



S.V. University 4-Year Honours Degree Programme
BSc (Physics) Honours Degree Syllabus (W.E.F. AY-2026-27)

**Model Syllabus for 4-Year UG Honours in B.Sc. (Physics) as Major in
consonance with Curriculum framework w.e.f. AY 2026-27**

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	IV	8	Electricity, Magnetism and Electromagnetic Theory	3	3
			Electricity, Magnetism and Electromagnetic Theory-Practical	2	1
		9	Analog Electronics	3	3
			Analog Electronics-Practical	2	1
		10	Advances in Physics	3	3
			Advances in Physics-Practical	2	1

SEMESTER-IV

COURSE 10: ADVANCES IN PHYSICS

Theory

Credits: 3

3 hrs/week

Course Objectives

1. To introduce students to fundamental concepts of quantum mechanics, classical mechanics, and the evolution of computing with emphasis on quantum computing principles.
2. To expose students to emerging areas in physics, including nanotechnology and renewable energy, and their practical applications in modern technology and sustainable development.

Learning Outcomes

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

1. Apply basic quantum mechanics concepts including the Schrödinger equation, quantum postulates, and Pauli matrices to simple physical systems.
2. Formulate and solve mechanical problems using Lagrangian and Hamiltonian formulations of classical mechanics.
3. Trace the historical and technological evolution of computers, and explain the significance of quantum algorithms and the concept of quantum supremacy.
4. Identify and describe types of nanomaterials and discuss their unique properties and applications in science and technology.
5. Compare various renewable energy sources and explain principles of energy generation, storage, and integration into modern power grids.

UNIT-I CONCEPTS OF QUANTUM MECHANICS

(9 hrs.)

Photoelectric effect, Compton Effect, Schrodinger's wave Equation time dependent, Time independent, Postulates of Quantum mechanics, Properties of wave function, Expectation values. One-dimensional problems - Particle in a box. Pauli spin matrices.

UNIT-II LAGRANGIAN MECHANICS

(9 hrs.)

Conservation laws, Constraints, Generalized coordinates and velocities, Virtual displacement, virtual work, D'Alembert Principle, Lagranges equation of motion, Application-Simple pendulum, Atwood machine. Principle of least action, Hamiltonian equation of motion, Legendre transformation.

UNIT III EVOLUTION OF COMPUTERS

(9 hrs.)

Computers: Mechanical to electronic evolution, Generations of computers: Vacuum tubes, transistors, ICs, microprocessors, Moore's Law and classical computing limitations, Need for a new paradigm: Introduction to quantum concepts, Key contributions from Feynman, Deutsch, and others, Overview of Shor's and Grover's algorithms, Concept and implications of quantum supremacy

UNIT IV: FUNDAMENTALS OF NANOTECHNOLOGY

(9 hrs.)

Introduction to Nanoscience and Nanotechnology, Definition, historical development, and importance. Volume to Surface ratio, quantum effects, Types of Nanomaterials: Nanoparticles, nanowires, nanotubes, quantum dots. Applications of Nanotechnology: In electronics, medicine, energy, and environment

UNIT V: RENEWABLE ENERGY

(9 hrs.)

Conventional and Non-conventional energy sources. Renewable energy and its resources
Solar energy - Generation, energy storage. Grid Integration and Smart Grids
Green energies - Wind energy, Biomass energy, Tidal energy and green energy, Fuel cells

Books and References

1. **Quantum Mechanics: Concepts and Applications** – Nouredine Zettili
2. **Principles of Quantum Mechanics** – R. Shankar
3. **A Textbook of Quantum Mechanics** – P.M. Mathews and K. Venkatesan (*Indian Author*)
4. **Classical Mechanics** – H. Goldstein, C. Poole, and J. Safko
5. **Introduction to Classical Mechanics** – R.G. Takwale and P.S. Puranik (*Indian Author*)
6. **Classical Mechanics** – J.C. Upadhyaya (*Indian Author*)
7. **Computer Organization and Architecture** – William Stallings
8. **Quantum Computation and Quantum Information** – Michael A. Nielsen and Isaac L. Chuang
9. **Fundamentals of Computers** – V. Rajaraman (*Indian Author*)
10. **Quantum Mechanics and Path Integrals** – Richard P. Feynman and A.R. Hibbs
11. **Introduction to Nanotechnology** – Charles P. Poole Jr. and Frank J. Owens
12. **Nanoscience and Nanotechnology** – M.A. Shah and Tokeer Ahmad (*Indian Author*)
13. **Renewable Energy Resources** – John Twidell and Tony Weir
14. **Non-Conventional Energy Sources** – G.D. Rai (*Indian Author*)
15. **Solar Energy: Principles of Thermal Collection and Storage** – S.P. Sukhatme and J.K. Nayak (*Indian Author*)

Student Activities

1. **Solve numerical problems** on particle in a box, harmonic oscillator, and quantum statistics to reinforce conceptual understanding.
2. **Create a comparison chart** of industrial materials highlighting their properties and specific applications across different industries.
3. **Prepare a poster or presentation** on types of nanomaterials and their real-life applications in healthcare, electronics, or energy.
4. **Demonstrate or simulate** the working of basic sensors and use a CRO or signal generator to observe and analyze waveforms.
5. **Build a working model** or give a seminar on a renewable energy system (e.g., mini solar panel setup or wind turbine model).

