Department of Physics

Mapping of the courses based on employability / entrepreneurship / skill development

Program: M. Sc. (Physics)

Mathematical methods	RJSPGPHY101	Skill development Unit I, II, III and IV: Complex variables, Matrices, second order linear differential equations, Integral transforms Problem solving skill- Students learn Mathematical Physics and solve different types of Physics related problems. They are also well equipped to tackle open ended problems and mathematical modelling.
Classical Mechanics	RJSPGPHY102	Skill development Unit I Lagrangian Mechanics Unit II Central force problem Students learn new principles of variational calculus and methods to solve complex classical systems. Students learn reduction of the Central force problem to one dimensional problem and finding orbits for different potential. Students also learn Hamilton's formalism.
Quantum Mechanics-I	RJSPGPHY103	Skill development Units I to IV: Formalism, Schrodinger's equation, Angular momentum Students learn higher concepts of Quantum mechanics along with its mathematical formalism and learn to solve advanced problems.
Solid State Physics	RJSPGPHY104	Skill development Unit I, II, III and IV: Crystal structure, Lattice vibration and Magnetism Students learn about X-Ray diffraction techniques and gain theoretical understanding of the atomic origin of magnetism.
General Laboratory 1	RJSPGPHY1P01	Skill development Students learn various investigative skills, including skills of independent investigation of Physics-related issues and problems. Students also develop the fundamental understanding of the instruments used.
Computer Laboratory 1	RJSPGPHY1P02	Skill development, entrepreneurship and employability Students learn how to write codes. They also get hands-on experience in easy methods of carrying out numerical analysis using C++ with applications to physical problems.

Statistical Mechanics	RJSPGPHY201	Skill development Unit I, II, III and IV: Thermodynamics, Boltzmann statistics, Quantum statistics and Interacting systems Students learn the microscopic origin of several laws especially in thermodynamics. The students also learn concepts and techniques to derive governing equations for macroscopic variables from the interactions at the microscopic level. .
Electrodynamics	RJSPGPHY202	Skill development: Unit I, II, III and IV: Maxwell's equation, Waveguides, Relativistic formalism Students learn advanced concepts involving Maxwell's equations. They will also be introduced to the Poynting theorem and its uses. They learn about the EM waves from the perspective originating from Maxwell's equations and their propagation through different media and through waveguides.
Quantum Mechanics - II	RJSPGPHY203	Skill development: Unit I, II, III and IV: Perturbation theory, Approximation methods, Scattering theory Students learn advanced concepts of quantum mechanics which will allow them to tackle more complex problems using perturbation theory.
Atomic and Molecular Physics	RJSPGPHY204	Skill development: Unit 1, II, III and IV: Schrodinger equation for two electron atoms, The L-S coupling approximation, Born-Oppenheimer approximation, Rotational and vibrational spectra The students learn different effects and derive them from the Schrodinger equation. The students will learn the theory of how an electromagnetic radiation is absorbed and emitted by an atom. They study various aspects of the spectra of atoms as well as molecules.
General Laboratory -II	RJSPGPHY2P01	Skill development: Students learn various investigative skills, including skills of independent investigation of Physics-related issues and problems. Students also develop the fundamental understanding of the instruments used.
Computer Laboratory -II	RJSPGPHY2P02	Skill development, entrepreneurship and employability Students learn how to write codes. They also get hands-on experience in easy methods of carrying out numerical analysis using Python with applications to physical problems.

