

# **PHYSICS MODULES**

(For AICTE Approved Colleges)

Prepared by

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## Preface

The genesis of this module lies in the Induction Program first conceived and started by IIT(BHU) on 2016 on mass scale for about 1000 students. The fact is that the students are overburdened and stressed out due to a hectic high school life. To refresh their creative mind, they were exposed to month long diverse credit courses like Physical Education, Human Values and Creative Practices, as well as several non-credit informal activities. In a welcome step the AICTE has proposed to extend this program to the Engineering Colleges affiliated to them.

In fact, purpose of this module is to bridge the gap between what the students need to know before they can start taking the advanced courses in the college level and what they are actually aware of from the intermediate level. Consequently, after the completion of the 3-weeks induction program, it is proposed that (besides other subjects) bridge courses in basic Physics, Chemistry and Mathematics should be taught to these students for the rest of the semester. The bridge courses will cover typical weaknesses of students in science at the 10+2 level.

The modules in Physics are prepared keeping in mind that an hour of discussion will bring all the students in the same stage such that they can cope up with the courses in their college level, that requires the concepts of different topics in Physics. The modules are made as interactive sessions between the students and the instructors. Furthermore, we have discussed those topics which harder to understand. At the end of the discussion teacher may also take a small test to understand how much the students followed the class.

We are very much grateful to all the faculty members (Prof. B. N. Dwivedi, Prof. O.N. Singh, Prof. D. Giri, Prof. P. Singh, Prof. S. Chatterjee, Prof. R. Prasad, Dr. (Mrs.) A. Mohan, Dr. P. C. Pandey, Dr. (Mrs.) S. Upadhyay, Dr. A. K. Srivastava, Dr. S. K. Mishra, Dr. A. S. Parmar, Dr. S. Tripathi, Dr. S. Patil, Dr. (Mrs.) S. Mishra, Dr. P. Dutta, Dr. S. K. Singh and Dr. (Mrs.) N. Agnihotri) in the Department of Physics who devoted their valuable time to prepare the module.

This is to mention that that modules are prepared for the students with an objective to create interest among them in the subject. Many materials from the Internet have been adopted to make this lecture more illustrative and elaborative. The materials from the Internet have been utilized solely for educational purpose.

Department of Physics

IIT(BHU), Varanasi

# Content

<b>Module</b>	<b>Lecture Required</b>
1. Mechanics	02
2. Mechanical Properties of Solids and Fluids	03
3. Waves and Oscillations	03
4. Electricity and Magnetism	03
5. Electromagnetic Signal	02
6. Optics	02
7. Semiconductor Electronics	03
8. Modern Physics	02
9. Atomic and Nuclear Physics	02

# Syllabus

**Note:** The concepts should be explained through demonstrative experiments.

- 1. Classical Mechanics:** Centre of Mass, Pure Translational and Rotational motion, Torque and angular momentum, Principle of moments (Moment of Inertia), Radius of Gyration, Generalized Motion, Kinematics of rotational motion about a fixed axis.
- 2. Mechanical Properties of Solids and Fluids:** Elastic behaviours of solids, Hooke's Law, Young's Modulus, Shear Modulus, Bulk Modulus, Applications of Elastic behaviours of materials, Compressibility, Viscosity, Relative density, Pascal's Law, Streamline Flow, Bernoulli's Principle, Surface Tension, Drops and Bubbles.
- 3. Waves and Oscillations:** Rectilinear motion, Oscillations or Vibrations, Simple Harmonic Motion, Damped Harmonic motion: Real oscillatory system, Forced or Driven oscillation, Types of Waves, Superposition of Waves, Reflection and Refraction, Standing Waves and Normal Modes, Beats, Resonance, Doppler's Effect.
- 4. Electricity and Magnetism:** Physical concepts of gradient, divergence, and curl; Laplacian operator, Concept of electricity and magnetism, Coulomb's law, Electrostatics, Magnetostatics, The Lorentz force, Maxwell's equations.
- 5. Electromagnetic Signal:** The dynamical magnetic field, The dynamical electric field, Electromagnetic Waves.
- 6. Wave Optics:** Interference of light, Photons, Young's Double Slit Experiment, Huygens's Principle, Diffraction, Diffraction Grating, Polarization.
- 7. Semiconductor Electronics:** Classification of metals, conductors and semiconductors, Fermi Level, Intrinsic Semiconductor, Extrinsic Semiconductor, p-n junction, Semiconductor Diode, Half-Wave Rectifier, Full-Wave Rectifier, Zener diode, Photodiode, Light emitting diode, Junction Transistor.
- 8. Modern Physics:** Wave nature of light, Particle nature of light: the photon.
- 9. Atomic and Nuclear Physics:** Matters, Atoms, Atomic Theory: Atomic Theory by John Dalton, Atomic Theory by J. J Thompson, Atomic Theory by Ernest Rutherford, Atomic Theory by James Chadwick, Discovery of the Neutron, Proton, Neutron, Electron, Limitations of Bohr's Theory