



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B. Sc. PHYSICS - SEMESTER – IV

TYPE OF COURSE: MAJOR DISCIPLINE SPECIFIC COURSE

PROGRAMME CODE: SCIUG101 COURSE CODE: SC23MJDSCPHY401
COURSE NAME: CLASSICAL MECHANICS, NUCLEAR PHYSICS AND PLASMA PHYSICS
(Effective from June 2024 Under NEP – 2020)

Total Credits: 04	THEORY MAJOR I	External Marks -50
Teaching Hours per Week: 04		Internal Marks - 50
Teaching Hours per Semester: 60		

Course Objective:

- 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.

Course Outcome:

After the successful completion of the course students will be able to

- 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.

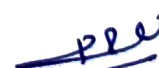
Syllabus

Unit No.	Content	Credit	Lect. Hrs 60
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 & SQs) Basic Reference: <i>Introduction to Classical Mechanics by R G Takwale & P S Puranik McGrawHill Education (India) Private Limited</i>	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

B Sc Sem III and IV Physics syllabi March-2024 under NEP2020



	Basic reference: <i>Nuclear Physics by S. B. Patel (New age International (p) Ltd. Publishers)</i>		
Unit -3	NUCLEAR PHYSICS : Radioactivity: Introduction (2.1), Properties of Radioactive rays (2.2), The law of Radioactive Decay (2.3) Statistical Nature of Radioactivity (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) <i>(Related Examples, Problems, MCQ & Short Questions)</i> Basic reference: <i>Nuclear Physics by S. B. Patel (New age International (p) Ltd. Publishers)</i>	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). <i>(Related Examples, Problems, MCQ & Short Questions)</i> Basic Reference: <i>Elements of Plasma physics by S.N. Goswami New Central book Agency (p) Ltd., Calcutta.</i>	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			


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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B. Sc. PHYSICS - SEMESTER – IV

TYPE OF COURSE: MAJOR DISCIPLINE SPECIFIC COURSE

PROGRAMME CODE: SCIUG101 COURSE CODE: SC23MJDSCPHY401A
COURSE NAME: MATHEMATICAL PHYSICS, QUANTUM MECHANICS, ELECTRONICS
(Effective from June 2024 Under NEP – 2020)

Total Credits: 04	THEORY	External Marks -50
Teaching Hours per Week: 04	MAJOR II	Internal Marks - 50
Teaching Hours per Semester: 60		

Course Objective:

- 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.

Course Outcome:

After the successful completion of the course students will be able to

- 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 Hrs 60
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) <i>(Note: The expressions for Divergence and curl are not to be derive but directly expressions are to be given.) (Related Examples, Problems, MCQ & SQs)</i> Basic Reference: 1. <i>Mathematical method for physical sciences by M.L.Boss John wiley Publication. (For Fourier series)</i> 2. <i>Mathematical Methods in Physical Sciences 2nd Edition by M.L. Boas. John Wiley & Sons. (For Curvilinear Co-ordinates)</i>	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 ($E < 0$) <i>(Related Examples, Problems, MCQ & SQs.)</i> Basic Reference: <i>A Text Book of Quantum Mechanics by Mathews and K. Venkatesan Tata Mc-Graw Hill Publication</i>	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) <i>(Related Examples, Problems, MCQ & SQs.)</i> 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 30 th 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 Universal 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. <i>(Related Examples, Problems, MCQ & Short Questions)</i> Basic Reference: <i>Hand book of Electronics by Gupta & Kumar 30th Revised Edi., 2002 Pragati Prakashan, Meerut.</i>	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			



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B. Sc. PHYSICS - SEMESTER – IV (PRACTICAL COURSE)

PROGRAMME CODE: SCIUG101

(Effective from June 2024 Under NEP – 2020)

LABORATORY EXPERIMENTS: MAJOR COURSE 2 Credit for Group A

COURSE CODE: SC23PMJDSCPHY401 Group A

TYPE OF COURSE	CREDIT	Marks	COURSE CODE
Major Discipline Core Course Practical (MJDSCP)	2 (Group A)	25 CCE + 25 SEE = 50	SC23PMJDSCPHY401
Teaching Hours Teaching Hours per Week: 08 Hours for 4 Credit practical (120 Hours per Semester) Teaching Hours per Week: 04 Hours for 2 Credit practical (60 Hours per Semester)			

