



**KADI SARVA VISHWAVIDYALAYA**  
**B.Sc Semester 4 (Physics Subject's Syllabus)**

**KADI SARVA**  
**VISHWAVIDYALAYA,**  
**GANDHINAGAR**



**B.Sc. Curriculum as Per NEP**

**Physics Subject Syllabus**  
**Semester 4**

**W.E.F. June 2024**



# KADI SARVA VISHWAVIDYALAYA

## B.Sc Semester 4 (Physics Subject's Syllabus)

### Physics Major Course - 8

#### PHM239-2C Basic Physics-V

#### LEARNING OUTCOMES:

- Understand the concept of origin of Physical Science.
- Develop a concrete understanding of the Physical systems around us.
- Gain knowledge about the various laws of nature, new frontier of physics with potential applications in our day-by-day life.
- Acquire the information of Digital electronics, Radioactivity, Detectors & Accelerators with illustrative examples.
- Understanding of concepts of Resolving power and atomic spectra with related problems.

#### TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Theory Hrs Per Week		Hrs.	Max Marks		
					CCE	SEE	
PHM239-2C	Basic Physics-V (Major)	4	4	2.5	50	50	100

#### **Unit 1: Digital Electronics**

**Teaching Hours: 15 (Weightage 25%)**

Introduction, Number systems used in Digital Electronics, Decimal, Binary, Hexadecimal and Octal, Binary Codes-(A) BCD, (B) Gray, (C) Excess-3 Codes, introduction to basic logic gates, NAND, NOR and XOR gate, De-Morgan's theorem, (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, Illustrative examples.

#### **Unit 2: Radioactivity, Detectors & Accelerators** Teaching Hours: 15 (Weightage 25%)

**Radioactivity:** Introduction, Radioactive growth and decay, Ideal equilibrium, Transient equilibrium and secular equilibrium, Artificial Radioactivity, Determination of the age of Earth, Carbon Dating, Illustrative Examples

**Detectors & Accelerators:** Introduction, Detectors for Nuclear Particles, (i) Proportional Counter (ii) The Geiger Counter, (iii) Scintillation Counter, (iv) Solid state or Semiconductor detectors Linear Accelerator and Cyclotron



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## B.Sc Semester 4 (Physics Subject's Syllabus)

### **Unit-3 Resolving Power** **25%)**

**Teaching Hours: 15 (Weightage**

Resolving Power, Rayleigh's Criterion, Limit of resolution of the eye, Limit of resolution of a convex lens, Resolving Power of Optical Instrument, Conditions for Resolutions according to Lord Rayleigh, Resolving Power of a telescope, Relation between magnifying power of telescope, Resolving power of a microscope, ways of increasing resolution, Magnification versus resolution, resolving power of a Prism, Resolving

Power of a Plane transmission grating. Illustrative Examples

### **Unit-4 Introduction to Atomic Spectra** **25%)**

**Teaching Hours: 15 (Weightage**

Orbital and Magnetic Dipole Moment, Larmor Precession, Space quantization, Electron spin, Vector model of atom, Spectroscopic terms and their notations, Stern Gerlach Experiment, Pauli's Exclusion Principle. Zeeman Effect- Normal Zeeman Effect and anomalous Zeeman Effect, Explanation of Normal Zeeman Effect, Explanation of Anomalous Zeeman Effect, Paschen back effect.

- \*Continuous Evaluation: It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests

### **Reference Books**

- 1) Hand book of Electronics by S. L. Gupta & V. Kumar, PragatiPrakashan
- 2) Digital Logic and Computer Design by M. Morris Mano, Pearson Publication
- 3) Nuclear Physics An Introduction by S. B. Patel, New Age International Publishers
- 4) Nuclear Physics by D. C. Tayal, Himalaya Publishing House
- 5) A Textbook of Optics by N. Subrahmanyam, Brij Lal, M. N. Avadhanulu - S.Chand
- 6) Optics by Ajoy Ghatak, McGraw-Hill Education
- 7) Atomic & Molecular Spectra: Laser by Raj Kumar, Kedar Nath Ram Nath Prakashan
- 8) Atomic & Molecular physics by Guptakumar



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**B.Sc Semester 4 (Physics Subject's Syllabus)**  
**Physics Major Course -9**

**PHM240-2C Basic Physics-VI**

**LEARNING OUTCOMES:**

- Understand the concept of origin of Physical Science.
- Develop a understanding of the magneto statics.
- Gain knowledge about the quantum mechanics.
- Acquire the information of basics of plasma.
- Understanding of concepts of Nano materials and nano devices.

