**Summer Term 2022**

# Course Handout Part II

**Date: 28.5.2022**

**Course No**. **: PHY F215**

###### Course Title : INTRODUCTION TO ASTRONOMY & ASTROPHYSICS

**Instructor in Charge**  **: Sarmistha Banik**

**Objectives & Scope of the Course:**

The course aims to give Physics/non-Physics major students an elementary introduction and overview of Astronomy & Astrophysics. 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 a broad spectrum of topics, from the era of Kepler to recent observation of gravitational waves, using basic principles of physics, keeping rigorous mathematics to minimum. We plan to have some hands-on session with telescope.

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

**Detailed Course Plan:**

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| --- | --- | --- | --- |
| **Lecture No.** | Learning objectives | Topics to be covered | **Chapter in the Text Book** |
| **1to 5** | **Basic Concept of Astronomy** | Celestial coordinates, Constellations, Telescopes, Magnitude scale, Optical Thickness, Hertzsprung--Russell Diagram. | TB 2-4,8 |
| **6-10** | **Radiation Mechanism & Stellar Spectra** | Radiation of Atoms and Molecules, Brightness and Flux Density, Photometric concepts, Polarization, Blackbody Radiation, The Rayleigh–Jeans Approximation, Planck Radiation Law, Temperature, Cosmic microwave radiation, Radiative Transfer(Absorption, Emission Reflection from an Opaque Body), Radiation from an Accelerated Charge. | TB-5, class notes |
| **11 to 15** | **Celestial**  **Mechanics** | Equations of Solution of the Equation of Motion Equation of the Orbit and Kepler’s First Law Orbital Elements Kepler’s Second and Third Law Systems of Several Bodies, Orbit Determination, Position in the Orbit, Escape Velocity, Virial Theorem, The Jeans Limit | TB 6, class notes |
| **16 to 22** | **Solar System** | An overview of solar system, planets, minor bodies of solar system, Energy sources of the sun, Internal Structure,The Atmosphere, Solar Activity | TB 7, 12, class notes |
| **23-24** | **Binary stars, Variable Stars** | Visual Binaries, Astrometric Binary Stars, Spectroscopic Binaries, Photometric Binary Stars | TB 9, 13 |
| **25-26** | **Stellar Evolution** | Evolutionary Time Scales, The Main Sequence Phase, The Giant Phase, The Final Stages of Evolution, Origin of the Elements | TB 11, class notes |
| **27 to 38** | **Compact Stars** | Degenerate Fermi Gas, Equation of state, TOV equation. Newtonian Stars: Hydrostatic equilibrium, equation of state.  White dwarf: Electron degeneracy pressure, Chandrasekhar mass limit  Neutron star: composition, radius, maximum mass, magnetic field  Pulsars: Discovery, rotation period, energy loss from a pulsar, magnetic field strength, ages of pulsars, Braking index,  Pulsars and the Interstellar Medium, Pulsar Timing  Black holes: Creation of black holes, black hole binaries, observational evidence  Gravitational waves, mergers of NS-NS. | TB 14, class notes |
| **39 to 42** | **Project Presentation** | Topics to be given during course work |  |

5. Evaluation Scheme:

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| --- | --- | --- | --- | --- | --- |
|  | Evaluation | Duration | **Weight age (%)** | **Date, Time** | **Nature of Component** |
| 1. | Mid-Sem | 90 mins. | 30.00% | 24/06 3.30 - 5.00PM | Closed Book |
| 3. | Quiz | 50 minutes | 10.00% |  | Open Book |
| 4 | Observation Project/Seminar | NA | 20.00% |  | Open Book |
| 5 | Comprehensive Examination | 180 mins. | 40.00% | 23/07 FN | Closed Book |

**6. Chamber Consultation Hour:** TBA

**7. Notices:** Notices for the course will be displayed on CMS.

**8. Make-up Policy:**  Make up for Mid-Sem and Compre will be given to emergency (hospitalization) case only, if forwarded by chief warden. Make up requests should reach the IC before the examination.

**9. Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**

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