DEPARTMENT OF PHYSICS

RAJEEV GANDHI GOVT. P.G. COLLEGE, AMBIKAPUR, CHHATTISGARH

B.Sc. -PHYSICS

(SEMESTER PATTERN)

CHOICE BASED CREDIT SYSTEM (CBCS) UNDER NEP-2020

PROGRAMME OUTCOME (PO), COURSE OUTCOME (CO) AND ITS MAPPING

DEPARTMENT OF PHYSICS

RAJEEV GANDHI GOVT. P.G. COLLEGE, AMBIKAPUR, CHHATTISGARH

VISION

The vision of the Physics Department is to provide in proficiency both in depth understanding of principles and concept of Physics, theoretical and experimental Physics. The Department aims to enhance the students' knowledge in basic and applied physics. To inculcate aptitude for a research career in academia or industry by introducing advanced ideas and techniques that are applicable while emphasizing the underlying concepts of Physics.

MISSION

- To impart quality education in Physics such that they aim to become Scientists in reputed Research Organisations. To make the students effectively disseminate their knowledge in Physics to coming generations..
- Develop the capacity and know -how to apply principles/laws of Physics to solve the problems. The ability to do and interpret the data obtained in experiments. To become a center of excellence and extend research facilities.
- Apply the Physics knowledge for sustainable development useful for society. Assume responsibility and always practice ethical principles. To function effectively as individual as well as in a team.

PROGRAMME OUTCOMES (POs)

PO 1	Disciplinary and inter-disciplinary knowledge for capacity building Students will acquire improved knowledge of the laws governing nature through classroom teaching and experimenting in the laboratories. They will develop a sense of interdisciplinary approach to identify and resolve issues through project, seminars, field work, internships and industrial visits.
PO 2	Skills for effective and efficient communication Students will be able to improve and enhance their communication skills such as reading, writing, listening and speaking. This will help them to express their ideas clearly and effectively and subsequently empower them to become agents of social change and hence pave the way for betterment of the society at large.
PO 3	Sense of inquiry and problem-solving skills Students will demonstrate the core competencies of their discipline through analytical reasoning, problem solving and research related skills, cooperation, team work, scientific reasoning and thinking that would make them emerge as entrepreneurs or administrative personnel.
PO 4	Skills to impact society Students will develop leadership, team spirit and other skills which will help them to identify, approach and analyze the existing societal problems with an eye to look beyond gender, age, caste, creed or nationality and work for the emancipation and empowerment of humanity.
PO 5	Energy, Ethics and Environment They will be able to involve themselves in framing policies and develop scientific temper to harness energy and work on alternate resources. They will be aware of the environmental issues and imbibe the spirit of ethical values in establishing a self-sustained environment for a healthy society.
PO 6	Self-directed and lifelong learning Through digital literacy, students will engage in self-paced and curious learning with limitless knowledge acquisition and hence develop motivation for a sustained lifelong learning capability. Students will accumulate knowledge by continuous learning and leverage the past knowledge seamlessly to solve the problems in the future.
PO 7	National and international-priorities preferences and perspectives Students will be able to prioritize national and global issues with an aim to build a nation and an integrated world through contributions that imbibe the spirit of multicultural competency, creative thinking, critical analysis, political awareness and the much-needed international policies.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO-1: Acquire an in-depth understanding and knowledge of the core areas of Physics encompassing mathematical physics, classical mechanics, quantum mechanics, electrodynamics, and statistical mechanics for explicating physical phenomena covering wide length and time scales.

PSO-2: Be capable of applying the core physical laws to unravel a multitude of physical properties, processes, and effects involving radiation, nuclei, atoms, molecules, and bulk forms of matter.

PSO-3: Develop hands-on skills for carrying out elementary as well as advanced experiments in different sub-fields of Physics viz. condensed matter physics, nuclear physics, particle physics, materials science, computational physics & electronics, along with enhancing their understanding of physical concepts and theories.

PSO-4: Attain abilities of critical thinking, problem mapping & solving using fundamental principles of Physics, systematic analysis & interpretation of results, and unambiguous oral & writing/presentation skills.

PSO-5: Have robust foundation in basic and practical aspects of Physics enabling them to venture into research in front-line areas of physical sciences, and career as Physics teachers and scientists.

Graduate Attributes

1. In depth understanding of the fundamental concepts of physics.
2. Ability to undertake problems in multidisciplinary domains of Science & Technology viz. Space Science, Medical Physics, Plasma Science, Quantum Technologies, Advanced Materials Science, Computational Techniques, etc.
3. Ability to apply the acquired knowledge of Physics to Engineering Problems.
4. Understanding of basic tools of computational physics and their application in various domains of physics and engineering.
5. Ability to perform the experiments and analyze the experimental data based on acquired knowledge in the domains of electronics, atomic and nuclear physics, condensed matter physics, optics and Lasers, and other advanced topics.
6. Skills to demonstrate basic principles of physics by use of simple experimental as well as high end experimental techniques.
7. Ability to develop advanced functional materials and carry out their characterization.
8. Ability to design, fabricate and characterize device structures such as sensors, solar cells, optical components, etc. for various applications.
9. Ability to make effective oral and written technical communication.
10. Appreciation and adherence to norms of professional ethics.

B.Sc. -PHYSICS (YEAR/SEMESTER)

(OLD COURSE)

PROGRAMME OUTCOME (PO), COURSE OUTCOME (CO) AND ITS MAPPING

B.Sc. I YEAR/Semester-I

Paper-I: Mechanics, Oscillations and Properties of matters

Course Outcomes

After completing the course the students will able to : -

CO-01: Understand laws of motion and their application to various dynamical situations, motion of inertial frames and concept of Galilean invariance. He / she will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.

CO-02: Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping.

CO-03: Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.

CO-04: Understand the phenomena of collisions and idea about center of mass and laboratory frames and their correlation.

CO-05: Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.

CO-06: Understand simple principles of fluid flow and the equations governing fluid dynamics.

CO-07: Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation.

CO-08: Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.

CO-09: In the laboratory course, the student shall perform experiments related to mechanics (compound pendulum), rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity) and fluid dynamics (verification of Stokes law, Searle method) etc.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02	✓		✓			✓	
CO-03							
CO-04	✓						
CO-05	✓						
CO-06	✓						
CO-07					✓		✓
CO-08			✓				
CO-09		✓	✓			✓	

B.Sc.-I YEAR /Semester-II

Paper-I: Electricity, Magnetism and Electromagnetic Theory

Course Outcomes

After completing the course the students will able to : -

CO-01: Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.

CO-02: Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.

CO-03: Apply Gauss's law of electrostatics to solve a variety of problems.

CO-04: Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.

CO-05: Demonstrate a working understanding of capacitors.

CO-06: Describe the magnetic field produced by magnetic dipoles and electric currents.

CO-07: Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.

CO-08: Understand the dielectric properties, magnetic properties of materials and the phenomena of electromagnetic induction.

CO-09: Describe how magnetism is produced and list examples where its effects are observed.

CO-10: Apply Kirchhoff's rules to analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.

CO-11: Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.

CO-12: In the laboratory course the student will get an opportunity to verify various laws in electricity and magnetism such as Lenz's law, Faraday's law and learn about the construction, working of various measuring instruments.

CO-13: Should be able to verify of various circuit laws, network theorems elaborated above, using simple electric circuits.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01							
CO-02			✓				
CO-03						✓	
CO-04	✓						
CO-05							✓
CO-06			✓				
CO-07							
CO-08							
CO-09	✓						
CO-10			✓				
CO-11						✓	✓
CO-12			✓	✓		✓	
CO-13				✓		✓	

B.Sc. –II YEAR/Semester-III

Paper-: Thermodynamics, Kinetic Theory and Statistical Physics

Course Outcomes

After completing the course the students will able to : -

CO-01: Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.
CO-02: Learn about Maxwell's thermodynamic relations.
CO-03: Learn the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equitation of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
CO-04: Learn about the real gas equations, Van der Waal equation of state, the Joule-Thompson effect.
CO-05: In the laboratory course, the students are expected to do some basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, temperature coefficient of resistant, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.
CO-06: Understand the concepts of microstate, macrostate, ensemble, phase space, thermodynamic probability and partition function.
CO-07: Understand the combinatoric studies of particles with their distinguishably or indistinguishably nature and conditions which lead to the three different distribution laws e.g. Maxwell-Boltzmann distribution, Bose-Einstein distribution and Fermi-Dirac distribution laws of particles and their derivation.
CO-08: Comprehend and articulate the connection as well as dichotomy between classical statistical mechanics and quantum statistical mechanics.
CO-09: Learn to apply the classical statistical mechanics to derive the law of equipartition of energy and specific heat.
CO-10: Understand the Gibbs paradox, equipartition of energy and concept of negative temperature in two level system.
CO-11: Learn to derive classical radiation laws of black body radiation. Wiens law, Rayleigh

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓				
CO-03							
CO-04							
CO-05						✓	
CO-06	✓				✓		
CO-07	✓						
CO-08					✓		
CO-09							
CO-10	✓						
CO-11			✓				

B.Sc. –II YEAR/Semester-IV

Paper-I: Waves, Acoustics and Optics

Course Outcomes

After completing the course the students will able to : -

CO-01: Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems.
CO-02: Apply basic knowledge of principles and theories about the behaviour of light and the physical environment to conduct experiments.
CO-03: Understand the principle of superposition of waves, so thus describe the formation of standing waves.
CO-04: Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.
CO-05: Use the principles of wave motion and superposition to explain the Physics of polarisation, interference and diffraction.
CO-06: Understand the working of selected optical instruments like biprism, interferometer, diffraction grating, and holograms.
CO-07: In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt firsthand.
CO-08: The motion of coupled oscillators, study of Lissajous figures and behaviour of transverse, longitudinal waves can be learnt in this laboratory course.

CO-09: Understand the spontaneous and stimulated emission of radiation, optical pumping and population inversion. Three level and four level lasers. Ruby laser and He-Ne laser in details. Basic lasing.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01							✓
CO-02			✓			✓	
CO-03	✓						
CO-04						✓	
CO-05				✓		✓	
CO-06	✓						
CO-07				✓		✓	
CO-08	✓			✓		✓	
CO-09	✓				✓		

B.Sc.-III YEAR/ Semester-V

Paper-I: Relativity, Quantum Mechanics, Atomic Molecular and Nuclear Physics

Course Outcomes

After completing the course the students will able to : -

CO-01: Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.
CO-02: Understand the theory of quantum measurements, wave packets and uncertainty principle.
CO-03: Understand the central concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation, time dependent and time independent cases, probability density and the normalization techniques, skill development on problem solving e.g. one dimensional rigid box, tunneling through potential barrier, step potential, rectangular barrier.
CO-04: Understanding the properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula.
CO-05: Ability to calculate the decay rates and lifetime of radioactive decays like alpha, beta, gamma decay. Neutrinos and its properties and role in theory of beta decay.
CO-06: Understand fission and fusion well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.
CO-07: In the laboratory course, the students will get opportunity to perform the following experiments
CO-08: Measurement of Planck's constant by more than one method.
CO-09: Verification of the photoelectric effect and determination of the work Function of a metal.
CO-10: Determination of the charge of electron and e/m of electron.
CO-11: Determination of the ionization potential of atoms.
CO-12: Determine the wavelength of the emission lines in the spectrum of Hydrogen atom.
CO-13: Plan and Execute 2-3 group projects in the field of Atomic, Molecular and Nuclear Physics in collaboration with other institutions, if, possible where advanced facilities are available.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓					✓	
CO-02	✓		✓				
CO-03	✓						
CO-04	✓						
CO-05				✓	✓	✓	
CO-06	✓						
CO-07						✓	
CO-08			✓				
CO-09			✓				
CO-10			✓			✓	
CO-11						✓	
CO-12							
CO-13		✓			✓		

