DEPARTMENT OF PHYSICS
PROGRAMME OUTCOMES AND COURSE OUTCOMES OF UNDER GRADUATE & POST GRADUATE PROGRAMME (2023 ONWARDS)

NAME OF THE PROGRAMME: BACHELOR OF PHYSICS– PROGRAMME OUTCOME	
PO1	**Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study
PO2	**Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
PO3	**Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
PO4	**Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of nonfamiliar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations
PO5	**Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
PO6	**Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation
PO7	**Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team
PO8	**Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO9	**Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.
PO10	**Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
PO11	**Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
PO12	**Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO13	**Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
PO14	**Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.
PO15	**Lifelong learning:** Ability to acquire knowledge and skills, including learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

NAME OF THE PROGRAMME: B.Sc PHYSICS – COURSE OUTCOMES
SEMESTER I

PROPERTIES OF MATTER AND SOUND	1.Relate elastic behavior in terms of three modulii of elasticity and working of torsion pendulum. **2** Able to appreciate concept of bending of beams and analyze the expression, quantify and understand nature of materials. **3** Explain the surface tension and viscosity of fluid and support the interesting phenomena associated with liquid surface, soap films provide an analogue solution to many engineering problems. **4** Analyze simple harmonic motions mathematically and apply them. Understand the concept of resonance and use it to evaluate the frequency of vibration. Set up experiment to evaluate frequency of ac mains **5** Understand the concept of acoustics, importance of constructing buildings with good acoustics. Able to apply their knowledge of ultrasonics in real life, especially in medical field and assimilate different methods of production of ultrasonic waves
INTRODUCTORY PHYSICS	1.Apply concept of vectors to understand concepts of Physics and solve problems **2** Appreciate different forces present in Nature while learning about phenomena related to these different forces. **3** Quantify energy in different process and relate momentum, velocity and energy **4** Differentiate different types of motions they would encounter in various courses and understand their basis **5** Relate various properties of matter with their behaviour and connect them with different physical parameters involved.
SEMESTER-II	
Heat and Thermodynamics	1.Acquires knowledge on how to distinguish between temperature and heat. Introduce him/her to the field of thermometry and explain practical measurements of high temperature as well as low temperature physics. Student identifies the relationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, super fluidity and Condensed Matter Physics. 2. Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines. 3. Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines. 4.Study the process of thermal conductivity and apply it to good and bad conductors. Quantify different parameters related to heat, relate them with various physical parameters and analyse them. 5. Interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law. Develop the

	statistical interpretation of Bose-Einstein and Fermi-Dirac. Apply to quantum particles such as photon and electron.
HEAT, OSCILLATIONS, WAVES & SOUND(PRACTICAL)	1.Understand various postulates of special theory of relativity. 2.Appreciate the importance of transformation equations and also the general theory of relativity.. 3.Realise the wave nature of matter and understand its importance 4.Derive Schrodinger equation and also realize the use of Operator 5.Apply Schrödinger equation to simple problems.
SEMESTER III	
Electricity, Magnetism & Electromagnetism	1.Describe various thermo-electric effects and their properties. **2** Apply Biot and Savart law to study the magnetic effect of electric current. **3** Use Faraday and Lenz laws in explaining self and mutual inductance. **4** Analyze the time variation of current and potential difference in AC circuits. **5** Relate different physical quantities used to explain magnetic properties of materials.
SEMESTER IV	
Waves and Optics	1. Explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations. 2. Discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement. 3. Investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions. 4. Discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions. 5. Discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acids and hydroxyl acids.
SEMESTER V	
Atomic and Molecular Physics	1. After studied unit-1, the student will be able to know the properties of cathode rays and positive rays. Also will be able to study the determination of specific charge of an electron. 2. After studied unit-2, the student will be know the different atom models and can get an idea about coupling schemes.. 3. After studied unit-3, the student will be able to study the Zeeman effect, Paschen Back effect and Stark effect. 4. After studied unit-4, the student will be able to know the basic idea of photoelectric Effect and can able to derive the equation for Einstein's photoelectric equation.

