K.T.S.P.MANDAL'S

HUTATMA RAJGURU MAHAVIDYALAYA, RAJGURUNAGAR

PHYSICS DEPARTMENT

Teaching Plan

2025-26 (2nd term)

PHY-251-MJ : Oscillation, Waves and Sound

Dr.V.B.Deshmukh

Month	period	Chapter	Topic taken
Dec.25 TJan.26	**12**	**OSCILLATIONS**	**Undamped (Free) Oscillation** Introduction Simple Harmonic Motion (SHM) and its Properties .Differential equation for undamped oscillations and its solution. Applications of SHM in Day-to-Day Life Examples: Simple Pendulum, Springs (Clocks, Musical Instruments, etc.) Composition of two SHM Lissajous figures and its application **Damped Oscillation** Introduction .Differential equation for damped oscillations and its solution Applications of damped oscillations in Day-tDay Life **Forcd Oscillations** Differential Equation for a Forced Oscillator and Its Solution Coupled Oscillation **Resonance** Types of Resonance Applications of Resonance in Daily Life **Log decrement** Numerical Problems
Jan 26 to Feb 26	**10**	**WAVE MOTION**	Introduction to Wave Motion Definition of Waves Longitudinal and Transverse Waves Characteristics of Waves **Applications of Longitudinal and Transverse Waves in Day-to-Day Life** **Seismic Waves** Qualitative Discussion Applications **Gravitational Waves** Qualitative Discussion Applications **Standing Waves** Qualitative Discussion Applications:

			Structural Engineering (Vibrations in Buildings and Bridges) Microwaves in Ovens Musical Instruments (Strings and Air Columns)
Feb 26 to March 26	**8**	**SOUND AND DOPPLER EFFECT**	Introduction to Sound Definition of Sound Types of Sound Waves: Musical Sound vs. Noise **Concept of Reverberation Time and Reverberation in a Hall Sabine's Formula** **Doppler Effect** Explanation of the Doppler Effect Applications: Red Shift and Blue Shift Medical Imaging Radar and Speed Trap Guns Numerical Problems

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PHYSICS DEPARTMENT

Teaching Plan

2025-26 (2nd term)

PHY-364: Nuclear Physics

Dr.V.B.Deshmukh

Month	period	Chapter	Topic taken
Jan.2026	12	**Nuclear Structure, Properties and Radioactivity**	Basic Concept of Nucleus: Composition, charge, size, density of nucleus(Revision) Nuclear Angular momentum, Nuclear magnetic dipole moment Electric quadrupole moment, Parity & symmetry, Mass defect and Binding energy, packing fraction, Classification of nuclei, Stability of nuclei (N Vs Z Curve) and problems. Radioactivity: Radioactivity disintegration (concept of natural and artificial radioactivity, Properties of α, β, γ-rays, Laws of radioactive decay, half-life, mean life, Specific activity and its units (Revision) Successive disintegration and equilibriums and radioisotopes. Radiocarbon dating Application of radioactivity (Agricultural, Medical, Industrial, Archaeological
Jan26	06	**Particle Accelerator and Radiation Detectors**	Particle Accelerators: Introduction and Classification Linear Accelerator (electron/proton LINAC) Cyclic Accelerator (Cyclotron) article Accelerators In India (Discussion only) Nuclear Detector: Classification of Nuclear Detectors Gas filled Detectors (G. M. counter) Solid state detectors (scintillation counter)
Feb26	09	**Nuclear forces and Nuclear Models**	Nuclear Forces: Classification of Nuclear Forces Meson

			theory of nuclear forces, Properties Of nuclear forces, properties of deuteron system, Elementary particles, Quarks model for elementary particles Shell Model: Assumptions, Evidences, and Spin and Parity limitations. Liquid drop model: Assumptions Semi-empirical B.E. formula
Feb 26 to Mar 26	09	**Nuclear Reactions and Reactor Theory**	Introduction to Nuclear reactions: Nuclear Reaction, Conservation laws (Revision) The Q-value equation, Exothermic and Endothermic reaction Compound nucleus, Threshold energy Nuclear cross-section Nuclear fission , nuclear fusion stellar energy, chain reaction and critical mass, Nuclear reactor and its basic components, homogeneous and heterogeneous reactors, power reactor, fast breeders Nuclear Reactors In India (Discussion only)

