Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

BoS in Physics

SEMESTER PATTERN

(w.e.f. Academic Year 2014-15)

SYLLABUS FOR B.Sc.-II EXAMINATION

B.Sc.-II, PHYSICS

JUNE -2014

Rajarshi Shahu Mahavidyalaya Latur
(Autonomous)
Department of Physics (w.e.f. 2014-15)
Structure of B.Sc. II Physics Syllabi

Sr. No.	Course Code	Title	Credits	Periods /Week	Marks		
		Semester-III			In Sem	End Sem	Total
7	U-PHY-335	Optics and Lasers-V	2	3	20	30	50
8	U-PHY-336	Mathematical Physics and Transducers-VI	2	3	20	30	50
9	U-PHY-337	Physics Laboratory Course III	2	3		50	50
10	U-PHY-338	Physics Laboratory Course IV	2	3		50	50
		Semester-IV					
11	U-PHY-435	Nuclear Physics and Relativity-VII	2	3	20	30	50
12	U-PHY-436	Waves, Oscillations and Acoustics-VIII	2	3	20	30	50
13	U-PHY-437	Physics Laboratory Course V	2	3		50	50
14	U-PHY-438	Physics Laboratory Course VI	2	3		50	50
		Total	16				400

B.Sc. II Year, Semester-III
Course Code - U-PHY-335

Optics and Lasers-V

Credits: 2 **No. Of Periods/Wk: 3** **Periods: 45**

Marks: 50 –End Sem.: 30 & In Sem.: 20 (UT: 15 & AT: 05)

Learning Objectives:

(1) To develop understanding of the concept of the light waves phenomena: interference, diffraction and polarization,

(2) To inculcate the idea of interference and diffraction among the students,

(3) To have a comprehensive overview of Resolving and Dispersive power,

4) To develop understanding of the fundamental of LASERS and its properties.

Course Outcomes:

On successful completion of this course, students will be able to:

(1) Explain the phenomenon of Interference, Diffraction, and Polarization,

(2) Interpret wavelength, resolving power, dispersive power, and specific rotation,

(3) Calculate the properties of various lasers and the propagation of laser beams,

(4) Calculate the wavelength of unknown sources,

(5) Determine specific rotation of sugar like solution.

Unit I: Interference: **[11periods]**

Introduction, Interference Due to Reflected Light (Thin Film), Condition for Maxima and Minima, Newton's Rings: Condition for Bright and Dark Rings, Circular Fringes, Radii of Dark Circular Fringes, Spacing between Fringes, Fringes of Equal Thickness, Dark Central Spot, Determination of Wavelength of Light. Michelson Interferometer: Principle, Construction and Working, Circular Fringes, Localized Fringes Determination of Wavelength of Monochromatic Light, Determination of Difference in the Wavelength of Two Waves, Numerical Problems. **[Book 1, Ch.-15]**

Unit II: Diffraction: **[11Periods]**

Introduction, Fresnel and Fraunhofer Diffraction, Fraunhofer's Diffraction Due to Single And Double Slit, Plane Diffraction Grating: Theory, Width of Principal Maxima, Determination of Wavelength of Sodium Light using Transmission Grating, Rayleigh Criterion, Resolving Power of Transmission Grating, Dispersive Power of Grating, Resolving Power of Prism, Numerical Problems**. [Book1, Ch.18, 19]**

Unit III: Polarization: **[12 Periods]**

Introduction, Polarization by Reflection, Brewster's Law, Polarized Light, Polarization by Double Refraction , Nicolprism as Polarizer and Analyzer , Malus Law, Optic Axis, Principle Section, Huygens's Explanation of Double Refraction , Elliptically and Circularly Polarized Light, Quarter Wave Plate, Half Wave Plate, Optical Activity , Specific Rotation, Laurent's Half Shade Polarimeter, Numerical Problems. **[Book 1 And 2, Ch.20]**

Units IV: Lasers: **11 Periods]**

Introduction, Interaction of Light with Matter, Absorption, Spontaneous and Stimulated Emission, Einstein Relations, Population Inversion: Condition for Stimulated Emission, Optical and Electrical Pumping, Pumping Scheme : Three Level, Four Level ,Optical Resonators Cavity, Laser Action, Properties of Lasers, Ruby Laser, Helium-Neon Laser, Applications of Lasers (Qualitative Only). [**Book-1, Ch.22, Book-2, Ch.1, 5]**

Recommended Books:

[1] A Text Book of Optics – Brij lal and Subrahmanyam. (S. Chand & Co.)

[2] Introduction to Laser Theory and its Applications- M .N Avadhanulu (S. Chand Publication-2001)

Reference Books:

[3] B.Sc. Physics Volume-I- C.L. Arora (S. Chand)

[4] Lasers and Nonlinear Optics – B.B.Laud (Willey .Eastern Limited)

[5] Optics and Atomic Physics – D.P. Khandelwal. (Himalaya Publishing House)

[6] Optics (Second Edition) – A.K. Ghatak

[7] Geometrical & Physical Optics by D. S. Mathur.