	5. After studied unit-5, the student will be able to study the rotational and vibrational energy of a molecule and also learn the Infrared spectra, Raman Effect and Laser.
Relativity and Quantum Mechanics	1. After studied unit-1, the student will be able to know the frames of reference and able to formulate the Galilean Transformation equations and Lorentz Transformation equations. 2. After studied unit-2, the student will be understand the matter waves and can derive an equation for de Broglie wavelength. Also able to distinguish between phase velocity and group velocity and demonstrate Davison & Germer experiment. 3. After studied unit-3, the student will be able to state the Heisenberg's Uncertainty Principle and able to derive the time dependent and time independent Schrödinger's equations. 4. After studied unit-4, the student will be able to know the basic idea of photoelectric effect and can able to derive the equation for Einstein's photoelectric equation. 5. After studied unit-5, the student will be able to learn postulates of quantum mechanics, operators and also able to acquire knowledge on Dirac's bra and ket notations.
Basic and Applied Electronics	1. After studied unit-1, the student will be able to classification of solids on the basis of band theory and know the construction, working and applications of semiconducting diodes and transistors. 2. After studied unit-2, the student will be able to design the RC-coupled amplifier and to study its frequency response curve. Also students will be able to classify the power amplifiers, to learn the h-parameters and to able to design oscillator circuits. 3. After studied unit-3, the student will be able to understand the multivibrators using transistors and can able to study the different wave shaping circuits. 4. After studied unit-4, the student will be able to know the basic idea of integrating circuits and able to fabricate diode, transistors, resistor and capacitors. Also students will be study the structure of operational amplifier and its parameters. 5. After studied unit-5, the student will be able to analyze the different applications of op-amp circuits like adder, subtractor etc.and also able to demonstrate 555 Timer and its applications.
SEMESTER VI	
Nuclear and Particle Physics	1.Describe various models that explain about the nuclear Structures **2.**Give reason for various kinds of radioactivity and also know laws governing them **3.** Know the principles and applications of various particle detectors and accelerators. **4.** Discuss the concepts used in nuclear reaction. **5 .**Classify various elementary particles and study the effect of

	cosmic rays
Solid state Physics	1.Classify the bonding &crystal structure also learn about the crystal structure analysis using X ray diffraction. **2.**Understand the lattice dynamics and thus learn the electrical and thermal properties of materials. **3.**Give reason for classifying magnetic material on the basis of their behaviour. **4** Comprehend the dielectric behavior of materials. **5**Appreciate the ferroelectric and super conducting properties of materials
Fundamentals of Microprocessor-8085	1. After studied unit-1, the student will be able to know the evolution of microprocessor, pin and architecture of 8085 microprocessor in detail. 2. After studied unit-2, the student will be able to describe different types of instructions like data transfer, arithmetic, logical and branching instructions with examples and it will be used for writing the assembly language programs. 3. After studied unit-3, the student will be able to write assembly language programs for simple arithmetic operations and hence they can apply it for interfacing applications. 4. After studied unit-4, the student will be able to learn the memory interface and peripheral interface devices. 5. After studied unit-5, the student will be able to know how to interface the peripheral device with microprocessor 8085 and they are able to write the programs for LED and Temperature control interface system.
Astrophysics	1. After studied unit-1, the student will be able to study the different types of optical instruments like telescopes and spectrographs will be used for observing/recording the space objects. 2. After studied unit-2, the student will be able to describe big bang theory, different types of galaxies, milky way and astronomical unit. 3. After studied unit-3, the student will be able to explain about stars, constellations, asteroids, meteorites and comets. 4. After studied unit-4, the student will be able to know the details of solar system and able to know the formation eclipse due to sun, moon and earth. 5. After studied unit-5, the student will be able to understanding the different space programmers/missions carried out by our Indian Space Research Organization (ISRO) and also to study the lunar and solar calendars.