LABORATORY EXPERIMENT COURSE: Group A

1. To determine wavelength of bright lines of Mercury light using Grating.
2. To Find out of Resolving Power of Telescope.
3. Study of X –ray diffraction using Powder pattern.
4. A Study of Decay of Temperature when body is allowed to cool (Thermocouple).
5. To study elliptically polarized light using Photocell and quarter wave plate.
6. To find out Activation energy of a Semiconductor. .
7. Numerical Analysis (Newton's Forward and Backward Interpolation Formula)
8. To Find out The Resolving Power of Prism.
9. To determine wavelength of monochromatic light by Edser's 'A' Pattern
10. Trapezoidal Simpson's rule for Numerical Integration

Course Objectives:

- To gain practical knowledge by applying the experimental method to correlate with the Physics theory.
- To provide hands on experience with equipment such as, spectrometer, A pattern, quarter wave plate, Travelling Microscope, Telescope etc.
- To impart practical knowledge by performing experiments based on the principles of theory courses.
- To provide training how to analyze the experimental data and graphical analysis.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in the group.

Course Outcome: Learning Outcomes:

By the end of the course, the students will be able to,

- Gains practical knowledge of experimental methods and Get sufficient knowledge about equipments like, spectrometer, A pattern, quarter wave plate, Travelling Microscope, Telescope etc.
- Determine wavelength, resolving power, electrical and optical properties.
- Get sufficient knowledge by performing experiments based on the principles of theory course.
- Analyze and understands the experimental data and graphical analysis.
- Develop the communication skills by discussing basic principles of scientific concepts in the group.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B. Sc. PHYSICS - SEMESTER – IV (PRACTICAL COURSE)

PROGRAMME CODE: SCIUG101

(Effective from June 2024 Under NEP – 2020)

LABORATORY EXPERIMENTS: MAJOR COURSE 2 Credit for Group B

COURSE CODE: SC23PMJDSCPHY401 Group B

TYPE OF COURSE	CREDIT	Marks	COURSE CODE
Major Discipline Core Course Practical (MJDSCP)	2 (Group B)	25 CCE + 25 SEE = 50	SC23PMJDSCPHY401
Teaching Hours			
Teaching Hours per Week: 08 Hours for 4 Credit practical (120 Hours per Semester)			
Teaching Hours per Week: 04 Hours for 2 Credit practical (60 Hours per Semester)			

LABORATORY EXPERIMENT COURSE: Group B

1. To Determine Current Sensitivity, Voltage Sensitivity, Figure of Merit and R_g of B.G
2. To Determine High Resistance by equal Deflection Method.
3. To Determine Low Value of 'C' using Schering Bridge.
4. Study of Characteristics of a Photodiode and Draw the Graph of $I_D \rightarrow V_D$.
5. Comparison of Capacity (C_1/C_2) by De-Sauty Method
6. Low Resistance by Method of Projection.
7. Lagrange's forward Formula and Backward Formula (Interpolation)
8. To find the H-Parameter's from The Transistor in Common Emitter Configuration.
9. To Study of Half Adder and Full Adder
10. To Study of the SCR Characteristics.

Course Objectives:

- To gain practical knowledge by applying the experimental method to correlate with the Physics theory.
- To provide hands on experience with equipment such as, BG, Schering bridge, Transistor, SCR etc.
- To provide training how to analyze the experimental data and graphical analysis.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in the group.

Course Outcome: Learning Outcomes:

By the end of the course, the students will be able to,

- Gains practical knowledge of experimental methods and Get sufficient knowledge about equipments like, BG, schering bridge, transistor, SCR etc.
- Determine current sensitivity, voltage sensitivity, capacity, low and high Resistance.
- Analyze and understands the experimental data and graphical analysis.
- Develop the communication skills by discussing basic principles of scientific concepts in the group.