Shri Shivaji Education Society, Amravati.

Shri Shivaji Science and Arts College, Chikhli, Dist. Buldhana

Department of Physics

B.Sc.-I, Sem.-I & II

Programme Outcomes

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

1) Understand physics fundamental concepts, including mechanics, electromagnetism, thermodynamics, quantum mechanics, and statistical physics.
2) Analyze and solve complex physical problems using mathematical and computational techniques.
3) Experience in conducting independent research projects, including literature review, hypothesis formulation, experimentation, data collection, and analysis.
4) Communicate complex scientific concepts clearly and effectively to diverse audiences, including peers, professionals, and the general public
5) Understand global scientific challenges and the role of physics in addressing environmental and sustainability issues
6) Apply physics knowledge to develop sustainable solutions and innovations.

Programme Specific Outcomes

PSO1 :Graduates will acquire a comprehensive knowledge and sound understanding of fundamentals of Physics.

PSO2 :Graduates will develop practical, analytical and mathematical skills in Physics.

PSO3 :Graduates will be prepared to acquire a range of general skills, to solve problems, to evaluate information, to use computers productively, to communicate with society effectively and learn independently.

PSO4 :Graduates will acquire necessary skills to enable them to crack competitive examination for career progression or seeking employment.

Code: Physics 129200/ Th1

Title of the course: Gravitation and Rotational Dynamics

Course Objectives:

1) To explain the concept of gravitational force and its universal nature.
2) To understand the laws of gravitation proposed by Newton and explore their implications.
3) To solve problems related to gravitational attraction between masses.
4) To investigate the effect of gravity on motion and orbits, including satellite motion.
5) To introduce the principles of rotational motion and dynamics.
6) To explore the concept of torque and its relationship with rotational motion.
7) To understand the parallel axis and perpendicular axis theorems.
8) To solve problems involving rotational motion, torque, and angular acceleration.

Course Outcomes:

1) On successful completion of this course, the students would be able to
2) Interpret the universal law of gravitation, gravitation field and gravitation potential.
3) Apply Kepler's laws to describe the motion of planets and others celestial bodies.
4) Understand the motion of satellites in orbit
5) Know the concept Black-hole
6) Relate rotational motion to linear motion through angular and linear quantities
7) Discuss the basic concepts of rotational dynamics and relate it with appropriate things.
8) Apply the parallel axes theorem and perpendicular axes theorem to calculate moments of inertia.
9) Discuss real world application of rotational mechanics, such as the dynamics of rotating machinery and vehicles.

Code: Physics 129/ OE-1

Title of the Course: Space Science (The Wonders of Physics)

Course Objectives:

1) To Introduce Space science.
2) To explain the formation of solar systems.
3) To relate Kepler's and Newton's laws to solar system.
4) To demonstrate formation of stars.
5) To describe origin of galaxies.
6) To apprise the creation of universe

Course Outcomes:

1) After completion of the course the students should be able to:
2) Understand the basic concepts to Space.
3) Discuss the laws of solar system.
4) Demonstrate formation of stellar objects.
5) Analyze evolution and origin of galaxies.
6) Demonstrate creation of Universe.

Code: Physics 129/ OE-2

Title of the Course: Non-Conventional Energy Sources

Course Objectives:

1. To provide an information of the most important renewable energy resources and the technologies for harnessing these resources within the framework.
2. To explore the concepts involved in solar energy, wind energy and ocean energy conversion system by studying its components, types

Course Outcomes:

After completion of the course the students should be able to:

1) Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells.
2) Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.
3) Explore the concepts involved in wind energy conversion system by studying its components, types and performance.
4) Illustrate ocean energy and explain the operational methods of their utilization.
5) Acquire the knowledge on Geothermal energy.

Code: Physics 129/ SEC-1/Lab

Title of the Course: Instrumentation and Measurement Skills

Course Objectives:

1) The objective of teaching this subject is to enable students for measurement of various mechanical and temperature instruments and equipment like Screw gauge, Vernier callipers, Travelling microscope, spherometer, Spectrometer, Electronic balance, Density meter, Thermometer, etc.
2) This subject will give in depth insight for taking accurate readings (measurements) of dimensions of daily usable devices such as rods, rings, strings, wires, chains, blocks, vessels etc.
3) Conversions of units into desired and applied practicable units. The subject will enrich students about measuring fundamental aspects of given mechanical, optical, thermal devices.