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PHYSICS DEPARTMENT

Teaching Plan

2025-26 (2nd term)

PHY-3611 SEC (AB): Instrumentation for Agriculture

Dr.V.B.Deshmukh

Month	period	Chapter	Topic taken
Jan26	2	**Introduction**	Necessity of instrumentation and control for agriculture, sensor requirement, remote sensing, bio sensors in agriculture
Jan 26	4	**Soil Properties & Sensing**	Properties of soil: fundamentals definitions and relationship, index properties of soil, permeability & seepage analysis, shear strength, Mohr's circle of stress, active & passive earth pressures, stability & slopes, Sensors: introduction to sonic anemometers, hygrometers, fine wire thermocouples, open & close path gas analyzers
Jan 26 to Feb 26	4	**Instrumentation in Continuous & Batch process**	Flow diagram of sugar plant, sensors & instrumentation setup, Flow diagram of fermenter & control (batch process), flow diagram of dairy industry & instrumentation setup for it, Juice extraction control process & instrumentation setup
Feb 26	4	**Instrumentation in Irrigation**	Water distribution and management control, Auto drip and sprinkler irrigation system, upstream & downstream control concept, SCADA for DAM parameters &contro
Feb 26 to Mar 26	4	**Greenhouse Parameters & Instrumentation**	Greenhouse effect, Concept and construction of greenhouse, merits & demerits, ventilation, cooling & heating, wind speed, temperature & humidity, soil moisture, rain gauge, carbon dioxide enrichment measurement & control, Leaf area length *evapotranspiration*, temperature, wetness & respiration measurement & data logging, electromagnetic radiations photosynthesis

Teaching Plan

2025-2026

DEPARTMENT OF PHYSICS

SEM VI

T.Y.B.Sc.

Name: Mr. Barne N.D. **PHY-365 (A): Electronics-II**

Months	Topic taken	Periods
Dec. 2025-Jan. 2026	**1: Semiconductor Devices:** a. LED and Photodiode, Optocoupler. (Working Principles) Problems. Ref. 1. b. BJT: Transistor amplifier classifications - Class A, B, C and AB (working only), Differential amplifier (transistorized), Problems. Ref. 1. c. Field Effect Transistor: JFET (Introduction, classification, principle, working and IV characteristics) MOSFETs (DE-MOSFET and E only MOSFET). Problems.	09
Jan. 2026	**Internal Exam**	
Feb. 2026-Feb. 2026	**2: Applications of Semiconductor Devices:** a. Three Pin Regulators: Block diagram of 3-pin IC regulator, study of IC-78XX, 79XX. Dual Power Supply using IC-78XX, 79XX. Ref. 1 b. Switching Regulators (SMPS): Introduction, Block diagram, Advantages and Disadvantages. Ref. 4 c. Modulation and Demodulation: Concept of Carrier Wave, Need of Modulation and Demodulation, Methods of Modulation like AM, FM, PM (Concepts Only), d. Concept of Modulation Index, Upper and Lower Side Band Frequencies in AM. Problems	09
Feb. 2026-Feb. 2026	**3: Integrated Circuits:** a. Integrated Circuits: Introduction, Scale of Integration, Advantages and drawbacks of IC Ref.4 b. OP-AMP Applications as Integrator, Differentiator, Comparator. Ref. 1 c. Timer IC-555: Block diagram, Astable, monostable multivibrator (working and design). Problems.	09

Jan. 2026	**INERNAL EXAM**	
Feb. 2026- March 2026	**4: Combinational and Sequential Circuits:** a. Combinational Circuits: Introduction to SOP and POS equation. Concept of Standard SOP and POS equation. Concept of K-map and their use in reduction of Boolean expressions, design of half adder, full adder, half subtract, Study of binary to gray and gray to binary code conversion. Problems. Ref. 2 b. Sequential Circuits: RS flip flop using NAND/NOR, clocked RS, D, JK and T-flip flops. Application of flip flops in Sequential Circuits as Counters and Registers. Asynchronous and Synchronous Counters. (3-bit Counter), Shift Registers and their types of operation -SISO, SIPO, PISO, PIPO (Concepts only).	09

Mr. Barne N. D.

Teaching Plan

2025-2026

DEPARTMENT OF PHYSICS

SEM VI

T.Y.B.Sc.

