Classical Physics

1.1 Course Number: PY111

1.2 Contact Hours: 3-1-0 Credits: 11

1.3 Semester-offered: 1st Year-Odd

1.4 Prerequisite: Class 12th level Physics and Mathematics

1.5 Syllabus Committee Member: Dr. A. Shukla (C), Dr. A. Sharma, Dr. J. Karthikeyan

2. **Objective:**

This course is prepared to understand the basic principles and fundamentals of classical Physics for macroscopic, microscopic and system of particles. The 1st part of the course is devoted on the understanding of mechanics of a mechanical system in different coordinate system and reference frames. The second part of the syllabus is devoted to thermal physics based on the connection of microscopic motion to macroscopic observation. Further the concept of electromagnetic waves -particle duality and need of other formulation to explain the finding which could not be explained by known classical mechanics. Also, the understanding of electromagnetic theory forms the basis for conceptualizing the signal communication techniques and also forms the basis of electric signal theory. The course also covers the behavior of system of particles at different physical parameters (such as temperature, pressure, volume, velocity etc.), which can be understood with the help of statistical mechanics, which is essential for higher learning in different transport phenomena related to heat and mass transfer. As the mechanics of very fast moving object could not be explained by the above laws and principles, some understanding of special theory of relativity is also provided in the syllabus.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Classical Mechanics	Co-ordinate systems, plane polar, cylindrical and spherical polar co-ordinate systems, frame of reference, rotational frame, Coriolis forces. Motion of system of particles, Conservation laws, Constraints and degrees of freedom, Generalized co-ordinates, Lagrange's and Hamilton's formulations.	10

2	Thermal Physics	Concepts of distribution of molecular velocities; distribution laws and statistics-MB, FD and BE; mean free path; Transport phenomena – viscosity, diffusion; thermal conductivity, measurement of thermal conductivity; periodic and aperiodic flow of heat, Wiedemann-Franz law. Heat radiation, black body and black body radiation, Planck's distribution law and its application to classical distribution (Raylegh-Jeans and Wiens) and total radiation (Stefan-Boltzmann) laws.	10
3	Wave Motion and Introduction to Electromagnetic waves	Longitudinal and transverse waves, wave equation, plane waves, phase velocity, superposition of waves and wave packets, group velocity, Electromagnetic Waves: Electric and magnetic fields in a medium, Maxwell's equations, EM wave equation, plane electromagnetic waves, Electromagnetic (EM) waves in vacuum and media, Energy and momentum of EM waves, Poynting's theorem.	11
4	Relativistic Mechanics	Michelson – Morley experiment, Postulates of Special theory of Relativity, Galilean and Lorentz transformation equations and its application, Time Dilation, Length Contraction, Relativistic mass, energy and momentum, Addition of velocities, Equivalence of mass & energy.	9
		Total	**40**

4. Readings

4.1 Textbooks:

1. Classical Mechanics, H Goldstein, Reading Mass Adison-Wesley Press, Inc.
2. Physics for Scientists and Engineers Raymond A. Serway and John W. Jewett
3. Concepts of Modern Physics, A. Beiser
4. Introduction to Electrodynamics, Griffiths D.J. (2012) PHI Learning Pvt. Ltd.

4.2 Reference books:

1. An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow, Tata McGraw-Hill,
2. Classical Dynamics, D T Greenwood, Prentice Hall of India, Pvt. Ltd., New Delhi
3. Physics: Principles with Applications Douglas C. Giancoli
4. Introduction to special relativity, Robert Resnick.
5. Introduction to Electricity & Magnetism Liao, Dourmashkin, and Belcher
6. Introduction to Electromagnetics, Griffith D.J. PHI Learning, 4th edition

5 Outcome of the Course:

This course is designed in such a way that the students learn the fundamentals of Classical Physics, which will build the base for the study of Engineering and Technology. On completion

of this course, the students will be able to have a basic understanding of motion of system of particles, statistical behavior of molecules and their correlation with gross properties such as temperature, heat conduction, Radiation Laws of Black Body etc. The course will also help students in understanding wave motion, the propagation characteristics of electromagnetic waves in vacuum as well as in materials systems and the concept of relativistic mechanics to study its effect on length, time and mass-energy equivalence.

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