B.Sc.-III YEAR/ Semester-VI

Paper-II: Solid State Physics, Solid State Devices and Electronics

Course Outcomes

After completing the course the students will able to : -

CO-01: A brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.
CO-02: Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.
CO-03: At knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss.
CO-04: Secured an understanding about the dielectric and ferroelectric properties of materials.
CO-05: Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.
CO-06: Understand the basic idea about superconductors and their classifications.
CO-07: N- and P- type semiconductors, mobility, drift velocity, fabrication of P-N junctions; forward and reverse biased junctions.
CO-08: Application of PN junction for different type of rectifiers and voltage regulators.
CO-09: NPN and PNP transistors and basic configurations namely common base, common emitter and common collector, and also about current and voltage gain.
CO-10: Biasing and equivalent circuits, coupled amplifiers and feedback in amplifiers and oscillators.
CO-11: To characterize various devices namely PN junction diodes, LEDs, Zener diode, solar cells, PNP and NPN transistors. Also construct amplifiers and oscillators using discrete components.
CO-12: Basic working of an oscilloscope including its different components and to employ the same to study different wave forms and to measure voltage, current, frequency and phase.
CO-13: Secure first-hand idea of different components including both active and passive components to gain a insight into circuits using discrete components and also to learn about integrated circuits.
CO-14: About analog systems and digital systems and their differences, fundamental logic gates, combinational as well as sequential and number systems.
CO-15: Synthesis of Boolean functions, simplification and construction of digital circuits by employing Boolean algebra.
CO-16: In the laboratory he is expected to construct both combinational circuits and sequential circuits by employing NAND as building blocks and demonstrate Adders, Subtractors, Shift Registers, and multivibrators using 555 ICs.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

Pos / Cos	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02	✓		✓				
CO-03	✓						
CO-04	✓						
CO-05	✓						
CO-06		✓				✓	
CO-07							
CO-08							
CO-09				✓			
CO-10							
CO-11							
CO-12							
CO-13		✓		✓	✓	✓	
CO-14							
CO-15					✓		
CO-16			✓		✓		

B.Sc. -PHYSICS

(SEMESTER PATTERN)

CHOICE BASED CREDIT SYSTEM (CBCS) UNDER NEP-2020

PROGRAMME OUTCOME (PO), COURSE OUTCOME (CO) AND ITS MAPPING

Discipline Specific Core Course (DSCC-1)

Semester-I

Paper: Mechanics

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understand laws of motion and their application to various dynamical situations.

CO-02: Learn the concept of inertial reference frames and Galilean transformations. Also, the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.

CO-03: Understand translational and rotational dynamics of a system of particles.

CO-04: Apply Kepler's laws to describe the motion of planets and satellite in circular orbit.

CO-05: Understand concept of Geosynchronous orbits

CO-06: Explain the phenomenon of simple harmonic motion.

CO-07: Understand special theory of relativity - special relativistic effects and their effects on the mass and energy of a moving object.

CO-08: In the laboratory course, the student shall perform experiments related to mechanics: compound pendulum, rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity), fluid dynamics, estimation of random errors in the observations etc.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓				
CO-03	✓						
CO-04					✓	✓	
CO-05			✓				
CO-06		✓			✓		
CO-07	✓						
CO-08			✓				✓

Generic Elective Course (GEC-1)

Semester-I

Paper: GENERAL PROPERTIES OF MATTERS

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Laws of motion and their application to various dynamical situations, and their applications to conservation of momentum, angular momentum and energy.

CO-02: Application of Kepler's laws to describe the motion of satellites in circular orbit.

CO-03: Concept of stress and strain and relation between elastic constants

CO-04: Postulates of Special Theory of Relativity, Lorentz transformation, relativistic effects on the mass and energy of a moving body.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓					✓	
CO-02			✓			✓	
CO-03			✓		✓	✓	
CO-04							

Value added Course (VAC-1)

Semester-I

Paper: BASIC PHYSICS OF NANO TECHNOLOGY-I

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understand the basics of nanotechnology.
CO-02: Learn about types, properties of different nanotechnologies.
CO-03: Understand the basic concepts of tools and techniques in nanotechnologies
CO-04: Learn about uses and applications of nanotechnologies.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓		✓		
CO-03	✓						
CO-04					✓		

Skill Enhancement Course (SEC-1)

Semester-I

Paper: ELECTRONIC INSTRUMENATATION-I

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understanding the physics of the devices their characteristics and applications, to be able to use them in electronic circuits.

CO-02: Students would be aware of various signal conditioning, processing and generation techniques thus being better equipped to understand their use in larger and complex systems.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓	✓				✓	
CO-02		✓	✓			✓	

Discipline Specific Core Course (DSCC-2)

Semester-II

Paper: Electricity and Magnetism

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Demonstrate the application of Coulomb's law for the electric field, and also apply it to systems of point charges as well as line, surface, and volume distributions of charges.

CO-02: Demonstrate an understanding of the relation between electric field and potential, exploit the potential to solve a variety of problems, and relate it to the potential energy of a charge distribution.

CO-03: Apply Gauss's law of electrostatics to solve a variety of problems.

CO-04: Calculate the magnetic forces that act on moving charges and the magnetic fields due to currents (Biot- Savart and Ampere laws)

CO-05: Understand the concepts of induction and self-induction, to solve problems using Faraday's and Lenz's laws.

CO-06: Understand the basics of electrical circuits and analyze circuits using Network Theorems.

CO-07: In the laboratory course the student will get an opportunity to verify network theorems and study different circuits such as RC circuit, LCR circuit. Also, different methods to measure low and high resistance, capacitance, self-inductance, mutual inductance, strength of a magnetic field and its variation in space will be learnt.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓			✓			
CO-02			✓		✓		
CO-03				✓		✓	
CO-04				✓			
CO-05	✓						
CO-06	✓						
CO-07				✓	✓	✓	

Generic Elective Course (GEC-2)

Semester-II

Paper: MATHEMATICAL PHYSICS

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understand functions of several variables.
CO-02: Represent a periodic function by a sum of harmonics using Fourier series and their applications in physical problems such as vibrating strings etc.
CO-03: Learn about gamma and beta functions and their applications.
CO-04: Solve linear partial differential equations of second order with separation of variable method.
CO-05: Understand the basic concepts of complex analysis and integration.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓		✓		
CO-03							
CO-04			✓	✓			
CO-05	✓						

Value added Course (VAC-2)

Semester-I

Paper: BASIC PHYSICS OF NANO TECHNOLOGY-II

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understand the basics of nanomaterials.
CO-02: Learn about types, properties of different nanomaterials.
CO-03: Understand the basic concepts of production of nanomaterials
CO-04: Learn about uses and applications of nanomaterials.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓		✓		
CO-03	✓						
CO-04					✓		

Skill Enhancement Course (SEC-2)

Semester-II

Paper: ELECTRONIC INSTRUMENATATION-II

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understanding the physics of the devices their characteristics and applications, to be able to use them in electronic circuits.

CO-02: Students would be aware of various signal conditioning, processing and generation techniques thus being better equipped to understand their use in larger and complex systems.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓					✓	
CO-02			✓		✓✓	✓	

Discipline Specific Core Course (DSCC-3)

SEMESTER-III

Paper: Thermal Physics

Course Learning Outcomes

Course Learning Outcomes

At the end of the course, students will be able to:

CO-01: Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics.

CO-02: Understand the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.

CO-03: Know about reversible and Irreversible processes.

CO-04: Learn about Maxwell's relations and use them for solving many problems in Thermodynamics

CO-05: Understand the concept and behavior of ideal and real gases.

CO-06: Learn the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equitation of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.

CO-07: In the laboratory course, the students are expected to do some basic experiments in thermal Physics, viz., determination of Mechanical Equivalent of Heat (J), coefficient of thermal conductivity of good and bad conductor, temperature coefficient of resistance, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓				✓	✓	
CO-02	✓		✓				
CO-03	✓						
CO-04						✓	
CO-05	✓						
CO-06			✓		✓		
CO-07				✓	✓	✓	

Discipline Specific Elective Course (DSEC-1)

SEMESTER-III

Paper: Digital Systems and Applications

Course Learning Outcomes

Course Learning Outcomes

This course lays the foundation for understanding the digital logic circuits and their use in combinational and sequential logic circuit design. It also imparts information about the basic architecture, memory and input/output organization in a microprocessor system. The students also learn the working of CRO.

CO-01: Course learning begins with the basic understanding of active and passive components. It then builds the concept of Integrated Chips (IC): its classification and uses.

CO-02: Differentiating the Analog and Digital circuits, the concepts of number systems like Binary,BCD, Octal and hexadecimal are developed to elaborate and focus on the digital systems.

CO-03: Sequential Circuits: Basic memory elements Flips-Flops, shift registers and 4-bits counters leading to the concept of RAM, ROM and memory organization.

CO-04: Timer circuits using IC 555 providing clock pulses to sequential circuits and develop multivibrators.

CO-05: Introduces to basic architecture of processing in an Intel 8085 microprocessor and to Assembly Language.

CO-06: Also impart understanding of working of CRO and its usage in measurements of voltage, current, frequency and phase measurement.

CO-07: In the laboratory students will learn to construct both combinational and sequential circuits by employing NAND as building blocks and demonstrate Adders, Subtractors, Shift Registers, and multivibrators using 555 ICs. They are also expected to use µP 8085 to demonstrate the same simple programme using assembly language and execute the programme using a µP kit.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓		✓		
CO-03							
CO-04		✓				✓	
CO-05							
CO-06		✓			✓		
CO-07				✓	✓	✓	

Discipline Specific Core Course (DSCC-4)

Semester-IV

Paper: Waves and Optics

Course Learning Outcomes

On successfully completing the requirements of this course, the students will have the skill and knowledge to:

CO-01: Understand Simple harmonic oscillation and superposition principle.

CO-02: Understand different types of waves and their velocities: Plane, Spherical, Transverse, Longitudinal.

CO-03: Understand Concept of normal modes in transverse and longitudinal waves: their frequencies and configurations.

CO-04: Understand Interference as superposition of waves from coherent sources derived from same parent source.

CO-05: Demonstrate basic concepts of Diffraction: Superposition of wavelets diffracted from aperture, understand Fraunhoffer and Fresnel Diffraction.

CO-06: In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt first hand. The motion of coupled oscillators, study of Lissajous figures and behaviour of transverse, longitudinal waves can be learnt in this laboratory course.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02	✓		✓				
CO-03	✓						
CO-04	✓						
CO-05						✓	✓
CO-06		✓			✓	✓	

Discipline Specific Elective Course (DSEC-2)

SEMESTER-IV

Paper: Mathematical Physics-II

Course Learning Outcomes

Course Learning Outcomes

After completing this course, student will be able to

CO-01: Determine continuity, differentiability and analyticity of a complex function, find the derivative of a function and understand the properties of elementary complex functions.

CO-02: Work with multi-valued functions (logarithmic, complex power, inverse trigonometric function) and determine branches of these functions

CO-03: Evaluate a contour integral using parametrization, fundamental theorem of calculus and Cauchy's integral formula.

CO-04: Find the Taylor series of a function and determine its radius of convergence.

CO-05: Determine the Laurent series expansion of a function in different regions, find the residues and use the residue theory to evaluate a contour integral and real integral.

CO-06: Understand the properties of Fourier and Laplace transforms and use these to solve boundary value problems.

CO-07: In the laboratory course, the students will learn the basics of the Scilab software/Python interpreter and apply appropriate numerical method to solve selected physics problems both using user defined and inbuilt functions from Scilab/Python.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02	✓		✓				
CO-03						✓	
CO-04			✓			✓	
CO-05			✓				
CO-06	✓				✓		
CO-07			✓		✓	✓	

Discipline specific core course (DSCC-5)

Semester-V

Paper: Elements of Modern Physics

Course Learning Outcomes

Course Learning Outcomes

After getting exposure to this course, the following topics would be learnt:

CO-01: Main aspects of the inadequacies of classical mechanics as well as understanding of the historical development of quantum mechanics.

CO-02: Formulation of Schrodinger equation and the idea of probability interpretation associated with wave-functions.