Course Outcomes:

1) Identify different types of mechanical, thermal devices/instruments.
2) Conversion of unit into desired, practicable and suitable (proper) units.
3) Errors in measurements, different methods of minimizing the errors.
4) Choosing the proper instrument between screw gauge, vernier callipers, spherometers, stop watch, spectrometers etc.

FIRST YEAR: SEMESTER – II

Code: Physics 129202/ Th 2

Title of the course: Oscillations and Properties of Matter

Course Objectives:

1. To define simple harmonic motion and identify its characteristics.
2. To relate simple harmonic motion to real-world examples.
3. To describe the oscillatory motion of a mass-spring system and a simple pendulum.
4. To define elasticity and understand the behavior of elastic materials.
5. To explore real-world examples of elasticity in engineering and materials science.
6. To explore the molecular basis of surface tension.
7. To explore applications of surface tension in everyday life and various industries.

Course Outcomes:

On successful completion of this course, the students would be able to

1. Understand the mathematical representation of simple harmonic motion using equations and graphs.

2. Relate position, velocity and acceleration in simple harmonic motion.

3. Relate the phase of motion to velocity and acceleration.

4. Apply the principles of simple harmonic motion to real-world applications.

5. Interpret stress-strain curves for different materials.

6. Differentiate between elastic and plastic deformation.

7. Understand how elasticity varies in different materials (metals, polymers, ceramics)

8. Differentiate between cohesive and adhesive forces.

9. Identify and explain the role of surface tension in everyday phenomena, such as soap bubbles, wetting of surfaces, etc.

Code: Physics 129203/ Lab-2

Course Objectives:

1. Teach accurate measurement techniques for physical quantities such as length, time, mass, and temperature.

2. Emphasize the importance of uncertainty and error analysis in experimental measurements.

3. Develop skills in data analysis using statistical methods and graphical representation.

4. Emphasize the connection between theoretical predictions and experimental results.

5. Encourage students to formulate hypotheses and design experiments to test them.

6. Emphasize the importance of documenting procedures, results, and conclusions.

7. Develop oral communication skills through presentations of experimental findings.

Course Outcomes:

On successful completion of this course, the students would be able to

1. Acquire skills in making accurate measurements and observations.

2. Learn how to collect experimental data systematically.

3. Understand sources of error in experimental measurements.

4. Design and plan experiments to test specific hypotheses.

5. Learn how to write clear and concise laboratory reports.

6. Create and interpret graphical representations of experimental data.

7. Formulate hypotheses, design experiments, and draw conclusions based on evidence.

8. Develop critical thinking skills by analyzing and interpreting experimental results.

Code: Physics 129/ OE-3

Title of the Course: Medical Physics

Course Objectives:

1. To promote the application of Physics
2. Understand the anatomy of the nervous system and its signal measurements.
3. Analyze and understand the applications of the imaging techniques transmission(x- ray and ultrasound)
4. Updating the knowledge in recent trends in medical field.

Course Outcomes:

After completing the course, the student will able to

1. Know the application of Physics in medical Sciences.
2. Understood the applications of the imaging techniques transmission(x- ray and ultrasound)
3. Understood the anatomy of the nervous system.

Code: Physics 129/ OE-4

Title of the Course: Physics behind Every Day Life

Course Objectives:

To introduces physics through a set of modules that closely connected to our everyday life and future

Course Outcomes:

After completing the course, the student will able to

1. Explain physics related phenomenon using basic physics principles and terminology
2. Perform basic calculation/estimations to solve simple physics related problems
3. Make correct judgment/decisions on physics related issues in their daily life based on basic physics principles.

Code: Physics 129/ VSC-1/Lab

Title of the Course: Electric Technician - I

Course Objectives:

1. Develop a strong understanding of safety protocols and procedures in electrical work, emphasizing adherence to industry standards and regulations.
2. Identify, select, and effectively utilize various electrical components, tools, and equipment used in electrical installations and repairs.
3. Understand the fundamental principles of electricity, including voltage, current, resistance, and power.

Course Outcomes:

1. Understand and apply the principles of electricity, including voltage, current, resistance, and power in practical scenarios.
2. Follow industry-standard safety protocols effectively while working with electrical systems, ensuring personal safety and compliance with regulations.

Physics 129/ SEC-2/Lab

Title of the Course: Instrumentation and Testing Skills

Course Objectives:

1. The objective of teaching this subject is to enable students for testing of various electronic and electrical Components and Instruments such as Diodes, Transistors, Transformer, Switches, Fuses, Cables, CRO, Multimeters, Voltmeter, and Ammeters etc.
2. Further this subject will give an insight upon the Soldering and De-soldering methods. This in turn will enhance their capabilities of Identifying, Assembling, and Fault diagnosis in a systematic way.
3. The subject will enrich students about reliability and quality control standards of equipment.