**TEACHING AND EVALUATION SCHEME:**

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Theory Hrs Per Week		Hrs.	Max Marks		
					CCE	SEE	
PHM240-2C	Basic Physics-VI (Major)	4	4	2.5	50	50	100

**Unit 1: Magnetostatics Teaching Hours: 15 (Weightage 25%)**

Magnetic Fields, Currents, The Biot-Savart Law, Steady Currents, The magnetic field of a steady current, The divergence and curl of  $\vec{B}$ , Application of Ampere's law, Comparison of Magneto statics and Electrostatics, Scalar and Vector potentials, The magnetic vector potential, Illustrative examples. related Problems

**Unit 2: Introduction to Quantum Mechanics Teaching Hours: 15 (Weightage 25%)**

The Schrodinger equation in one dimension, The statistical interpretation, Probability: Discrete Variables and Continuous Variables, Normalization, Momentum, The Uncertainty Principle, The infinite square well, Illustrative examples.

**Unit-3 Basic concepts of Plasma Teaching Hours: 15 (Weightage 25%)**

Introduction, Composition and Characteristics of a Plasma, Collisions, Elastic collisions, Inelastic collisions, Surface Phenomena, Transport Phenomena, Diffusion and Mobility, Viscosity, Conductivity, Recombination, Ohm's law, Gas Discharge, Composition of various natural and Man-made Plasma, Plasma diagnostics, Plasma waves and Instabilities Confinement of Plasma, Space Plasma, Illustrative examples.



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## B.Sc Semester 4 (Physics Subject's Syllabus)

### Unit-4 Nano material and Nano Devices

Teaching Hours: 15 (Weightage 25%)

Introduction, synthesis of nano structured material, top-down approach in nanomaterial synthesis, bottom-up process synthesis of nano particles, Epitaxial Technique for synthesis of nano material, chemical method nano material synthesis, Nanotechnology and environment, properties and possible applications.

Nano magnets, classification of Nano-magnetic materials, , Nano-magnetism in technology, applications of semiconductor nanostructures and devices, applications of semiconductor nano structured, carbon nanotubes, types of carbon nanotubes, synthesis of carbon nanotubes, properties of carbon nano tubes, Applications, Illustrative examples

\*Continuous Evaluation: It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests

### Reference Books

- 1) Introduction to Electrodynamics by D. J. Griffiths, Pearson Education
- 2) Introduction to Quantum Mechanics by D. J. Griffiths, Pearson Education
- 3) Elements of Plasma Physics by S. N. Goswami, New Central Book Agency (P) Ltd., Calcutta.
- 4) Engineering Physics by V. Rajendran, McGraw Hill Education, New Delhi
- 5) Engineering Physics by H. K. Malik, A. K. Singh, McGraw Hill Education, New Delhi



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**B.Sc Semester 4 (Physics Subject's Syllabus)**  
**Physics Major Course -10**

**PHM241-2C Physics Practical - IV**

**LEARNING OUTCOMES:**

- Understand the concept of Basic logic gates & Universal logic gates.
- Use of thermocouple to understand the decay of Temperature.
- Graph and characteristics plotting of UJT and FET
- Understand the Self-inductance of coil with the help of Anderson Bridge.
- Comprehend the Surface Area to Volume Ratio property of nanomaterials.
- Gain the knowledge of viscosity of a fluid using coaxial viscometer.

**TEACHING AND EVALUATION SCHEME:**

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Practical Hrs Per Week		Hrs.	Max Marks		
					CCE	SEE	
PHM241-2C	Physics Practical - IV	8	4	5	50	50	100

**Unit-I Teaching Hours : 60 (Weightage :50%)**

- 1) Construction of AND, OR, NOT Gates using NAND & NOR Universal gates.
- 2) To compare the Capacity of two capacitors (C1/C2) by De Sauty method.
- 3) To find the viscosity of a fluid using coaxial viscometer.
- 4) To understand the Surface Area to Volume Ratio property of nanomaterials.
- 5) To study the absorption co-efficient of liquid using photocell.
- 6) To determine low value of 'C' using Schering bridge.
- 7) To find the wavelength of light using an Edser's "A" Diffraction Pattern.
- 8) To determine the value of unknown wavelength using Cauchy's constant.

**Unit-II Teaching Hours : 60 (Weightage :50%)**

- 1) To verify De Morgan's Theorems using NAND gate (IC-7400)
- 2) To determine wavelength using Hartmann formula
- 3) To find the decay of Temperature when body is allowed to cool. (Thermocouple)
- 4) To measure the activation energy of a semiconductor.
- 5) To study the characteristics of UJT.
- 6) To find the characteristics of JFET & Determination of  $\mu$ ,  $r_d$ ,  $g_m$
- 7) To determine self-inductance with the help of Anderson Bridge.
- 8) To find a low resistance using Carey Foster bridge

**Note:**

- 1) New Experiments can be introduced AND / OR replaced as per need by the permission of the Head / Principal of the institute.