NAME OF THE PROGRAMME: MASTER OF PHYSICS– PROGRAMME OUTCOME

PO1	**Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to Solve business problems through research in Global context.
PO2	**Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making..
PO3	**Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all Organizational activities.
PO4	**Communication Skill** Ability to develop communication, managerial and interpersonal skills.
PO5	**Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals.
PO6	**Employability Skill** Inculcate contemporary business practices to enhance employability skills in the Competitive environment.
PO7	**Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur.
PO8	**Contribution to Society** Succeed in career endeavors and contribute significantly to society.
PO9	**Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective.
PO10	**Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.

NAME OF THE PROGRAMME: MASTERS IN PHYSICS– COURSE OUTCOMES	
SEMESTER-I	
MATHEMATICAL PHYSICS	1. Understand use of bra-ket vector notation and explain the meaning of complete orthonormal set of basis vectors, and transformations and be able to apply them. 2. Able to understand analytic functions do complex integration, by applying Cauchy Integral Formula. Able to compute many real integrals and infinite sums via complex integration. 3. Analyze characteristics of matrices and its different types, and the process of diagonalization. 4. Solve equations using Laplace transform and analyze the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology. 5. To find the solutions for physical problems using linear differential equations and to solve boundary value problems using Green's

	function. Apply special functions in computation of solutions to real world problems
CLASSICAL MECHANICS AND RELATIVITY	1. Understand the fundamentals of classical mechanics. 2. Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems. 3. Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems. 4. Analyze the small oscillations in systems and determine their normal modes of oscillations 5. Understand and apply the principles of relativistic kinematics to the mechanical systems.
LINEAR AND DIGITAL ICs AND APPLICATIONS	1. Learn about the basic concepts for the circuit configuration for the design of linear Integrated circuits and develops skill to solve problems. 2. Develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits. 3. Gain knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it. 4. Learn about various techniques to develop A/D and D/A converters. 5. Acquire the knowledge about the CMOS logic, combinational and sequential circuits.
ENERGY PHYSICS	1.To identify various forms of renewable and non-renewable energy sources. 2 Understand the principle of utilizing the oceanic energy and apply it for practical applications. 3 Discuss the working of a windmill and analyze the advantages of wind energy. 4 Distinguish aerobic digestion process from anaerobic digestion. 5 Understand the components of solar radiation, their measurement and apply them to utilize solar energy.
BIO PHYSICS	1. Understand the structural organization and function of living cells and should able to apply the cell signaling mechanism and its electrical activities. 2 Comprehension of the role of bio molecular conformation to function. 3 Conceptual understanding of the function of biological membranes and also to understand the functioning of nervous system. 4 To know the effects of various radiations on living systems and how to prevent ill effects of radiations. 5 Analyze and interpret data from various techniques viz., spectroscopy, crystallography, chromatography etc.,

PRACTICAL I- ANALOG & DIGITAL EXPERIMENTS	1. Improve the analytical and observation ability in Physics Experiments 2. Conduct experiments on applications of FET and UJT. 3 Analyze various parameters related to operational amplifiers. 4. Understand the concepts involved in arithmetic and logical circuits using IC's . 5. Acquire knowledge about Combinational logic circuits.
SEMESTER -II	
STATISTICAL MECHANICS	1. To examine and elaborate the effect of changes in thermodynamic quantities on the states of matter during phase transition. 2. To analyze the macroscopic properties such as pressure, volume, temperature, specific heat, elastic moduli etc. using microscopic properties like intermolecular forces, chemical bonding, atomicity etc. Describe the peculiar behaviour of the entropy by mixing two gases. Justify the connection between statistics and thermodynamic quantities 4. Differentiate between canonical and grand canonical ensembles and to interpret the relation between thermodynamically quantities and partition function. 4. To recall and apply the different statistical concepts to analyze the behaviour of ideal Fermi gas and ideal Bose gas and also to compare and distinguish between the three types of statistics. 5. To discuss and examine the thermo dynamical behaviour of gases under fluctuation and also.
QUANTUM MECHANICS – I	1. Demonstrates a clear understanding of the basic postulates of quantum mechanics which serve to formalize the rules of quantum Mechanics. 2 Is able to apply and analyze the Schrodinger equation to solve one dimensional. Problems and three dimensional problems. 3 Can discuss the various representations, space time symmetries and formulations of time evolution. 4 Can formulate and analyze the approximation methods for various quantum mechanical problems. 5 To apply non-commutative algebra for topics such as angular and spin angular momentum and hence explain spectral line splitting.
ELECTROMAGNETIC THEORY	1.Solve the differential equations using Laplace equation and to find solutions for boundary value problems. 2 Use Biot-Savart's law and Ampere circuital law to find the magnetic induction & magnetic vector potential for various physical problems 3 Apply Maxwell's equations to describe how electromagnetic field