Course Outcomes:

1. Identify of different types of Electronic & Electrical Components & Devices.
2. Test different types of Electronic & Electrical Components & Instruments
3. Practice of Soldering & Desoldering process with correct methods.
4. Capabilities of identifying, assembling, fault diagnosis of electrical and electronic Components & Devices.
5. Identify faults in domestic electronic gadgets.

Physics MJ Theory 3 – 129212	
Mathematical Background, Electrostatics and Magnetostatics	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To provide students with a strong foundation in the mathematical tools essential for physics, including scalar and vector fields, gradient, divergence, curl, and integral theorems. 2. To develop an understanding of electrostatics, including electric fields, electric potential, Gauss's theorem, and their applications to various charge distributions. 3. To introduce the concept of capacitance and its applications in different configurations of capacitors, including the effects of dielectric materials. 4. To familiarize students with magnetostatics, including Biot-Savart's law, Ampere's circuital law, and their applications to current-carrying conductors and solenoids. 5. To enhance problem-solving skills through numerical applications and practical examples related to electrostatics and magnetostatics.
Course Outcomes:	By the end of the course, students will be able to: 1. Apply mathematical concepts such as gradient, divergence, curl, and integral theorems to solve physics problems. 2. Analyze and compute electric fields and potentials for various charge distributions using Gauss's theorem and other electrostatic principles. 3. Evaluate the capacitance of different capacitor configurations and understand the role of dielectric materials in capacitors. 4. Determine magnetic fields due to current-carrying conductors and solenoids using Biot-Savart's law and Ampere's circuital law. 5. Solve numerical problems related to electrostatics and magnetostatics, demonstrating a clear understanding of theoretical concepts. 6. Relate the physical significance of key concepts such as electric flux, potential, and magnetic induction to real-world applications.

Physics MJ Theory 4 – 129213	
Solid State Devices I	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To introduce the fundamental concepts of semiconductors and types. 2. To explain the working principles of PN junctions, rectifiers, and their applications in power supplies. 3. To analyze the role of filter circuits in reducing ripple voltage and their design considerations. 4. To explore the characteristics and applications of Zener diodes as voltage regulators. 5. To study the construction, working principles, and applications of key semiconductor devices such as LEDs, photodiodes, varactor diodes, and SCRs. 6. To provide hands-on problem-solving experience through numerical examples and circuit analysis.
Course Outcomes:	By the end of this course, students will be able to: 1. Understand the behavior of electrons and holes in intrinsic and extrinsic semiconductors, and calculate Fermi levels. 2. Analyze the characteristics of PN junctions under different biasing conditions and their applications in rectifiers. 3. Design basic power supply circuits incorporating rectifiers, filters, and regulators to achieve stable DC output. 4. Evaluate the performance of filter circuits (capacitor, inductor, L-section, π-section) and compute ripple factors. 5. Apply Zener diodes in voltage regulation circuits and solve related numerical problems. 6. Demonstrate the working principles of LEDs, photodiodes, varactor diodes, and SCRs in practical applications such as inverters and temperature control systems. 7. Interpret circuit diagrams and troubleshoot common issues in semiconductor-based electronic systems.

Physics MJ Lab/ Practical 3 – 129214	
Experiments related to Physics MJ Th3 and MJ Th4	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. Understanding basic electronic components and instruments. 2. Develop hands-on skills in circuit assembly and testing 3. Develop skills in data analysis and graphical representation. 4. Emphasize the connection between theoretical predictions and experimental results. 5. Foster analytical and critical thinking. 6. Emphasize the importance of documenting procedures, results, and conclusions. 7. Develop oral communication skills through presentations of experimental findings.
Course Outcomes:	By the end of this course, students will be able to: 1. Identify and use basic electronic components and instruments. 2. Learn how to write clear and concise laboratory reports. 3. Create and interpret graphical representations of experimental data. 4. Develop critical thinking skills by analyzing and interpreting experimental results. 5. Demonstrate an understanding of concepts involved in semiconductor devices operation and their characteristics. 6. Identify and handle different types of semiconductor devices. 7. Learn best practices for handling, cleaning and maintaining the instruments. 8. Construct and troubleshoot electronic circuits. 9. To develop experimental thinking about electrostatics and magnetostatics.

