Dr. A. G. D. Bendale Mahila Mahavidyalaya, Jalgaon

Department of Physics

F.Y. B. Sc. course outcomes:

1. PHY-111: Mechanics and Properties of Matter

CO1: To understand Compound pendulum, Differential equation of motion, time period, explanation of length of equivalent simple pendulum, point of suspension & point of oscillation and their interchangeability, condition of minimum time period.
CO2: To know about Kater's pendulum and its application to determine 'g'
CO3: To understand Torsional pendulum and its application to determine modulus of rigidity.
CO4: To know Bifilar suspension and Bifilar pendulum with parallel threads.
CO5: Determination of Bending of beams and Bending moments, general expression and expressions for beams having rectangular and circular cross-section,
CO6: To understand Cantilever loaded at the free end, Expressions for cantilevers having rectangular and circular cross section.
CO7: Determination of General expression for depression of a beam supported at its both ends and loaded in the middle, expressions for the beams having rectangular and circular cross-section, Experiment to determine 'Y' by bending of a beam.
CO8: Basic concepts of surface tension and angle of contact.
CO9: To understand Pressure difference across a liquid surfaces, Excess pressure inside a liquid drop and a soap bubble, Relation between surface tension and surface energy.
CO10: To know Relation between surface Tension, excess pressure & radius of curvature.
CO11: Determination of surface tension by Jaeger's method, Applications of surface tension with explanation.
CO12: General concept of fluid flow, Streamline and turbulent flow, Equation of continuity of flow, Energy possessed by a liquid.
CO13: Concept of pressure energy, Bernoulli's Theorem and its applications as venturimeter, Pitot tube.
CO14: Definition of viscosity, Poiseuille's equation, Experimental determination of coefficient of viscosity by using Poiseuillie's equation.

2.PHY-112: Electricity and Magnetism

- **Basic Outcomes of Course :**

- **CO 1.** To understand the fundamental Physics related to current electricity.
- **CO 2.** To study the working and operation of few electrical D.C. circuits.
- **CO 3.** Classify different types of magnetic materials with their properties.
- **CO4.** To acquire knowledge about the phenomenon of electromagnetic induction.
- **CO5.** To understand Kirchhoff's law by loop analysis.
- **CO6.** To understand and illustrate Network theorem including Thevenin's theorem, Norton's theorem and Maximum power theorem.

3. PHY-121 : Heat and Thermodynamics

- **Basic Outcomes of Course :**

CO1: To understand and discuss the results of Andrew's experiment and Amagat's experiments.
CO2: To determine van der Wall's equation, Critical constants and concept of Bolye's temperature.
CO3: Understand basic concept of thermodynamics and to distinguish between work done due to Adiabatic and isothermal changes.
CO4: To understand Carnot's ideal heats engine, Carnot cycle and its efficiency, Carnot's theorem, Otto and Diesel engines with their efficiencies.
CO5: To state First and Second latent heat equations.
CO6: To understand Concept of entropy, Change of entropy in Reversible process and Irreversible process, T-S diagram.
CO7: Knowledge of basic principles of refrigeration methods: Evaporative refrigeration, refrigeration by throttling of gas, vapour refrigeration.
CO8: To learn basic components of simple vapour compression refrigeration understand its working with Flow diagram.

4. PHY-122: THEORETICAL PHYSICS

- **Basic Outcomes of Course :**

Course Outcomes:
CO1. Students understand how to do addition, subtraction, multiplication, division and complex conjugate of complex numbers.

CO2. They learned how to write complex numbers in Rectangular, Polar and Exponential forms.
CO3. They understand how to complex numbers used to determine velocity and acceleration in circular motion.
CO4. They understand how to do differentiation like partial differentiation, total differential, and exact differential.
CO5. They learned how to Change of variables from Cartesian to polar coordinates.
CO6. They learned scalars and vectors and its Dot product and cross product of two vectors with their properties.
CO7. They understand Scalar triple product with properties and its geometrical interpretation.
CO8. They learned how to take divergence of vector field and circulation (Curl) of vector field.

5. PHY 103: Practical Physics

SECTION-I

- **CO 1.** To acquire knowledge about experiments related to mechanics.
- **CO 2.** To understand the fundamental related to elasticity and viscosity.
- **CO 3.** To describe the fundamentals of electricity and magnetism.
- **CO 4.** Creating awareness about the consumption of electricity with energy meter.
- **CO 5.** Understanding of the optical phenomenon through experiments of Optics.

