DEPARTMENT OF PHYSICS

Learning Outcomes Based Curriculum
Interdisciplinary (CBCS) Courses

PH 600: Introduction to the Cosmos **L3-T0-P0-CH3-CR3**

Course Outcomes:

CO1: The students will get an overview of Astronomy and sky observation.
CO2: The students will understand the basic astronomy, how the philosophy of understanding the Universe through observations have been changing with time, scientific information and explanation of the celestial objects and phenomena etc.
CO3: The students are expected to learn wisdom of scientific temperament, creating a sense of social responsibility to lead the society in the field of science and technology.

Course Contents:

History of Astronomy, Classical Astronomy, Models of the Universe, New era of Astronomy.

Brief idea about celestial co-ordinate system, luminosity and magnitude of astrophysical objects.

Telescopes and its working (brief idea of ground and space based telescopes), CCD detectors. Role of Earth's atmosphere in observations (atmospheric extinction). Electromagnetic spectrum from the cosmos and the information gained from this.

Stars and Constellations. Qualitative idea about formation of a star, chemical abundances in a star. Measurements of mass, luminosity and temperature of a star. Saha equation.

H-R diagram and location of different stages of star. Sun as a star. Planets, satellites, asteroids and interplanetary dust. Stellar Evolution.

Red shift. Hubble's law. Hubble's classification of galaxies. The local group of galaxies. Radio galaxies, Quasars and Active Galactic Nuclei (AGN). Formation of the Universe.

Fundamental forces in nature. Big bang and formation of the first particles, formation of the first elements. Abundances of various elements in the Universe.

Detection technique of Exoplanet, Characteristics of Extraterrestrial life, Possible communication with Extraterrestrial life.

Text Books:-

1. Shu, F. H., *The Physical Universe* (McGraw-Hill, 2010)
2. Abhyankar, K. D., *Astrophysics: stars and galaxies* (Universities Press, 2002)

Reference Books:-

1. Weinberg, S. *The First Three Minutes: A Modern View Of The Origin Of The Universe* (Basic Books, 1993)

2. Tayler, R. J., *The Stars: Their Structure and Evolution* (Cambridge University Press; 2 edition, 1994)
3. Narlikar, J. V., *An Introduction to Cosmology* (Cambridge University Press; 3 edition, 2002)
4. Hawking, S., *On The Shoulders Of Giants,* (Running Press, 2002)

PH 602: History of physics **L3-T0-P0-CH3-CR3**

Course Outcomes:

CO1: The students will be able to get a general understanding of the chronology of the developments of physics and physical concepts.
CO2: The students will have the knowledge on development of scientific ideas in general and of physics in particular in ancient human civilizations like Egyptian, Babylonian, Indian, Chinese, Greek, Islamic etc.
CO3: The students will be able to gain the knowledge on the chronology of developments of different branches of physical sciences, like, mechanics, electricity and magnetism, thermodynamics etc. in the middle ages.
CO4: The students will learn about the history of the developments in various aspects of the modern physics, e.g, nuclear and particle physics, radioactivity, quantum mechanics, theory of relativity, electronics etc.

Course Contents:

Early History: *Science and physics, ancient Greek civilization*, Muslim scientists, medieval years, *Indian and Chinese civilizations.*

Scientific Revolution: *Nicolaus Copernicus, Galileo Galilei, Johannes Kepler*, Rene Descartes, *Sir Isaac Newton,* early thermodynamics.

Later Developments: Mechanics and its developments, thermodynamics and laws of thermodynamics, electricity and magnetism, James Clerk Maxwell, Maxwell equations.

Birth of Modern Physics: Radiation experiments, *Albert Einstein and theory of relativity, special relativity, general relativity*, development of quantum mechanics.

Contemporary Particle Physics: Standard model of particle physics, discoveries of particles, quark model, quantum field theory, quantum electrodynamics, quantum chromodynamics, beyond standard model, string theory, quantum gravity and super-symmetry, Higgs Boson.

Influential Physicists: [The instructor will discuss on minimum 10 influential physicists in different branches of Physics]

Optional topics:
(i) A brief introduction to Philosophy of Science, including "falsification" by Karl Popper.
(ii) Ten most famous experiments in Physics
(iii) Ten most fundamental equations of Physics
(iv) Scientific methodology

Text books:

1. Einsten A. and Infeld, L., *The Evolution of Physics*, (The Scientific Book Club, 1999).
2. Simony Karoly, *A Cultural History of Physics*, (CRC Press, Taylor and Francis, 2008).
3. Bernard C.I., *The Birth of a New Physics*, (W. W. Norton and Company, 2011).

References Books:

1. *Great books of the western world*, edited, (Encyclopedia Britanica Publications, 2010).
2. Agar, Jon, *Science in the twentieth century and beyond*, (Cambridge: polity press, 2012).
3. Ben-Claim, Michael, *Experimental philosophy and the birth of empirical science*, (Aldershot: Ashgate, 2004).
4. Dear, Peter, *The mathematical way in the scientific revolution*, (university of Chicago press,1995).
5. Drak, Stillman, *Galileo at Work: His scientific biography*, (University of Chicago press, 1978).
6. Heilbron, J.L., *Electricity in the 17th and the 18th centuries*, (University of California press,1979).
7. Jhiele, Pudiger, *Arabic Sciences and Philosophy*, (Cambridge University press, 2005).
8. Schweber, Silvan, *QED the man who made it*, (Princeton University press, 1994).
9. Kragh, Helge, *Quantum Generations: A history of physics in the twentieth century*, (Princeton University press,1999).