CO-03: The spontaneous and stimulated emission of radiation, optical pumping and population inversion. Three level and four level lasers. Ruby laser and He-Ne laser in details. Basic lasing

CO-04: The properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula.

CO-05: Decay rates and lifetime of radioactive decays like alpha, beta, gamma decay. Neutrino, its properties and its role in theory of beta decay.

CO-06: Fission and fusion: Nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.

CO-07: In the laboratory course, the students will get opportunity to measure Planck's constant, verify photoelectric effect, determine e/m of electron, Ionization potential of atoms, study emission and absorption line spectra. They will also find wavelength of Laser sources by single and Double slit experiment, wavelength and angular spread of He-Ne Laser using plane diffraction grating.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						✓
CO-02			✓		✓		
CO-03							
CO-04			✓				✓
CO-05					✓		
CO-06			✓				
CO-07	✓					✓	✓

Discipline specific Elective course (DSEC-3)

Semester-V

Paper: Quantum Mechanics

Course Learning Outcomes

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understand and explain the differences between classical and quantum mechanics

CO-02: Learn operator formalism for observables and basic commutation relations.

CO-03: Solve Schrödinger equation for simple potentials like linear Harmonic oscillator and Hydrogen atoms.

CO-04: Understand the space, time and displacement symmetries.

CO-05: Formulate the Heisenberg & Dirac formulation of quantum mechanics-explain various types of imperfections in crystals.

CO-06: Solve the linear harmonic oscillator and hydrogen-like atom problems using Dirac formulation-analyze the mechanisms behind elastic and plastic deformation is solids and compare different strengthening techniques.

CO-07: Demonstrate angular momentum operators associated with spherical and symmetrical systems. -summarize ceramics and its types and relate their applications with properties.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓				
CO-03				✓		✓	
CO-04	✓						
CO-05						✓	
CO-06		✓			✓		
CO-07			✓		✓	✓	

Generic Elective course (GEC-3)

Semester-V

Paper: Quantum Mechanics

Course Learning Outcomes

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: Understand and explain the differences between classical and quantum mechanics

CO-02: Learn operator formalism for observables and basic commutation relations.

CO-03: Solve Schrödinger equation for simple potentials like linear Harmonic oscillator and Hydrogen atoms.

CO-04: Understand the space, time and displacement symmetries.

CO-05: Formulate the Heisenberg & Dirac formulation of quantum mechanics-explain various types of imperfections in crystals.

CO-06: Solve the linear harmonic oscillator and hydrogen-like atom problems using Dirac formulation-analyze the mechanisms behind elastic and plastic deformation is solids and compare different strengthening techniques.

CO-07: Demonstrate angular momentum operators associated with spherical and symmetrical systems. -summarize ceramics and its types and relate their applications with properties.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓				
CO-03				✓			
CO-04	✓						
CO-05						✓	✓
CO-06		✓		✓		✓	
CO-07		✓				✓	

Discipline Specific Core Course (DSCC-6)
Semester-VI
Paper: Solid State Physics-I
Course Learning Outcomes

Course Learning Outcomes

On successful completion of the module students should be able to

CO-01: Elucidate the concept of lattice, crystals and symmetry operations.

CO-02: Understand the elementary lattice dynamics and its influence on the properties of materials.

CO-03: Describe the main features of the physics of electrons in solids: origin of energy bands, and their influence electronic behavior.

CO-04: Explain the origin of dia-, para-, and ferro-magnetic properties of solids.

CO-05: Explain the origin of the dielectric properties exhibited by solids and the concept of polarizability.

CO-06: Learn the properties of superconductivity in solid.

CO-07: In the laboratory students will carry out experiments based on the theory that they have learned to measure the magnetic susceptibility, dielectric constant, trace hysteresis loop.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02	✓		✓				
CO-03						✓	✓
CO-04							✓
CO-05							
CO-06		✓			✓		
CO-07						✓	

Discipline Specific Elective Course (DSEC-4)

Semester-VI

Paper: Analog Systems and Applications

Course Learning Outcomes

Course Learning Outcomes

At the end of this course, the following concepts will be learnt

CO-01: Characteristics and working of pn junction.

CO-02: Two terminal devices: Rectifier diodes, Zener diode, photodiode etc.

CO-03: NPN and PNP transistors: Characteristics of different configurations, biasing, stabilization and their applications.

CO-04: CE and two stage RC coupled transistor amplifier using h-parameter model of the transistor.

CO-05: Designing of different types of oscillators and their stabilities.

CO-06: Ideal and practical op-amps: Characteristics and applications.

CO-07: In the laboratory course, the students will be able to study characteristics of various diodes and BJT. They will be able to design amplifiers, oscillators and DACs. Also different applications using Op-Amp will be designed.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓				
CO-03					✓		
CO-04	✓		✓				
CO-05		✓				✓	
CO-06		✓			✓		
CO-07			✓			✓	

Generic Elective Course (GEC-4)

Semester-VI

Paper: Analog Systems and Applications

Course Learning Outcomes

Course Learning Outcomes

At the end of this course, the following concepts will be learnt

CO-01: Characteristics and working of pn junction.

CO-02: Two terminal devices: Rectifier diodes, Zener diode, photodiode etc.

CO-03: NPN and PNP transistors: Characteristics of different configurations, biasing, stabilization and their applications.

CO-04: CE and two stage RC coupled transistor amplifier using h-parameter model of the transistor.

CO-05: Designing of different types of oscillators and their stabilities.

CO-06: Ideal and practical op-amps: Characteristics and applications.

CO-07: In the laboratory course, the students will be able to study characteristics of various diodes and BJT. They will be able to design amplifiers, oscillators and DACs. Also different applications using Op-Amp will be designed.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07
CO-01	✓						
CO-02			✓				
CO-03					✓		
CO-04	✓		✓				
CO-05		✓				✓	
CO-06		✓			✓		
CO-07			✓			✓	

DEPARTMENT OF PHYSICS

RAJEEV GANDHI GOVT. P.G. COLLEGE, AMBIKAPUR, CHHATTISGARH

M.Sc. (PHYSICS)

UNDER CHOICE BASED CREDIT SYSTEM

PROGRAMME OUTCOME (PO), COURSE OUTCOME (CO) AND ITS MAPPING

DEPARTMENT OF PHYSICS

RAJEEV GANDHI GOVT. P.G. COLLEGE, AMBIKAPUR, CHHATTISGARH

VISION

The vision of the Physics Department is to provide in proficiency both in depth understanding of principles and concept of Physics, theoretical and experimental Physics. The Department aims to enhance the students' knowledge in basic and applied physics. To inculcate aptitude for a research career in academia or industry by introducing advanced ideas and techniques that are applicable while emphasizing the underlying concepts of Physics.

MISSION

- To impart quality education in Physics such that they aim to become Scientists in reputed Research Organisations. To make the students effectively disseminate their knowledge in Physics to coming generations..
- Develop the capacity and know -how to apply principles/laws of Physics to solve the problems. The ability to do and interpret the data obtained in experiments. To become a center of excellence and extend research facilities.
- Apply the Physics knowledge for sustainable development useful for society. Assume responsibility and always practice ethical principles. To function effectively as individual as well as in a team.

PROGRAMME OUTCOMES (POs)

PO-1:	**Knowledge:**	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
PO-2:	**Research Aptitude:**	Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis
PO-3:	**Communication:**	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large
PO-4:	**Problem Solving:**	Capability of applying knowledge to solve scientific and other problems
PO-5:	**Individual and Team Work:**	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO-6:	**Investigation of Problems:**	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions
PO-7:	**Modern Tool usage:**	Ability to use and learn techniques, skills and modern tools for scientific practices
PO-8:	**Science and Society:**	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices
PO-9:	**Life-Long Learning:**	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life

PO-10: **Project Management:** Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO-1: Acquire an in-depth understanding and knowledge of the core areas of Physics encompassing mathematical physics, classical mechanics, quantum mechanics, electrodynamics, and statistical mechanics for explicating physical phenomena covering wide length and time scales.

PSO-2: Be capable of applying the core physical laws to unravel a multitude of physical properties, processes, and effects involving radiation, nuclei, atoms, molecules, and bulk forms of matter.

PSO-3: Develop hands-on skills for carrying out elementary as well as advanced experiments in different sub-fields of Physics viz. condensed matter physics, nuclear physics, particle physics, materials science, computational physics & electronics, along with enhancing their understanding of physical concepts and theories.

PSO-4: Attain abilities of critical thinking, problem mapping & solving using fundamental principles of Physics, systematic analysis & interpretation of results, and unambiguous oral & writing/presentation skills.

PSO-5: Have robust foundation in basic and practical aspects of Physics enabling them to venture into research in front-line areas of physical sciences, and career as Physics teachers and scientists.

Graduate Attributes

1. In depth understanding of the fundamental concepts of physics.
2. Ability to undertake problems in multidisciplinary domains of Science & Technology viz. Space Science, Medical Physics, Plasma Science, Quantum Technologies, Advanced Materials Science, Computational Techniques, etc.
3. Ability to apply the acquired knowledge of Physics to Engineering Problems.
4. Understanding of basic tools of computational physics and their application in various domains of physics and engineering.
5. Ability to perform the experiments and analyze the experimental data based on acquired knowledge in the domains of electronics, atomic and nuclear physics, condensed matter physics, optics and Lasers, and other advanced topics.
6. Skills to demonstrate basic principles of physics by use of simple experimental as well as high end experimental techniques.
7. Ability to develop advanced functional materials and carry out their characterization.
8. Ability to design, fabricate and characterize device structures such as sensors, solar cells, optical components, etc. for various applications.
9. Ability to make effective oral and written technical communication.
10. Appreciation and adherence to norms of professional ethics.

M.Sc. Semester-I

Paper-I: MSP-101: Mathematical Physics

Course Outcomes

After completing the course the students will able to : -

CO -01- Familiarized with different special functions like Associated Legendre Polynomials, Laguerre's Polynomials, etc. and their solutions in solving different physical problems.

CO -02- To obtain knowledge of Fourier and Laplace Transforms in solving different problems of Mechanics and Electronics etc.

CO -03- Learn about the concept and uses of Tensors and Tensor algebra (Null tensor, addition, subtraction, inner product, outer product).

CO-04- Solve different physical problems which contain complex variables and implementation of complex variable for calculation of integrals, and also able to expand functions in Taylor's and Laurent's series. Knowledge of theorems of residues and contour integration.

CO -05- Obtain the basic knowledge of Group theory and its applications. This theory is also used to describe the crystal symmetry and electronic structure of crystals.

CO-06- Understand the calculus of residue and evaluate some typical definite integral using the Method of contour integration

CO-07- Find explicit expressions of Hermite, Laguerre, Bessel and Legendre polynomials using the corresponding generating functions and derive orthogonality relations and various recurrence relations among these special functions for their applications in solving quantum mechanical systems.

CO -08- Apply the knowledge of matrices for solving linear algebraic equations and Learn basics of group theory and prepare group multiplication tables for understanding crystallography.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01				✓						
CO-02	✓									
CO-03								✓		
CO-04				✓						
CO-05		✓								
CO-06	✓				✓					
CO-07						✓				
CO-08						✓				

M.Sc. Semester-I

Paper-II: MSP-102: Classical Mechanics

Course Outcomes

After completing the course the students will able to : -

CO- 01- To apply Lagrangian and Hamiltonian for solving simple classical dynamics problems.

CO -02- Apply Newton's laws of motion and conservation law of energy, linear and angular momentum to solve advanced problems involving the dynamic motion of classical mechanical system

CO- 03- Solve the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulations of classical mechanics.