Name: Mr. Barne N.D. PHY-3610 SEC (Z): Calibration Techniques

Months	Topic taken	Periods
Dec. 2025- Jan. 2026	**Unit-1: Principles of Calibration** 1. Introduction and Importance of Calibration 2. Traceability in Calibration 3. Calibration Uncertainty 4. Various Calibration Methods 5. Factors Affect Calibration 6. Instrument Classification and Instrument Identification	04
Jan. 2026- Jan. 2026	**Unit-2: Pressure Calibration** 1. Introduction to pressure calibration 2. Pressure unit conversion standards 3. Types of Pressure Gauges 4. Calibration of Pressure Gauges a. Accuracy b. Pressure Media c. Contamination d. Height Difference e. Leak test of Piping f. Adiabatic Effect g. Torque Force h. Calibration Position i. Generating Pressure j. Pressurizing the Gauge k. Reading the Pressure Value l. Number of Calibration Points m. Hysteresis (deviation of calibration points) n. Number of Calibration cycles 5. Instruments required for calibration: a. Pressure comparator b. Master Gauge 6. Pressure Calibration with Example	06

Jan. 2026	**Internal Exam**	
Feb 2026 - Feb. 2026	**Unit-3: Calibration of Electronic Instruments** 1. Identification of Components 2. Equipment required for calibration 3. Procedure of Calibration a. Read operational Specifications b. Sequence of events c. Identification of common Faults 4. Electronic Calibration with Examples (Oscilloscopes, Multimeters, Function Generators, Signal Generators)	04
Jan. 2026	**INERNAL EXAM**	
Feb. 2026 - March 2026	**Unit-4: Temperature Calibration** 1. Temperature units and Conversions 2. Temperature Sensors 3. Calibration of temperature sensors a. Handling temperature sensor b. Preparations c. Temperature sources d. Reference Temperature Sensor e. Immersion Depth f. Stabilization g. Temperature sensor handle h. Calibrated temperature range i. Calibration Points j. Adjusting/trimming a temperature sensor 4. Examples:	04
March 2026 –March 2026	**Activity:** 1. RTD calibration check 2. Calibration of digital balance 3. Calibration of PH/Conductivity meter 4. Calibration of Volt meter 5. Calibration of Current meter **6.** Calibration of Oscilloscopes	18

Teaching Plan

2025-2026

DEPARTMENT OF PHYSICS

SEM VI

T.Y.B.Sc.

Name: Mr. Barne N.D. **PHY-361: Solid State Physics**

Months	**Topic taken**	**Periods**
Dec. 2025-Jan. 2026	**1: The Crystalline Structures** Lattice, Basis, Translational Vectors, Primitive Unit Cell, Symmetry Operations, Different types of lattices: 2D and 3D (Bravais lattices) Miller indices, Inter Planer Distances, SC, BCC and FCC structures, Packing Fraction, Crystal structures NaCl, diamond, CsCl, ZnS, HCP, Concept of Reciprocal Lattice and itsproperties, Problems	10
Jan. 2026 - Feb. 2026	**2: X ray Diffraction and Experimental Methods** Bragg's Diffraction, Bragg's Law, Experimental X-ray diffraction Methods: The Laue Method, Bragg's Spectrometer, The Powder Crystal Method, Analysis of cubic structure by Powder Method, Ewald's Construction, Bragg's Diffraction condition in direct and reciprocal lattice, Problems	09
Jan. 2026	**Internal Exam**	
March 2026-March 2026	**3: Free Electron and Band Theory of Metals** Assumptions of Classical and Somerfield Free Electron model, Energy levels and Density of States (Oneand Three Dimensions), Nearly free electron model, Fermi energy, Fermi level, Hall Effect, Mobility, HallAngle Band Theory of Solids: Origin of energy gap, Energy bands in Solids, Distinction between metal,semiconductor and insulator, Problems.	09
March 2026-March 2026	**4: Magnetism** Diamagnetism, Langevin theory of Diamagnetism, Paramagnetism, Langevin theory of Paramagnetism,Ferromagnetism, Antiferromagnetism, Ferromagnetic Domains, Hysteresis, Curie temperature, Neeltemperature, Superconductivity, Problems	08

Teaching Plan

2025-2026

DEPARTMENT OF PHYSICS

SEM VI

T.Y.B.Sc.