Computational Physics	RJSPGPHY301	Skill development and employability: Unit I, II, III and IV: Molecular dynamics, Monte Carlo simulations, Density Functional Theory and Finite Element method Students acquire various techniques to tackle complex problems using computer simulations.
Nuclear Physics	RJSPGPHY302	Skill development: Unit I, II, III and IV: Gamma decay, Nuclear Models, Deuteron Problem, Quantum Chromodynamics Students learn different models in detail and different types of reactions. Students are introduced to elements of particle Physics.
8,16 bit-Microprocessors, Microcontrollers and PIC Microcontroller	RJSPGPHY3ET05	Skill development, employability and entrepreneurship: Unit I, II, III and IV: 8086 Microprocessor and 8051 Microcontroller Students acquire the 8086 , PIC Microcontroller and 8051 controller programming skill
Core Electronics, Embedded Systems and RTOS	RJSPGPHY3ET06	Skill development, employability and entrepreneurship: Unit I, II, III and IV: Data acquisition and data Transmission, Embedded System Students acquire the skill of advanced electronic device design.
Fundamentals of Material Science	RJSPGPHY3ET11	Skill development, employability: Unit I, II, III and IV: Crystal structure, Industrial application of diffusion process, Phase diagrams Students learn various aspects of materials Science and engineering. Students learn the concept of crystal and amorphous material's structure and apply it in synthesis of materials. They develop the skill to design new materials. The deep knowledge of the subject can give employment in teaching and R & D areas.
Nanoscience and Nanotechnology	RJSPGPHY3ET12	Skill development, employability in industry and research field: Unit I, II, III: Metal nanostructure and fabrication of quantum structures, carbon nanostructure, mechanical and magnetic properties of nanostructures, Nanoparticles of gold, CdSe, Iron oxide and carbon The students extend their knowledge of Nanoscience and Nanotechnology and apply it on atoms and molecules of nanomaterials. They also learn various methods of synthesis of nanoparticles, application of which is required in modern industries.
Project 1	RJSPGPHY3P01	Skill development, entrepreneurship and employability- Students learn various investigative skills, including skills of independent investigation of Physics-related issues and problems. Students develop technical and analytical skills that lead to development of projects. The procedural knowledge is used in professional fields

Elective Lab Course -1	RJSPGPHY3P02	Skill development: Students learn various investigative skills, including skills of independent investigation of Physics-related issues and problems. Students also develop the fundamental understanding of the instruments used.
Experimental Physics	RJSPGPHY401	Skill development and employability: Unit I, II, III and IV: Data Analysis in Physical Sciences, Vacuum techniques, nuclear detectors, characterization techniques Students learn methods to carry out data analysis and the estimation of errors. They also learn about different experimental techniques like SEM, TEM, XRD, XRF, XPS, Raman, UV Visible etc.
Solid State Devices	RJSPGPHY402	Skill development, employability: Unit I, II, III and IV: Semiconductor Physics and Semiconductor devices The students learn different aspects of semiconductors, their classification, crystal structures, etc. They also study the transport properties and different types of recombination. They acquire skill to fabricate the p-n junctions by different methods and also study their characteristics. They also acquire skills to apply their knowledge on different devices such as BJT, MOFET etc.
Advanced Microprocessor and ARM 7	RJSPGPHY4ET05	Skill development, employability and entrepreneurship: Unit I, II, III and IV: PIC Flash microcontrollers and industrial applications, ARM 7 Students acquire programming skill of PIC microcontroller and their interfacing and ARM 7 which can be used in various electronic industries.
VHDL and Communication Interface	RJSPGPHY4ET06	Skill development: Unit I, II, III and IV: VHDL programming and USB and Communication interface Students acquire the VHDL programming skill.
Properties of solids	RJSPGPHY4ET04	Skill development and employability: Unit I, II, II and IV: Optical and Dielectric properties, Transport Properties, Magnetism and Magnetic materials, Superconductivity Students will have the opportunity to work in R & D and in industries.
Materials and their Applications	RJSPGPHY4ET11	Skill development and employability: Unit I, II, II and IV: Engineering alloys, Corrosion, Ceramic, polymeric and composite materials The students learn various methods of synthesis of materials, applications of which are required in various modern Engineering industries.

Project 2	RJSPGPHY4P01	Skill development, entrepreneurship and employability- Students learn various investigative skills, including skills of independent investigation of Physics-related issues and problems. Students develop technical and analytical skills that lead to development of projects. The procedural knowledge is used in professional fields
Elective Lab Course- 2	RJSPGPHY4P02	Skill development: Students learn various investigative skills, including skills of independent investigation of Physics-related issues and problems. Students also develop the fundamental understanding of the instruments used.