

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
FIRST SEMESTER 2016-2017
COURSE HANDOUT

Date: 01.08.2016

Course No. : PHY F215
Course Title : INTRO TO ASTRO & ASTROPH
Instructor : Rahul Nigam [Office A-204]
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Objectives & Scope of the Course:

The course aims to give Physics/non-Physics major students an elementary introduction and overview of Astrophysics and Cosmology. This is for students who were always curious about the sky out there but never had a chance to know it deeper. And of course, for students who want to pursue their career in Astro. The course covers broad spectra of topics, from the era of Kepler to Einstein, using basic principles of physics, keeping rigorous mathematics to minimum. Students can have hands-on experience working on a relevant topic of their choice also. We plan to have some sky-watching sessions also.

Text Book: Fundamental Astronomy: Karttunen, H., Kröger, P., Oja, H., Poutanen, M., Donner, K.J

Reference Book: An Introduction to Modern Cosmology by Andrew Liddle

G Ryan and Andrew J Norton Stellar Evolution and Nucleosynthesis

Detailed Course Plan:

Lecture Number	Chapters	Topics to be Covered	Book Chapters
1	Introduction	Brief historical timeline of astronomy	Class notes
2 to 4	Basic Concept of Astronomy	Celestial coordinates, Photometric concepts (Intensity, radiation, Luminosity), Magnitude scale, H-R diagram, Constellations. Astronomical nomenclature, Telescope, Radiation mechanism, Emission & Absorption Coefficients and Optical Thickness.	TB 2-5
5 to 8	Celestial Mechanics	Recapitulation of Vector calculus, Newtonian Mechanics and Gravity, Kepler's planetary motion, 2 body problem, Kepler's Equation & its solution, Escape velocity, Virial theorem.	TB 6, class notes
9 to 15	Solar System	An overview of solar system, planets, minor bodies of solar system, solar atmosphere, stellar rotation and magnetic field, solar interior-helioseismology and solar neutrino problem, energy sources of the sun.	TB 7, 12, class notes
	TEST1		
16-17	Binary stars, Variable Stars	Visual Binaries, Astrometric Binary Stars, Spectroscopic Binaries, Photometric Binary Stars	TB 9, 13
18-20	Stellar Evolution	Main Sequence, Stellar evolution, Red giant, Final stages of evolution, Supernova, Origin of elements, Star formation-Jeans Criterion for gravitational collapse.	TB 11, class notes
21 to 27	Compact Stars	Degenerate Fermi Gas, Equation of state, TOV equation. Newtonian Stars: Hydrostatic equilibrium, equation of state.	TB 14, class

		White dwarf: Electron degeneracy pressure, Chandrasekhar mass limit Neutron star: composition, radius, maximum mass Pulsars: Discovery, rotation period, energy loss from a pulsar, magnetic field strength, ages of pulsars. Black holes: Creation of black holes, black hole binaries, observational evidence.	notes
28	Interstellar medium	Large Scale Distribution of Interstellar Matter, Interstellar Lines, Interstellar Clouds, dust, gas, molecules.	TB 15
29 to 32	Galaxies	Our Galaxy (Milky Way), Classification of Galaxies Distribution of Galaxies: Luminosity and Mass, spectra of Galaxies, Local Group of Galaxies, Cluster of Galaxies, Radio Galaxies, AGN, Quasars.	TB 17, 18, lecture notes
	TEST 2		
33 to 42	Cosmology	Introduction, Observational Overview of the Universe: Homogeneity and isotropy, The expansion of the Universe, Particles in the Universe. Newtonian Gravity :The Friedmann equation The Geometry of the Universe: Flat, spherical, hyperbolic. Simple Cosmological Models : Hubble's law, Expansion and redshift, Solving the equation: Matter, Radiation, mixture. Cosmological Constant. Dark matter, The Cosmic Microwave Background, The early Universe: Big Bang, Baryogenesis, inflation, nucleosynthesis, recombination, last scattering surface.	RB

5. Evaluation Scheme:

	Evaluation	Duration	Weight age (%)	Date, Time	Nature of Component
1.	Test I	60 mins.	20.00%	9/9, 4.00--5.00 PM	Close Book
2.	Test II	60 mins.	20.00%	24/10, 4.00--5.00 PM	Open Book
3.	Seminar	10 mins. each	20.00%		Open
4.	Comprehensive Examination	180 mins.	40.00%	10/12 AN	Closed Book

6. Chamber Consultation Hour: By prior appointment

7. Notices: Notices for the course will be displayed on the Physics Group notice board and CMS.

8. Make-up Policy: Make-up will be given only against the application forwarded by chief warden. No make-up requests after completion of examination will be entertained.

**Instructor
PHY F215**