and cosmology	(Lectures 12) The Milky Way-shape, size and its components; classification of galaxies –Hubble's tuning fork diagram; types – spirals, elliptical and lenticular; difference between spirals and ellipticals. Large scale structure of the universe – galaxies, clusters, superclusters, filaments, walls and voids; Cosmological Principle; Hubble's law; Newtonian cosmology and derivation of Friedman equation; closed and oscillating universe, flat and open universe; the Hot Big Bang model; Cosmic Microwave Background (CMB); steady state universe (introduction only); flat rotation curves in galaxies and evidence of dark matter; dark energy (introduction only).	12	

Reading list

1. Astrophysics for physicists, A. Rai Choudhuri, Cambridge University Press.
2. An introduction to the theory of stellar structure and evolution, D. Prialnik, Cambridge University Press.
3. Astrophysics- Stars and galaxies, K. D. Abhyankar, Tata McGraw Hill Pub.
4. Textbook of astronomy and astrophysics with elements of cosmology, V. B. Bhatia, Narosa Pub.
5. Astronomy Methods - A Physical Approach to Astronomical Observations, Hale Bradt, Cambridge University Press.
6. Introduction to astrophysics, H.L. Duorah and K. Duorah, Mani Manik Prakash (Guwahati) Digital Principles and Applications, A. P. Malvino, D. P. Leach and Saha, 7th Ed., 2011, Tata McGraw
7. The physical universe – An introduction to astronomy, F. H. Shu, University of Science Books.

8. The structure of the universe, J.V. Narlikar, Oxford University Press.
9. Introduction to cosmology, B. Ryden, Cambridge University Press

Graduate Attributes

i. Course Objective

- To introduce the students with fundamental concepts and observational techniques in astronomy including virtual observatory tools,
- to introduce them with physical processes occurring inside the celestial objects and
- to introduce the physical concepts required for the study of recent frontiers in astrophysics.

ii. Learning outcome

On successful completion of this course students will be able to understand the fundamental concepts in astronomy. They will be able to apply physics of celestial objects in understanding the universe. They will be equipped with the skills required for (i) observational astronomy (ii) virtual observatory tools and (iii) physical concepts of recent frontiers in astrophysics.

Theory Credit: 04 (Three)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

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