Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE, VASHI, NAVI MUMBAI

[AUTONOMOUS COLLEGE]

DEPARTMENT OF PHYSICS

B.Sc. Physics Curriculum

Program Outcomes (POs):

PO-1	**Disciplinary Knowledge:** Understand the basic concepts, fundamental principles, theoretical formulations and experimental findings and the scientific theories related to Physics, Chemistry, Mathematics, Microbiology, Computer Science, Biotechnology, Information Technology and its other fields related to the program.
PO-2	**Communication Skills:** Develop various communication skills such as reading, listening and speaking skills to express ideas and views clearly and effectively.
PO-3	**Critical Thinking:** Propose novel ideas in explaining the scientific data, facts and figures related to science and technology.
PO-4	**Analytical Reasoning and Problem Solving:** Hypothesize, analyze, formulate and interpret the data systematically and solve theoretical and numerical problems in the diverse areas of science and technology.
PO-5	**Sense of Inquiry:** Curiously ask relevant questions for better understanding of fundamental concepts and principles, scientific theories and applications related to the study.
PO-6	**Use of Modern Tools:** Operate modern tools, equipments, instruments and laboratory techniques to perform the experiments and write the programs in different languages (software).
PO-7	**Research Skills:** Understand to design, collect, analyze, interpret and evaluate information/data that is relevant to science and technology.
PO-8	**Application of Knowledge:** Develop scientific outlook and apply the knowledge with respect to subject.
PO-9	**Ethical Awareness:** Imbibe ethical, moral and social values and exercise it in day to day life.
PO-10	**Teamwork:** Work collectively and participate to take initiative for various field-based situations related to science, technology and society at large.
PO-11	**Environment and Sustainability:** Create social awareness about environment and develop sustainability for betterment of future.

PO-12	**Lifelong Learning:** Ability of self-driven to explore, learn and gain knowledge and new skills to improve the quality of life and sense of self-worth by paying attention to the ideas and goals throughout the life.

Program Coordinator **Chairman, BOS** **Principal**

I/C PRINCIPAL
KARMAVEER BHAURAO PATIL COLLEGE
VASHI, NAVI MUMBAI 400 703.

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Program Specific Outcomes (PSOs): PHYSICS

PSO-1	Problem Analysis – Ability to solve the problems using the fundamental principles of physics.
PSO-2	Acquired skills – Capability to adopt and absorb ideas and theories in the physics and interdisciplinary fields.
PSO-3	Competent to engage themselves in lifelong learning, develop professional-societal ethics and communicate effectively.

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COURSE OUTCOMS (COs):

Course Code	Course Outcomes: Students should be able to ….
UGPH101 Mechanics – I	**CO - 1:** understand laws of motion and their application to various dynamical situations and concept of conservation of energy, momentum, angular momentum and apply them to basic problems. **CO - 2:** understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping. **CO - 3:** write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions. **CO - 4:** understand the phenomena of collisions and idea about center of mass and laboratory frames and their correlation. **CO - 5:** explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
UGPH102 Mechanics – II	**CO -1:** understand the notion of inertial and non-inertial frames and concept of Galilean invariance [2]. **CO -2:** apply Kepler's law to describe the motion of rockets, planets and satellites in circular orbit [3]. **CO -3:** understand the principles of elasticity through the study of Young's modulus, modulus of rigidity and bulk modulus [2,]. **CO - 4:** describe special relativistic effects and their effects on the mass and energy of a moving object [2]. **CO - 5:** appreciate the nuances of Special Theory of Relativity (STR) [3].
UGPH201 Electricity	**CO - 1:** interpret the gradient of a scalar function, divergence and curl of a vector function and fundamental theorems of vector calculus. **CO - 2:** 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 - 3:** explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics. **CO - 4:** apply Gauss's law in electrostatics and dielectrics to solve the electrostatic problems. **CO - 5:** illustrate the construction and working of various types of capacitors and dielectric properties of the materials.
UGPH202 Magnetism & EMT	**CO - 1:** describe the magnetic field produced by magnetic dipoles and electric currents. **CO - 2:** explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields. **CO - 3:** understand the magnetic properties of materials and the

