B.Sc.PHYSICS-SEMESTER–IV

TYPEOFCOURSE:MAJORDISCIPLINESPECIFICCOURSE

PROGRAMMECODE:SCIUG101 **COURSECODE:SC23MJDSCPHY401**

COURSENAME:CLASSICAL MECHANICS, NUCLEAR PHYSICS AND PLASMA PHYSICS

(EffectivefromJune2024UnderNEP–2020)

TotalCredits:04 TeachingHoursperWeek:04TeachingHoursperSemester: 60	THEORY MAJOR I	ExternalMarks-50 InternalMarks-50

CourseObjective:

- To understand the principles of classical mechanics
- To get knowledge of nuclear physics, detectors and accelerators.
- To get comprehensive knowledge of radioactivity.
- To understand the Plasma and its behaviour.

CourseOutcome:

Afterthesuccessfulcompletionofthecoursestudentswillbe ableto

- Get complete understanding of classical mechanics through equation of motion, motion under force, mechanics of system of particles, energy of the system etc.
- Understand the nuclear physics through the Q equation, types of nuclear reaction, detectors, accelerators, Cyclotron and Synchrotron.
- Understand the details of radioactivity and its properties, radioactive growth and decay, determination of the age of the Earth, Carbon dating etc.
- The knowledge of basic concepts of Plasma, composition and characteristics of Plasma, collisions, diffusion and mobility, viscosity, conductivity etc. will be accomplished.

Syllabus

UnitNo.	Content	Credit	Lect.Hrs60
Unit-1	**CLASSICAL MECHANICS:Mechanics of a Single Particle and of System of Particles:** Equation of Motion (3.3), (a) Motion under Constant Force, (b) Motion under a Force which depends on Time only, (d) Case (1) Motion of a particle subjected to a Resistive Force, Case (2) Motion of particle falling under the action of Gravity near the surface of Earth.(3.3) Mechanics of system of particles (3.5), Angular Momentum of the system (3.5 a), Energy of the System(3.5 b), Kinetic Energy of the system(3.5 c), Motion of system with variable mass(3.6) (*Related Examples, Problems, MCQ & Short Questions)* **Basic Reference**: *Introduction to Classical Mechanics by R G Takwale & P S Puranik McGrawHill Education (India) Private Limited*	1	15
Unit 2	**NUCLEAR PHYSICS :The Q-Equation:** Introduction (3.1), Types of Nuclear Reaction (3.2), The Balance of Mass and Energy in Nuclear Reaction (3.3), The Q-equation (3.4), solution of the Q-Equation (3.5) **Detectors and Accelerators**: Introduction (1.1.1), Interaction between Particles and Matter (A brief survey) (1.1.2), Detectors for Nuclear Particles (1.1.3), (i) Proportional counter (iii) scintillation counter (iv) Solid State or Semiconductor detectors, Particle Accelerators(1.1.4),: Need for an Accelerator of charged Particles : (ii) The Cyclotron, (iii) Synchrotron. (*Related Examples, Problems, MCQ & SQs.)*	1	15

	Basic reference: *Nuclear Physics by S. B. Patel (New age International (p) Ltd. Publishers)*		
Unit -3	**Radioactivity:** Introduction (2.1), Properties ofRadioactive rays (2.2), The law of Radioactive Decay (2.3) Statistical Nature ofRadioactivity (2.4), The Statistical Errors of Nuclear Physics(2.5), Radioactive growth and decay(2.6), Ideal equilibrium(2.7), Transient equilibrium and secular equilibrium(2.8) Radioactive series(2.9) Determination of the age of the Earth(2.12), Carbon Dating-Archaeological Time Scale(2.13) (*Related Examples, Problems, MCQ & Short Questions)* **Basic reference**: *Nuclear Physics by S. B. Patel (New age International (p) Ltd. Publishers)*	1	15
Unit-4	**PLASMA PHYSICS** The Basic concepts of Plasma: Introduction (1.1), Composition and Characteristics of a Plasma (1.2), Collisions (1.3), Elastic collisions (1.3.1), Inelastic collisions (1.3.2), Surface Phenomena (1.4), Transport Phenomena (1.5), Diffusion and Mobility(1.6), Viscosity, Conductivity(1.7), Recombination(1.8), Ohm's law (1.9), Gas Discharge (1.10), Composition of various natural and Man-made Plasma (1.11), Plasma Diagnostics (1.12), Plasma waves and Instabilities Confinement of Plasma (1.13), Space Plasma (1.14). (*Related Examples, Problems, MCQ & Short Questions)* **Basic Reference:** *Elements of Plasma physics by S.N. Goswami New Central book Agency (p) Ltd., Calcutta.*	1	15

