Department of Physics
SYLLABUS-AY 2024-25

S. No.	Semester	Paper	Title of the Paper
1	1	C-1	**Essentials and Applications in Mathematical, Physical & Chemical Sciences (**Course code: **BSCM24101)**
2	1	C-2	**Advances in Mathematical, Physical & Chemical Sciences (**Course code: **BSCM24102)**
3	2	C-3 & M-1	**Mechanics & Properties of Matter (**Course code: **PHY 24201)**
4	2	C-4	**Waves & Oscillations (**Course code : **PHY 24202)**
5	3	C-5 &M-2	**Optics (**Course code : **PHY 23301)**
6	3	C-6	**Heat and Thermodynamics (**Course code : **PHY 23302)**
7	3	C-7	**Electronic Devices and Circuits** (Course code : **PHY 23303)**
8	3	C-8	**Analog and Digital Electronics (Course code: PHY 23304)**
9	4	C-9 & M-3	**Electricity, Magnetism & Electronics (**Course code: **PHY 23401)**
10	4	C-10 &M-4	**Modern Physics (**Course code :**PHY 23402)**
11	4	C-11	**Introduction to Nuclear and Particle Physics** (Course code : **PHY23403**)
12	5	VIB	**Low Temperature Physics & Refrigeration (**Course code: **PHY 205303-6B)**
13	5	VIIB	**Solar Energy & Applications (**Course code : **PHY 205304-7B)**
10	6		**Long Internship**

Semester 4		
Course code : **PHY 23401** **Electricity, Magnetism & Electronics**		
S. No.	CO	Description
1	1	Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Permittivity and Dielectric constant.
2	2	Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents and to distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
3	3	Phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Q- factor, Power factor and the comparative study of series and parallel resonant circuits and to Develop an understanding on the unification of electric and magnetic fields and Maxwell's equations governing electromagnetic waves.
4	4	Describe the operation of p-n junction diodes, zener diodes, light emitting diodes and transistors
5	5	Understand the operation of basic logic gates and universal gates and their truth tables.

Semester 4		
Course code : **PHY 23402** **Modern Physics**		
S. No.	CO	Description
1	1	Develop an understanding on the concepts of Atomic and Modern Physics, basic elementary quantum mechanics and nuclear physics.
2	2	Develop critical understanding of concept of Matter waves and Uncertainty principle.
3	3	Get familiarized with the principles of quantum mechanics and the formulation of Schrodinger wave equation and its applications.
4	4	Examine the basic properties of nuclei, characteristics of Nuclear forces, salient features of Nuclear models and different nuclear radiation detectors and to classify Elementary particles based on their mass, charge, spin, half-life and interaction.
5	5	Get familiarized with crystal structures and to increase the awareness and appreciation of superconductors and their practical applications

Semester 4		
Course code : **PHY 23403** **Introduction to Nuclear and Particle Physics**		
S. No.	CO	Description
1	1	To know about high energy particles and their applications which prepares them for further study and research in particle physics.
2	2	Students can explain important concepts on nucleon-nucleon interaction, such as its short-range, spin dependence, isospin, and tensors.
3	3	Students can show the potential shapes from nucleon nucleon interactions.
4	4	Students can explain the single particle model, its strengths, and weaknesses
5	5	Students can explain magic numbers based on this model

B.Sc. Honours Course Syllabus (Single Major) (w.e.f:2023-24A.B)
SEMESTER-IV
Course-IX: ELECTRICITY, MAGNETISM AND ELECTRONICS

Course code: PHY23401
Theory Credits: 3 **3 hrs/week**

UNIT-I

1.Electrostatics: (6hrs)

Gauss's law-Statement and its proof, Electric field intensity due to (i) uniformly charged solidsphere and (ii) an infinite conducting sheet of charge, Deduction of Coulomb's law from Gauss law, Electrical potential– Equipotential surfaces, Potential due to a (i)uniformly charged sphere

2.Dielectrics:(6 hrs)

Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics,Dielectric strength, Capacitance of a parallel plate condenser with dielectric slab between the plates, Electric displacement D, electric polarization P, Relation between D, E and P, Dielectricconstant and electric susceptibility.