To make student able to perform

1. M.I. of a disc by torsional pendulum.
2. 2.η by torsional oscillation.
3. Determination of acceleration due to gravity by Kater's reversible pendulum.
4. Determination of Y by using flat spiral spring.
5. Determination of ηby using flat spiral spring.
6. To determine Y of rectangular beam by method of bending.
7. To determine Y by vibrational cantilever.

8. Poisson's ratio of rubber by using cord/rubber tube.
9. Determination of coefficient of viscosity of water by Poiseuille's method.
10. Verification of Bernoulli's theorem.
11. To determine the surface tension by Jaeger's method.
12. Thermal conductivity by Lee's method.
13. Thermocouple as thermometer.

SECTION-II

1. Verification of Kirchhoff's laws.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.
4. Maximum power transfer theorem.
5. Verification of Joule's law.
6. Determination of time constant of L-R circuit.
7. Determination of time constant of R-C circuit using charging and discharging of condenser through resistor.
8. To determine efficiency and turns ratio of transformer.
9. Study of spectrometer and determination of angle of prism.
10. Use of analog/digital multimeter.
11. Electric billing with energy meter.
12. Study of I-V characteristics of solar cell.
13. Frequency of a. c. using vibrating wire and magnet.

S.Y. B. Sc. Course Outcome:

1. PHY-231: Waves and Oscillations

- **Basic Outcomes of Course :**

CO1. The ability of students developed how to do composition of two S.H.M.s having equal frequencies along same line of vibration.

CO2. They learned how to get the lissajous figures using mechanical, optical and electrical methods.

CO3. They understand what is Oscillations and how it is divided into different type on basis of it motion and different force action on it.

CO4. Student learned how energy, power dissipated in the oscillations and how to calculated quality factor.

CO5. The ability of student developed how to used Damped free oscillations in LCR ckt..

CO6. They understand when the amplitude resonance and its relation with maximum power.

CO7. They learned how hearing ability of human being changes on the basis of sound intensity and its relation with loudness.

CO8. They learned how we can produce ultrasonic wave.

2 . (b) PHY- 232 (B) - Instrumentation -I

- **Basic Outcomes of Course :**

CO1: To know Standards of measurements and calibration

CO2: To understand Static performance characteristics such as Accuracy, Precision, Sensitivity, Linearity.

CO3: Concepts of errors and their types.

CO4: To know the principal, construction and working of Liquid- in-glass thermometer, Pressure thermometers their types Constant volume gas thermometer and Vapour pressure thermometer.

CO5: To study the principal, construction and working of Metalic resistance thermometer , Semiconductor resistance sensors ,Thermo-electric sensors .

CO6: To know the principal, construction and working of Total radiation pyrometer and Selective radiation pyrometer

CO7: Measurement of high pressure , Measurement of low pressure

CO8 : To study the principal, construction and working of McLeod gauge, Pirani gauge. Characteristics of sound ,Sound pressure level, Sound power level, Variation of intensity of sound with distance.

CO9 : To know the principal, construction and working of Microphones such as Condenser type microphone,Electret Microphone, Electrodynamic types of microphone .

CO10 : To study the principal, construction and working of Measurement of magnetic field by Search coil , Measurement of magnetic field by Hall gauge meter.

3. PHY – 241: Modern Physics

- **Basic Outcomes of Course :**

CO 1. To study conventional, non-conventional energy sources, solar cell-(types, working principle, operation and its applications)

CO2. To learn LASER (principle, characteristics, steps of formation, types, applications)

CO 3. To understand Bohr's and Sommerfield theories of hydrogen atom along with limitations of quantum mechanical model.

CO 4. Study of matter waves through few experiments and uncertainty principle.

4. PHY-242: Optics

- **Basic Outcomes of Course**

CO1: To study of Deviation produced by thin lenses, equivalent focal length of two thin lenses separated by a distance and when in contact, Power of lens.

CO2: To understand Spherical aberration in lens, reduction of spherical aberration, Chromatic aberration, Achromatism. Intensity distribution in the interference pattern, Phase change on reflection.

CO3: To study Interference due to reflected light, Interference in thin wedge shaped film, fringe width in case of fringes of equal thickness.

CO4: Newton's rings theory and its application to determine wavelength of source and refractive index of liquids, Michelson Interferometer.

CO5: To study the concept of Fraunhofer diffraction at single slit and double slits, Theory of plane transmission grating, Intensity distribution in diffraction pattern. Fresnel diffraction, rectilinear propagation of light, Resolving power of grating.