: Further Reading – Other References:

1. Concept of Modern Physics by Besier McGraw-Publishers
2. Classical Mechanics by Goldstein Narosa Publishing House New Delhi
3. Classical Mechanics by Yashavant Waghmare
4. Classical Mechanics by N C Rana and P S Joag
5. Elements of Nuclear Physics by M.L.Pandya & R.P.S. Yadav Kedarnath Rmnath Meerut
6. Nuclear Physics by Kaplan 3. Nuclear Physics by D C tayal, Himalaya Publishing House
7. Nuclear Physics by S N Ghoshal S. Chand
8. Elements of Nuclear physics by M.L.Pandya & R.P.S. Yadav Kedarnath Rmnath Meerut
9. Nuclear Physics by Kaplan 3. Nuclear Physics by D C tayal, Himalaya Publishing House
10. Introduction to Plasma Physics and Controlled Fusion Vol-1 F.F.Chen.
11. Plasma physics by S.N.Sen

HEMCHANDRACHARYANORTHGUJARATUNIVERSITY,PATAN

B.Sc.PHYSICS-SEMESTER–IV

TYPEOFCOURSE:MAJORDISCIPLINESPECIFICCOURSE

PROGRAMMECODE:SCIUG101 **COURSECODE:SC23MJDSCPHY401A**

COURSENAME:MATHEMATICAL PHYSICS, QUANTUM MECHANICS, ELECTRONICS

(EffectivefromJune2024UnderNEP–2020)

TotalCredits:04 TeachingHoursperWeek:04TeachingHoursperSemester: 60	THEORY MAJOR II	ExternalMarks-50 InternalMarks-50

CourseObjective:

- To get knowledge of mathematical Physics by using Fourier Series and Curvilinear coordinates.
- To get knowledge of Quantum mechanics.
- To get basic knowledge of transistor amplifiers, JFET, UJT and SCR.
- To attain knowledge of digital electronics through BCD, universal gates, arithmetic circuits etc.

CourseOutcome:

Afterthesuccessfulcompletionofthecoursestudentswillbe ableto

- Get understanding of mathematical Physics through Fourier series, application of Fourier series, even and odd functions. As well as Curvilinear Coordinates, Scale factor for orthogonal systems.
- Student will attain the knowledge of quantum mechanics through the study of normalization and probability and particle in a square well potential, Schrodinger equation and stationer states.
- Students will get basic knowledge of transistor amplifiers, h-parameters with equivalent circuit, Mathematical analysis and solid state Devices.
- Through the digital electronics students will study number system using Decimal, Binary, Hexadecimal and Octal, Binary, BCD, Gray, Excess-3 Codes, Universal Gate, Arithmetic Circuits – Exclusive – OR Gate, Application of X-OR Gate etc.