	phenomena of electromagnetic induction. **CO - 4:** deduce the equation of continuity and illustrate local and global conservation of charge and energy. **CO - 5:** analyze the nature of an electro-magnetic waves and their propagation through different media.
UGPH301 Mechanics, Oscillations and Sound	**CO - 1:** understand the behavior of rigid body dynamics, including the principle and scope of mechanics [2]. **CO - 2:** apply the knowledge of the dynamics of rigid bodies, conservation of energy, oscillations, waves and mechanical properties of matter [3] **CO - 3:** understand physical characteristics of simple harmonic motion (SHM) and Damped harmonic motion (DHM) to analyse the nature of vibrations [2]. **CO - 4:** analyze the concept of Doppler effect and its Applications in day-to-day life [4]. **CO - 5:** understand the concept of Acoustic effect and its applications in various fields [2].
UGPH302 Electromagnetism and optics	**CO - 1:** compare the basic laws of electro-statics and magneto-statics and understand the motion of charged particles in uniform and constant electric and magnetic fields [2]. **CO - 2:** distinguish diffraction and interference and compare Fresnel and Fraunhofer class of diffraction. Student can also understand theory of the plane diffraction grating [4]. **CO - 3:** analyze the difference between the grating spectrum and prism spectra [4]. **CO - 4:** explain the phenomenon of polarization and Malus' law and discuss the phenomenon of double refraction and identify the ordinary and extraordinary spectra [2,6]. **CO - 5:** illustrate Rayleigh's criterion about the limit of resolution and compare resolving power of optical instruments such as telescope, prism and grating [2].
UGPH303 Analog Electronics	**CO - 1:** understand the general amplifier characteristics, amplifier notations and various parameters [2]. **CO - 2:** analyse the need of feedback and types of feedback and Classify the different types of oscillators depending on components used and calculate the frequency of operation [3,4]. **CO - 3:** define various parameter of an Op-amplifier such as input bias and offset current, output offset voltage,

	differential mode gain, common mode gain and common mode rejection ratio (CMRR) and Draw the block diagram of Op-amplifier [2,4]. **CO - 4:** understand the theory of multivibrators and its types and between oscillators and multivibrators and Draw the schematic internal block diagram of IC555 timer [2,4].
UGPH 401 Thermodynamics and Materials Science	**CO - 1:** understand the different thermal processes and laws of thermodynamics to identify its applications [2]. **CO - 2:** describe the thermodynamic properties of a substance[1]. **CO - 3:** apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process and applications [3]. **CO - 4:** analyze the refrigerators, heat pumps and calculate coefficient of performance[4]. **CO - 5:** understand the concept of the materials, types, properties and their various applications associated with the different fields [2].
UGPH402 Wave Mechanics	**CO - 1:** define black body radiation, photoelectric effect, Compton effect, De Broglie hypothesis and wave - particle duality and interpret Heisenberg's uncertainty principle and translate it in its different forms [1,2]. **CO - 2:** illustrate the concept of wave function, Max Born's interpretation and the concept of operators, eigen value equations and expectation values of operators in quantum mechanics [2]. **CO - 3:** analyze the importance of quantum mechanics in explaining significant phenomena in Physics and improve quantitative problem solving skills in all the topics covered [4]. **CO - 4:** discuss the potential barrier for finite height and width and deduce an expression for approximate transmission probability [6]. **CO - 5:** analyse the theory of alpha decay from radioactive nucleus and illustrate the harmonic oscillator in one dimension [4].
UGPH403 Digital Electronics	**CO - 1:** understand, analyze the different number systems and Solve the examples based on binary addition and subtraction of numbers [2,3,4]. **CO - 2:** identify signed and unsigned binary numbers and determine 1's and 2's complements of any binary number [2,5]. **CO - 3:** illustrate the working of different flip-flops and their applications [5]. **CO - 4:** draw schematic circuit diagrams and explain the working of different types of counters, discuss the working of

	different types of registers [2,4].
UGPH302 (CBCS) Statistical Physics	**CO-1**: Discuss the basic concepts of thermodynamics and it is expected to learn Maxwell's thermodynamic relations **CO-2**: Demonstrate the fundamentals of the kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path, viscosity, thermal conductivity, and diffusion **CO-3:** Distinguish the spectral distribution such as the Stefan-Boltzmann's, Rayleigh-Jean's, and Planck's law and their significances. **CO-4:** Compute the Measurement of Planck's constant using black body radiation. **CO-5:** Apply the quantum statistical distributions, like Bose-Einstein, Maxwell-Boltzmann, and Fermi Dirac statistics
UGPH401 (CBCS) Wave and Oscillation	**CO-1:** Discuss the concepts of the Superposition Principle of SHMs of the same and different frequencies. **CO-2:** Apply the SHMs to different applications **CO-3:** Analyze the Lissajous Figures of equal and unequal frequency and their uses. **CO-4:** Describe the fluid pressure and hydrostatic force of different pressure gauges and the mechanics of fluids at rest and in motion by observing the fluid phenomena **CO-5:** Demonstrate the ability to represent acoustic parameters such as pressure, intensity, equivalent level descriptors, and statistical level descriptors.
UGPH403 – (CBCS) Analog Electronics	**CO - 1**: understand the general amplifier characteristics, amplifier notations and various parameter [2]. **CO - 2:** analyse the need of feedback and types of feedback and classify the different types of oscillators depending on components used and calculate the frequency of operation [4]. **CO - 3:** define various parameter of an Op-amplifier such as input bias and offset current, output offset voltage, differential mode gain, common mode gain and common mode rejection ratio (CMRR) and Draw the bock diagram of Op-amplifier [2]. **CO - 4:** understand the theory of multivibrators and its types and between oscillators and multivibrators and Draw the schematic internal block diagram of IC555 timer [4].