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## B.Sc Semester 4 (Physics Subject's Syllabus)

- 2) Hands-on / Project / Model etc. will carried out additionally for the enhancement of related skills

### Physics Minor Course – Semester 4

#### PHE223-2C Introduction to Computational Physics with Python

#### LEARNINGOUTCOMES:

- Gain the knowledge of computational physics and its needs.
- To understand the basics of scientific, numerical simulation and modeling in Python.
- To learn to use the graphical capabilities of Matplotlib to visualize numerical solutions into highly interpretable forms.
- Practical performance enhances the knowledge and understanding to solve the problems of Physics in Python.

#### TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme Per Week		Credits	Examination Scheme			Total Marks
		Theory Hrs Per Week	Practical Hrs Per Week		Hrs.	Max Marks		
						CCE	SEE	
PHE223-2C	Introduction to Computational Physics with Python	2	4	4	2.5	50	50	100

#### **Unit 1: Python: Overview & Basic Syntax**

**Teaching Hours: 15 (Weightage :25%)**

Introduction, Short History, Types of Python, Python environment setup, Identifiers, Keywords, Lines and indentation, Multi-line statements. Quotation, Comments, Blank lines, Types of Variables – Assigning values to variable, multiple assignments, data types, numbers, strings, lists, tuples, dictionary, data type conversion, Basic Operators- Types of Operators, Arithmetic operators, Comparison Operators, Assignment, Bitwise, Logical, Membership, Identity & operator precedence

#### **Unit-2 :Decision making, loops, classes & objects, and data vizulization**

**Teaching Hours: 15 (Weightage :25%)**

Decision Making - *If* statement, *If....else* statement, The *elif*statement, Single statement suite, Loops- While, the Infinite loop, *else* with loops, For loops, Iterations, Nested loop, Loop control, Break, Continue, Introduction to Numpy&Scipy, Data Visualization with Matplotlib – Simple Plot, Figures, Subplots, Axes & Ticks, Examples and exercise



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### List of Practical

Teaching Hours: 60 (Weightage :50%)

- 1) Projectile Motion: Calculate the trajectory of a projectile launched at an angle with a given initial velocity, assuming no air resistance.
- 2) Gravitational Force: Calculate the gravitational force between two objects given their masses and the distance between them using Newton's law of universal gravitation.
- 3) Simple Pendulum: Calculate the period and frequency of a simple pendulum given its length and the acceleration due to gravity.
- 4) Circular Motion: Calculate the centripetal force required to keep an object moving in a circle given its mass, velocity, and radius of the circle.
- 5) Work and Energy: Calculate the work done on an object by a force and its change in kinetic energy.
- 6) Simple Harmonic Motion: Simulate the motion of a mass-spring system or a pendulum undergoing simple harmonic motion.
- 7) Temperature Conversion: Convert temperature between Celsius, Fahrenheit, and Kelvin scales using appropriate conversion formulas.
- 8) Density and Buoyancy: Calculate the buoyant force acting on an object submerged in a fluid given its volume and density.
- 9) Ohm's Law: Calculate the current, voltage, or resistance in an electrical circuit using Ohm's law.
- 10) Motion with Constant Acceleration: Calculate the final velocity, displacement, or time taken for an object moving with constant acceleration.

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- Hands-on / Project /Model etc. will carried out additionally for the enhancement of related skills.

\*Continuous Evaluation: It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests

### Reference Books

- 1) Essential Python for the Physicist by Giovanni Moruzzi, Springer
- 2) [www.python.org](http://www.python.org)
- 3) Python Essential Reference by David M. Beazley, Pearson Education





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**B.Sc Semester 4 (Physics Subject's Syllabus)**  
**Physics SEC (Skill Enhancement Course) – Semester 4**

**SEC267-2C Physics in Biology and Medicine - II**

LEARNING OUTCOMES:

- Understand the concept of origin of Physical Science in biology and medicine.
- Understand the concepts of Elasticity and strength of material on human body.
- Gain the physics knowledge of fluids on human physical activity.

Subject Code	Subject Title	Teaching Scheme Per Week		Credits	Examination Scheme			Total Marks
		Theory Hrs Per Week	Practical Hrs Per Week		Hrs.	Max Marks		
						CCE	SEE	
SEC267-2C	Physics in Biology and Medicine – II	2	0	2	2	25	25	50

**Unit-1: Elasticity and strength of material      Teaching Hours: 15 (Weightage 50%)**

Longitudinal stretch and compression, A Spring, Bone Fracture: Energy considerations, Impulsive forces, Fracture due to fall: Impulsive force considerations, Airbags: Inflating collision protection devices, Whiplash injury, Falling from great height, Osteoarthritis and exercise.

**Unit-2: Fluids      Teaching Hours: 15 (Weightage 50%)**

Force and pressure in a fluid, Pascal's principle, Hydrostatic Skeleton, Archimedes Principle, Power requirement to remain a float, Buoyancy of Fish, Surface tension, Soilwater, Insect Locomotion on water, contraction of muscles, Surfactant.

**Reference Books**

- 1) Physics in Biology and Medicine by Paul Davidovits; 5<sup>th</sup> edition, Academic Press.