UNIT-II

3.Magnetostatics:(6 hrs)

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Ampere's Circuital Law and its application to Solenoid,Hall effect, determination of Hall coefficient and applications.

4.Electromagnetic Induction:(6 hrs)

Faraday's laws of electromagnetic induction, Lenz's law, Self induction and Mutual induction,Self inductance of a long solenoid, Mutual inductance of two coils, Energy stored in magnetic field, Eddy currents.

UNIT-III

5.Alternating currents:(6 hrs)

Alternating current - Relation between current and voltage in LR and CR circuits, Phasor and Vector diagrams, LCR series and parallel resonant circuit, Q –factor, Power in ac circuits, Power factor.

6.Electromagnetic waves-Maxwell's equations: (6 hrs) Idea of displacement current,Maxwell's equations-Derivation, Maxwell's wave equation (with derivation), Transverse nature of electromagnetic waves, Poynting theorem (Statement andproof),velocity wave equation using Maxwells relations in vaccum.

Practical Course C-9: Electricity, Magnetism and Electronics

Work load: 30 hrs **2 hrs/week**

Minimum of 6 experiments to be done and recorded

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –Sonometer.
4. Verification of Kirchoff's laws and Maximum Power Transfer theorem.
5. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
6. PN Junction Diode Characteristics
7. Zener Diode –V-I Characteristics
8. Zener Diode as a voltage regulator
9. Transistor CE Characteristics- Determination of hybrid parameters
10. Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.
11. Verification of De Morgan's Theorems.
12. Construction of Half adder and Full adders-Verification of truth tables

B.Sc. PHYSICS SYLLABUS

II Year B.Sc.-Physics: IV Semester

Course C-10: MODERN PHYSICS

(Course code :**PHY 23402)**

Work load:60hrs per semester **4 hrs/week**

UNIT-I :

1. Atomic and Molecular Physics: **(12 hrs)**

Vector atom model and Stern-Gerlach experiment, Quantum numbers associated with it,Angular momentum of the atom, Coupling schemes, Spectral terms and spectral notations, Selection rules, Intensity rules, Fine structure of Sodium D-lines, Zeeman effect,Experimental arrangement to study Zeeman effect;Raman effect, Characteristics of Raman effect,

Experimental arrangement to study Raman effect, Quantum theory of Raman effect,Applications of Raman effect.

UNIT-II:

2. Matter waves & Uncertainty Principle: **(12 hrs)**

Matter waves, de Broglie's hypothesis, Wave length of matter waves, Properties of matter waves, Davisson and Germer's experiment, Phase and group velocities, Heisenberg's uncertainty principle for position and momentum& energy and time, Illustration of uncertainty principle using diffraction of beam of electrons (Diffraction by a single slit)and photons(Gamma ray microscope),Bohr's principle of complementarity.

UNIT-III:

3. Quantum (Wave) Mechanics: **(12 hrs)**

Basic postulates of quantum mechanics, Schrodinger time independent and time dependent wave equations-Derivations, Physical interpretation of wave function, Eigen functions, Eigen values, Application of Schrodinger wave equation to (i) one dimensional potential box of infinite height(InfinitePotential Well).

UNIT-IV:

4. Nano materials: **(7hrs)**

Nanomaterials – Introduction, Electron confinement, Size effect, Surface to volume ratio, Classification of nano materials– (0D, 1D, 2D); Quantum dots, Nano wires, Fullerene, CNT, Graphene(Mention of structures and properties),Distinct properties of nano materials (Mention-*mechanical,optical, electrical, and magnetic properties*); Mention of applications ofnano materials: (*Fuel cells,Phosphors for HD TV),*

UNIT-V:

5.Superconductivity: **(5 hrs)**

Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect , Isotope effect,Type I and Type II superconductors, BCS theory (elementary ideas only),Applications of superconductors