UGPHEC01 **(CBCS)** **Instrumentation**	**CO - 1:** demonstrate and describe the construction and working principle and applications of different types of transducers, sensors, basic analytical instruments, and diagnostic medical instruments [3]. **CO - 2:** design the oscillator circuit, the circuits of second-order active filters and digital to analog (DAC) and analog to digital (ADC) converter circuits [6]. **CO - 3:** compare the signal conditioning equipment and single and multi-channel systems [4]. **CO - 4:** construct the schematic block diagram of the instrumentation system, draw the block diagram of digital multimeter and single trace, dual trace, and digital storage CRO and data acquisition system [6].
UGPHSEC01 – **(CBSC)** **Physics Workshop Skills**	**CO-1:** use mechanical tools to make simple measurements of length, height, time, area, and volume. **CO-2**: use various instruments for making electrical and electronic measurements using a multimeter, oscilloscopes, power supply, electronic switches, and relays. **CO-3:** use various machine tools like lathe shaper, milling and drilling machines etc. and working with wooden and metal blocks. **CO-4:** use various machine tools, lathes, shapers, drilling machines, cutting tools, welding sets and also in different gear systems, pulleys etc. **CO-5:** demonstrate mechanical processes such as casting, foundry, machining, welding etc.
UGPH602 - Electronics	CO - 1: draw the block diagrams of linear IC voltage regulators and monolithic switching regulators, an audio-video system, and analog and digital communication systems in general [5]. CO - 2: design and construct the analog circuits for signal generation, instrumentation system, filter circuits, comparators, amplifiers multivibrators etc. using Op-amp and circuits for various applications such as ramp generators, tone burst oscillators, VCO, PWM, and PPM etc. using IC555 [6]. CO - 3: design and construct TTL and CMOS - NAND and NOR and MOS inverter circuits [6].

	CO - 4: identify different types of microphones, speakers and know the basic requirements of amplifiers and audio system and analyse the different methods of sound recording such as magnetic recording, digital recording and optical recording (CDs and DVDs) etc [2]. CO - 5: demonstrate and analyse the various analog and digital modulation and demodulation techniques and basi communication systems including fiber-optic communication [2] CO - 6: describe the working principle of LCD, LED and Cable TV [2]
UGPH501 Mathematical, Thermal and Statistical Physics	**CO - 1:** learn and understand basics of Fourier series, Probability, Differential equation and Matrices [2]. **CO - 2:** solve the problems on Fourier series, Probability, Differential equation and Matrices [3] **CO - 3:** understand and apply the concepts of thermodynamical potentials relation, change of phase, intrinsic energy and joules-kelvin effect [3]. **CO - 4:** analyse probability of a distribution, , Maxwell-Boltzmann statistics, Bose-Einstein statistics and Fermi- Dirac statistics [4]. **CO - 5:** describe and evaluate the terms Clausius-Clapeyron equation, Black-body radiation, The Rayleigh-Jeans formula and Planck radiation formula [2,5]
UGPH502 Solid State Physics	**CO - 1:** discuss the classical theory of free electron along with drawbacks and compare classical and quantum theory of free electrons [2]. **CO - 2:** describe the concept of relaxation time, collision time and mean free path and their role in electrical conduction and also explain Langevin theory and deduce Clausius-Mossotti relation [1]. **CO - 3:** describe Kronig-Penney model and Bloch theorem and understand concept of brillouin zones and distinguish between extended, reduced and periodic zone schemes [1,2]. **CO - 4:** calculate the carrier concentration, charge density in case of intrinsic semiconductors and explain acceptor and donor impurities and map the Fermi level in extrinsic semiconductors [3]. **CO - 5:** explain the Hall effect and calculate carrier concentration and recognize the type of semiconductor [2]. **CO - 6:** calculate the contribution of magneto-static energy, elastic energy and anisotropy in magnetic properties and