Name: Mr. Barne N.D. **PHY-363: Thermodynamics and Statistical Physics**

Months	**Topic taken**	**Periods**
Jan. 2026 - Jan. 2026	**Unit-1: Transport phenomenon and Maxwell's relations:** Mean free path, Transport phenomenon, Viscosity, Thermal conductivity and diffusion. Thermodynamic functions: Internal Energy, Enthalpy, Helmholtz function, Gibb's function, Derivation of Maxwell Relations, Specific heat and latent heat equations, Joule Thomson effect (ThrottlingProcess), Problems.	09
Jan. 2026 – Feb. 2026	**Unit-2: Elementary Concepts of Statistics:** Probability, distribution functions, Random Walk and Binomial distribution, Simple random walk problem,Calculation of mean values, Probability distribution for large-scale N, Gaussian probability distributions, Problems.	09
Jan. 2026	**Internal Exam**	
Feb. 2025 - March 2025	**Unit-3: Statistical Distribution of System of Particles and Ensembles:** Specification of state of system, Statistical ensembles, Basic Postulates, Probability calculations, Behaviorsof density of states, Thermal, Mechanical and general interactions Micro canonical Ensemble (Isolated System), Canonical ensembles, simple application of canonicalensemble, Molecules in Ideal gas, Calculation of mean values in canonical ensemble. Problems.	12
March 2026- March 2026	**Unit-4: Introduction to Quantum Statistics:** Quantum distribution function, Maxwell-Boltzmann's statistics, Bose-Einstein Statistics, Fermi-DiracStatistics, Comparison of the distributions. Problems.	06

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PHYSICS DEPARTMENT

Teaching Plan

2025-26 (2nd term)

TYBSC PH-342: Quantum Mechanics

Prof .V.R.Sonawane

MONTHS	TOPICS	LECTURE	
Jan-26	**Origin of Quantum Mechanics:(10L)** 1. Historical Background a) Review of Black body radiation, b) Review of photoelectric effects. 2. Matter waves - De Broglie hypothesis. Davisson and Germer experiment. 3. Wave particle duality 4. Wave function of a particle having definite momentum. 5. Concept of wave packet, phase velocity, group velocity and relation between them 6. Heisenberg's uncertainty principle with thought experiment. - Electron diffraction experiment, different forms of uncertainty.	**10L**	

Jan-26	**2. The Schrodinger equation: (15 L)** 1. Physical interpretation of wave function 2. Schrodinger time dependent equation. 3. Schrodinger time independent equation.(Steady state equation). 4. Requirements of wave function. 5. Probability current density, equation of continuity, and its physical significance. 6. Definition of an operator in Quantum mechanics. - Eigen function and Eigen values. 7. Expectation value – Ehrenfest's theorem	**15L**	
Feb-26	**3. Applications of Schrodinger Steady state equation: (12 L)** 1. Free particle. 2. Particle in infinitely deep potential well (one - dimension). 3. Particle in three dimension rigid box. 4. Step potential. 5. Potential barrier. (Qualitative discussion).Barrier penetration and tunneling effect. 6. Harmonic oscillator (one-dimension), correspondence principle	**12L**	
March-26	**4. Operators in Quantum Mechanics: (05 L)** 1. Hermitian operator. 2. Position, Momentum operator, angular momentum operator, and total energy operator (Hamiltonian). 3. Commutator brackets- Simultaneous Eigen functions. 4. Commutator algebra. 5. Commutator brackets using position, momentum and angular momentum operator. 6. Raising and lowering angular momentum operator. 7. Concept of parity, parity operator and its Eigen values.	**5L**	

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PHYSICS DEPARTMENT

Teaching Plan

2025-26 (2nd term)

T.Y.B.Sc PHY-346: Elective II

Prof .V.R.Sonawane

MONTH	TOPICS	LECTURE
Jan -26	**1. Introduction to Lasers:** *Ordinary light and Lasers, Brief history of Lasers, Interaction of radiation with matter, *Energy levels, Population density, Boltzmann distribution, Transition Lifetimes, Allowed and Forbidden Transitions, Stimulated Absorption, *Spontaneous Emission and Stimulated Emission, Einstein's Coefficients, Einstein's relations.	**(08 L)**
Feb - 26	**2. Laser Action:** *Condition for large stimulated emission, Population inversion Condition for light amplification, Gain coefficient Active medium, Metastable states Pumping schemes: three level and four level	**(06 L)**
Feb -26	**3. Laser Oscillator:** *Optical feedback, round trip gain, threshold gain, critical population inversion, Optical	**(07 L)**