	behaves in different media. 4 Apply the concept of propagation of EM waves through wave guides in optical fiber.communications and also in radar installations, calculate the transmission and reflection coefficients of electromagnetic waves. 5 Investigate the interaction of ionized gases with self-consistent electric and magnetic fields.
ADVANCED OPTICS	1. Discuss the transverse character of light waves and different polarization phenomenon. 2 Discriminate all the fundamental processes involved in laser devices and to analyze the design and operation of the devices. 3 Demonstrate the basic configuration of a fiber optic – communication system and Advantages. 4 Identify the properties of nonlinear interactions of light and matter. 5 Interpret the group of experiments which depend for their action on an applied magnetic and electric field.
PHYSICS OF NANOSCIENCE AND TECHNOLOGY	1.Understand the basic of nanoscience and explore the different types of nanomaterials and should comprehend the surface effects of the nanomaterials. 2 Explore various physical, mechanical, optical, electrical and magnetic properties nanomaterials. 3 Understand the process and mechanism of synthesis and fabrication of nanomaterials. 4 Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques. 5 Apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.
PRACTICAL II GENERAL EXPERIMENTS	1. Understand the strength of material using Young's modulus. 2. Acquire knowledge of thermal behavior of the materials. 3. Understand theoretical principles of magnetism through the experiments. 4. Acquire knowledge about arc spectrum and applications of laser. 5 Improve the analytical and observation ability in Physics Experiments.
SEMESTER-III	
QUANTUM MECHANICS – II	1. Familiarize the concept of scattering theory such as partial wave analysis and Born approximation. 2 Give a firm grounding in relativistic quantum mechanics, with emphasis on Dirac equation and related concepts. 3 Discuss the relativistic quantum mechanical equations namely, Klein-Gordon and Dirac equations and the phenomena accounted by them like electron spin and magnetic moment.

	4 Introduce the concept of covariance and the use of Feynman graphs for depicting different interactions. 5 Demonstrate an understanding of field quantization and the explanation of the scattering matrix.
CONDENSED MATTER PHYSICS	1. Student will be able to list out the crystal systems, symmetries allowed in a system and also the diffraction techniques to find the crystal structure. 2. Students will be able to visualize the idea of reciprocal spaces, Brillouin Zone and their extension to band theory of solids. 3 Student will be able to comprehend the heat conduction in solids. 4 Student will be able to generalize the electronic nature of solids from band theories. 5. Student can compare and contrast the various types of magnetism and conceptualize the idea of superconductivity.
ASTRO PHYSICS	1Recall and understand the electromagnetic radiation from celestial objects. Analyze the wave nature of light in the form of ray diagram. Apply the knowledge of phenomenon of diffraction and asses, how diffraction limits the resolution of any system having a lens or mirror. Distinguish between reflecting and refracting telescopes and their usage. **2** Correlate luminosity, flux and magnitude, related to the brightness of a star. Analyze the evolution of stars using HR diagram. Apply and examine the various laws related to temperature of a star. Assess the distance of stars, measured using trigonometric parallax method. Understand the position of star in the celestial sphere. Distinguish between sideral and universal time. **3** Define nuclear fusion, which is the fundamental energy source of stars. Analyze how neutrinos are born during the process of nuclear fusion in the sun. Recall and explain the CNO cycle – the main source of energy of hotter stars. Comprehend stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories **4** Remember and illustrate the structure of our Milky way galaxy. Classify the types of galaxies. Understand the presence of dark matter in the universe. Explain how quasars and active galaxies are powered by super massive black holes which produce copious luminosity. **5** Explain cosmology, a branch of astronomy that involves the origin and evolution of the universe, from the Big Bang to today and on into the future. Define Hubble's law of cosmic expansion. Analyze and assess the big bang nucleo synthesis universe that explains the relative.
NUMERICAL METHODS AND COMPUTER PROGRAMMING - Theory	1.Recall the transcendental equations and analyze the different root finding methods. Understand the basic concept involved in root finding procedure such as Newton Raphson and Bisection methods, their limitations. 2 Relate Simultaneous linear equations and their matrix representation Distinguish between various methods in solving

