DEPARTMENT OF PHYSICS

FAZL ALI COLLEGE

MOKOKCHUNG: NAGALAND

COURSE OUTCOME OF

PHYSICS (HONS) B.Sc. COURSE

PHY101

Mechanics, Properties of Matter, Relativity & Electricity

(4 credits - 60 hours)

Course Overview:

This paper provides a framework on which all other fields of physics are based. **Mechanics** deals with the study of forces that keep bodies in equilibrium or causes it to move. The hidden symmetry and invariance underlying Newton's laws, the relation between energy, momentum and their conservation laws which is at the heart of the motion of everything, will be studied. **Properties of Matter** will deal with the study of elastic properties of solids and fluids in motion. **Relativity** will introduce the student to the fascinating inter-relationship between space, time and mass and the equivalence between mass and energy. **Electricity** will explore the behaviour of alternating currents in various circuits, upon which electronics is based.

At the end of the study, the student will have learnt the fundamental principles governing the physical universe, have conceptual and mathematical understanding of the principles of physics and have developed problem solving skills.

PHY102

Practicals

(1 credit)

Course Overview

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience.

PHY103

Mathematical Physics I

(3 credits - 45 hours)

Course Overview

Mathematical Physics I focuses on mathematical tools from the physicist's point of view. **Vector Analysis** used extensively in almost all areas of physics; **Matrices** which finds applications in optics, quantum mechanics, solution of linear equations; **Fourier Series**

which provides a simple analysis of complex oscillatory phenomena; these are all covered in this course.

At the end of the study, the student will have learned how to use these tools to apply them to various areas of physics and solve problems.

PHY201

Thermal Physics & Oscillations

(4 credits – 60 hours)

Course Overview

Thermal Physics studies the relation between heat and work, the motion at the molecular and atomic level and its relation to the quantity we call heat and temperature on the large scale platform. This paper also deals with the kinetic theory, thermodynamics and thermal properties at ultra cold temperatures and the phenomenon of superconductivity. **Oscillations** starts from a study of simple repetitive motion of particles and then on to more complex motions which is at the heart of much of physics: mechanical oscillations such as sound, water waves to electrical oscillations and waves to quantum phenomenon. It ends with application of sound in real life; hall acoustics, music etc.

At the end of the study, the student will have learned the fundamental principles governing the behaviour of matter at the molecular level and its large-scale aspects of heat and temperature, have conceptual and mathematical understanding of the principles of oscillation physics and develop problem solving skills in these areas.

PHY202

Practicals

(1 credit)

Course Overview

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience.

PHY203

Mathematical Physics - II

(2 credits - 30 hours)

Course Overview

This paper dwells on the mathematical tools for the physicist. **Differential Equations** provides a simple description of natural phenomena involving rate at which things happen and has wide application in modeling (situations where simple equations and solutions are not available). Not only in physics but other areas of science and economics makes extensive use of differential equations. The harmonic functions such as Legendre polynomials, Hermite functions, Bessel functions etc will be studied in this paper. **Beta and Gamma Functions** which are essential to the solution of many integrals in applied physics, are covered in this paper.

At the end of the study, the student will have learned how to use these tools to apply them to various areas of physics and solve problems.

PHY204

Computational Physics Practicals

(1 credit)

Course Overview

This course introduces computational approach to solve physics problems. After introducing the nuances of numerical programming, four different problems are addressed. Although each problem may have various approaches with their advantages and disadvantages, only one approach is selected. This is to ensure that the student gets enough time to focus on the problem and learn this new discipline.

At the end of the course, the student will have learnt to do numerical computations and be able to apply it to real-life problems of physics.

PHY301

Electrodynamics I and Quantum Mechanics I

(4 credits - 60 hours)

Course Overview

Electrodynamics I expounds on the fundamental inter-relation between magnetism and electricity. It starts off from Coulomb's law and ends up in electro-magnetic induction which relates mechanical energy to electric and magnetic energies. **Quantum Mechanics**

studies the properties of matter and energy at sub-atomic levels and takes a different look at reality with non-intuitive conclusions. The student will learn how starting from simple assumptions, one can calculate the energy levels and states of atoms, lifetime of states etc.

At the end of the study, the student will have learnt the fundamental principles governing the relationship between electric and magnetic fields, have conceptual and mathematical understanding of the close inter-relation between electricity and magnetism as well as quantum mechanical concepts and develop problem solving skills.

PHY302

Practicals

(1 credit)

Course Overview

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience.

PHY303

Thermodynamics & Statistical Physics

(3 credits - 45 hours)

Course Overview

This course is an advanced treatment of **Thermodynamics**. Starting from Maxwell's equations, it relates the measurable properties such as pressure and temperature to more abstract quantities such as entropy as well as phase transitions. **Statistical Physics** studies the motion of matter at the atomic level and relates the microscopic quantities such as molecular velocities to the macroscopic quantities such as pressure, heat etc and connects order/disorder to entropy. The statistics of classical particles and quantum particles are also discussed.

At the end of the study, the student will have learned the fundamental principles of heat at the macroscopic and microscopic levels, have conceptual and mathematical understanding of the principles involved and develop problem solving skills.