	explain the phenomenon of superconductivity and Meissner effect [3].
UGPH503 Atomic & Molecular Physics	**CO - 1:** understand the wave function of the hydrogen atom using the Schrödinger equation and analyze the properties of the vector atom model [2]. **CO - 2:** understand atomic spectra with different coupling interactions under electric and magnetic fields [2]. **CO - 3:** understand the various Molecular spectra, and their interactions [2]. **CO - 4:** describe different resonance spectroscopic techniques and its applications [1].
UGPH504: Electrodynamics	**CO - 1:** state and explain the basic laws of electrostatics, magnetostatics and electromagnetic theory [2]. **CO - 2:** explain bound charges in electrostatics and bound currents in magnetostatics and give their physical interpretations. Compare and contrast between electrostatics and magneto-statics [2,4]. **CO - 3:** deduce the expressions for equation of continuity and energy density in electrostatic, magnetostatic and electro-magnetic systems [5]. **CO - 4:** assess the status of electrodynamics before Maxwell and explain his correction to basic Ampere's law and justify the non-existence of magnetic monopoles in nature [3,5]. **CO - 5:** derive Maxwell's equation in free space and media and apply these equations for analysing the electromagnetic fields due to time varying charge and current distributions. Formulate the associated boundary conditions [5]. **CO - 6:** solve the numerical problems based on electrostatics, magnetostatics and propagation of plane electromagnetic waves in vaccum, conducting and non-conducting media [5].
UGPHEC01	**CO - 1:** demonstrate and describe the construction and working principle and applications of different types of transducers, sensors, basic analytical instruments and diagnostic medical instruments [2,3]. **CO - 2:** design the oscillator circuit, the circuits of second order active filters and digital to analog (DAC) and analog to digital (ADC) converter circuits [6]. **CO - 3:** compare the different signal conditioning equipments and single and multi-channel systems [4]. **CO - 4:** construct the schematic block diagram of instrumentation system, draw the block diagram of digital multimeter and single trace, dual trace and digital storage CRO and data acquisition system [6].

UGPH601 Classical Mechanics	**CO - 1:** understand the motion in the central force field and rigid dynamics [2]. **CO - 2:** describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism [2]. **CO - 3:** understand Euler's and Bernoulli's laws and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids 2,4] . **CO - 4:** understand the basics of fluid dynamics, streamline and turbulent flow, Reynolds's number, coefficient of viscosity, and Poiseuille's equation [2,5] **CO - 5:** describe and understand the motion of the forces in non-inertial systems and ability to perform calculations using relativistic mechanics [2,4].
UGPH602: Electronics	**CO - 1:** draw the block diagrams of linear IC voltage regulators and monolithic switching regulators, an audio-video system, and analog and digital communication system in general [4]. **CO - 2:** design and construct the analog circuits for signal generation, instrumentation system, filter circuits, comparators, amplifiers and multivibrators etc. using Op-amp and circuits for various applications such as ramp generator, tone burst oscillator, VCO, PWM and PPM etc. using IC 555 [6]. **CO - 3:** design and construct TTL and CMOS - NAND and NOR and MOS inverter circuits [6]. **CO - 4:** identify different types of microphones, speakers and know the basic requirements of amplifiers and audio system in general and analyse the different methods of sound recording such as magnetic recording, digital recording and optical recording (CDs and DVDs) etc. [2,4]. **CO - 5:** demonstrate and analyse the various analog and digital modulation and demodulation techniques and basic communication system including fibre- optic communication [3,4]. **CO - 6:** describe the working principle of LCD, LED and Cable TV [2,4].
UGPH 603 Nuclear Physics	**CO - 1**: understand the different types of nuclear models: Shell model and Liquid drop model. **CO - 2:** state the Law of radioactive decay and enlist its applications. **CO - 3:** understand nuclear compositions and elementary particles, charge symmetry and independence, spin dependence of nuclear force. **CO - 4:** conceptualize the basic principle and classification of Nuclear Reactors. **CO - 5:** differentiate the principle and working of particle detectors and accelerators

UGPH604 Applied Physics	**CO - 1**: understand basics of chemical physics like solution chemistry, chemical kinetics, phase equilibrium etc. [2]. **CO - 2**: learn the concepts of electrochemistry and its applications in batteries and fuel cells [1, 3]. **CO - 3**: study physical concepts and techniques for better understanding of biological science [2] **CO - 4**: summarize different types of pollution and its effect on the environment [2]. **CO - 5**: know about the planetary evolution of earth and its internal structure [1]
UGPHEC02 Microcontroller: Architecture, Programming, Interfacing and Introduction to Python	**CO - 1:** understand the basic concepts of microcontroller 8051, 8255 and Python programming [2]. **CO - 2:** apply the instruction set to write a program in 8051[3]. **CO - 3:** apply and use the concept of variables, function, string, list and dictionaries to write a program in python programming [3]. **CO - 4:** analyse the modes of 8255 PPI [4]. **CO - 5:** describe pin description and architecture of 8051 microcontroller [2].

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