**Vijayanagara Sri Krishnadevaraya University, Ballari**

**Department of Studies in Physics**

**Programme:** Master of Science (M.Sc.) in Physics

**Programme Overview:**

**Duration: 2 Years ( 4 semesters) Programme Code:901**

Master of Science (M.Sc.) in Physics programme is designed to prepare students for a career in teaching, research or industry by introducing them to a wide range of concepts in physics and training in techniques applicable in various research areas. The course aims in providing basic understanding of principles and concepts of physics, expertise in experimentation to understand the theoretical and experimental dimensions of physics.

**Programme Outcomes (POs):**

At the end of the programme the students will be able to:

**PO1:** Apply the domain knowledge solve to practical problems.

**PO2:** Apply the mathematical techniques to interpret behavior of physical systems.

**PO3:** Demonstrate the ability to design & execute experiments, and anlyse the results.

**PO4:** Demonstrate the ability to propose and execute a research project, and ethically report the results with concern for society and environment.

**PO5:** Work in a group to execute a project and contribute as an individual.

**PO6:**  Effectively communicate the concepts, applications and research results in physics (both written and oral).

**PO7:** Develop lifelong learning habits by continuously updating advances in physics / science.

**Programme Specific Outcomes (PSOs):**

At the end of the programme the students will be able to:

**PSO1:** Apply the knowledge of basic concepts in Solid State Physics / Nuclear Physics

 to understand/analyse/design the properties of matter and devices.

**PSO2:** Demonstrate the ability to design & execute experiments in Solid State Physics / Nuclear

 Physics, and anlyse the results.

**Course Outcomes:**

**M.Sc. Physics (Semester I)** (**CBCS): 2016-17 Scheme**

**I Semester**

**COURSE: MATHEMATICAL PHYSICS I (PH HCT 110)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 110.1 | Apply differential equations and special functions to physical problems. |
| PH HCT 110.2 | Apply Fourier series and integral transforms to physical situations. |
| PH HCT 110.3 | Understand concepts and methods in Matrices and Tensors.  |
| PH HCT 110.4 | Write a Fortran program for some simple physics problems.  |

**COURSE: QUANTUM MECHANICS I (PH HCT 120)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 120.1 | Understand physical basis of quantum mechanics and Schrodinger wave equation. |
| PH HCT 120.2 | Solve few one dimensional and three dimensional Eigen value problems. |
| PH HCT 120.3 | Understand general formulism of quantum mechanics.  |
| PH HCT 120.4 | Understand approximation methods for stationary states and theory of scattering.  |

 **COURSE: ATOMIC, MOLECULAR AND OPTICAL PHYSICS (PH HCT 130)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 130.1 | Understand fundamental concepts in atomic physics. |
| PH HCT 130.2 | Understand the concepts of rotational molecular spectroscopy and Raman spectroscopy.  |
| PH HCT 130.3 | Understand the concepts of Vibrational and electronic spectroscopy.  |
| PH HCT 130.4 | Understand the concepts and applications of lasers & Optical fibers. |

 **COURSE: ELECTRONICS (PH SCT 140)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 140.1 | Understand fundamental ideas in Bipolar junction transistor. |
| PH SCT 140.2 | Understand the basic ideas in OP-Amps, Active filters and Signal generators.  |
| PH SCT 140.3 | Understand the concepts ICs, digital electronics and logic gates.  |
| PH SCT 140.4 | Understand the sequential circuits, A/D, D/A conversion circuits.  |

 **Practical I: ELECTRONICS LAB I (PH HCP 150)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCP 150.1 | Design the basic electronic circuits.  |
| PH HCP 150.2 | Study the basic characteristics of basic electronic circuits.  |
| PH HCP 150.3 | Analyse characteristics of basic electronic circuits.  |

**PRACTICAL II: GENERAL AND COMPUTATIONAL LAB I (PH HCP 160)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCP 150.1 | Design few experiments in general physics.  |
| PH HCP 150.2 | Study the basic characteristics of few devices in general physics.  |
| PH HCP 150.3 | Verify basic theorems/laws/distributions in general physics  |
| PH HCP 150.4 | Write and execute a computer program for simple physical problems. |