CO -04- Explore the application of Hamilton's equations in solving the equation of motion of a particle in a central force field, projectile motion of a body

CO -05- Formulate the equations of rigid body dynamics and demonstrate the examples of non-inertial frames of reference

CO -06- Develop a deep understanding to tackle the problems of small oscillations and special theory of Relativity

CO-07- Newtonian mechanics, Virtual work, DÁlembert's principle, Formulation of Lagrangian mechanics and problem solving with the help of it. Compare the formulation of Hamiltonian and Lagrangian mechanics and solve the problems of classical and relativistic mechanics

CO -08- To understand rigid body dynamics and small oscillations using Lagrangian approach

CO -09- Acquire knowledge of Poisson and Lagrange Brackets and establish relationships between their Properties

CO -10- Demonstrate the concept of motion of a particle under central force and apply advanced methods to deal with central force problems.

CO -11- Use Hamilton-Jacobi theory for finding the solutions of various Classical systems

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01						✓				
CO-02		✓								
CO-03				✓						
CO-04								✓		
CO-05								✓		
CO-06		✓						✓		
CO-07				✓						
CO-08	✓									
CO-09	✓									
CO-10			✓				✓			
CO-11				✓						

M.Sc. Semester-I

Paper-III: MSP-103: Quantum Mechanics-I

Course Outcomes

After completing the course the students will able to : -

CO -01- Understand and explain the differences between classical and quantum mechanics Learn operator formalism for observables and basic commutation relations.

CO -02- Solve Schrödinger equation for simple potentials like linear Harmonic oscillator and Hydrogen atoms.

CO -03- Understand the space, time and displacement symmetries.

CO -04- Formulate the Heisenberg & Dirac formulation of quantum mechanics-explain various types of imperfections in crystals.

CO -05- Solve the linear harmonic oscillator and hydrogen-like atom problems using Dirac formulation-analyze the mechanisms behind elastic and plastic deformation is solids and compare different strengthening techniques.

CO -06- Demonstrate angular momentum operators associated with spherical and symmetrical systems. -summarize ceramics and its types and relate their applications with properties.

CO -07- Explain scattering theory, formulate and solve scattering equation-classify polymers and composites based on their properties and applications.

CO -08- Apply the Variational principle and WKB Approximation to solve the real problems-Classify nanomaterials, their fabrication techniques and co relate the effects of confinement to nanoscale on their properties.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02				✓						
CO-03	✓									
CO-04								✓		
CO-05				✓						
CO-06						✓				
CO-07				✓						
CO-08						✓	✓			

M.Sc. Semester-I

Paper-V: MSP-A01: CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM

Course Outcomes

After completing the course the students will able to : -

CO -01- Have a comprehensive understanding of the meaning, features and characteristics of the Preamble of the Constitution of India.

CO -02- Describe in details the difference between Constitution and Constitutionalism.

CO -03- Compare and contrast the different forms of government, namely – unitary and federal, parliamentary and presidential with particular reference to Indian Political System.

CO -04- Demonstrate an in-depth knowledge of the concepts of Citizenship, Fundamental Rights, Constitutional amendment procedures and the judicial system in India.

CO -05- Explain in detail the Legislative, Executive and Judicial structure in the Government of India.

CO- 06- Critically analyse the process of devolution and decentralization of powers in relation to centre-state government.

CO -07- Show interest in research studies in relevant topics, like –decentralization of governance, local self-governance.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02										✓
CO-03	✓									
CO-04						✓				
CO-05						✓				
CO-06		✓				✓				
CO-07		✓								

M.Sc. Semester-I

Paper-V: MSP-A02: Electronic Devices and Applications

Course Outcomes

After completing the course the students will able to : -

CO -01- Understanding the physics of the devices their characteristics and applications, to be able to use them in electronic circuits.

CO -02- Students would develop an insight into the technologies that go into an IC chip that they would be extensively using during and after the course.

CO- 03- In depth understanding would enable the students to appreciate the beauty of the subject and design amplifiers that are technically sound.

CO -04- Students would develop a comprehensive understanding of contemporary integrated circuit amplifier design.

CO -05- Understand the working of latches, flip-flops, designing registers, counters, a/d and d/a converters.

CO -06- Students would be aware of various signal conditioning, processing and generation techniques thus being better equipped to understand their use in larger and complex systems.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02			✓				✓			
CO-03	✓									
CO-04						✓				
CO-05	✓									
CO-06	✓	✓								

M.Sc. Semester-I

Paper-V: MSP-A03: CONDENSED MATTER PHYSICS – I

Course Outcomes

After completing the course the students will able to : -

CO -01- Have an understanding of basic physical concepts (like band gap, holes, effective mass, etc.) related to semiconductors.

CO-02- Appreciate the concept and importance of Fermi surface of metals and its experimental determination through De Hass-van Alphen effect, along with magneto-transport in a 2D channel.

CO -03- Learn the description of collective excitations of the Fermi Sea (plasmons) and the electrostatic screening of electron-impurity interaction, in terms of the dielectric function of the electron gas.

CO -04- Understand different physical quantities (reflectivity coefficient, reflectance, real & imaginary parts of response etc.) related to the optical response of solids, and Raman Effect in crystals.

CO -05- Relate the dielectric polarization with the macroscopic electric field and the local electric field acting on an atom in the dielectric, along with frequency dependence of polarizability.

CO -06- Comprehend ferroelectricity and the Landau theory of phase transition.

CO -07- Calculate magnetic susceptibility for atoms, insulating solids and conduction electrons, and have an understanding of the microscopic origin of ferromagnetism and anti-ferromagnetism.

CO-08- Determine the low-energy excitations (spin waves/magnons) for ferromagnetic and antiferromagnetic systems, understand principle underlying their experimental measurement, and learn about ferromagnetic domains.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02						✓				
CO-03								✓		
CO-04	✓									
CO-05										✓
CO-06	✓									
CO-07				✓						
CO-08			✓							✓

M.Sc. Semester-I

Paper-V: MSP-A04: HIGH ENERGY PHYSICS I

Course Outcomes

After completing the course the students will able to : -

CO-01-Realize the Fundamental constituents of matter, their origination

CO-02-Understand qualitative and quantitative analysis of Resonance and Dalitz plots.

CO-03-Formulate Quantum mechanical scattering theory leading to understand origination of field particles.

CO-04-Understand three major interactions viz strong, electromagnetic and weak are in existence.

CO-05-Understand Isospin formulation and its fundamentals.

CO-06-Invariance and violation of various conservation laws and symmetries in these interactions.

CO-07-Understand fundamental knowledge of the subject matter leading to the attempt for grand unification.

CO-08-Formulate Parity conservation, violation and Charge conjugation invariance.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01										✓
CO-02	✓		✓							
CO-03				✓						
CO-04	✓									
CO-05										✓
CO-06	✓				✓					
CO-07				✓						
CO-08	✓		✓							

MSP-111/112: Lab Course A/B

Students are expected to understand various theory and principles concerned with mechanics, optics and semiconductor electronics and will be able to following in connection of the same.

CO-1: Design and resolve circuits for electronic applications.

CO-2: Record data as required by the experimental objectives.

CO-3 : Analyse recorded data and formulate it to get desired results.

CO-4: Interpret results and check for attainment of proposed objective.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01							✓			✓
CO-02						✓				
CO-03						✓				
CO-04		✓				✓				

M.Sc. Semester-II

Paper-I: MSP-201:Electronics

Course Outcomes

After completing the course the students will able to : -

CO -01- Acquire knowledge of operational amplifier circuits and their applications.

CO -02- Gain knowledge and evaluate the Boolean expressions, combinational logic circuits and Simplifications using Karnaugh maps.

CO -03- Analyze the operation of decoders, encoders, multiplexers, adders and subtractors.

CO 04- Understand the working of latches, flip-flops, designing registers, counters, a/d and d/a converters.

CO 05- Design and Analyze synchronous and asynchronous sequential circuits.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02		✓								
CO-03						✓				
CO-04	✓									
CO-05						✓				

M.Sc. Semester-II

Paper-II: MSP-202: Atomic & Molecular Physics

Course Outcomes

After completing the course the students will able to : -

CO- 01- Deal with problems related to Hydrogen-like atomic spectra.

CO -02-Having knowledge about the rotational, vibrational and Raman spectroscopy of molecules.

CO -03- Developing analytical, laboratory and computing skills through problem solving, laboratory & computer based exercises which involve the applications of atomic and molecular physics.

CO -04- Carry out experimental and theoretical studies on atomic and molecular physics with focus on structure & dynamics of atoms and molecules.

CO- 05-Account for theoretical models, terminology & working methods used in atomic and molecular physics.

CO -06-To successfully apply the theoretical techniques presented in course to practical problems.

CO -07- comprehend the instrumentation techniques that are used in different regions of spectra.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01								✓		
CO-02	✓		✓							
CO-03		✓	✓			✓				
CO-04						✓				
CO-05									✓	
CO-06						✓				
CO-07							✓			

M.Sc. Semester-II

Paper-III: MSP-203:Quantum Mechanics-II

Course Outcomes

After completing the course the students will able to : -

CO 01- Understand the kinematics of scattering process.

CO 02- Evaluate the partial wave analysis using Born approximation method.

CO 03- Applytime Independent perturbation theory for non-degenerate case.

CO 04- Gain knowledge on WKB approximation method to study alpha decay. Remember time dependent perturbation theory.

CO 05- Analyze the interaction of an atom with electromagnetic radiation and the relativistic quantum mechanics using Klein Gordon equation, Explore the properties of gamma matrices.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02									✓	
CO-03						✓				
CO-04	✓									
CO-05						✓				

M.Sc. Semester-II

Paper-IV: MSP-221:RESEARCH METHODOLOGY & COMPUTER APPLICATION: BASICS

Course Outcomes

After completing the course students will be able to demonstrate-

CO-01- Knowledge of research process reading evaluating developing and analyzing the ideas/ thought in critical/ analytical manner.

CO-02- literature reviews using print and online database of the subject and allied branches in perspectives of its inter -relation and so on.

CO-03- competent use of MLA and APA format for citation of print and electronic materials available .

CO-04- Potentials to identify explain, compare and prepare the key elements of research proposal and research report.

CO-05- Compare and contrast qualitative and quantitative research paradigms and to explain the use of each in research.

CO-06- The rationale for research ethics and importance of local processes for Institutional Review Board reviews for its rational improvisation.

CO-07- How Educational research contributes to the objectives of doctoral programme and specific career in higher education

CO-08- Competent use of information received in general social welfare and issues relevant and focused in the context of humanity as whole and its positive solutions in larger interest be devised.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02									✓	
CO-03							✓			
CO-04		✓								
CO-05										✓
CO-06		✓						✓		
CO-07		✓								✓
CO-08			✓			✓	✓			

M.Sc. Semester-II

Paper-V: MSP-B01: ENVIRONMENTALAND FOREST LAWS

Course Outcomes

After completing the course the students will able to : -

CO- 01- The primary learning outcome is to sensitize the students towards human activities that adversely affect the environment and the need for regulation of such activities.

CO -02- Students will develop a thorough understanding of practice and procedure followed by various environmental law enforcing agencies/bodies.

CO 03- Students will be able to pursue environmental litigation before the National Green Tribunal and assist the Tribunal as a researcher or in any other capacity.

CO 04- Students will be able to assist industries and projects in obtaining environmental clearance and compliances with other environmental laws.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01								✓		
CO-02						✓				✓
CO-03		✓								✓
CO-04		✓								✓

M.Sc. Semester-II

Paper-V: MSP-B02: ELECTRONIC INSTRUMENTATION

Course Outcomes

After completing the course the students will able to : -

CO -01- Measure various electrical parameters with accuracy, precision, resolution.

CO -02- Design different types of amplifiers and filters.

CO -03- Select specific instrument for specific measurement function.

CO -04- Understand principle of operation, working of different electronic instruments like digital multi meter, vector voltmeter, and power factor meter.

CO -05- Analyze the functioning, specification, and applications of signal generators and signal analyzing instruments.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02						✓				
CO-03								✓		
CO-04								✓		
CO-05						✓				

M.Sc. Semester-II

Paper-V: MSP-B03:CONDENSED MATTER PHYSICS – II

Course Outcomes

After completing the course the students will able to : -

CO -01- Explicate response of band electrons to an external electric field and their scattering, and calculate currents in bands.