IKS-Physics Theory – 129215	
Indian Knowledge Systems (IKS)-Physics	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To introduce students to the foundational concepts of Indian Knowledge Systems and their contributions to physical sciences. 2. To explore ancient Indian theories of matter, atomic structure, and energy, and compare them with modern scientific principles. 3. To examine the historical development of mechanics and motion in ancient Indian texts, including early understandings of gravity and forces. 4. To study the astronomical and cosmological models proposed by ancient Indian scholars and their relevance to modern astronomy. 5. To analyze the integration of traditional Indian knowledge with contemporary physics and its influence on modern Indian scientists.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the key concepts of Indian Knowledge Systems and their significance in the history of science. 2. Compare Kanada's atomic theory (Anu theory) with Dalton's atomic theory and evaluate their similarities and differences. 3. Describe ancient Indian perspectives on motion (Gati), forces (Bala), and gravity as documented in texts like "Lilavati" and others. 4. Analyze the contributions of Aryabhata, Varahamihira, and other scholars to astronomy and cosmology, including models like the Surya Siddhanta. 5. Evaluate the influence of ancient Indian scientific thought on modern physics and scientists such as C.V. Raman and S.N. Bose. 6. Appreciate the interdisciplinary connections between traditional knowledge systems and contemporary scientific research.

Physics MN Theory 3 – 129216	
Mathematical Physics and Solid State Devices	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To provide students with a strong foundation in mathematical tools essential for physics, including scalar and vector fields, gradient, divergence, curl, and integral theorems. 2. To introduce the fundamental concepts of semiconductors, including intrinsic and extrinsic types, carrier concentrations, and Fermi levels. 3. To explain the working principles of PN junctions, rectifiers, and power supplies, along with their applications in electronic devices. 4. To equip students with problem-solving skills through numerical applications in semiconductor physics.
Course Outcomes:	By the end of the course, students will be able to: 1. Apply mathematical concepts such as gradient, divergence, curl, and integral theorems to solve physics problems. 2. Explain the behavior of intrinsic and extrinsic semiconductors, including carrier concentrations and Fermi levels. 3. Describe the operation of PN junctions under different biasing conditions and interpret their characteristics. 4. Compare the performance of half-wave, full-wave, and bridge rectifiers and their applications in power supplies. 5. Demonstrate an understanding of the construction and working principles of Zener diodes, LEDs, and photodiodes. 6. Solve numerical problems related to Mathematical Physics and semiconductor physics.

Physics MN Lab/ Practical 3 – 129217	
Experiments related to Physics MN Th3	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. Understanding basic electronic components and instruments. 2. Develop hands-on skills in circuit assembling and testing 3. Develop skills in data analysis and graphical representation. 4. Emphasize the connection between theoretical predictions and experimental results. 5. Foster analytical and critical thinking. 6. Emphasize the importance of documenting procedures, results, and conclusions. 7. Develop oral communication skills through presentations of experimental findings.
Course Outcomes:	On successful completion of this course, the students would be able to 1. Identify and use basic electronic components and instruments. 2. Learn how to write clear and concise laboratory reports. 3. Create and interpret graphical representations of experimental data. 4. Develop critical thinking skills by analyzing and interpreting experimental results. 5. Demonstrate an understanding of concepts involved in semiconductor devices operation and their characteristics. 6. Identify and handle different types of semiconductor devices. 7. Learn best practices for handling, cleaning and maintaining the instruments. 8. Construct and troubleshoot electronic circuits.

Physics OE-5 Theory – 129218	
Solar Energy and Its Applications	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To introduce students to the fundamental concepts of energy, sustainability, and the critical role of renewable energy in addressing environmental challenges. 2. To provide an overview of solar energy, including its principles, advantages, and limitations, without requiring advanced mathematical background. 3. To explore practical solar thermal applications such as water heating, cooking, and space conditioning. 4. To explain the basics of solar photovoltaics, including electricity generation, types of solar panels, and their applications in residential and industrial settings. 5. To examine emerging solar technologies like solar-powered vehicles, solar architecture, and innovative trends such as floating solar plants. 6. To analyze the economic and policy aspects of solar energy, including costs, incentives, and global or regional (e.g., Indian) perspectives.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the importance of energy sustainability and the environmental benefits of transitioning to renewable sources like solar energy. 2. Describe the basic principles of solar radiation and how it is harnessed for practical applications. 3. Compare different solar thermal technologies (e.g., water heaters, cookers) and their suitability for specific needs. 4. Outline the process of electricity generation using solar photovoltaics and distinguish between types of solar panels. 5. Discuss emerging solar technologies and their potential to revolutionize transportation, architecture, and large-scale energy production. 6. Evaluate the economic viability of solar energy projects and the impact of government policies on adoption. 7. Contextualize solar energy trends within a regional framework (e.g., India's solar mission or global initiatives).