**COURSE: ASTROPHYSICS (PH SCT 141)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 141.1 | Understand fundamental concepts in Astrophysics. |
| PH SCT 142.2 | Understand the basic properties of stars.  |
| PH SCT 143.3 | Understand the fundamentals of solar system.  |
| PH SCT 144.4 | Understand the concepts of Star clusters, galaxies and the universe.  |

**II Semester**

 **COURSE: MATHEMATICAL PHYSICS II (PH HCT 210)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 210.1 | Apply complex analysis and vector analysis to simple physical problems. |
| PH HCT 210.2 | Understand basics group theory and its applications in physics. |
| PH HCT 210.3 | Understand methods of few numerical techniques. |
| PH HCT 210.4 | Write C-Programming for simple physics problems and understand the PC based instrumentation. |

 **COURSE: QUANTUM MECHANICS II (PH HCT 220)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 220.1 | Understand time –dependant phenomenon by using concepts in quantum mechanics . |
| PH HCT 220.2 | Understand identical particles, angular momentum and symmetry principles.  |
| PH HCT 220.3 | Understand relativistic equations in quantum mechanics. |
| PH HCT 220.4 | Understand the concepts in quantization of fields.  |

 **COURSE: ELEMENTS OF SOLID STATE PHYSICS (PH SCT 230)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 230.1 | Understand the fundamentals of crystal structure and X-ray diffraction. |
| PH SCT 230.2 | Understand binding in crystals and lattice vibrations.  |
| PH SCT 230.3 | Understand concepts of energy bands in solids and types of defects.  |
| PH SCT 230.4 | Understand the basic concepts in semiconductors and superconductors.  |

 **COURSE: ELEMENTS OF NUCLEAR PHYSICS (PH SCT 240)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 240.1 | Understand the basic properties of nucleus and nuclear forces. |
| PH SCT 240.2 | Understand the fundamental nuclear reactions and nuclear models.  |
| PH SCT 240.3 | Understand nuclear decay types and fundamentals of interaction of radiation with matter.  |
| PH SCT 240.4 | Understand the basics nuclear energy, fundamental interactions and elementary particles.  |

 **PRACTICAL III: Optics lab (PH HCP 260)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCP 260.1 | Set-up basic experiments in optics. |
| PH HCP 260.2 | Determine the basic properties of light using experimental methods. .  |
| PH HCP 260.3 | Verify basic laws in optics.  |

 **PRACTICAL IV: GENERAL AND COMPUTATIONAL LAB II (PH HCP 270)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCP 270.1 | Set-up basic experiments in general physics. |
| PH HCP 270.2 | Determine the basic physical constants of materials/other general constants by experimental techniques.  |
| PH HCP 270.3 | Verify few laws in physics.  |
| PH HCP 270.4 | Write and execute a computer program for simple physical problems. |

 **COURSE: ATMOSPHERIC AND SPACE SCIENCE (PH SCT 241)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 241.1 | Understand fundamental ideas in physical Meteorology and atmospheric pollution. |
| PH SCT 241.2 | Understand the concepts in optics of the atmosphere and atmospheric instrumentation systems.  |
| PH SCT 241.3 | Understand the concepts in orbital motion and space dynamics.  |
| PH SCT 241.4 | Understand the methods in remote sensing.  |

 **COURSE: MODERN PHYSICS (PH OET 250)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH OET 250.1 | Understand the basic concepts and devices in electronics. |
| PH OET 250.2 | Understand the basic concepts in Nuclear physics and astronomy.  |
| PH OET 250.3 | Understand the basic concepts in condensed matter physics and thermodynamics.  |
| PH OET 250.4 | Understand the basic phenomenon in optics and idea about lasers.  |

 **COURSE: GENERAL PHYSICS (PH OET 251)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH OET 251.1 | Understand the basic concepts mechanics and heat.  |
| PH OET 251.2 | Understand the fundamentals of electricity and magnetism.  |
| PH OET 251.3 | Understand the basic phenomena of light.  |
| PH OET 251.4 | Understand the basic concepts of atomic and nuclear physics. |

**III Semester**

**COURSE: CLASSICAL MECHANICS (PH HCT 310)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 310.1 | Understand and Apply Newtonian mechanics to some physical situations.  |
| PH HCT 310.2 | Understand and Apply Lagrangian formalism to some physical situations. |
| PH HCT 310.3 | Understand and Apply Hamiltonian formalism to some physical situations. |
| PH HCT 310.4 | Understand the fundamentals of relativistic mechanics and continuum mechanics.  |