CO -02- Develop a semi-classical description of electrical and thermal transport in metals using the Boltzmann approach, and explain different thermoelectric effects.

CO -03- Distinguish nanostructures from bulk materials and learn principle of different imagining techniques for nanostructures.

CO -04- Calculate the electronic structure of nano-scale 1D, 0D solids in effective mass approximation, and use it to explain the electrical transport in these solids.

CO -05- Treat the electron-electron interactions in Hartree and Hartree-Fock approximations using the variational principle and apply these to calculate electronic properties of simple metals.

CO -06- Learn the concept of screening and calculate the screened potential using the Thomas-Fermi and Lindhard approaches.

CO -07- Transform the Schrodinger equation for a many-particle system (bosons as well as fermions) to the second quantized form, and construct field operators for one- and two-body operators.

CO- 08- Apply the second-quantized method to a degenerate homogenous electron gas for calculating the first-order ground-state energy.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01				✓						
CO-02		✓	✓			✓				
CO-03								✓		
CO-04				✓						
CO-05		✓								
CO-06					✓			✓		
CO-07	✓									
CO-08						✓				

M.Sc. Semester-II

Paper-V: MSP-B04: HIGH ENERGY PHYSICS - II

Course Outcomes

After completing the course the students will able to : -

CO-01-Realize the Weak interaction, Leptons fundamentals their decay. -

CO-02-Understand the concept of Helicity, Higgs field and existence of Higgs Bosons.

CO-03-Understand of the relativistic kinematics and its importance in calculations at relativistic energies.

CO-04-Construct Analysis of the decay energy in various high energy reactions.

CO-05-Understand the interaction of charge particles with matter and will be able to calculate the dynamics of high energy particles.

CO-06-Learn the quantitative and qualitative analysis of Energy loss and Straggling mechanism.

CO-07-Understand radiations mechanism at relativistic velocities.

CO-08-Grasp details of particle accelerators for the creation of high energy particles will be provided.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓							✓		
CO-02	✓									
CO-03	✓									
CO-04	✓									
CO-05						✓				
CO-06	✓									
CO-07								✓		
CO-08			✓					✓		

M.Sc. Semester-II

MSP-211/212: Lab Course A/B

Students are expected to understand working mechanicsand factors governing semiconductor electronics devices and in connection of the same students are expected to

CO-1 Design and resolve circuits for electronic applications.

CO-2 Record data as required by the experimental objectives.

CO-3 Analyse recorded data and formulate it to get desired results.

CO-4 Interpret results and check for attainment of proposed objective.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01						✓				
CO-02			✓			✓				
CO-03						✓				
CO-04						✓				

M.Sc. Semester-III

Paper-I: MSP-301:Solid State Physics

Course Outcomes

After completing the course the students will able to : -

CO -01- Acquire knowledge about different experimental approaches in the study of Fermi surfaces in different materials.

CO -02- know Semiconductor properties and carrier concentration, effect of temperature on mobility, electrical conductivity and Hall Effect in conductors and semiconductors.

CO -03- Understand piezo, pyro and Ferro electricity, ferroelectric domains and hysteresis.

CO -04- Understand basic theories of magnetic materials like ferromagnetism, ferrimagnetism, antiferromagnetism.

CO -05- elaborate electron in potential wells, degeneracy state, density of states, thermal and electrical conductivity of metals, and thermoelectric power.

CO -06- Acquire basic knowledge on (low temperature) superconductivity in type I and type II super conductors, and also different theoretical approaches to super conductivity (BCS).

CO -07- Understanding of various phenomena related to super conductivity, such as the Meissner effect, flux quantization, Giæver- and Josephson tunnelling.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02	✓		✓							
CO-03	✓									
CO-04	✓									
CO-05								✓		
CO-06	✓				✓					
CO-07								✓		

M.Sc. Semester-III

Paper-II: MSP-302: NUCLEAR AND PARTICLE PHYSICS

Course Outcomes

After completing the course the students will able to : -

CO -01- Understand Nuclear Force And Nuclear Models.

CO -02- Analyze the semi empirical mass formula and its applications using liquid drop model and shell model.

CO -03- Understand the concept of Nuclear Decay Processes.

CO -04- Interpret the Classification of nuclear reactions.

CO -05- Understand the Classification of elementary Particles and their Quantum Numbers

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02			✓			✓				
CO-03	✓									
CO-04						✓		✓		
CO-05	✓									

M.Sc. Semester-III

Paper-III: MSP-303: Classical Electrodyanmics

Course Outcomes

After completing the course the students will able to : -

CO -01- Acquire knowledge on general wave equation using Maxwell's equations and able to derive Laplace equations for electrostatic potential in Cartesian, spherical and cylindrical coordinates.

CO -02- Analyze scalar and vector magnetic potentials and the propagation of EM waves in different media.

CO -03- Understand the propagation of EM waves in bounded and unbounded media & Boundary conditions for E, D, B and H.

CO -04- Understand poynting theorem and its physical significance.

CO -05- Apply vector calculus to static electric-magnetic fields in different situations.

CO -06- Formulate potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media.

CO -07- Interpret the deeper meaning of the Maxwellian field equations and account for their symmetry and transformation properties.

CO -08- Define and derive expressions for the energy both for the electrostatic and magneto statics fields, interpret Poyntings theorem derived from Maxwell's equations.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02			✓			✓				
CO-03	✓									
CO-04	✓									
CO-05						✓				
CO-06								✓		
CO-07						✓				
CO-08								✓		

M.Sc. Semester-III

Paper-IV: MSP-S02: INTELLECTUAL PROPERTY RIGHTS

Course Outcomes

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

CO-01:- The concept and development of all forms of I.P.R.

CO-02:- Distinguish and explain various forms of I.P.R

CO-03:- Identify criteria's to fit one's own intellectual work in particular forms of I.P.R

CO-04:- Apply statutory provisions to protect particular forms of I.P.R

CO-05:- Apply the concept and forms of I.P.R in research field

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01								✓		
CO-02								✓		
CO-03						✓				
CO-04			✓							
CO-05		✓	✓			✓				

M.Sc. Semester-III

Paper-V: MSP-C01: Tribal Studies

Course Outcomes

After completing the course the students will able to : -

CO -01-Describe the need and importance of Tribal Studies, since tribes constitute a significant portion of Indian Population.

CO -02-Identify major tribes of India, with their racial, lingual, and geographical classification.

CO -03-Enumerate various issues posing threat to the tribal existence, identity, development.

CO -04-Critically describe various Laws, Policies, programmes and Constitutional provisions corresponding to tribal development in India.

CO -05-Evaluate various welfare agencies and the programmes related to Scheduled Tribes in the fields of education, employment and social justice.

CO -06-Create a deliberate interest in getting involved with the activities initiated for the improvement of the lives of tribals.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01								✓		
CO-02			✓			✓				
CO-03						✓				
CO-04						✓				
CO-05			✓							✓
CO-06		✓			✓					

M.Sc. Semester-III

Paper-V: MSP-C03: MICROWAVE ELECTRONICS

Course Outcomes

After completing the course the students will able to : -

CO -01- Analyze the wave propogation in TE, TM or TEM modes, in structures such as Rectangular waveguides

CO -02- Design various microwave components such as power dividers, hybrid junctions, microwave Solid state dives, ferrite devices and microwave amplifier

CO- 03- Demonstrate various perceive operating principles of basic passive and active microwave devices.

CO -04-.Perform analysis mathematically the operation and working of the various tubes

CO- 05- Demonstrate various microwave bench setup for measuring various parameters.

CO -06- Understand the operation and working of the various tubes or sources for the transmission of the microwave frequencies.

CO -07- Understand and Analyze various parameters and characteristics of the various waveguide components.

CO -08- Understand and analyze various semiconductor devices.

CO -09- Apply Smith chart use for solution of transmission line problems and impedance matching.

CO -10- Analyze the difference between the conventional tubes and the microwave tubes for the transmission of the EM waves.

CO -11- Acquire knowledge about the measurements to be done at microwaves.

CO -12- Acquire complete knowledge about the applications of the microwaves for Radar Communications. Design and simulate waveguide components for various applications.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01		✓				✓				
CO-02			✓			✓				
CO-03										✓
CO-04						✓				
CO-05						✓				
CO-06								✓		
CO-07	✓									
CO-08	✓									
CO-09		✓				✓		✓		
CO-10		✓	✓			✓				
CO-11	✓									
CO-12	✓	✓	✓							

M.Sc. Semester-III

Paper-V: MSP-C03: NANO SCIENCE

Course Outcomes

After completing the course the students will able to : -

CO-O1-Understand the basics of nanoscience.

CO-O2-Describe the various techniques to fabricate nanostructure.

CO-O3-Comprehend the principles and working of characterization tools for analyses of

Grasp the concepts of various physical properties of nanostructures.

CO -04- The ability to develop case studies of nanomaterials with a focus on fundamentals, fabrication, characterization, and applications.

CO -05- Gain experience in applying unique properties of nanomaterials to solve problems and challenges in our life.

CO -06- Understand the quantum nanostructures, such as quantum dots, nanowires and quantum wells and their density of states.

C0-O7- Gain the knowledge in dispersion relation of electron in solids.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01								✓		
CO-02	✓									
CO-03	✓									
CO-04	✓									
CO-05						✓				
CO-06	✓									
CO-07	✓					✓				

M.Sc. Semester-III

Paper-V: MSP-C04: HIGH ENERGY PHYSICS – III

Course Outcomes

After completing the course the students will able to : -

CO-01- Understand the complex properties and behaviour of high energy particles at the microscopic level.

CO-02- Learn about the knowledge of different types of high energy particles.

CO-03- Understanding of spin parity concept & magic no. Related to shell.

CO-04- Learn about the classification of fundamental particles and their interactions according to the Standard Model quark structure of mesons and baryons.

CO-05- Explain the experimental evidence for quarks, gluons, quark confinement, asymptotic freedom, sea quarks, the running coupling constant and colour charge

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02			✓					✓		
CO-03	✓									
CO-04								✓		
CO-05							✓			

M.Sc. Semester-III

MSP-311/312: Lab Course A/B

Students are expected to understand working mechanicsand factors governing semiconductor electronics devices and in connection of the same students are expected to

CO-1: Design and resolve circuits for electronic applications.

CO-2: Record data as required by the experimental objectives.

CO-3: Analyse recorded data and formulate it to get desired results.

CO-4: Interpret results and check for attainment of proposed objective.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓					✓				
CO-02		✓	✓			✓				
CO-03						✓				
CO-04						✓		✓		

M.Sc. Semester-IV

Paper-I: MSP-401:MATERIAL SCIENCE AND LASER PHYSICS

Course Outcomes

After completing the course the students will able to : -

CO -01- Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor), Co-ordination Number etc.

CO -02- know the Mechanical response of Materials under applied load such as elastic response, stress-strain curve, viscoelasticity, Plastic deformation.

CO -03- understand and explain Corrosion and degradation of materials and corrosion inhibition

CO -04- Understand concept of mechanical behavior of materials and calculations of same using appropriate equations

CO -05- Explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy. Construction and identification of phase diagrams and reactions

CO -06- Explain features, classification, applications of newer class materials like smart materials, piezoelectric materials, biomaterials, composite materials etc.

CO -07- Compare among different of crystal imperfections.

CO -08- Gain knowledge on laser rate équations for Two, Three, Four-level laser systems.

CO -09- Understand Einstein relations for émission and absorption of radiation.

CO -10- Gain knowledge on classification of laser systems.