SEMESTER-IV

COURSE 10: ADVANCES IN PHYSICS

Practical

Credits: 1

1 hrs/week

Course Objective:

To provide students with hands-on experience and demonstrations of fundamental and emerging concepts in modern physics through physical and simulated experiments, focusing on quantum phenomena, material properties, energy technologies, and basic nanoscience.

Learning Outcomes

After successful completion of the course, the student will be able to:

1. **Demonstrate understanding of quantum and thermal physics principles** through experiments such as photoelectric effect and Boltzmann constant determination.
2. **Analyze electrical and magnetic properties** of materials using real measurements (resistivity, magnetization, LDR, etc.).
3. **Explore basic properties of nanomaterials and their synthesis** through simple laboratory techniques like green synthesis of nanoparticles.
4. **Develop awareness of renewable energy technologies** and compare efficiencies of energy devices like solar panels, LEDs, and fuel cells.
5. **Apply instrumentation skills** in using sensors, CROs, and circuit components for measuring physical parameters.
6. **Interpret results from simulated experiments** and link theoretical physics models with practical outcomes (e.g., Maxwell-Boltzmann distribution, particle in a box).
7. **Enhance scientific inquiry and experimental reporting skills** through observations, data analysis, and interpretation.

A minimum of 6 experiments to be performed and recorded

1. Photoelectric Effect using UV LED and LDR
 - Demonstrates threshold frequency and energy quantization.
2. Determination of Boltzmann Constant from Diode Characteristics
 - Uses current–voltage relation of a diode.
3. Simple Pendulum – Time Period vs. Lagrangian Prediction
 - Validates theoretical dynamics.
4. Atwood Machine – Verification of Newton's Laws
 - Demonstrates conservation of energy and force analysis.
5. LCR Circuit and Impedance Measurement
 - Explores phase relations and resonance in AC circuits..
6. Synthesis of Iron Oxide Nanoparticles (Green Method)
 - Simple and safe wet-chemical synthesis using plant extracts.
7. Surface Area to Volume Ratio Demonstration Using Sugar Cubes/Sponge
 - Explains nanoscale effects visually.

8. Wind Energy Demonstration (Fan + Mini Turbine Setup)
 - Demonstrates wind-to-electricity conversion.
9. Hydrogen Generation via Electrolysis and Fuel Cell Demonstration
 - Produces H_2 and shows voltage from a fuel cell.
10. Efficiency Comparison Between LED and Incandescent Bulbs
 - Measures power consumption and light output.
11. Solar Panel Efficiency under Different Light and Load Conditions
 - Demonstrates photovoltaic energy conversion and optimization.
12. Battery/Fuel Cell Voltage Measurement with Varying Load
 - Observes how output voltage changes with load resistance.

Simulation-Based or Digital Experiments

13. 1D Particle in a Box – Simulation using PhET/Python
 - Visualizes quantum confinement and energy levels.
14. Rutherford Scattering Simulation
 - Models scattering patterns and cross-section concepts.
15. Spin- $\frac{1}{2}$ System and Pauli Matrices – Qiskit or QuTiP
 - Simulates spin operators and quantum states.
16. Visualization of Kepler's Laws and Satellite Orbits
 - Models elliptical motion and geostationary conditions.
17. Lagrangian and Hamiltonian Simulation (e.g., Double Pendulum)
 - Explores classical mechanics through dynamic systems.
18. Basic Quantum Circuit Simulation using IBM Quantum Lab (Qiskit)
 - Visualizes gates, superposition, and basic algorithms.

Prepared by:

Dr. G. Suresh Babu
Member, BOS
Lecturer in Physics
GDC, Puttur
Tirupati Dist. A.P.

Dr. C. Bapanayya
Member, BOS
Lecturer in Physics
SVA GDC(M) Srikalahasti
Tirupati Dist. A.P

Dr. A. Sujala Swapna Smitha
Member, BOS
Lecturer in Physics
GDC, Puttur
Tirupati Dist. A.P

Dr. C. Sai Vandana
Member, BOS
Lecturer in Physics
GDC(W) Srikalahasti
Tirupati Dist. A.P

Dr. E. Rekha
Member, BOS
Lecturer in Physics
SWR GDC(W) Kalikiri
Annamayya Dist. A.P



Dr. M. Surya Sekhar Reddy
Chairperson, BOS
Lecturer in Physics
GDC(W) Madanapalle
Annamayya Dist. A.P.

4- Year UG Honours, Major
Syllabus
(2026-27)
Semester-IV

Model Question Paper

Time : 3hrs

Marks:75

Part-A

Answer any Five Questions. Each Question carries 3 Marks.

5x3=15

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Answer the following questions. Each question carries 12 Marks

5x12=60

11. a) Unit-I
(Or)
b) Unit-I

12. a) Unit-II
(Or)
b) Unit-II

13. a) Unit-III
(Or)
b) Unit-III

14. a) Unit-IV
(Or)
b) Unit-IV

15. a) Unit-V
(Or)
b) Unit-V