**COURSE: ELECTRODYNAMICS AND PLASMA PHYSICS (PH HCT 320)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 320.1 | Understand principles and laws in electro and magnetostatics. .  |
| PH HCT 320.2 | Understand Maxwell’s equations and their applications to concepts involving electromagnetic waves. |
| PH HCT 320.3 | Understand fundamental ideas in electromagnetic radiation and fields. |
| PH HCT 320.4 | Understand the fundamentals of plasma and related phenomena.  |

**COURSE: SOLID STATE PHYSICS I (PH SCT 330)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 330.1 | Understand basic concepts of periodic structures and applications different electron models.  |
| PH SCT 330.2 | Understand concepts related to lattice vibrations and lattice waves in solids.  |
| PH SCT 330.3 | Understand concepts related to thermal and elastic properties of solids. |
| PH SCT 330.4 | Understand the fundamentals of Fermi surface in solids and related phenomena.  |

 **COURSE: NUCLEAR PHYSICS I (PH SCT 331)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 331.1 | Understand basic properties of nucleus, concepts related to electric quadropole moment and beta decay.  |
| PH SCT 331.2 | Understand different nuclear radiation detectors and their working & applications.  |
| PH SCT 331.3 | Understand concepts related to thermal and elastic properties of solids. |
| PH SCT 331.4 | Understand the fundamentals of nuclear electronics used in nuclear technology.  |

 **COURSE: SOLID STATE PHYSICS II (PH SCT 340)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 340.1 | Understand the transport properties of metals & semiconductors and related phenomena. |
| PH SCT 340.2 | Understand the dielectric properties of materials, ferroelectricity and related concepts. |
| PH SCT 340.3 | Understand magnetic properties of materials based on different theories. |
| PH SCT 340.4 | Understand superconductivity phenomenon, associated theories and applications.  |

 **COURSE: NUCLEAR PHYSICS II (PH SCT 341)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 341.1 | Understand principles of nuclear spectroscopy, gamma ray spectroscopy and related instrumentation. |
| PH SCT 341.2 | Understand basic principles of different nuclear techniques for material characterization.  |
| PH SCT 341.3 | Understand deuteron problem and concepts associated with nuclear forces.  |
| PH SCT 341.4 | Understand various nucleon-nucleon scattering mechanisms and associated concepts.  |

 **PRACTICAL V: SOLID STATE PHYSICS LAB I (PH HCP 350)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCP 350.1 | Set-up basic experiments in solid state physics. |
| PH HCP 350.2 | Determine the basic physical constants of materials by experimental techniques.  |
| PH HCP 350.3 | Compute structure factor in crystals.  |

 **PRACTICAL V: NUCLEAR LAB I (PH HCP 351)**

**Course Outcomes (CO): After completion of this course student should be able to**

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| **CO** | **Statement** |
| PH HCP 351.1 | Set-up basic experiments in nuclear physics. |
| PH HCP 351.2 | Determine the basic physical parameters of nuclear radiations/radioactive sources.  |
| PH HCP 351.3 | Compute stopping power , energy loss, nuclear mass and binding energy.  |

 **PRACTICAL VI: SOLID STATE PHYSICS LAB II (PH HCP 360)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCP 360.1 | Set-up basic experiments in solid state physics. |
| PH HCP 360.2 | Determine the basic physical constants of materials by experimental techniques.  |
| PH HCP 360.3 | Compute intensities in X-ray powder pattern.  |

 **PRACTICAL V: NUCLEAR LAB II (PH HCP 361)**

**Course Outcomes (CO): After completion of this course student should be able to**

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| **CO** | **Statement** |
| PH HCP 361.1 | Set-up basic experiments in nuclear physics and also related to solar radiation. |
| PH HCP 361.2 | Determine the basic physical parameters of nuclear radiations/radioactive sources/solar devices.  |
| PH HCP 361.3 | Understand nuclear models and analyse nuclear structure.  |