Physics VSC-2 Lab/ Practical – 129219	
Electrical Installation for Residential Buildings	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. Introduce Fundamental Electrical Concepts 2. Develop Proficiency in Electrical Tools and Safety Practices 3. Explain Residential Electrical Components and Systems 4. Teach Electrical Circuit Design and Load Calculation 5. Enable Hands-On Wiring and Installation Skills 6. Impart Troubleshooting and Maintenance Skills 7. Foster Compliance with Standards and Codes 8. Encourage Systematic Project Execution
Course Outcomes:	After completing the course, the student will be able to: 1. Define key electrical terms, list safety rules, and identify basic tools used in residential wiring. 2. Explain working principles of residential circuits and components; interpret wiring diagrams and basic load calculations. 3. Demonstrate proper use of tools and install residential electrical wiring, DBs, switches, sockets, and light fixtures. 4. Diagnose electrical faults in residential systems and suggest corrective actions. Assess electrical installations for adherence to safety codes (like IS/IE rules) and quality workmanship 5. Design, plan, install, and test a fully functional residential electrical wiring project based on a given layout.

Physics FP/CEP-1 Project – 129220	
Field Project / CE Services in Physics: Phase-I	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. To provide hands-on experience in applying theoretical physics knowledge to real-world challenges through field-based projects or community engagement (CE) services. 2. To train students in identifying, analyzing, and solving practical problems encountered in physics-related fieldwork or community service activities. 3. To encourage students to integrate physics concepts with interdisciplinary knowledge, technology, and societal needs. 4. To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences. 5. To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.
Course Outcomes:	1. Students will be able to apply physics principles and analytical techniques to investigate and solve real-world problems in field settings. 2. Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service. 3. Students will be able to design, plan, and execute a field project or community service activity from inception to completion, including documentation and reporting. 4. Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events. • Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well-being.

Physics MJ Theory 5 – 129221	
Solid State Devices-II	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To introduce the fundamental principles of Bipolar Junction Transistors (BJTs), including their construction, working, configurations, and characteristics. 2. To analyze transistor biasing techniques, stability factors, and the operation of different amplifier classes (A, B, AB and C). 3. To study Field Effect Transistors (FETs), including JFETs and MOSFETs, their construction, working principles, characteristics, and differences from BJTs. 4. To understand the basics of Operational Amplifiers (Op-Amps), their ideal characteristics, key parameters, and applications in analog circuits. 5. To develop problem-solving skills through numerical analysis of transistor and FET parameters. 6. To explore practical applications of transistors and Op-Amps in amplifier circuits, signal processing, and other electronic systems.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the construction, working of CB and CE configurations of BJT and interpret their characteristics. 2. Analyze transistor biasing circuits, stability factors, and the significance of the operating point in amplifier design. 3. Compare the performance of different amplifier classes (A, B, AB and C) and their applications. 4. Describe the working principles of JFETs and MOSFETs, their characteristics, and key differences from BJTs. 5. Interpret the ideal characteristics and parameters of Op-Amps. 6. Design basic Op-Amp circuits (inverting/non-inverting amplifiers, adders, subtractors, differentiators, and integrators). 7. Solve numerical problems related to transistor biasing, FET parameters, and Op-Amp configurations. 8. Evaluate the role of transistors and Op-Amps in modern electronic devices and signal-processing applications.