PHY401

Electronics I & Optics

(4 credits - 60 lectures)

Course Overview

Electronics is at the heart of the amazing technology at our disposal. The students will learn about the building blocks of electronics technology (diodes and transistors) and their roles and properties in different circuits. In **optics**, the student will study the principles of image formation from geometrical considerations and the oscillatory nature of light is brought out by the phenomenon of interference, diffraction and its relation to electrodynamics through the phenomenon of polarization and lasers.

At the end of the study, the student will have learned the fundamental principles governing the operation of electronic devices and circuits and optics, have developed conceptual and mathematical understanding of the principles involved and develop problem solving skills.

PHY402

Practicals

(1 credit)

Course Overview

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience.

PHY403

Mathematical Physics III & Quantum Mechanics II

(3 credits - 45 hours)

Course Overview

The algebra and calculus of complex number and complex functions is developed in **Mathematical Physics III** and the student will appreciate how complex integrations can greatly simplify a problem. Tensors which takes mathematics to a higher level of understanding and is the language of general relativity, fluid mechanics, elasticity, electrodynamics is studied in this paper. **Quantum Mechanics II** focuses of the matrix mechanics approach to the study of the field and develops the operator mechanism for solution of problems.

At the end of the study, the student will have learnt the fundamental principles governing the physical properties of matter at sub-microscopic levels, have developed conceptual and mathematical understanding of the principles involved and develop problem solving skills using these and the mathematical tools developed.

PHY501

Nuclear Physics I & Solid State Physics I

(4 credits - 60 hours)

Course Overview

Nuclear Physics I focuses on the sub-atomic world of the nucleus and its constituents. The shape of the nucleus and its properties, the lifetime of excited states and the extraction of energy through the process of fusion and fission will be studied. **Solid State Physics I** studies the inter-relations between the atoms to form the structures that we are more familiar with. From thermal properties and electrical properties of matter to the shape of the atomic crystals - the reach of this subject is vast.

At the end of the study, the student will have learnt the fundamental principles governing the behaviour of the nucleus and the complex relations between atoms to form structures through bonds, have conceptual and mathematical understanding of the principles of physics involved and develop problem solving skills.

PHY502

Practicals

(1 credit)

Course Overview

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience.

PHY503

Electrodynamics II and Electronics II

(3 credits - 45 hours)

Course Overview

Electrodynamics II provides more in-depth exposition of the subject, from Maxwell's equations to electromagnetic waves in media. **Electronics II** also gives a more detailed study of electronics including multistage amplifiers and oscillators and ends with digital electronics.

At the end of the study, the student will have learnt the fundamental principles of electromagnetism and electronics, have conceptual and mathematical understanding of the principles of physics involved and develop problem solving skills.

PHY601

Atomic Physics, Particle Physics & Cosmic Rays

(4 credits - 60 hours)

Course Overview

Atomic Physics studies the behavior of atoms and molecules and the manifestations of its properties through emission of light, X rays and so on. The esoteric world of sub-nuclear particles at ultra high energies will be dealt with in **particle physics and cosmic rays**.

At the end of the study, the student will have learnt the fundamental principles governing the structure of the atom and the interactions of particles at ultra high energies, have developed conceptual and mathematical understanding of the principles of physics and problem solving skills.

PHY602

Practicals

(1 credit)

Course Overview

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience.

Note: The student will select only one paper from among PHY603, PHY604 and PHY605

PHY603

Astrophysics, Cosmology and Classical Mechanics

(2 credits - 30 hours)

Course Overview

Astrophysics deals with the physics of the Universe, including the physical properties of celestial objects, their interactions and behaviour. **Cosmology** deals with the origin, structure and space-time relationships of the universe. Stellar evolution, black holes, the Big Bang and the future of the universe are some of the topics to be studied in this paper. **Classical Mechanics** studies the fundamental nature of the forces governing motion, by reformulating Newton's laws of motion to address a huge range of problems ranging from molecular dynamics to the motion of celestial bodies. The student will study constrained motion, principle of virtual work, d'Alembert Principle to Lagrange's equation of motion.

At the end of the study, the student will have learnt the fundamental principles governing the structure and growth of celestial bodies in the universe and the complex relations between them. They will have developed conceptual and mathematical understanding of the principles of motion and develop problem solving skills.

Note: The student will select only one paper from among PHY603, PHY604 and PHY605

PHY604

Solid State Physics II

(2 Credits – 30 hours)

Course Overview

Solid State Physics II continuous on with the study of crystals and X rays diffraction, heat, electrical and magnetic properties.

At the end of the study, the student will have developed deeper insight into solid state physics and the have developed problem solving skills.

Note: The student will select only one paper from among PHY603, PHY604 and PHY605

PHY605

Nuclear Physics II

(2 units – 30 hours)

Course Overview

Nuclear Physics II studies α, β and γ ray spectroscopy, the liquid drop and shell models of the nucleus and the still not well-understood nature of nuclear forces.

At the end of the study, the student will have learnt the fundamental principles of nuclear physics and develop problem solving skills.

PHY606

Physics (Honours) Practicals

(1 credit)

Course Overview

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience.

PHY607

Project Work

(2 credits)

Course Overview

This course will introduce students to simple research work appropriate to their level where they will use their knowledge to apply it to some simple problem/application. This will lead them learn by themselves and develop a better understanding of Physics and may inspire them to take up research at a higher level.