	simultaneous linear equations. 3 Understand, how interpolation will be used in various realms of physics and Apply to some simple problems Analyze the newton forward and backward interpolation 4 Recollect and apply methods in numerical differentiation and integration. Assess the trapezoidal and Simson's method of numerical integration. 5 Understand the basics of C-programming and conditional statements.
PRACTICAL III - ADVANCED EXPERIMENTS	1.Develop the programming skills of Microprocessor 2. Appreciate the applications of Microprocessor programming 3. Understand the structure and working of 8085 microprocessor and apply it. 4. Acquire knowledge about the interfacing peripherals with 8085 microprocessor. 5. Acquire knowledge about the interfacing 8051 microcontroller with various peripherals.
SEMESTER-IV	
NUCLEAR AND PARTICLE PHYSICS	1.Gain knowledge about the concepts of helicity, parity, angular correlation and internal conversion. 2 Demonstrate knowledge of fundamental aspects of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter. 3 Use the different nuclear models to explain different nuclear phenomena and the concept of resonances through Briet-Weigner single level formula 4 Analyze data from nuclear scattering experiments to identify different properties of the nuclear force. 5 Summarize and identify allowed and forbidden nuclear reactions based on conservationlaws of the elementary particles.
SPECTROSCOPY	1.Understand fundamentals of rotational spectroscopy, view molecules as elastic rotors and interpret their behavior. Able to quantify their nature and correlate them with their characteristic properties. 2 Understand the working principles of spectroscopic instruments and theoretical background of IR spectroscopy. Able to correlate mathematical process of Fourier transformations with instrumentation. Able to interpret vibrational spectrum of small molecules. 3 Interpret structures and composition of molecules and use their knowledge of Raman Spectroscopy as an important analytical tool 4 Use these resonance spectroscopic techniques for quantitative and qualitative estimation of a substances.

	5 Learn the electronic transitions caused by absorption of radiation in the UV/Vis region of the electromagnetic spectrum and be able to analyze a simple UV spectrum.
SOLAR ENERGY UTILIZATION	1.Gained knowledge in fundamental aspects of solar energy utilization 2. Equipped to take up related job by gaining industry exposure 3. Develop entrepreneurial skills 4. Skilled to approach the needy society with different types of solar cells 5. Gained industrialist mindset by utilizing renewable source of energy.
Practical-IV COMPUTATIONAL PROGRAMMING AND SIMULATION (PYTHON / C)	1.Program with the Python / C 2 Use various numerical methods in describing/solving physics problems. 3 Solve problem, critical thinking and analytical reasoning as applied to scientific problems. 4 To enhance the problem-solving aptitudes of students using various numerical methods. 5 To apply various mathematical entities, facilitate to visualise any complicate tasks. 6.Process, analyze and plot data from various physical phenomena and interpret their meaning. 7.Identify modern programming methods and describe the extent and limitations of computational methods in physics 8 Work out numerical differentiation and integration whenever routine are not applicable. 9 Apply various interpolation methods and finite difference concepts. 10.Understand and apply numerical methods to find out solution of algebraic equation using different methods under different conditions, and numerical solution of system of algebraic equation.