Physics MJ Theory 6 – 129222	
Optics and Laser	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To introduce the fundamental principles of wave optics, including interference, diffraction, and polarization, and their significance in understanding light behavior. 2. To analyze interference phenomena in thin films, Newton's rings, and Michelson interferometer, including numerical problem-solving. 3. To study diffraction patterns (Fresnel and Fraunhofer) and their applications in determining light wavelength using single/double slits and diffraction gratings. 4. To explain the concept of polarization, its production methods (e.g., Nicol prism, retardation plates), and its role in creating elliptically/circularly polarized light. 5. To explore the principles of lasers, including stimulated emission, population inversion, and the working of Ruby, He-Ne, and semiconductor lasers. 6. To highlight practical applications of optical phenomena and lasers in medical, industrial, agricultural, and research fields.
Course Outcomes:	By the end of the course, students will be able to: 1. Describe the conditions for interference and apply the superposition principle to analyze thin-film interference and Newton's rings. 2. Solve numerical problems related to wavelength determination using interference (Michelson interferometer) and diffraction (grating) techniques. 3. Distinguish between Fresnel and Fraunhofer diffraction and interpret diffraction patterns from single/double slits. 4. Explain polarization mechanisms (e.g., double refraction, quarter/half-wave plates) and demonstrate how to produce polarized light. 5. Illustrate the working principles of lasers, including population inversion and pumping processes in 3-level/4-level systems. 6. Compare the construction and operation of Ruby, He-Ne, and semiconductor lasers. 7. Discuss real-world applications of lasers and polarized light across diverse fields (e.g., medical surgery, optical communications).

Physics MJ Lab/ Practical 4 – 129223	
Experiments related to Physics MJ Th5 and MJ Th6	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. Develop practical skills in optical experimentation, measurement, and analysis. 2. Understand the principles of wave optics, including interference, diffraction, and polarization, through hands-on experiments. 3. Apply experimental techniques to measure physical constants and optical properties of materials. 4. Analyses the behavior of light in various optical systems, including lasers, polarizers, and diffraction gratings. 5. Foster a deeper understanding of the connection between theory and practice in optical physics.
Course Outcomes:	On successful completion of this Practical course, the students would be able to: 1. Understand the different optical phenomena like Interference, Diffraction and Polarization. 2. Determine the wavelength of light by different phenomena like Interference and diffraction. 3. Demonstrate an understanding of the key concepts of LASER. 4. Acquire skills in observing and measuring different types of errors. 5. Perform procedures and techniques related to experiments based on Optics and Lasers. 6. Learn best practices for handling, cleaning and maintaining equipments, components & devices.

Physics MN Theory 4 – 129224	
Transistor, Op-Amp, Fibre Optics and Laser	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To provide a comprehensive understanding of Bipolar Junction Transistors (BJTs), including their construction, working principles, configurations (CB, CE, CC), and characteristics. 2. To analyze transistor biasing techniques, stability factors, and the performance of CE amplifiers, including hybrid parameters and gain calculations. 3. To introduce the fundamentals of fiber optics, including light propagation, acceptance angle, numerical aperture, and their applications in communication systems. 4. To study the principles of lasers, including stimulated emission, population inversion, and the working of Ruby and He-Ne lasers, along with their practical applications. 5. To develop problem-solving skills through numerical analysis of transistor parameters and fiber optic properties.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the construction, working, and configurations of PNP and NPN transistors, and interpret their characteristics in CB and CE modes. 2. Analyze transistor biasing circuits, stability factors, and the DC load line to determine the operating point in different regions (active, cut-off, saturation). 3. Evaluate the performance of CE amplifiers by calculating input/output impedance, current gain, voltage gain, and power gain using hybrid parameters. 4. Describe the principles of fiber optics, including total internal reflection, light propagation, and the significance of acceptance angle and numerical aperture. 5. Compare the advantages and disadvantages of optical fibers and their applications in communication systems. 6. Illustrate the working of lasers, including population inversion and pumping processes in three-level and four-level systems. 7. Discuss the applications of Ruby and He-Ne lasers in medical, industrial, agricultural, and research fields. 8. Solve numerical problems related to transistor biasing, fiber optics, and laser parameters.

Physics MN Lab/ Practical 4 – 129225	
Experiments related to Physics MN Th3	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. Develop practical skills in optical experimentation, measurement, and analysis. 2. Understand the principles of wave optics, including interference, diffraction, and polarization, through hands-on experiments. 3. Apply experimental techniques to measure physical constants and optical properties of materials. 4. Analyses the behavior of light in various optical systems, including lasers, polarizers, and diffraction gratings. 8. Foster a deeper understanding of the connection between theory and practice in optical physics.
Course Outcomes:	On successful completion of this Practical course, the students would be able to: 1. Understand the different optical phenomena like Interference, Diffraction and Polarization. 2. Determine the wavelength of light by different phenomena like Interference and diffraction. 3. Demonstrate an understanding of the key concepts of LASER. 4. Acquire skills in observing and measuring different types of errors. 5. Perform procedures and techniques related to experiments based on Optics and Lasers. 6. Learn best practices for handling, cleaning and maintaining equipments, components & devices.