CO -11- Gain knowledge on application of various laser systems

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓							✓		
CO-02	✓		✓							
CO-03	✓									
CO-04	✓									
CO-05						✓				
CO-06	✓									
CO-07						✓				
CO-08	✓									
C0-09	✓							✓	✓	
CO-10	✓									
CO-11	✓									

M.Sc. Semester-IV

Paper-II: MSP-402: Spectroscopy

Course Outcomes

After completing the course the students will able to : -

CO -01- Recognize spectroscopy in microwave, Rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines

CO -02-Study of Vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman Spectra

CO -03-Make Students aware of the fine structure of ESR absorption, Hyperfine structure, Double resonance in ESR, Techniques of ESR spectroscopy

CO -04-Understand Principles and Applications of Mossbauer spectroscopy

CO -05-Understand concepts of Nuclear and Radiation Chemistry. Applications of Radioisotopes.

CO -06-Understand Micro-wave, IR and RAMAN spectroscopy and interpret the data from these measurements.

CO -07-Understand the basic principles of NMR and ESR spectroscopy and its applications

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓					✓				
CO-02			✓				✓	✓		
CO-03								✓		
CO-04								✓		
CO-05	✓									
CO-06	✓				✓					
CO-07	✓									

M.Sc. Semester-IV

Paper-III: MSP-403: Statistical Physics

Course Outcomes

After completing the course the students will able to : -

CO -01- Explain the fundamentals of statistical physics and thermodynamics as logical consequences of the postulates

CO -02- Gain knowledge about classical and quantum statistical mechanics, including Boltzmann, Fermi-Dirac, and Bose-Einstein statistics.

CO -03- Apply the formalism of statistical mechanics and probability theory to derive relations between thermo dynamical quantities.

CO -04- Understand and explain the importance of Phase transition of first and second order, Landau theory of phase transition, Ising model, Brownian motion, Langevin theory, Fokker- Planck equation. Weiss theory of ferromagnetism

CO -05- broad understanding of Statistical Mechanics, and show a critical awareness of the significance and importance of the topics, methods and techniques.

CO -06- Understand the physical statistics and its relation to information theory and able to Solve statistical mechanics problems for simple non-interacting systems.

CO -07- Understand the phase transitions and universality in second order phase transitions.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓					✓	✓			
CO-02	✓		✓							
CO-03		✓				✓				
CO-04	✓									
CO-05	✓									
CO-06	✓				✓					
CO-07	✓									

M.Sc. Semester-IV

Paper-IV: MSP-412: DISSERTATION

Course Outcomes

Upon successful completion, students will have the knowledge and skills to:

CO-01: gain in-depth knowledge and use adequate methods in the major subject/field of study.
CO-02: create, analyze and critically evaluate different technical/research solutions
CO-03: clearly present and discuss the conclusions as well as the knowledge and arguments that form the basis for these findings
CO-04: identify the issues that must be addressed within the framework of the specific dissertation in order to take into consideration.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓			✓		✓				✓
CO-02			✓			✓	✓			✓
CO-03	✓						✓			
CO-04		✓			✓	✓				

M.Sc. Semester-IV

Paper-V: MSP-D01:ENERGY PHYSICS

Course Outcomes

After completing the course the students will able to : -

CO -01- Understanding of the nucleus at low energy.

CO -02- Develop basics to solve some of the problems of nuclear physics and their limitations in nature.

CO -03- Gain the knowledge Energy Sources and their availability-prospects of renewable energy sources.

CO -04- Explain the Solar cell electrical characteristics, Efficiency-Solar water Heater-Solar, And Solar Cooking-Solar Green House.

CO- 05- Understand the basic Principles of wind energy conversion-power in the wind-forces in the blades.

CO- 06- learn the Biomass conversion Technologies and apply in daily life.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02			✓			✓				
CO-03	✓									
CO-04										
CO-05	✓							✓		
CO-06		✓			✓			✓		

M.Sc. Semester-IV

Paper-V: MSP-D02:SATELLITE COMMUNICATION AND REMOTE SENSING

Course Outcomes

After completing the course the students will able to : -

CO -01- The knowledge about the Satellite communications Principles and Properties

CO -02- Know about the Space craft subsystems and Launch vehicles.

CO -03- Design the Satellite Earth station antennas.

CO -04- analyze the effects of various parameters on Satellite System performance.

CO -05- understand the applications of Satellite Communication.

CO -06- learn the dynamics of the satellite.

CO -07- understand the communication satellite design.

CO -08- understand how analog and digital technologies are used for satellite communication networks.

CO -09- learn the design of satellite links.

CO -10- study the design of Earth station and tracking of the satellites.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02	✓		✓							
CO-03		✓				✓				
CO-04					✓	✓				
CO-05	✓									
CO-06	✓				✓					
CO-07	✓									
CO-08					✓	✓				
CO-09					✓			✓		
CO-10	✓		✓			✓				

M.Sc. Semester-IV

Paper-V: MSP-D03:CRYSTAL GROWTH AND THIN FILM PHYSICS

Course Outcomes

After completing the course the students will able to : -

CO 01- Understand the fundamentals of crystal growth and nucleation.

CO 02- Analyse the low temperature method of crystal growth.

CO 03- Understand the melt growth technique of crystal growing.

CO 04- Be aware of Thin film formation through vapour deposition

CO 05- Introduce Characterization techniques

.

CO 06- Understand the formation of thin film mechanism.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02			✓			✓				
CO-03	✓									
CO-04								✓		
CO-05		✓					✓			
CO-06	✓									

M.Sc. Semester-IV

Paper-V: MSP-D04: RENORMALIZATION AND SUPERSYMMETRY

Course Outcomes

After completing the course the students will able to : -

CO -01- Understand the algebraic origin of supersymmetry as an extension of Special Relativity.

CO -02- Understand research papers dealing with the phenomenology of supersymmetric particles and supersymmetric model building.

CO -03- Interpret the current and future experimental results from searches for supersymmetry.

CO -04- Understand the fundamental arguments in favor of supersymmetry at low energies, and the problems that the theory faces.

CO -05- Carry out calculations in perturbation theory of supersymmetric particle production, scattering on ordinary matter, annihilation and decay.

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MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓									
CO-02	✓		✓							
CO-03						✓		✓		
CO-04	✓									
CO-05	✓			✓						

M.Sc. Semester-IV

MSP-411/412: Lab Course A/B

Students are expected to understand working mechanicsand factors governing semiconductor electronics devices and in connection of the same students are expected to

CO-1: Design and resolve circuits for electronic applications.

CO-2: Record data as required by the experimental objectives.

CO-3: Analyse recorded data and formulate it to get desired results.

CO-4: Interpret results and check for attainment of proposed objective.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10
CO-01	✓				✓	✓				
CO-02	✓		✓							
CO-03						✓				
CO-04					✓	✓		✓		

RAJEEV GANDHI GOVT. POST GRADUATE COLLEGE, AMBIKAPUR, SURGUJA (CG), INDIA

Relevance of courses to Local / Regional / National / Global development needs during……..

(NEW NEP COURSE)

	Paper Code	Course Code	Course Title	Description	Relevance			
CLASS					Global	National	Regional	Local
B.Sc. I Physics	**PSCC-1T**	**DSCC-1**	**Mechanics**	Co-ordinate System, Roptational DynamicsKepler's Laws, Center of Mass, Rigid Body Motion, Bifilar Oscillations, Harmonic	✓	✓		
	PGEC-1T	**GEC-1**	**GENERAL PROPERTIES OF MATTERS**	Elasticity,Vector,motion,special theory of relativity	✓	✓		
	PSCC-1P	**DSCC-1LAB**	**LAB COURSE**	Study of Compound Pendulum, Determination of Y,k, η by Searl's,Fly wheel,Maxwqell needle	✓	✓		
	PGEC-1P	**PGEC-1P**	**LAB COURSE**	Study of Compound Pendulum, Determination of Y,k, η by Searl's,Fly wheel,Maxwqell needle	✓	✓		
	PVAC-1T	**VAC-1**	**BASIC PHYSICS OF NANO TECHNOLOGY-I**	Basic idea of nanotechnology,Techniques & Tools used in nanotechnology	✓	✓		
	PSEC-1T	**SEC-1**	**ELECTRONIC INSTRUMENATATION -I**	Qualities of Measurement,Measurement of Resistance and Impedance	✓	✓	✓	✓
B.Sc. II	**PSCC-2T**	**DSCC-2**	**Electricity and magnetism**	Coulomb's Law, Gauss's law and its application's,Magnetic Field,Kirchhoff's Law,Network theorems	✓	✓		
	PSCC-2P	**DSCC-2LAB**	**LAB COURSE**	Study of LCR circuit,network theorems,inductance	✓	✓	✓	

Physics	PGEC-2T	GEC-2	MATHEMATICAL PHYSICS	Fourier seriesSome Special ,Partial Differential Equations,Complex Analysis	✓	✓		
	PVAC-1T	VAC-1	BASIC PHYSICS OF NANO TECHNOLOGY-II	nanomaterials, applications of nanomaterials,Carbon nanomaterials	✓	✓		
	PSEC-2T	SEC-2	ELECTRONIC INSTRUMENATATION-II	Oscilloscopes ,scope Power,Transducers and sensors	✓	✓	✓	✓
B.Sc. III Physics	PSCC-3T	DSCC-3	THERMAL PHYSICS	The law of Thermodynamics, Entropy, Thermodynamic Function, Blackbody Spectrum, Transport phenomena in gases, Behavior of Real Gases, B-E, F-	✓	✓	✓	✓
	PSCC-3P	DSCC-3LAB	LAB COURSE	Searle‟s Apparatus ,Angstrom‟s Method.,Charlton‟s disc method,PRT,Thermo-emf .	✓	✓	✓	
	PDSEC-1T	PDSEC-1	Digital Systems and Applications	Digital Circuits,Boolean algebra,Data processing circuits,Combinational & Sequential Circuits,register , cpounter,timer IC	✓	✓	✓	✓
	PDSEC-1P	PDSEC-1LAB	LAB COURSE	Study of logic gate,boolean algebra, flip/flop,Combinational & Sequential Circuits	✓	✓	✓	✓
B.Sc. IV Physics	PSCC-4T	DSCC-4	WAVES AND OPTICS	Waves in media, Reflection refraction and Diffraction of Sound, Aplanatic points, combination of lances, interference and diffraction of light,	✓	✓		
	PSCC-4P	DSCC-4LAB	LAB COURSE	Lissajous Figures.Schuster`s focusing,refractive index ,Michelson's interferometer,determine wavelength	✓	✓		
	PDSEC-2T	PDSEC-2	MATHEMATICAL PHYSICS-II	Complex Analysis,Fourier Transforms,Laplace Transforms,Dirac delta function	✓	✓		
	PDSEC-2P	PDSEC-2LAB	LAB COURSE					

B.Sc. V Physics	PSCC-5T	DSCC-5	Elements of Modern Physics	Reference System, Compton Effect, Origin of Quantum Theory, Schrodinger's Equation	✓	✓		
	PSCC-5P	DSCC-5LAB	LAB COURSE	Photo-electric effect,1.Measurement of Planck's constant ,ionization potential of mercury,tunneling effect ,single slitdouble slits	✓	✓		
	PDSEC-3T	DSEC-3	QUANTUM MECHANICS	Compton Effect, Origin of Quantum Theory, Schrodinger's Equation,Eigen value	✓	✓		
	PDSEC-3	DSEC-3LAB	LAB COURSE	Electron spin resonance,Zeeman effect,4.Quantum efficiency of CCDs,tunneling effect .	✓	✓		
	PGEC-3T	GEC-3	QUANTUM MECHANICS	Origin of Quantum Theory, Schrodinger's Equation,Eigen value	✓	✓		
	PGEC-3P	GEC-3LAB	LAB COURSE	Electron spin resonance,Zeeman effect,4.Quantum efficiency of CCDs,tunneling effect .	✓	✓		
B.Sc. VI Physics	PSCC-6T	DSCC-6	SOLID STATE PHYSICS-I	Amorphous and Crystalline solids, X- ray Diffraction, Energy Bands in Solid, Semiconductors, and diode,Magnetic Properties of Matter,Dielectric Properties of Materials,Superconductivity	✓	✓		
	PSCC-6P	DSCC-6LAB	LAB COURSE	susceptibiity ,piezoelectric crystal,Hall coefficient ,X-Ray diffraction	✓	✓		
	PDSEC-4T	DSEC-4	Analog Systems and Applications	Semiconductor Diodes,Two-terminal Devices and their Applications,Bipolar Junction transistors,Feedback in Amplifiers,Sinusoidal Oscillators	✓	✓	✓	✓
	DSPEC-4P	DSEC-4LAB	LAB COURSE	Zener diode ,solar cells ,Bipolar Junction Transistor ,oscillator ,Op-amp	✓	✓	✓	✓