**COURSE: ENERGY SCIENCE (PH OET 370)**

**Course Outcomes (CO): After completion of this course student should be able to**

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| **CO** | **Statement** |
| PH OET 370.1 | Understand laws of thermodynamics and their applications. |
| PH OET 370.2 | Understand various renewable energy resources and related concepts.  |
| PH OET 370.3 | Understand production of biomass energy. |
| PH OET 370.4 | Understand fundamentals of biogas technology.  |

**COURSE: RADIATION PHYSICS (PH OET 371)**

**Course Outcomes (CO): After completion of this course student should be able to**

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| **CO** | **Statement** |
| PH OET 370.1 | Understand different nuclear radiations and their interaction with matter.  |
| PH OET 370.2 | Understand biological effects of radiation.  |
| PH OET 370.3 | Understand radiation protection in medicine. |
| PH OET 370.4 | Understand fundamentals of lasers and their few applications.  |

**IV Semester**

 **COURSE: STATISTICAL MECHANICS (PH HCT 410)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 410.1 | Understand basic ideas in thermodynamics and statistical mechanics.  |
| PH HCT 410.2 | Understand various partition functions and their usefulness in determining thermodynamic potentials. |
| PH HCT 410.3 | Understand different statistics and their physical applications.  |
| PH HCT 410.4 | Understand fluctuations, irreversible thermodynamics and related concepts.  |

 **COURSE: ANALYTICAL TECHNIQUES AND INSTRUMENTATION (PH HCT 420)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH HCT 420.1 | Understand basic principles and applications of spectrophotometry, Thermal analyses techniques & X-ray spectrometry.  |
| PH HCT 420.2 | Understand basic principles and applications of Electron and Ion spectroscopic techniques.  |
| PH HCT 420.3 | Understand basic principles and applications of optical, electrical and magnetic resonance techniques.  |
| PH HCT 420.4 | Understand basic principles and applications of nuclear, low temperature and vacuum techniques.  |

**COURSE: SOLID STATE PHYSICS III (PH SCT 430)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 430.1 | Understand magnetic resonance techniques and related concepts.  |
| PH SCT 430.2 | Understand optical properties of semiconductors, low dimensional semiconductor structures and amorphous semiconductors.  |
| PH SCT 430.3 | Understand elastic properties of materials including ductility, plastic deformation and creep.  |
| PH SCT 430.4 | Understand general and AC properties of ferrites, and their applications.  |

**COURSE: NUCLEAR PHYSICS III (PH SCT 431)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 431.1 | Understand different nuclear models with a specific emphasis of shell model.  |
| PH SCT 431.2 | Understand nuclear collective model and related concepts.  |
| PH SCT 431.3 | Understand nuclear reactions and related concepts. |
| PH SCT 431.4 | Understand basic ideas of heavy ion physics.  |

**COURSE: SOLID STATE PHYSICS IV (PH SCT 440)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 440.1 | Understand transport properties, magnetic field effects and optical properties of semiconductors.  |
| PH SCT 440.2 |  Understand principle of working and applications of semiconductors devices.  |
| PH SCT 440.3 | Understand principle of working and applications photovoltaic converters.  |
| PH SCT 440.4 | Understand different synthesizing and characterization methods of nanomaterials.  |

**COURSE: NUCLEAR PHYSICS IV (PH SCT 441)**

**Course Outcomes (CO): After completion of this course student should able to**

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| **CO** | **Statement** |
| PH SCT 441.1 | Understand neutron physics and related concepts. |
| PH SCT 441.2 | Understand fundamentals ideas and related phenomena in reactor physics.  |
| PH SCT 441.3 | Understand fundamentals ideas and related phenomena in particle physics. |
| PH SCT 441.4 | Understand fundamentals of strange particles and unified model.. |

 **COURSE: PROJECT**

**Course Outcomes (CO): After completion of the project student should able to**

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| **CO** | **Statement** |
| Project 1.1 | Conduct literature survey on specified area of research. |
| Project 1.2 | Define or state the research problem.  |
| Project 1.3 | Plan the activities of the project and its timeline.  |
| Project 1.4 | Identify requirements of hardware/software for performing specified project. |
| Project 1.5 | Conduct investigations on defined research problem. |
| Project 1.6 | Analyse experimental observations by scientific methods.  |
| Project 1.7 | Report results of investigation ethically with concern for society/environment. |
| Project 1.8 | Work effectively in a team and contribute independently. |
| Project 1.9 | Communicate (oral and written) the results of investigation. |

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