Department of Physics

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

Course name	Course Code	Unit No. And topics focusing on Employability / Entrepreneurship / Skill development
Mathematical and Classical Physics	Course Code: RJSUPHY101	Skill development Unit I, II and III: Newton's laws and elasticity, Vector algebra, First law of Thermodynamics Problem solving skill- Students can solve different types of Physics related problems. They are also well equipped to tackle open ended problem.
Nuclear and Modern Physics	Course Code: RJSUPHY102	Skill development Unit I, II and III: Nuclear structure and radioactivity, Nuclear reactions, Origin of quantum theory, X-Ray production and properties. Apart from problem solving ability students also know the various fields where nuclear and Modern Physics can be applied.
Practical Course I	RJSUPHY1P01	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.
Mathematical Physics, Oscillations and Optics	RJSUPHY201	Skill development- Unit I, II and III: Differential equations, Superposition of harmonic oscillations, Lenses and human eye Problem solving skill- Students can solve different types of Physics related problems. They are also well equipped to tackle open ended problem.
Electricity and Electrostatics	RJSUPHY202	Skill development Unit I and II: Students can get in depth knowledge by practicing these subjects on different circuit softwares.
Practical Course II	RJSUPHY2P01	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.
Mechanics and Thermodynamics	RJSUPHY301	Skill development Unit I, II and III: Oscillations, compound pendulum, Second and third law of Thermodynamics Problem solving skill- Students can solve different types of Physics related problems. They are also well equipped to tackle open-ended problems.

Vector Calculus and Analog Electronics	RJSUPHY302	Skill development, entrepreneurship and employability Unit I: Vector calculus Students can solve complex problems using various computer softwares. Unit II and III: Analog Electronis1 and 2 Students acquire skill and knowledge of Analog Electronics that opens a vast field of employment or self employment.
Applied Physics I	RJSUPHY303	Skill development and employability Unit I, II and III: Acoustics, lasers and fibre optics, Biophysics, Materials-Properties and Applications Students develop skills in related field of specialization. They link the core subject with different disciplines.
Practical course-III	RJSUPHY3P01,RJSUPHY3P02 and RJSUPHY3P03	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.
Optics	RJSUPHY401	Skill development, entrepreneurship and employability Unit I, II and III: Diffraction, Polarization and Interferometry Students acquire knowledge and skill which is required in many industries like opto-mechanical manufacturing units.
Quantum Mechanics	RJSUPHY402	Skill development Unit I, II and III: Schrodinger's wave equation and its application to steady state equations Students develop ability to solve Physics problems and also develop skills in mathematical modeling.
Applied Physics II	RJSUPHY403	Skill development, entrepreneurship and employability Unit I and II: Digital Electronics and Communication techniques Students develop the experiential skill in Digital Electronics and Communication techniques needed for Electronics and Communication industries. Unit III: Geophysics Students learn the role of Physics in interdisciplinary areas related to Geophysics.
Practical 4	RJSUPHY4P01,RJSUPHY4P02 and RJSUPHY4P03	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.
Mathematical and Statistical Physics	RJSUPHY501	Skill development Unit I, II, III and IV: Probability, Statistical Thermodynamics, Classical and Quantum Statistics Problem solving skill- Students learn Mathematical Physics and solve different types of Physics related problems. They are also well equipped to tackle open ended problem and mathematical modeling.