Physics OE-6 Theory – 129226	
Physics in Agriculture	
Credits: 02	**Workload (Hrs./Week): 02**
Course Objectives:	1. To develop an appreciation of the role of physical principles in traditional and modern agriculture. 2. To encourage interdisciplinary understanding of agriculture as a blend of science, environment, and economics. 3. To promote awareness about sustainable agricultural techniques using basic scientific ideas.
Course Outcomes:	By the end of this course, students will be able to: 1. Recognize how natural physical forces like gravity, pressure, and energy affect farming. 2. Describe the use of sunlight, water, and soil in crop production from a layperson's scientific viewpoint. 3. Understand simple working principles of tools and machines used in agriculture. 4. Appreciate the role of climate, light, and renewable energy in farming systems. 5. Promote sustainable practices and technological awareness in rural communities.

Physics VSC-3 Lab/Practical – 129227	
Mobile Repairing Technician	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. Diagnose and fix common hardware issues (displays, batteries, charging ports, speakers) through hands-on disassembly and soldering techniques. 2. Troubleshoot OS failures, perform firmware flashing (Android/iOS), bypass FRP locks, and repair IMEI/baseband errors. 3. Troubleshoot power circuits, replace ICs, and repair water-damaged devices using microsoldering and jumper techniques. 4. Complete practical repairs on live faulty devices, from screen replacements to motherboard troubleshooting. 5. Build confidence to launch a repair business or work in service centers, with knowledge of tools, safety, and customer service basics.
Course Outcomes:	After completing the course, the student will be able to: 1. Replace broken displays (LCD/OLED), batteries, charging ports, and speakers. 2. Fix power issues (dead phone, overheating) using multimeter and soldering techniques. 3. Flash stock/custom ROMs using Odin, SP Flash Tool, and iTunes. 4. Bypass FRP (Google Lock) and repair IMEI/network issues. 5. Repair water-damaged phones and replace faulty ICs (charging IC, WiFi/BT IC). 6. Perform microsoldering and jumper wire repairs on PCBs. 7. Extract data from locked/crashed phones using software/hardware methods. 8. Understand service center operations, pricing strategies, and customer handling

Physics SEC-3 Lab/Practical – 129228	
Computing in Scilab	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. Equip students with practical computing skills using Scilab. 2. Enable application of computational methods to physics problems. 3. Train in symbolic and numerical computation, data visualization, and simulation. 4. Familiarize students with Xcos for physical system modelling.
Course Outcomes:	Upon successful completion, students will be able to: 1. Use Scilab for solving mathematical and physics-based problems. 2. Write and execute scripts using programming constructs. 3. Perform matrix operations, calculus, and numerical methods. 4. Simulate systems and analyse data using built-in visualization tools. 5. Model physical systems using Xcos.

Physics FP/CES-2 Project – 129229	
Field Project / CE Services in Physics: Phase-II	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. To provide hands-on experience in applying theoretical physics knowledge to real-world challenges through field-based projects or community engagement (CE) services. 2. To train students in identifying, analyzing, and solving practical problems encountered in physics-related fieldwork or community service activities. 3. To encourage students to integrate physics concepts with interdisciplinary knowledge, technology, and societal needs. 4. To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences. 5. To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.
Course Outcomes:	1. Students will be able to apply physics principles and analytical techniques to investigate and solve real-world problems in field settings. 2. Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service. 3. Students will be able to design, plan, and execute a field project or community service activity from inception to completion, including documentation and reporting. 4. Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events. 5. Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well-being.

B.Sc. Part-III (PHYSICS) Semester V

Discipline Specific Core (DSC-25)

Title: Quantum Mechanics, Crystallography, Electrical Properties of Materials and Transducers

Theory Credits: 4.5

Course Outcomes:

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

1. Gain knowledge of foundations of Quantum Mechanics, understand the concept of wave-particle duality, Matter waves, develop critical understanding of concept Heisenberg's Uncertainty Principle and anticipation of quantum mechanical aspects in real world.
2. Understand the basic aspects of wave-function, Group velocity, Phase velocity, Schrodinger's Time-dependent and Time independent equations, Quantum Mechanical Operators, Energy Eigen Functions and Eigen Values.
3. Examine the Crystal Structures, Calculate Miller Indices, identify Bravais Lattice and understand various types of defects in solids.
4. Understand the electric properties of materials. Explain mean free path, drift velocity, conductivity and Fermi Energy. Identify conductors, semiconductors and insulators. Calculate energy band gaps.
5. Understand the construction and working of various transducers such as Resistive transducer, Strain gauges, LVDT, Pressure Inductive transducer, Capacitive Pressure Transducer, Load cell, Piezoelectrical and Photo Electric transducer, Temperature transducers: RTD (Resistance Temperature Detectors), Thermistors and Thermocouple. Construct some of these transducers.
6. Understand principles and working of Temperature Sensors. Construction of Real Time Thermometers using Temperature Sensors.