	PGEC-4T	**GEC-4**	**Analog Systems and Applications**	Semiconductor Diodes,Two-terminal Devices and their Applications,Bipolar Junction transistors,Feedback in Amplifiers,Sinusoidal Oscillators	✓	✓	✓	✓
	PGEC-4P	**GEC-4LAB**	**LAB COURSE**	Zener diode ,solar cells ,Bipolar Junction Transistor ,oscillator ,Op-amp	✓	✓	✓	✓
B.Sc. VIII Physics	**PSCC-8T**	**DSCC-7**	**PHYSICS OF DEVICES AND INSTRUMENTS**	MOSFETS,UJT and JFET,communication systems,Filters,Phase Locked Loop(PLL)	✓	✓	✓	✓
	PSCC-8P	**DSCC-8LAB**	**LAB COURSE**	study of MOSFETS,UJT and JFET,communication(PAM,AM,PM,FM,PWM, ASK,FSK systems,Filters,Phase Locked Loop(PLL)	✓	✓	✓	✓
	PDSEC-8T	**DSEC-8**	**Nuclear and Particle Physics-II**	General Properties of Nuclei,Nuclear Reactions,Particle physics,Detector for Nuclear Radiations	✓	✓		
	PDSEC-9T	**DSEC-9**	**Electronics**	Circuit Analysis,Physics of Semiconductor Devices,Digital Circuit,Communication System	✓	✓	✓	✓
	PDSEC-9P	**DSEC-9LAB**	**LAB COURSE**	ADC,DAC,Electronic voltmeter,CLAMPERS and CLIPPERS ,Uni-Junction Transistor FET and MOSFET characterization ,Amplifier	✓	✓	✓	✓
	PDSEC-10	**DSEC-10**	**Applied Optics**	Lasers,Spectroscopy,Holography,Optical fibres	✓	✓	✓	✓
	PDSEC-10P	**DSEC-10LAB**	**LAB COURSE**	Study the characteristics of solid-state ,LDR,LED,LasersSpectroscopy	✓	✓	✓	✓

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Relevance of courses to Local / Regional / National / Global development needs during……..

(NEW NEP COURSE)

	PAPER CODE	Course Code	Course Title	Description	Relevance			
					Global	National	Regional	Local
B.Sc. I Physics	**PHY101**	UD 1	Mechanics, oscillations and properties of matter	Co-ordinate System, Kepler's Laws, Center of Mass, Rigid Body Motion, Bifilar Oscillations, Harmonic Oscillator, CRO, Elasticity, Viscosity	✓	✓		
B.Sc. II Physics	**PHY201**	UD 1	Electricity, magnetism and electromagnetic theory	Gradient of Scalar Field, Coulomb's Law, Gauss's law and its application's, Dielectric Constants, LCR circuits,Faraday's Law,	✓	✓		
	PHY202	UD 1	Lab course-1	Study of Compound Pendulum, Determination of Y,k, η by Searl's Apparatus,	✓	✓	✓	✓
B.Sc. III Physics	PHY301	UD 1	Thermodynamics,kinetic theory and statisticalphysics	The law of Thermodynamics, Entropy, Thermodynamic Function, Blackbody Spectrum, Transport phenomena in gases, Behavior of Real Gases, B-E, F-	✓	✓	✓	✓
B.Sc. IV Physics	PHY401	UD 1	Waves, acoustics and optics	Waves in media, Reflection refraction and Diffraction of Sound, Aplanatic points, combination of lances, interference and diffraction of light,	✓	✓	✓	✓
	PHY402	UD 1	Lab course	Polarisation of Light, Study of Newton's ring, Newton's Cooling Law	✓	✓	✓	✓
B.Sc. V Physics	PHY501	UD 1	QUANTUM MECHANICS,ATOMIC MOLECULER,AND NULEAR	REFERENCE SYSTEM,QUANTUM THEORY,SPECTRA,STRUCTURE OF NUCLI	✓	✓		

B.Sc. VI Physics	PHY601	UD 1	Solid state physics, solid state devices and electronics	Amorphous and Crystalline solids, X- ray Diffraction, Energy Bands in Solid, Semiconductors, and diode,Transistor and Amplifiers	✓	✓	✓	
	PHY602	UD 1	Lab course	Study of Zener diode, Determination of e/m, Characteristics curve study of CB, CE and CC Transistor		✓	✓	✓

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Relevance of courses to Local / Regional / National / Global development needs during……..

(NEW NEP COURSE)

	Paper Code	Course Code	Course Title	Description	Relevance			
CLASS					Global	National	Regional	Local
B.Sc. I Physics	**PSCC-1T**	**DSCC-1**	**Mechanics**	Co-ordinate System, Roptational DynamicsKepler's Laws, Center of Mass, Rigid Body Motion, Bifilar Oscillations, Harmonic	✓	✓		
	PGEC-1T	**GEC-1**	**GENERAL PROPERTIES OF MATTERS**	Elasticity,Vector,motion,special theory of relativity	✓	✓		
	PSCC-1P	**DSCC-1LAB**	**LAB COURSE**	Study of Compound Pendulum, Determination of Y,k, η by Searl's,Fly wheel,Maxwqell needle	✓	✓		
	PGEC-1P	**PGEC-1P**	**LAB COURSE**	Study of Compound Pendulum, Determination of Y,k, η by Searl's,Fly wheel,Maxwqell needle	✓	✓		
	PVAC-1T	**VAC-1**	**BASIC PHYSICS OF NANO TECHNOLOGY-I**	Basic idea of nanotechnology,Techniques & Tools used in nanotechnology	✓	✓		
	PSEC-1T	**SEC-1**	**ELECTRONIC INSTRUMENATATION -I**	Qualities of Measurement,Measurement of Resistance and Impedance	✓	✓	✓	✓
B.Sc. II	**PSCC-2T**	**DSCC-2**	**Electricity and magnetism**	Coulomb's Law, Gauss's law and its application's,Magnetic Field,Kirchhoff's Law,Network theorems	✓	✓		
	PSCC-2P	**DSCC-2LAB**	**LAB COURSE**	Study of LCR circuit,network theorems,inductance	✓	✓	✓	

Physics	PGEC-2T	GEC-2	MATHEMATICAL PHYSICS	Fourier seriesSome Special ,Partial Differential Equations,Complex Analysis	✓	✓		
	PVAC-1T	VAC-1	BASIC PHYSICS OF NANO TECHNOLOGY-II	nanomaterials, applications of nanomaterials,Carbon nanomaterials	✓	✓		
	PSEC-2T	SEC-2	ELECTRONIC INSTRUMENATATION-II	Oscilloscopes ,scope Power,Transducers and sensors	✓	✓	✓	✓
B.Sc. III Physics	PSCC-3T	DSCC-3	THERMAL PHYSICS	The law of Thermodynamics, Entropy, Thermodynamic Function, Blackbody Spectrum, Transport phenomena in gases, Behavior of Real Gases, B-E, F-	✓	✓	✓	✓
	PSCC-3P	DSCC-3LAB	LAB COURSE	Searle‟s Apparatus ,Angstrom‟s Method.,Charlton‟s disc method,PRT,Thermo-emf .	✓	✓	✓	
	PDSEC-1T	PDSEC-1	Digital Systems and Applications	Digital Circuits,Boolean algebra,Data processing circuits,Combinational & Sequential Circuits,register , cpounter,timer IC	✓	✓	✓	✓
	PDSEC-1P	PDSEC-1LAB	LAB COURSE	Study of logic gate,boolean algebra, flip/flop,Combinational & Sequential Circuits	✓	✓	✓	✓
B.Sc. IV Physics	PSCC-4T	DSCC-4	WAVES AND OPTICS	Waves in media, Reflection refraction and Diffraction of Sound, Aplanatic points, combination of lances, interference and diffraction of light,	✓	✓		
	PSCC-4P	DSCC-4LAB	LAB COURSE	Lissajous Figures.Schuster`s focusing,refractive index ,Michelson's interferometer,determine wavelength	✓	✓		
	PDSEC-2T	PDSEC-2	MATHEMATICAL PHYSICS-II	Complex Analysis,Fourier Transforms,Laplace Transforms,Dirac delta function	✓	✓		
	PDSEC-2P	PDSEC-2LAB	LAB COURSE					

B.Sc. V Physics	PSCC-5T	DSCC-5	Elements of Modern Physics	Reference System, Compton Effect, Origin of Quantum Theory, Schrodinger's Equation	✓	✓		
	PSCC-5P	DSCC-5LAB	LAB COURSE	Photo-electric effect,1.Measurement of Planck's constant ,ionization potential of mercury,tunneling effect ,single slitdouble slits	✓	✓		
	PDSEC-3T	DSEC-3	QUANTUM MECHANICS	Compton Effect, Origin of Quantum Theory, Schrodinger's Equation,Eigen value	✓	✓		
	PDSEC-3	DSEC-3LAB	LAB COURSE	Electron spin resonance,Zeeman effect,4.Quantum efficiency of CCDs,tunneling effect .	✓	✓		
	PGEC-3T	GEC-3	QUANTUM MECHANICS	Origin of Quantum Theory, Schrodinger's Equation,Eigen value	✓	✓		
	PGEC-3P	GEC-3LAB	LAB COURSE	Electron spin resonance,Zeeman effect,4.Quantum efficiency of CCDs,tunneling effect .	✓	✓		
B.Sc. VI Physics	PSCC-6T	DSCC-6	SOLID STATE PHYSICS-I	Amorphous and Crystalline solids, X- ray Diffraction, Energy Bands in Solid, Semiconductors, and diode,Magnetic Properties of Matter,Dielectric Properties of Materials,Superconductivity	✓	✓		
	PSCC-6P	DSCC-6LAB	LAB COURSE	susceptibiity ,piezoelectric crystal,Hall coefficient ,X-Ray diffraction	✓	✓		
	PDSEC-4T	DSEC-4	Analog Systems and Applications	Semiconductor Diodes,Two-terminal Devices and their Applications,Bipolar Junction transistors,Feedback in Amplifiers,Sinusoidal Oscillators	✓	✓	✓	✓
	DSPEC-4P	DSEC-4LAB	LAB COURSE	Zener diode ,solar cells ,Bipolar Junction Transistor ,oscillator ,Op-amp	✓	✓	✓	✓

	PGEC-4T	GEC-4	Analog Systems and Applications	Semiconductor Diodes,Two-terminal Devices and their Applications,Bipolar Junction transistors,Feedback in Amplifiers,Sinusoidal Oscillators	✓	✓	✓	✓
	PGEC-4P	GEC-4LAB	LAB COURSE	Zener diode ,solar cells ,Bipolar Junction Transistor ,oscillator ,Op-amp	✓	✓	✓	✓
B.Sc. VIII Physics	PSCC-8T	DSCC-7	PHYSICS OF DEVICES AND INSTRUMENTS	MOSFETS,UJT and JFET,communication systems,Filters,Phase Locked Loop(PLL)	✓	✓	✓	✓
	PSCC-8P	DSCC-8LAB	LAB COURSE	study of MOSFETS,UJT and JFET,communication(PAM,AM,PM,FM,PWM, ASK,FSK systems,Filters,Phase Locked Loop(PLL)	✓	✓	✓	✓
	PDSEC-8T	DSEC-8	Nuclear and Particle Physics-II	General Properties of Nuclei,Nuclear Reactions,Particle physics,Detector for Nuclear Radiations	✓	✓		
	PDSEC-9T	DSEC-9	Electronics	Circuit Analysis,Physics of Semiconductor Devices,Digital Circuit,Communication System	✓	✓	✓	✓
	PDSEC-9P	DSEC-9LAB	LAB COURSE	ADC,DAC,Electronic voltmeter,CLAMPERS and CLIPPERS ,Uni-Junction Transistor FET and MOSFET characterization ,Amplifier	✓	✓	✓	✓
	PDSEC-10	DSEC-10	Applied Optics	Lasers,Spectroscopy,Holography,Optical fibres	✓	✓	✓	✓
	PDSEC-10P	DSEC-10LAB	LAB COURSE	Study the characteristics of solid-state ,LDR,LED,LasersSpectroscopy	✓	✓	✓	✓

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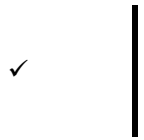
Relevance of courses to Local / Regional / National / Global development needs during……..

