



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



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.


Program Coordinator


Chairman, BOS


Principal



COURSE OUTCOMES (COs):

Course Code	Course Outcomes: Students should be able to
UGPH101 Classical Physics, Optics and Thermodynamics	<p>CO - 1: compare pseudo force and other physical forces and inertial and non-inertial frames of reference, discuss the concepts of static and dynamic frictions and apply them for solving real world problems [4].</p> <p>CO - 2: describe concepts of longitudinal, shear and bulk elasticity and use them to determine Poisson's ratio for different materials [5].</p> <p>CO - 3: state the equation of continuity, Bernoulli's principle and Poisson's equation and apply them to perform calculations [3].</p> <p>CO - 4: compare mirrors and lens and analyse the various defects such as distortion, aberration and astigmatism in geometrical optics and map the cardinal points and explain different optical phenomena [6].</p> <p>CO - 5: describe the adiabatic and isothermal processes and evaluate the work done during these processes and predict the possible applications of related to thermodynamics [5].</p>
UGPH102 Modern Physics, Nuclear Physics and Solid State Physics	<p>CO - 1: understand the origin of Quantum theory, demonstrate Davisson-Germer and G. P. Thompson experiments, production of X-rays and analyse their results [4].</p> <p>CO - 2: differentiate the properties of continuous and characteristic X-ray spectra and pair production and pair inhalation [4].</p> <p>CO - 3: define mass defect and binding energy, relation between them and packing fraction [2].</p> <p>CO - 4: explain the process of radioactivity and its applications of radioactive isotopes in agriculture, medical and industrial sectors [3].</p> <p>CO - 5: identify 14 – Bravais lattice crystal structures and determine Miller indices and interplaner distances of different crystal structures</p>
UGPH201 Mathematical Physics	<p>CO - 1: understand dot and cross products and commutative and distributive laws associated [2].</p> <p>CO - 2: describe scalar and vector triple products and illustrate their physical significance, develop the vector identities required for their applications [6].</p> <p>CO - 3: define 'del' operator and explain gradient of a scalar function and interpret its physical significance [2].</p> <p>CO - 4: explain the divergence and curl of vector function and interpret their physical significance and state the fundamental theorems for gradient, divergence and curl [2]</p> <p>CO - 5: describe first order homogeneous and non-homogeneous differential equations with variable coefficients and deduce second order homogeneous equations with constant coefficients [5]</p> <p>CO - 6: solve numerical problems based on the topics such as LC, LR circuits, spring – mass system (SHM) and transient response [3].</p>
UGPH202 Electricity, Electro-magnetic	<p>CO - 1: analyse the complicated circuits and be able to convert them into their simple equivalent circuit counterparts [4].</p> <p>CO - 2: explain resonance in series and parallel LCR circuits and calculate the</p>



Electronics	<p>CO - 3: analyze and calculate the phase difference between current and voltage in LR, CR and LCR circuits [4].</p> <p>CO - 4: understand the basic laws of electrostatics, magnetostatics and electrostatics in general, compare electrostatics with magnetostatics and solve the numerical based on them [4].</p> <p>CO - 5: understand the basics of rectifiers, filter circuits and describe the basics of different logic circuits including ex-or gates [2].</p> <p>CO - 6: illustrate basics of Boolean algebra and analyse De-Morgan's theorems and the construct the circuits for half annder and full adder [6].</p>
UGPH301 Mechanics, Oscillations and Sound	<p>CO - 1: understand the behavior of rigid body dynamics, including the principle and scope of mechanics [2].</p> <p>CO - 2: apply the knowledge of the dynamics of rigid bodies, conservation of energy, oscillations, waves and mechanical properties of matter [3].</p> <p>CO - 3: understand physical characteristics of simple harmonic motion (SHM) and Damped harmonic motion (DHM) to analyses the nature of vibrations [2].</p> <p>CO - 4: analyze the concept of Doppler effect and its Applications in in day-to-day life [4].</p> <p>CO - 5: understand the concept of Acoustic effect and its applications in various fields [3].</p>
UGPH302 Electromagnetism and optics	<p>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 [4]</p> <p>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]</p> <p>CO - 3: analyze the difference between the grating spectra and prism spectra [4].</p> <p>CO - 4: explain the phenomenon of polarization and Malus' law and discuss the phenomenon of double refraction and identify the ordinary and extraordinary spectra [3].</p> <p>CO - 5: illustrate Rayleigh's criterion about the limit of resolution and compare resolving power of optical instruments such as telescope, prism and grating [3].</p>
UGPH303 Analog Electronics	<p>CO - 1: understand the general amplifier characteristics, amplifier notations and various parameter [2].</p> <p>CO - 2: analyse the need of feedback and types of feedback and Classify³ the different types of oscillators depending on components used and calculate the frequency of operation [4].</p> <p>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 Draw⁴ the block diagram of Op-amplifier [2].</p> <p>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].</p>
UGPH 401 Thermodynamics and Materials Science	<p>CO - 1: understand the different thermal processes and laws of thermodynamics to identify its applications [2].</p> <p>CO - 2: describe the thermodynamic properties of a substance [2].</p> <p>CO - 3: apply the laws of thermodynamics to formulate the...</p>



