

AS101: Astrophysics and Astronomy - the language of the Cosmos (20 lectures in 30 hrs.)

(A certificate course for high school, UG, PG students)

Instructors: S.K. Chakrabarti, S. Palit, T. Basak, D. Bisht, P. Nandi

Mode of Instruction: English (every three months)

Syllabus

Orientation (2 Lectures)

Instructor: Sourav Palit/Devendra Bisht

Mass, length, time and magnitude scales in astronomy. Basic introduction of stars, galaxies, clusters, interstellar medium, black holes and other compact objects, our own galaxy Milky Way: components, morphology and kinematics of the Milky way, the galactic center, spiral arms.

Basic laws of heavenly bodies (3 Lectures)

Instructor: Prantik Nandi

Newton's law of gravitation, Kepler's laws, Archimedes principle and their applications in astronomy. Dark Matter, motion and properties of binary stars, mass measurements; Accretion flows in binaries.

Observational Astronomy (4 Lectures)

Instructor: Devendra Bisht

Observational tools for multi-wavelength astronomy - optical telescopes (refracting and reflecting telescopes), radio telescopes, astronomical instruments and detectors, observations at other wavelengths (infrared, ultraviolet, X-ray and gamma-ray astronomy), all-sky survey.

Interaction of light and matter (3 Lectures)

Instructor: Tamal Basak

Thermal radiation and thermodynamic equilibrium - Kirchhoff's law of thermal emission, Boltzmann and Saha equation, thermodynamics of black body radiation, concept of local thermodynamic equilibrium.

Stars (4 Lectures)

Instructor: Devendra Bisht

Properties of stars (distance, brightness, size, mass, temperature, luminosity), stellar spectra, spectral lines, the Hertzsprung-Russell (HR) diagram, luminosity and radius, evolution of stars: pre-main-sequence, main-sequence, evolution of high-mass and low-mass stars, late-stage evolution of stars.

Cosmology (4 Lectures)

Instructor: Sandip K. Chakrabarti

Newtonian cosmology, Olber's paradox, Hubble's law and the expanding Universe, standard cosmology, Big bang nucleosynthesis, Decoupling, Cosmic Microwave Background (CMB), dark energy and the accelerating Universe.

Sitapur Observatory trip (1 night)

Instructors: Devendra Bisht, Kuldeep Belwal, Mohit Bisht, Shraddha Biswas, Soumojit Tiwari

Discussion on the observables in the night sky, software guided observation using optical telescopes.