Practicals for Discipline Specific Core (DSC-25)

Title: Practicals for Discipline Specific Core (DSC-25)

Practical Credits: 2.25

Course Outcomes:

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

1. Analyze and interpret experimental data to draw meaningful conclusions.
2. Apply theoretical knowledge from lectures to practicals/experiments.
3. Develop proficiency in conducting experiments related to Crystallography, Electrical Properties of Materials and Transducers.
4. Adhere to laboratory safety protocols and proper handling of materials and instruments.
5. Collect accurate data and interpret experimental results to assess the viability and efficiency of different energy resources.
6. Collaborate effectively with team members to conduct experiments and solve complex problems.

Discipline Specific Elective [DSE-I (a)]

Title: Atomic and Molecular Physics, Nuclear Physics & Energy Resources

Theory Credits: 4.5

Course Outcomes:

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

1. Evaluate the validity and limitations of theoretical models and experimental data in atomic physics.
2. Describe the structure of atoms, including electron configurations and the periodic table.
3. Demonstrate proficiency in experimental techniques related to atomic and molecular physics.
4. Develop and apply problem-solving skills to theoretical and practical problems in atomic and molecular physics.
5. Describe the principles of nuclear fission, fusion and their applications.
6. Understand the different types of radioactivity and their properties.
7. Critically evaluate nuclear physics theories, models, and experimental data.
8. Evaluate the environmental impacts of different energy resources and technologies, focusing on sustainability and mitigation strategies.
9. Understand the principles behind electrical energy generation, transmission, and distribution.

Practical for Discipline Specific Elective [DSE-I (a)]

Title: Practical for Atomic and Molecular Physics, Nuclear Physics & Energy Resources

Practical Credits: 2.25

Practicals: Atomic and Molecular Physics, Nuclear Physics & Energy Resources

Course Outcomes:

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

1. Analyze and interpret experimental data to draw meaningful conclusions.
2. Apply theoretical knowledge from lectures to practicals/experiments.
3. Develop proficiency in conducting experiments related to energy resources and atomic and molecular spectroscopy.
4. Adhere to laboratory safety protocols and proper handling of materials and instruments.
5. Collect accurate data and interpret experimental results to assess the viability and efficiency of different energy resources.
6. Collaborate effectively with team members to conduct experiments and solve complex problems.

Discipline Specific Elective [DSE-I (b)]

Title: Digital Electronics

Theory Credits: 4.5

Course Outcomes:

On successful completion of this course the students should be able to:

1. Know number systems, binary codes, their interconversions and arithmetic.

2. Understand the basic gates and use of NAND and NOR as a universal gate.

3. Design and construct logic circuits using logic gates.

4. Understand Boolean algebra to minimize logic equation.

5. Understand use of logic gates as adder and subtractor.

6. Understand difference between analog and digital circuits.

7. Know about logic families like DTL, TTL, CMOS, etc.

8. Know the construction and working of different types of Encoders and Decoders.

9. Design and construct different types of Encoders and Decoders.

10. Know the construction and working of different types of Multiplexers and Demultiplexers.

11. Design and construct different types of Multiplexers and Demultiplexers using gates.

B.Sc. Part-III (PHYSICS) Semester VI (CBCS Pattern)

Discipline Specific Elective [DSE-I (c)]

Title: Introduction to Python Programming

Theory Credits: 4.5

Course Outcomes:

On successful completion of this course the students should be able to:

1. Demonstrate proficiency in Python programming language, including understanding the syntax, data types, control structures, and built-in functions/operators.
2. Develop problem-solving skills, ability to analyze problems, design algorithms, and implement solutions.
3. Implement debugging techniques and exception handling, identifying and fixing syntax errors, runtime errors, and semantic errors in Python code.
4. Develop fundamental data structures and algorithms in Python, lists, tuples, dictionaries, and string manipulation and understand their applications.
5. Demonstrate proficiency in file handling operations, reading from and writing to text files, using modules in Python for mathematical operations, random number generation and time-related functionalities.