CO6: To understand basics of Polarization, Polarization by reflection, Brewster's law, Polarization by double refraction in uniaxial crystals, Double refracting crystals, Huygens explanation for normal incidence, Positive and negative crystals.

CO7: Production and detection of circularly and elliptically polarized light, Construction of Polaroid, Quarter and Half wave plates, Nicol prism, Rotation of the plane of polarization, Specific rotation, Polarimeter, Optical Activity

5.PHY 233: PRACTICAL COURSE-I

SECTION-I

To make student able to perform

1. Determination of the decrement factor by using Logarithmic decrement (in air / water).
2. Study of acoustic resonance by using bottle as a resonator.
3. Determination of velocity of sound by using Kundt's tube.
4. Study of electrical resonance by using series L-C-R circuit.
5. Study of acoustic resonance by using resonance tube.

6. Study of resonance using Kater's pendulum.
7. Comparison of capacities by De Saughty's method.
8. R, Γ, Q using damped harmonic motion.
9. Demonstration of Lissajous figures by using C.R.O.

10. Frequency response of CE single stage transistor amplifier and to calculate its bandwidth.

OR

SECTION-II INSTRUMENTATION-I

1. Use of C.R.O as a measurement tool for different electrical parameters (frequency, a.c. /d.c.voltage, pulse height, pulse width, rise time and fall time).
2. To obtain Lissajous figures using C.R.O.
3. To determine characteristics of Thermistor and to find an unknown temperature by using thermistor.
4. Measurement of magnetic field by search coil.
5. Measurement of magnetic field by hall probe method.
6. Directional characteristics of a microphone.
7. Platinum resistance thermometer. (Determine the melting temperature of Wax)
8. Velocity of sound by phase shift method.
9. Measurement of Noise by Using Sound Pressure level Meter.

T.Y. BSc. PHYSICS

Course Outcomes

PHY351: Mathematical Physics

- **Basic Outcomes of Course**
- **On completion of this course a student should be able to:**

CO1. Have knowledge about, and being able to use, advanced mathematical methods and theories on various mathematical and physical problems.

CO2. Use mathematical formulations, analyses and models to obtain insight in specialized areas of Physics.

CO3. Be able to apply skills of mathematical, statistical and physical modeling in applied fields and on technological problems.

CO4. Be able to carry out, present and document a comprehensive independent work, demonstrating command of the terminology of the subject area.

CO5. Identify different special mathematical functions.

CO6. Apply techniques of vector analysis, such as gradient of scalar, divergence of vector, curl of vector,

CO7. To the study of special functions of mathematical physics

CO8. To understand Cartesian (X, Y, Z), Spherical polar (r,θ,φ) and Cylindrical (ρ,φ,z) co-ordinate systems and their transformation equations.

CO9. To understand expression for gradient, divergence, curl and Laplacian in curvilinear, spherical polar and cylindrical co-ordinate systems.

CO10. Solve partial differential equations with appropriate initial or boundary conditions with Green function techniques

CO11. Have confidence in solving mathematical problems arising in physics by a variety of mathematical techniques

CO12. To understand special relativity theory and to solve Lorent'z transformation equations, Length contraction, time dilation,

PHY 352: Classical Mechanics

- **Basic Outcomes of Course**

CO1. Students learned how Newton's laws of motion is important in science and what is its Limitations.

CO2. The ability of students developed how to differentiate different types of forces.

CO3. They understand strategy of satellite launching on the basis of equation of orbit using kepler's laws.

CO4. They learned how to calculate virtual work and its relation with virtual displacement.

CO5. The ability of students developed how to use Lagranges equation in the different type of motion.

CO6. They understand important of phase space and how to derived Hamilton's canonical equation of motion.

CO7. They understand how Hamilton's equation is more important than Lagranges equation and Newton's machnics.

CO8. The ability of students developed how to use Hamilton's equation in the different type of motion.

PHY 353: Atomic and Molecular Physics

- **Basic Outcomes of Course**

Upon successful completion of this course it is intended that a student will be able to:

CO1. State and explain the key properties of vector atom model and the importance of the Pauli Exclusion Principle.
CO2. To explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields.
CO3. To state and justify the selection rules for various optical spectroscopies in terms of the symmetries of molecular vibrations.
CO4. List different types of atomic and molecular spectra and related instrumentation.
CO5. Describe theories explaining the structure of atoms and the origin of the observed spectra
CO6. Identify atomic effect such as space quantization and Zeeman Effect.
CO7. To understand the Origin and nature of x-ray, Characteristic x-ray spectra,
CO8. To state Moseley's law and its importance, regular and irregular doublets and their laws.