	resonator, condition for steady state oscillations, cavity resonance frequencies	
March -26	**4. Laser Output:** *Lineshape broadening: - Lifetime broadening - Collision broadening - Doppler broadening	**(03L)**
March - 26	**5. Characteristics of Laser:** Directionality, Monochromatic Coherence Brightness	**(04 L)**
March	**6. Types of Lasers:** *Solid State Lasers – Ruby Laser, Diode Laser *Gas Lasers – He Ne Laser, CO2 Laser *Liquid Lasers: Tunable dye laser *Applications of Lasers *Industrial – welding, cutting, drilling Nuclear Science – laser isotope separation, laser fusion	**(12 L)**

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Teaching Plan

2025-26 (2nd term)

F.Y.B.Sc. PHY 151-T

Prof .V.R.Sonawane

MONTH	TOPIC	LECTURES
Jan-26	**1. Thermal Physics** 1.1 Concepts of Heat and Temperature 1.2 Zeroth Law of Thermodynamics 1.3 Thermodynamics Variables 1.4 Van der Waal's Equation of State 1.5 First Law of Thermodynamics and its differential form (Revision) 1.6 Application of the First Law of Thermodynamics 1.7 Second Law of Thermodynamics (Kelvins and Clausius' Statements) 1.8 Carnot's Cycle and its Efficiency 1.9 Concept of Entropy, Principle of Increase of Entropy. Entropy of Steam 1.10 Application of Second Law of thermodynamics 1.11 Third law of Thermodynamics 1.12 Application of Third Law of Thermodynamics 1.13 Numerical Problems	**8L**

Feb-26	**2. Electrostatics** 2.1 Concept of Electric Charge, Electrostatic Forces (Coulomb's law) 2.2 Electric Lines, Field and Its Physical Significance 2.3 Concept of Electric Flux 2.4 Gauss's Law in Electrostatics and Its Applications 2.5 Concept of Electric Potential 2.6 Concept of Electrostatic Energy 2.7 The Four Quantities for Point Charges 2.8 Relationship between Electric Field, Electric Force, Electric Potential, and Electric Potential Energy 2.9 Concept of Electric Dipole & Dipole moment 2.10 Torque on a Dipole Placed in an Electric Field 2.11 Concept of Dielectric & Polarization 2.12 Electric Vectors and Their Relations 2.13 Gauss Law in Dielectric 2.14 Concept of Capacitor, Capacitance and its applications 2.15 Numerical Problem	**8L**
March - 26	3. **Magnetostatics** 3.1 Magnetic Field Lines, Magnetic Force & Its Properties. 3.2 Biot-Savart's Law and Its Applications 3.3 Ampere's Circuital Law and Its Applications 3.4 Introduction to Magnetization 3.5 Types of Magnetic Materials 3.6 Numerical Problems	**7L**

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PHYSICS DEPARTMENT

Teaching Plan

2025-26 (2nd term)

S.YBSc PHY-252-MJ:PAPER-2

Prof .V.R.Sonawane

MONTH	TOPICS	LECTURE
Jan - 26	**1. Geometrical optics and Lens aberrations** **(a) Geometrical optics:** 1.1 Introduction to lenses and sign conventions. 1.2 Thin lenses: Lens equation for single convex lens 1.3 Lens maker equation 1.4 Concept of magnification, deviation and power of a thin lens 1.5 Equivalent focal length of two thin lens system 1.6 Concept of cardinal points 1.7 Problems **(b) Lens Aberrations:** 1.8 Introduction to Aberration 1.9 Types of aberration: Monochromatic and Chromatic Aberration (Only discussion)	**12L**
Feb26	**2. Optical Instruments** 2.1 Introduction to optical instruments 2.2 Types of optical instruments: Simple Microscope, Compound Microscope and Astronomical telescope (only construction and working) 2.3 Eyepiece: Ramsden's eye piece (Expression), Huygens eye piece and Gauss's eyepiece (only qualitative discussion) 2.4 Problems.	**6L**

March – 26	**3. Interference and Diffraction** (a) Interference: 3.1 Introduction to interference 3.2 Types of Interference (only discussion) 3.3 Phase change on reflection (Stokes treatment). 3.4 Interference due to reflected light 3.5 Interference due to transmitted light. 3.6 Newton's ring (to calculate wavelength)	**12L**