	<p>CO - 4: analyze the refrigerators, heat pumps and calculate coefficient of performance [4].</p> <p>CO - 5: understand the concept of the materials, types, properties and their various applications associated with the different fields [2].</p>
<p>UGPH402 Wave Mechanics</p>	<p>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 [2]</p> <p>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 [3].</p> <p>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].</p> <p>CO - 4: discuss the potential barrier for finite height and width and deduce an expression for approximate transmission probability [2].</p> <p>CO - 5: analyse the theory of alpha decay from radioactive nucleus and illustrate the harmonic oscillator in one dimension [4].</p>
<p>UGPH403 Digital Electronics</p>	<p>CO - 1: understand², analyze⁴ the different number systems and Solve³ the examples based on binary addition and subtraction of numbers [2].</p> <p>CO - 2: identify signed and unsigned binary numbers and determine⁵ 1's and 2's complements of any binary number [2].</p> <p>CO - 3: illustrate the working of different flip-flops and their applications [5].</p> <p>CO - 4: draw schematic circuit diagrams and explain⁴ the working of different types of counters, discuss² the working of different types of registers [4].</p>
<p>UGPH501 Mathematical, Thermal and Statistical Physics</p>	<p>CO - 1: learn and understand basics of Fourier series, Probability, Differential equation and Matrices [2].</p> <p>CO - 2: solve the problems on Fourier series, Probability, Differential equation and Matrices [4]</p> <p>CO - 3: understand and apply the concepts of thermodynamical potentials relation, change of phase, intrinsic energy and joules-kelvin effect [2].</p> <p>CO - 4: analyse probability of a distribution, , Maxwell-Boltzmann statistics, Bose-Einstein statistics and Fermi- Dirac statistics [4].</p> <p>CO - 5: describe and evaluate the terms Clausius-Clapeyron equation, Black-body radiation, The Rayleigh-Jeans formula and Planck radiation formula [2].</p>
<p>UGPH502 Solid State Physics</p>	<p>CO - 1: discuss the classical theory of free electron along with drawbacks and compare classical and quantum theory of free electrons [2].</p> <p>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 [2].</p> <p>CO - 3: describe Kronig-Penney model and Bloch theorem and understand concept of brillouin zones and distinguish between extended, reduced and periodic zone schemes [2].</p> <p>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 [4].</p> <p>CO - 5: explain the Hall effect and calculate carrier concentration and recognize the type of semiconductor [2].</p>



	anisotropy in magnetic properties and explain the phenomenon of superconductivity and Meissner effect [4].
UGPH503 Atomic & Molecular Physics	<p>CO - 1: understand the wave function of the hydrogen atom using the Schrödinger equation and analyze the properties of vector atom model [2].</p> <p>CO - 2: understand atomic spectra with different coupling interactions under electric and magnetic fields [2].</p> <p>CO - 3: understand the various Molecular spectra, and their interactions [2].</p> <p>CO - 4: describe different resonance spectroscopic techniques and its applications [3].</p>
UGPH504: Electrodynamics	<p>CO - 1: state and explain the basic laws of electrostatics, magnetostatics and electromagnetic theory [2].</p> <p>CO - 2: explain bound charges in electrostatics and bound currents in magnetostatics and give their physical interpretations and compare electrostatics with magneto-statics [2].</p> <p>CO - 3: deduce the expressions for equation of continuity and energy density in electrostatics, magneto-statics and electro-magnetic systems [5].</p> <p>CO - 4: analyse 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 [4].</p> <p>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].</p> <p>CO - 6: solve the numerical problems based on electrostatics, magnetostatics and propagation of plane electromagnetic waves in vacuum, conducting and non-conducting media [5].</p>
UGPHEC01	<p>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].</p> <p>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].</p> <p>CO - 3: compare the different signal conditioning equipments and single and multi-channel systems [4].</p> <p>CO - 4: construct the schematic block diagram of instrumentation system, draw⁶ the block diagram of digital multimeter and single trace, dual trace and digital storage CRO and data acquisition system [6].</p>
UGPH601	<p>CO - 1: understand the motion in Central force field and rigid dynamics [2].</p> <p>CO - 2: describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism [2].</p> <p>CO - 3: understand the Euler's and Bernoulli's laws and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids [2].</p> <p>CO - 4: understand the basics of fluid dynamics, streamline and turbulent flow, Reynolds's number, coefficient of viscosity and Poiseuille's equation [2].</p> <p>CO - 5: describe and understand the motion of the forces in non-inertial systems and Ability to perform calculations using relativistic mechanics [2].</p>