PHY 355: Solid State Physics

- **Basic Outcomes of Course**

Students should gain basic knowledge of solid state physics. This implies that the student will:

CO1. Be able to account for interatomic forces and bonds
CO2. Have a basic knowledge of crystal systems and spatial symmetries
CO3. Be able to account for how crystalline materials are studied using diffraction, including concepts like the Ewald sphere, form factor, structure factor, and scattering amplitude.
CO4. Be able to perform structure determination of simple structures
CO5. Understand the concept of reciprocal space and be able to use it as a tool know the significance of Brillouin zones
CO6. Know what phonons are, and be able to perform estimates of their dispersive and thermal properties
CO7. Be able to calculate thermal and electrical properties in the free-electron model and know Bloch's theorem and energy band and distinction between metals, semiconductors and insulators
CO8. Be able to estimate the charge carrier mobility and density.
CO9. Be able to account for what the Fermi surface is and how it can be measured.
CO10. To understand Lattice heat capacity and to compare Classical theory, Einstein's theory, Debye's theory of specific heat of solids.
CO11. To apply techniques of X-Ray Diffraction and UV Spectroscopy to study crystals.

PHY- 356(A): Technical Electronics- I

- **CO 1.** To describe construction and specification of resistors, capacitors, inductor, transformers of different types along with switches and relay.
- **CO 2.** To study construction of LED, LCD, LDR, photodiode, phototransistor along with applications.
- **CO 3.** To understand PCB in view of (idea, advantages, steps of making, precautions) along with principle of Photolithography
- **CO 4.** To study construction and working of different types of transducers including LVDT.
- **CO 5.** To study construction and working operation of different types of D to A and A to D converters.
- **CO 6.** Study of measuring instruments like CRO, function generator, DFM, DVM.

PHY- 357 Practical I

Course Outcomes:

CO1. Students understand how to find Y and η by Searl's method .

CO2. Students understand how to find Y by Koenig's method.

CO3. Students understand how to use Searl's Goniometer.

CO4. Students understand how to calculate resolving power of grating.

CO5. Students experimentally understand how to estimate temperature of Na flame.

CO6. Students experimentally understand how to study variation of resistance of a filament of a bulb with its temperature.

CO7. Students experimentally understand the determination of circular aperture of LASER

CO8. Students experimentally understand the determination of velocity of sound using ultrasonic Interferometer.

PHY- 358 Practical II

Course Outcomes:

CO9. Students understand how to used UJT as relaxation oscillator.

CO10. They learned how to measure resistivity of sample by two probe method.

CO11. They understand how to used CRO for Time and Frequency determinations.

CO12. They learned how to used OP AMP for R-2R ladder.

CO13. They learned how to used OP AMP for square and triangular wave developed.

CO14. They developed ability of connecting circuits in proper way.

CO15. They learned the function of LDR and its used practical.

PHY- 359 Project 1

- **CO 1.** To allot a project
- **CO 2.** Preparation of a primary project report (topic selection, literature Search Strategy, literature Review, Project Planning).
- **CO 3.** Further PPT presentation of concern project is expected from students.

PHY 361: Classical Electrodynamics

- **Basic Outcomes of Course**

CO1. To state Gauss law and its application to obtain electric field for different cases.

CO2. Describe and explain the relationship between the electric field and the electrostatic potential.

CO3. Understand the relation between Electric displacement vector D, Susceptibility, Permittivity, Dielectric constant.

CO4. To understand Lorentz force on a point charge moving in a magnetic field.

CO5. To state Biot and Savert's law and Ampere's circuital law to Describe and explain the generation of magnetic fields by electrical currents;

CO6. Be able to solve relevant theoretical problem and use their conceptual understanding of the electromagnetic laws in order to qualitatively describe the behavior of the solution to the problem

CO7. Understand origin of Maxwell's equations in magnetic and dielectric media

CO8. Write down Maxwell's equations in linear, isotropic, homogeneous media

CO9. To derive continuity conditions on electromagnetic fields at boundaries

CO10. To derive electromagnetic wave solutions and propagation in dielectric and other media and understand transport of energy and Poynting vector.

CO11. Show Maxwell's equations at dielectric boundaries calculate reflection and transmission coefficients for waves at dielectric boundaries.

PHY-362: Quantum Mechanics

- **Basic Outcomes of Course**

CO1. To develop a knowledge and understanding of the concept that quantum states live in a vector space.

CO2. To solve quantum mechanics problems.

CO3. Formulation of Schrödinger equation-time dependent and time independent forms.