Syllabus

Unit No.	Content	Credit	Lect.Hrs60
Unit-1	**MATHEMATICAL PHYSICS** **Fourier series**:Introduction (7.1), Periodic functions (7.2), Application of Fourier series (7.3), Average values of a function (7.4), Fourier Co-efficient (7.5), Diriclet's condition (7.6), Complex form of Fourier Series(7.7), Other Interval even and odd function(7.8), Parceval Theorem(7.11) **Curvilinear Co-ordinates**: Curvilinear coordinates (10.6), Scale factors & basis factor for orthogonal systems (10.7), General Curvilinear coordinates (10.8), Vector operators in orthogonal Curvilinear Coordinates (10.9) ***(Note: The expressions for Divergence and curl are not to be derive but directly expressions are to be given.)***(*Related Examples, Problems, MCQ & SQs)* **Basic Reference**: 1. *Mathematical method for physical sciences by M.L.Boss John wiley Publication. (For Fourier series)* 2. *Mathematical Methods in Physical Sciences 2nd Edition by M.L. Boas. John Wiley & Sons. (For Curvilinear Co-ordinates)*	1	15

Unit 2	**Quantum Mechanics** Normalization and Probability Interpretation(2.4), Non-Normalizable Wave functions and Box Normalization(2.5),Conservation of Probability(2.6), Expectation values, Ehrenfest's Theorem(2.7), Admissibility Condition on the Wave function(2.8), Stationary States- The time Independent Schrodinger Equation (2.9), Particle in a Square Well Potential, Bound States in a square well (E < 0) (*Related Examples, Problems, MCQ & SQs.)* **Basic Reference**: *A Text Book of Quantum Mechanics by Mathews and K.Venkatesan Tata Mc-Graw Hill Publication*	1	15
Unit -3	**ELECTRONICS** **Basic Transistor Amplifier:** Transistor as four pole (9.2), h-parameters with h-parameters equivalent circuit (9.5 complete), Ground Emitter Circuit-Mathematical analysis using h-parameters only (9.6), Comparative study of three types of Amplifiers(9.9) (*Related Examples, Problems, MCQ & SQs.)* **Solid state Devices**: Junction Field Effect Transistor (JFET) (12.1 to 12.6), Uni Junction Transistor (UJT) (26.6, 26.6.1 to 26.6.3), Silicon Control Rectifier (SCR) **Basic Reference**: 1) Hand book of Electronic by Gupta&Kumar 30th Edi, 2002 Pragati Prakashan 2) Electronics and Radio Engineering by M.L.Gupta (9th Edition-2002) DhanRaj & Sons. (For Ch-9)	1	15
Unit-4	**Digital Electronics:** Introduction (21.1), Number system used in Digital Electronics (21.2), Decimal, Binary, Hexadecimal and Octal (21.2.1 to 21.2.4), Binary Codes-(A) BCD, (B) Gray, (C) Excess-3 Codes (21.4), Universal Gate -NAND Gate, Bubbled OR Gate, Universal Gate-NOR Gate, Bubbled AND Gate, To Prepare NOT, AND and OR Gate Using Univarsal Gate (NAND Gate), Arithmetic Circuits – Exclusive – OR Gate (21.9), Application of X-OR Gate: (i) Binary to Gray Code Converter (ii) A Parity Checker (iii) The Half Adder (iv) The Full Adder (v) Parallel Adder (vi) Half Subtractor, (vii) Full subtractor. (*Related Examples, Problems, MCQ & Short Questions)* **Basic Reference**: *Hand book of Electronics by Gupta & Kumar 30th Revised Edi., 2002 Pragati Prakashan, Meerut.*	1	15

: Further Reading – Other References:

1. Mathematical method for Engineer and Physicist by L. A. Pipes Tata Mc-Graw Hill Publication
2. Mathematical Physics by B D Gupta
3. Quantum Quantum Mechanics by John L. Powell and Bend Crasemann
4. Quantum Mechanics by Ghatak and Lokanathan Quantum Quantum Mechanics by Schiff
5. Electronic Devices and Circuits by A. Mottershead prentice- Hall of India
6. Integrated Electronics by Milliman & Halkias
7. Basic Electronics and Linear Circuits by N. N. Bharagava, D.C.Kulshreshtha, S.C. Gupta