<p>Electronics</p>	<p>monolithic switching regulators, an audio-video system, and analog and digital communication system in general [5].</p> <p>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 IC555 [6].</p> <p>CO - 3: design and construct TTL and CMOS - NAND and NOR and MOS inverter circuits [6].</p> <p>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].</p> <p>CO - 5: demonstrate and analyse the various analog and digital modulation and demodulation techniques and basic communication system including fibre- optic communication [2]</p> <p>CO - 6: describe the working principle of LCD, LED and Cable TV [2]</p>
<p>UGPH 603 Nuclear Physics</p>	<p>CO - 1: understand the different types of nuclear models: Shell model and Liquid drop model [2].</p> <p>CO - 2: state the Law of radioactive decay and enlist its applications [2].</p> <p>CO - 3: understand nuclear compositions and elementary particles, charge symmetry and independence, spin dependence of nuclear force [2].</p> <p>CO - 4: conceptualize the basic principle and classification of Nuclear Reactors [4].</p> <p>CO - 5: differentiate the principle and working of particle detectors and Accelerators [4].</p>
<p>UGPH604 Applied Physics</p>	<p>CO - 1: understand basics of chemical physics like solution chemistry, chemical kinetics, phase equilibrium etc. [2].</p> <p>CO - 2: learn the concepts of electrochemistry and its applications in batteries and fuel cells [2].</p> <p>CO - 3: understand physical concepts and techniques for better understanding of biological science [2].</p> <p>CO - 4: identify different types of pollution and its effect on environment [2].</p> <p>CO - 5: demonstrate the planetary evolution of earth and its internal structure [3].</p>
<p>UGPHEC02 Microcontroller: Architecture, Programming, Interfacing and Introduction to Python</p>	<p>CO - 1: understand the basic concepts of microcontroller 8051, 8255 and Python programming [2].</p> <p>CO - 2: apply the instruction set to write a program in 8051 [3].</p> <p>CO - 3: apply and use the concept of variables, function, string, list and dictionaries to write a program in python programming [3].</p> <p>CO - 4: analyse the modes of 8255PPI [4].</p> <p>CO - 5: describe pin description and architecture of 8051 microcontroller [2].</p>



Names and Signatures of the Course Coordinators

Course Code	Name of the Course Coordinator	Signature
UGPH101	Dr. Yadav S. P.	
UGPH102	Dr. Gaikar P. S.	
UGPH201	Dr. Yadav S. P.	
UGPH202	Dr. Gaikar P. S.	
UGPH301	Dr. Chandekar K. V.	
UGPH302	Dr. Chavan A. U.	
UGPH303	Dr. Patil B. B.	
UGPH401	Dr. Chandekar K. V.	
UGPH402	Dr. Chavan A. U.	
UGPH403	Dr. Patil B. B.	
UGPH501	Dr. Gaikar P. S.	
UGPH502	Dr. Chavan A. U.	
UGPH503	Dr. Yadav S. P.	
UGPH504	Dr. Pujari V. B.	
UGPHEC01	Dr. Pujari V. B.	
UGPH601	Dr. Chandekar K. V.	
UGPH602	Dr. Pujari V. B.	
UGPH603	Dr. Yadav S. P.	
UGPH604	Dr. Pujari V. B.	
UGPHEC02	Dr. Gaikar P. S.	