INTER-DISCIPLINARY COURSE

Semester III

PHYIDC-1 (Theory): Physics in Daily Life	
45 Lectures	**3 Credits**

Note: Applications listed in each section below are not exhaustive but indicative only. Instructors are encouraged to explain other possible applications related to each section if time permits to elucidate corresponding physical laws/phenomena.

Newton's laws of Motion

Relevant theory: Velocity, acceleration, momentum; Reference frames, Inertial and non- inertial frames; Newton's laws of motion; Friction; Advantages and disadvantages due to friction, translational and rotational motion, Linear momentum, Kinetic and potential energy. Motion of a projectile.

A few applications in day to-day life (No derivation): Movement of electric fan after switching off, movement of passengers inside bus, working of air bag inside car, pushing a push-cart (empty and loaded), kicking football with different forces, riding bicycle (to accelerate need to push the paddle harder), banking of road, sedimentation in river flow, walking, swimming, tension of rope **etc.**

Heat and Thermodynamics

Relevant theory: Heat and temperature, Measurement of heat and temperature, different scales and their relation, Thermal conductivity, conductivity of solids and fluids

A few applications in day to-day life (No derivation): working of thermos flask, use of blanket, multiple layers of clothing better than a single thick cloth, black bottom surface of utensils, nonmetal handles of utensils, food cooks quicker in oil than water, working of pressure cooker, clinical thermometer, extreme weather of desert, wind flow: low pressure, cyclone, **etc.**

Sound

Relevant theory: Sound Sources, Wave length, frequency and time period of wave. Reflection of sound,

A few applications in day to-day life (No derivation): examples of echo, working of SONAR, working of radar, construction of auditorium, working of stethoscope, application of ultrasound in pathology, ability of sound to travel further in cold days, use of hollow cavity in musical instruments, reason behind the fact that empty vessel sounds more, **etc.**

Light

Relevant theory: Light sources, Reflection, Refraction and scattering of light, Phenomenon due to reflection and refraction, total internal reflection, Mirrors and lenses.

A few applications in day to-day life (No derivation): apparent depth, colour of sky, twinkling of stars, mirage, optical fibers, rainbow, rear view mirror, human eye, defects in eye and their correction, spectacles, **etc.**

Electricity and Electronics

Relevant theory: Current; A.C and D.C, Voltage, Ammeter, Voltmeter, Galvanometer; uses of these, basic principle of transformers and generators (no deduction required); amplifiers, rectifier, etc. Semiconductors, uses in daily life. Diode and Transistors.

A few applications in day to-day life (No derivation): Conversion of AC to DC power by mobile chargers, Use of DC power in LED, Electric bulbs: Filament, CFL, LED, Electric heater, Estimation of electricity consumption of a household, Electrical safety, Use of transistors as amplifier and switch, working of microphone and speaker, **etc.**

Atomic and Nuclear Physics

Relevant theory: Atom and atomic nucleus, Dimension, atomic and nuclear densities, atomic spectra, Radioactivity, alpha, beta and gamma radiation, half -life and average life.
A few applications in day to-day life (No derivation): Sodium lamp, neon lights, Nuclear power plant, radioactive hazards, radiation detectors, Use of atomic absorption and emission spectrometers in medical laboratory and mining industry, **etc.**

Electromagnetic Theory

Relevant theory: Comparative study among different waves, Radio, T.V, Microwaves
A few applications in day to-day life (No derivation): microwave oven, Use of microwave in wireless network, Application of electromagnetic wave in mobile, TV and radio broadcast, **etc.**

Quantum Mechanics

Relevant theory: Basic difference between classical and Quantum Mechanics, Quantum theory of light, Quantum Tunneling. (no deduction required)

A few applications in day to-day life (No derivation): LASER, MRI, **etc.**

Reference Books

- Fundamentals of Physics with Applications by A. Beiser
- Optics by Ajay Ghatak. Tata McGraw-Hill publishing Co. Ltd.
- Elements of Properties of Matter, D.S Mathur, S .Chand & Co
- Electricity and Magnetism, A. S. Mahajan, A. A. Rangwala, McGraw Hill
- Concepts of Modern Physics, A. Beiser, Tata McGraw-Hill publishing Co. Ltd.

Semester IV

PHYIDC-2 (Theory): Introduction to Astronomy	
45 Lectures	**3 Credits**
Astronomical Scales	
Astronomical Distance, Mass and time scales. Parallax, Distance measurement. Distance between Earth and Sun (Astronomical unit), Light year, Parsec, Pinhole camera for measurement of radius of the sun. Celestial Spheres. Astronomical Coordinate Systems. Construction of Galilean Telescope, other optical Telescopes and magnification power. Celestial objects visible with them.	
Eclipse	
Solar eclipse, Lunar eclipse, Total, annular and partial eclipses.	
Sun	
Transient phenomenon: Sun spot, Solar storm, Diamond ring in the Sun and the source of energy in the Sun, Tides.	
Night sky	
Name of constellations, Nebula, Comets, Kuiper belt, Solar system, Planets with habitable conditions, Search for Extra Terrestrial Intelligence (S.E.T.I.).	
Stars and its classifications	
HR diagram, Normal Stars, White dwarf, Neutron star, Black hole.	
The Milky way	
Basic structure and properties of the Milky Way.	
Galaxies	
Elliptical, Spiral and Lenticular galaxies, Galactic halo.	
Reference Books	
• Modern Astrophysics, B. W. Carroll & D. A. Ostlie, Addison-Wesley Publishing Co. • Introductory Astronomy and Astrophysics, M. Zeilik and S. A. Gregory, Saunders College Publishing. • The physical universe: An introduction to astronomy, F. Shu, Mill Valley: University Science Books. • Fundamentals of Astronomy (Fourth Edition), H. Karttunen et al. Springer. • Astro Physics a modern perspective-K. S. Krishnasamy, (New Age International (P) Ltd, 2002) • An introduction to Astrophysics - Baidyanath Basu, (Prentice-Hall of India Private limited, 2001). • Textbook of Astronomy and Astrophysics with elements of cosmology, V. B. Bhatia, Narosa Publication.	