(NEW NEP COURSE)

	PAPER CODE	Course Code	Course Title	Description	Relevance			
					Global	National	Regional	Local

B.Sc. I Physics	**PHY101**	UD 1	Mechanics, oscillations and properties of matter	Co-ordinate System, Kepler's Laws, Center of Mass, Rigid Body Motion, Bifilar Oscillations, Harmonic Oscillator, CRO, Elasticity, Viscosity	✓	✓		
B.Sc. II Physics	**PHY201**	UD 1	Electricity, magnetism and electromagnetic theory	Gradient of Scalar Field, Coulomb's Law, Gauss's law and its application's, Dielectric Constants, LCR circuits,Faraday's Law,	✓	✓		
	PHY202	UD 1	Lab course-1	Study of Compound Pendulum, Determination of Y,k, η by Searl's Apparatus,	✓	✓	✓	✓
B.Sc. III Physics	PHY301	UD 1	Thermodynamics,kinetic theory and statisticalphysics	The law of Thermodynamics, Entropy, Thermodynamic Function, Blackbody Spectrum, Transport phenomena in gases, Behavior of Real Gases, B-E, F-	✓	✓	✓	✓
B.Sc. IV Physics	PHY401	UD 1	Waves, acoustics and optics	Waves in media, Reflection refraction and Diffraction of Sound, Aplanatic points, combination of lances, interference and diffraction of light,	✓	✓	✓	✓
	PHY402	UD 1	Lab course	Polarisation of Light, Study of Newton's ring, Newton's Cooling Law	✓	✓	✓	✓
B.Sc. V Physics	PHY501	UD 1	QUANTUM MECHANICS,ATOMIC MOLECULER,AND NULEAR	REFERENCE SYSTEM,QUANTUM THEORY,SPECTRA,STRUCTURE OF NUCLI	✓	✓		
B.Sc. VI Physics	PHY601	UD 1	Solid state physics, solid state devices and electronics	Amorphous and Crystalline solids, X- ray Diffraction, Energy Bands in Solid, Semiconductors, and diode,Transistor and Amplifiers	✓	✓	✓	
	PHY602	UD 1	Lab course	Study of Zener diode, Determination of e/m, Characteristics curve study of CB, CE and CC Transistor				



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Relevance of courses to Local / Regional / National / Global development needs during……..

DEPARTMENT OF PHYSICS

CLASS	Paper	Course Type	Course Code	Course Title	Description	Relevance			
						Global	National	Regional	Local
M.Sc. Physics semester I	I	CCC	MSP 101	Mathematical Physics	Complex Variables,Matrices Analysis,Special functions,Laplace & Fourier transform Vector & Tensor,Group Theory & Probability theory	✓	✓		
	II	CCC	MSP 111	Lab Course A	Study of characteristics of SCR,TRAIC,MOSFET,LED, UJT,FET,DIAIC	✓	✓	✓	✓
	III	CCC	MSP 112	Lab Course B	Study various types of logic gates,Universal gate, Demorgan's theorem,Full adder,Half adder, Boolean theorem	✓	✓	✓	✓
	IV	CCC	MSP 102	Classical Mechanics	Rigid body dynamics, Lagrange's equation Hamilton's Principle,Canonical transformation & Conservation	✓	✓		
	V	CCC	MSP 103	Quantum Mechanics I	Basic Formalism, Applications,General Formalism, Approximation Method, Angular Momentum & Identical Particle	✓	✓		
	VI	RJ/FST/ES		Social Outreach & Internship/Entrepren eurship	Internship/Entrepreneurship Courses			✓	✓
		ECC/CB	MSP A01	Constitutionalism &Indian Political System	Meaning, Features and Characteristics of the Constitution of India,Indian Political System. Legislative, Executive and Judicial structure,	✓	✓	✓	✓

					Central and State Bodies				
	VII	ECC/CB	MSP A02	Electronic Devices and Applications	Fabrication of IC and logic families,Opto electronic devices,Timer and applications,Op-amp applications,Pulse and digital Communication	✓	✓	✓	✓
		ECC/CB	MSP A03	Condensed Matter	Phase transformation and alloys,High temperature superconductors and GMR/CMR materials Novel organic materials ,Polymers,Structural characterization and electron structure determination	✓	✓		
		ECC/CB	MSP A04	High Energy Physics-I	Elementary particles and the fundamental forces Theoretical developments,Symmetries, Quark and Antiquark states	✓	✓		
	I	CCC	MSP 201	Electronics	Operational Amplifiers,Oscillators,Wave Shaping Circuits,Digital Electronics,Sequential Logic	✓	✓	✓	✓
	II	CCC	MSP 211	Lab Course A	Find the root of an Equation using secant method, Method. Method, lagragian inverse formula.Euler equation,trapezoidal method.	✓	✓		
	III	CCC	MSP 212	Lab Course B	To study universal gate,half adder, full adder DAC convertor, ADC convertor,clocked R-S flip-flop,D Flip Flop,T Flip Flop using NAND/NOR gate.To study Ex-OR Gate and Ex-NOR Gate	✓	✓	✓	✓
	IV	CCC	MSP 202	Atomic and	Problems related to Hydrogen-like atomic				

				Molecular Physics	spectra, knowledge about the rotational, vibrational and Raman spectroscopy of molecules, Applications of atomic and molecular physics. Spectroscopy (qualitative) Laser cooling and trapping of atoms.	✓	✓		
ysics se	V	CCC	MSP 203	Quantum Mechanics II	Scattering Theory,Perturbation Theory,Relativistic Quantum Mechanics,Dirac equation,Quantisation of fields	✓	✓		
	VI	OSC	MSP 221	Research methodology & computer Application: basics	Concept of research,Tools of Research,Methods of Research,Treatment of Data,Writing Research Report	✓	✓	✓	✓
	VII	ECC/CB	MSP B01	Environmental and Forest Laws	EVOLUTION OF FOREST AND WILD LIFE LAW, FOREST PROTECTION AND LAW,WILDLIFE PROTECTION AND LAW, BASIC CONCEPTS, ENVIRONMENTAL CONSTITUTIONALISM	✓	✓		
		ECC/CB	MSP B02	Electronic Instrumentation	Transducers,Digital Instrumentation, Analytical Instrumentation,Bio-Medical Instrumentation,Computer Peripherals	✓	✓	✓	✓
		ECC/CB	MSP B03	Condensed Matter- II	Disordered systems,Nanomaterials, Different methods of preparation of nanomaterials,Films and surfaces, Experimental technique	✓	✓		
		ECC/CB	MSP B04	High Energy Physics - II	Weak interaction, concept of Helicity, Higgs field,t Analysis of the decay energy,t Analysis of the decay energy	✓	✓		

ysics se	I	CCC	MSP 301	Solid State Physics	Crystal Physics,Lattice dynamics, Theory of metals and semiconductors Magnetism,Super conductivity.	✓	✓		
	II	CCC	MSP 311	Lab Course A	find the root of an Equation using Newton– Raphson method,Bisection Method, Simpson 1/3rd Method,Simpson 3/8th Method,Jacobi method Newton forward difference Method.	✓	✓		
	III	CCC	MSP 312	Lab Course B	Construct and study T-Type,RS,D Flip Flop using NAND/NOR gate,(DAC) using R-2R ladder method,full substractor,Half substractor	✓	✓	✓	✓
	IV	CCC	MSP 302	Nuclear and Particle Physics	Nuclear Structure And Models,Nuclear Interactions Nuclear reactions ,Nuclear decay, Particle Physics	✓	✓		
	V	CCC	MSP 303	Classical Electro Dynamics	Electrostatics,Boundary Value Problems in Electrostatics, Magnetostatics ,Time varying fields Lorentz transformations	✓	✓		
	VI	OSC	MSP S02	Intellectual Property, Human Rights &Environment: Basics	Patent ,Copyright ,Human Rights , National Human Rights Commission Basic concepts in human health and disease,	✓	✓	✓	✓
	VII	ECC/CB	MSP C01	Tribal Studies	Tribal Studies,Scheduled Tribe in India, Iliteracy ,Welfare-Concept, Characteristics, Tribal Development Programs for Scheduled Tribes	✓	✓		
		ECC/CB	MSP C02	Microwave Electronics	Waveguides and components, CIRCUIT THEORY OF WAVE GUIDE ANTENNAS,APPLICATIONS OF MICROWAVES FERRITES	✓	✓	✓	✓

	VII							
		ECC/CB	MSP C03	Nano Science	Introduction to Nanoparticles,Nanocrystals Characteristics of Nanomaterials Nano Tubes ,Applications	✓	✓	
		ECC/CB	MSP C04	High Energy Physics - III	High energy particles at microscopic level, different types, spin parity concept, quark structure	✓	✓	
	I	CCC	MSP 401	Materials Science and Laser Physics	Phase Diagram,Defects,Optical Properties, Dielectric Properties and Ferro Electrics,Elastic , Behaviour Polymer and Ceramics ,Laser Physics	✓	✓	
	II	CCC	MSP 411	Lab Course A	C++ program for aitken's delta squire method. steffensed method,striling formula, iteration method.cholesky method, ramberg's method. successive approximation DAC method Gaussian integration method global illumination formula libemann method	✓	✓	✓	✓
	III	CCC	MSP 412	Lab Course B	working of OP- AMP as a square wave generator as a inverting & non-inverting amplifier as subtractor,as adder amplifier,as a Integrator as a differentiator,To study the characteristics of Thyraton	✓	✓	✓	✓
	IV	SSC/PRJ	MSP 421	Dissertation	to enable the students to learn on their own as well development of skill related to research and developmental activities	✓	✓	✓	✓
	V	CCC	MSP 402	Spectroscopy	Microwave spectroscopy,Infrared spectroscopy				

ysics se					Raman Spectroscopy,NMR and NQR Techniques ESR and Mossbauer Spectroscopy	✓	✓		
	VI	CCC	MSP 403	Statistical Physics	Basic Principles, Canonical and Grand Canonical ensembles,Canonical ensemble,Partition function and Statistics,Identical particles and symmetry requirement,Theory of Metals	✓	✓		
	VII	ECC/CB	MSP D01	Energy Physics	Introduction to Energy Sources,Energy from the oceans,Basic Principles of wind energy conversion Energy from Biomass,Solar radiation and its measurements	✓	✓		
		ECC/CB	MSP D02	Satellite Communication and Remote Sensing	Principle of Satellite Communication Satellite Analog Communication,Digital Satellite transmission,Concept and Foundations of Remote Sensing,Microwave Remote Sensing Tools	✓	✓	✓	
		ECC/CB	MSP D03	Crystal Growth & Thin film Physics	Nucleation and Growth Nucleation,Growth Techniques Solution Growth Technique, Melt and Vapour Growth Techniques Melt technique Thin Film Deposition Techniques Thin Films Characterization Technique X – Ray Diffraction	✓	✓		
		ECC/CB	MSP D04	Renormalization and Supersymmetry	Theory of renormalization,Renormalization of Yang Mills theories,Applications of the renormalization group of quantum chromodynamics. Perturbation theory anomalies. Applications to particle phenomenology. Grand unification , The supersymmetric Standard Model	✓	✓		