Solid State Physics	RJSUPHY502	Skill development and employability Unit I: Crystal Physics Students develop fundamental understanding of crystalline and noncrystalline structures Unit II and III: Electrical properties of metals, Band theory of solids Students learn how charge carriers are transported and knowledge of conducting property of materials leads to the usage of the materials in industries. Unit IV: Diode theory and Superconductivity Students are opened to vast fields of Magnetism and superconductivity.
Atomic and Molecular Physics	RJSUPHY503	Skill development and employability Unit I and II: Hydrogen atom and Zeeman effect Students learn to analyze and apply the knowledge of atomic and molecular Physics in various other disciplines. Unit III and IV: Molecular spectra and Raman effect Students are exposed to the vast field of spectroscopy like Raman spectroscopy and apply their skills in developing better instruments used in material science and medical science.
Electrodynamics	RJSUPHY504	Skill development Unit I and II: Electrostatics in matter and Magnetostatics Students learn to apply basic skills to solve complex problems. They also understand how optical laws can be derived from electromagnetic principles. Unit III and IV: Magnetostatics in matter and Electrodynamics, Electromagnetic waves Students develop quantitative problem solving skills.
Applied Component: EI	RJSUPHYAC505	Skill development, entrepreneurship and employability Unit I, II and III: Transducers, Optoelectronic devices, SMPS and Measuring instruments, Modern techniques and appliances, C++ programming Students acquire knowledge and skills that make them eligible to work in industries or get self employment. Unit IV: Basic C++ programming The C++ programming skill makes the students work in many software companies.
Lab Course 1	RJSUPHY5P01	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.
Lab Course 2	RJSUPHY5P02	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.
Project 1	RJSUPHY5P03	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 leads to development of projects. The procedural knowledge is used in professional fields.

Applied Component Lab Course 1	RJSUPHYAC5P01	Skill development, entrepreneurship and employability- The learners develop instrumentation handling skills.
Classical Mechanics	RJSUPHY601	Skill development Unit I and II: Central force and Lagrange's equation The students learn the concepts needed for the important formalism of Lagrange's equations and solve problems in Mechanics. They also acquire the ability to solve difficult problems in rigid body dynamics. Unit III and IV: Fluid motion and rigid body rotation, Nonlinear Mechanics Students apply the knowledge and skills learnt in previous units to understand the phenomenon of nonlinear dynamics.
Electronics	RJSUPHY602	Skill development, entrepreneurship and employability Unit I, II and III: JFET, MOSFET, OpAmp applications, Multivibrators The students acquire knowledge of semiconductor devices and learn their applications in various industries and self employment. Unit IV: Logic families and digital communication The learners develop the circuit building and designing skills of basic electronic circuits for universal logic building blocks and basic concepts of digital communication. They also develop quantitative problem solving skills.
Nuclear Physics	RJSUPHY603	Skill development and employability Unit I and II: Alpha, Beta decay, Gamma decay Students develop the understanding of the fundamental principles and concepts governing classical, nuclear and particle physics. They also acquire knowledge of interactions of ionizing radiation with matter. Unit III and IV: Nuclear energy and particle accelerator The students learn the key techniques for particle accelerators and the physical processes involved in nuclear power generation. Knowledge on elementary particles helps students to understand the fundamental constituents of matter and lay foundation for the understanding of unsolved questions about dark matter, antimatter and other research oriented topics.
Special Theory of Relativity	RJSUPHY604	Skill development Unit I, II: Special Theory of relativity and Relativistic Kinematics Students understand the importance of postulates of special relativity, Lorentz transformation equations and how it changed the way we look at space and time, Absolutism and relativity, Common sense versus Einstein concept of Space and time. Unit III and IV: Relativistic Dynamics and Electrodynamics Students can solve problems based on length contraction, time dilation, velocity addition, Doppler effect, mass energy relation and resolve paradoxes in relativity like twin paradox etc

Applied Component: EI	RJSUPHYAC605	Skill development, entrepreneurship and employability Unit II, III and IV: Microprocessor, Scilab and advanced C++ programming Students learn how to write codes. They also get hands-on experience in easy methods of carrying out numerical analysis using Scilab and C++ with applications to physical problems.
Lab Course 3	RJSUPHY6P01	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.
Lab Course 4	RJSUPHY6P02	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.
Project 2	RJSUPHY6P03	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
Applied Component Lab Course 2	RJSUPHYAC6P01	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 Scilab and C++ with applications to physical problems.
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 Lab 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 Lab 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 Lab -2	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 Lab -2	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 -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- 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.