REFERENCE BOOKS

1) BSc Physics, Vol.4, Telugu Akademy, Hyderabad
2) Atomic Physics by J.B. Rajam; S.Chand& Co.,
3) Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.
4) Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
5) Nuclear Physics, D.C.Tayal, Himalaya Publishing House.
6) S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ.Co.)
7) K.K.Chattopadhyay&A.N.Banerjee, Introd.to Nanoscience and Technology (PHILearning Priv.Limited).
8) Nano materials, A K Bandopadhyay. New Age International Pvt Ltd (2007)
9) Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, BaldevRaj,BB Rath and J Murday-Universities Press-IIM

B.Sc. Honours Course Syllabus (Single Major) (w.e.f:2023-24 A.B)

SEMESTER-IV

COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Course Code: PHY23403

Theory Credits: 3 **3 hrs./week**

UNIT-I: Introduction to Nuclear Physics

Nuclear Structure: General Properties of Nuclei, Mass defect, Binding energy; Nuclear forces: Characteristics of nuclear forces- Yukawa's meson theory; Nuclear Models- Liquid drop model- Semi empirical mass formula, nuclear shell model.

UNIT-II: Elementary Particles And Interactions

Discovery and classification of elementary particles, properties of leptons, mesons and baryons; Types of interactions- strong, electromagnetic and weak interactions; Conservation laws – Isospin, parity, charge conjugation

UNIT-III: Nuclear Reactions and Nuclear Detectors

Nuclear Reactions: Types of reactions, Conservation Laws in nuclear reactions, Reaction energetic, Threshold energy, nuclear cross-section; Nuclear detectors: Geiger- Muller counter, Scintillation counter, Cloud chamber

UNIT-IV: Nuclear Decays and Nuclear Accelerators

Nuclear Decays: Gamow's theory of alpha decay, Fermi's theory of Beta- decay, Energy release in Betadecay, selection rules. Nuclear Accelerators: Types- Electrostatic and electrodynamics accelerators; Cyclotron-construction, working and applications; Synchrocyclotron-construction, working and applications.

UNIT-V: Applications of Nuclear and Particle Physics

Medical Applications: Radiation therapy and imaging techniques, nuclear energy: nuclear reactors and power generation, Particle physics in high-energy Astro Physics.

Reference Books:

1. Nuclear Physics, Irving Kaplan, Narosa Pub. (1998).
2. Nuclear Physics, Theory and experiment – P.R. Roy and B.P. Nigam, New Age Int.1997.
3. Atomic and Nuclear Physics (Vol.2), S.N. Ghoshal, S. Chand & Co. (1994).
4. Nuclear Physics, D.C. Tayal, Himalaya Pub. (1997).
5. Atomic and Nuclear Physics, R.C. Sharma, K. Nath& Co., Meerut.
6. Nuclei and Particles, E. Segre.
7. Introduction to Nuclear Physics, H.A. Enge, Addison Wesley (1975).

SEMESTER-IV

COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Practical Credits: 1 **2 hrs/week**

COURSE OBJECTIVE:

1) To familiarize students with experimental techniques and methodologies used in nuclear and particle physics.
2) To provide hands-on experience in conducting experiments related to nuclear and particle physics.

LEARNING OUTCOMES:

1) Gain a solid understanding of fundamental concepts in nuclear and particle physics.
2) Acquire knowledge of experimental techniques and methodologies used in the field.
3) Understand the principles and operation of laboratory equipment and instruments specific to nuclear
4) and particle physics experiments.
5) Develop proficiency in conducting experiments related to nuclear and particle physics.
6) Acquire skills in data acquisition, analysis, and interpretation using appropriate software and techniques.
7) Learn to design and perform experiments, including calibration, measurement, and control of variables.

EXPERIMENT LIST

1. GM counter – Determination of dead time
2. Study of characteristic curve of GM counter and estimation of its operating voltage
3. Estimation of efficiency for a gamma source of GM counter
4. To verify inverse square law using GM counter
5. Production and Attenuation of bremsstrahlung
6. Estimation of efficiency for a beta source of GM counter
7. Study of back scattering of beta particles