CO4. To derive energy Eigen value and eigen functions particle in a box and 1-D harmonic oscillator.

CO5. To formulate the Schrödinger wave equation in terms of spherical polar co-ordinates for its application to solve Hydrogen atom problem.

CO6. To understand Postulate of quantum mechanics, operators and use of commutation and commutative algebra of operators to solve quantum mechanics problem.

PHY 363: Nuclear Physics

- **Basic Outcomes of Course**

CO1. Students understand different composition of nucleus.
CO2. They understand relation between Binding energy and packing fraction.
CO3. They understand the nature of nuclear force.
CO4. They understand concept of radioactivity and its different concept of life and its various applications.
CO5. They understand different nuclear models and them limitation.
CO6. They understand type nuclear reaction on the basis of exoergic or endoergic concept.
CO7. They understand nuclear fission and nuclear fusion reactions on the basis mass gain or mass loss of nucleus.
CO8. They understand different nuclear reactor and the function of working.

PHY 364: Statistical Mechanics & Thermodynamics

- **Basic Outcomes of Course**

CO1. To understand basic concepts of probability and probability distribution.
CO2. To solve Random walk problem in one dimension and Gaussian probability distribution.
CO3. To understand specification of the state of the system (Classical & Quantum).
CO4. To state Basic postulate of equal a priori probability,
CO5. To understand Statistical Ensembles and Calculation of microstates of an ideal monatomic gas.
CO6. To understand Distribution of energy between systems in equilibrium.
CO7. To state Boltzmann relation for entropy and to perform Statistical calculations of thermodynamic quantities.
CO8. To state Equipartition theorem and its application to mean K.E. of a molecule in a gas and to Harmonic oscillator.
CO9. To derive Maxwell's equations from thermodynamic potentials
CO10. To state TdS and energy equation.

PHY- 365: Elements of Material Science

- **Basic Outcomes of Course**

Get knowledge of Historical perspectives of materials science.
CO1. To classify between advanced materials, Smart materials, Nano structured Materials.
CO2. To understand chemistry of organic material and its classification.
CO3. To understand and learn the Mechanical Properties, Thermal Properties, Electrical Properties, and Magnetic Properties of materials.
CO4. To understand the basic concept of Dislocations and Plastic Deformation.
CO5. To understand Atomic Diffusions and its Mechanism.
CO6. To state Fick's Law (I_{st} and II_{nd} Law).

CO7. To understand basics of phase diagram, its classifications, and its interpretation.

CO8. To study Binary Phase Diagram for: i) Sugar-Water, ii) NaCl-water, and Alloys forming Eutectic: Pb –Sn diagram.

PHY- 366(A): Technical Electronics- II

- **CO 1.** To describe sound system including types of microphones and speakers.
- **CO 2.** To study public address system and its installation along with different phonic systems and CD player.
- **CO 3.** To study bio medical instruments including various types of electrodes, ECG, and ultrasonography.
- **CO 4.** To study peizo-electric and optoelectronic transducers along with chemical sensors (PH, gas, humidity).
- **CO 5.** To understand the operating principle, block diagram and features of modern home appliances (Microwave Oven, Cellular phone, Washing machine, Electronic Weighing System)

PHY- 367 Practical III

Course Outcomes:

CO1. Students understand how to calculate Surface tension by Quinke's method.

CO2. Students understand how to calculate Thermal conductivity of rubber by tubing method.

CO3. Students understand how to calculate Thermal conductivity of metal by Forbe's method.

CO4. Students understand verification of certain laws of probability distribution.

CO5. Students understand verification of Stefan's law by torch bulb filament.

CO6. Students understand calculation of velocity of sound by phase shift method.

CO7. Students understand calculation of viscosity by rotating cylinder method.

CO8. Students understand determination of 'g' by conical pendulum.

PHY- 368 Practical IV

Course Outcomes:

CO9. Students understand how to used OP AMP as adder.

CO10. They understand how to used OP AMP as substractor.

CO11. They learned how to used CRO for Time and Frequency determinations.

CO12. They understand how to used OP AMP as differentiator.

CO13. They developed ability of connecting circuits in proper way.

CO14. They learned how to used IC 7490 as different counting modes.

PHY- 369: Project work – II

- **CO 1.** To check the part of experimental work done by the candidate on the given topic.
- **CO 2.** To made discussion with student on the results obtained from experimentation.
- **CO 3.** To guide student for writing the conclusion of the project based on the results obtained so far.
- **CO 4.** Further students are advice to prepare PPT presentation of their concern project.