B.Sc. II Year, Semester-III

Course Code: U-PHY-336

Mathematical Physics and Transducers-VI

Credits: 2 No. of Periods/Wk: 3 Total Periods: 45

Marks: 50 –End Sem.: 30 & In Sem.: 20 (UT: 15 & AT: 05)

Learning Objectives:

(1) Introduce students to use mathematical methods to solve physics problems.

(2) Provide students with basic skills of the application of mathematical methods in physics.

(3) To make students familiar with the most important special operators of mathematical physics, including Gradient, Divergence and Curl.

(4) To gain knowledge about the measuring instruments and the methods of measurement and the use of different transducers.

Course Outcomes:

After successful completion of the course the student will be able to:

(1) Calculate with vectors and scalars in physics,

(2) Determine the difference between Complex numbers and Real number,

(3) Learn geometrical representation of complex numbers,

(4) Find Fourier Series of periodic function,

(5) Use Laplace transform as tools of Physics,

(6) Differentiate between the types of transducers available.

Unit I: Vector Analysis: [12 Periods]

Introduction, Scalar Triple Product, Vector Triple Product, Scalar and Vector Field , Gradient of a Scalar Field , Divergence of a Vector Field , Curl of a Vector Field and Their Physical Interpretation , Laplacian Operator (∇^2), Line Integral, Surface Integral, Volume Integral, Gauss's Divergence Theorem, Stoke's Theorem, Green's Theorem, (Statements Only), Proof of Vector Identities.

1) $\nabla \times \nabla\phi = 0$

2) $\nabla \cdot (\nabla \times A) = 0$

3) $\nabla \cdot (\phi A) = \phi(\nabla \cdot A) + A \cdot (\nabla\phi)$

4) $\nabla \times (\phi A) = \phi(\nabla \times A) + (\nabla\phi) \times A$

5) $\nabla \cdot (\nabla\phi) = \nabla^2\phi$

6) $\nabla \cdot (A \times B) = B \cdot (\nabla \times A) - A \cdot (\nabla \times B)$

Numerical Problems. **[Book-1, Ch.1]**

Unit II: Complex Variables: **[10 Periods]**

Introduction, Definition of Complex Number, Complex Algebra (Addition, Subtraction, Multiplication, Division), Conjugate Complex Number, Argand Diagram, Geometrical Representation of Sum, Difference, Product and Quotient of Complex Numbers, Properties of Moduli, Arguments and Geometry of Complex Numbers, Rectangular, Polar and Exponential form of Complex Numbers, De-Movie's Theorem, Extraction of Roots, Numerical Problems. **[Book-1, Ch.4, Book-2, Ch.5]**

Unit III: Fourier Series and Laplace Transform: **[13 Periods]**

Introduction, Definition, Evaluation of the Coefficients of Fourier Series, Cosine Series, Sine Series, Dirichlet's Conditions, Graphical Representations of Even and Odd Functions, Physical Applications of Fourier Series Analysis: Square Wave, Full and Half Wave Rectifiers, Laplace Transform: Conditions for Existence of Laplace Transform, Laplace inverse transformation, Some Simple Properties of Laplace Transform, and Numerical Problems. **[Book-1, Chap-7, Ch.15]**

Unit-IV: Transducers: **[10 Periods]**

Introduction, Definition, Classification of Transducers, Resistive Pressure Transducer, Inductive Pressure Transducer, Capacitive Pressure Transducer, Linear Variable Differential Transformer (LVDT), Strain Gauge, Moving Coil Microphone and Carbon Microphone, Loudspeaker. **[Book-3, Ch.36]**

Recommended Books:

[1] Mathematical Physics - B.S. Rajput and Yog Prakash.

[2] Mathematical Physics- B.D. Gupta (Vikas Publishing House)

[3] Basic Electronics- B.L. Thereja (Solid State- Multicolor Edition)

Reference Books:

[4] Vector Analysis- Murray R. Spigel.

[5] Mathematical Physics - B.S. Rajput and Yog Prakash

[6] Methods of Mathematical Physics by Laud Talbout and Gambhir

[7] Mathematical Methods in Physical Sciences- Masy and Bias.

[8] Advanced Engineering Mathematics- H.K. Das.

B.Sc. II Year, Semester-III
Course Code: U-PHY-337
Physics Laboratory Course-III
Credits: 2 No. Of Periods/Wk: 3
Marks: 50 –End Sem.: 30 & In Sem.: 20

Learning Objectives:

To perform the Various Experiments Based on Properties of Matter and Spectroscopy.

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Determine moment of Inertia of a flywheel and metallic rod using Bifilar suspension,

(2) Determine resolving power and refractive index of prism,

(3) Make adjustments for Newton's ring on lens and determine the wavelength of Sodium source.

List of Experiments:

1. Moment of Inertia of a Flywheel,
2. Moment of Inertia by bifilar Suspension,
3. Y by Cantilever (Oscillation Method),
4. η by Torsional Pendulum,
5. Coefficient of Viscosity by Searle's Viscometer,
6. Surface Tension by Fergusson Method,
7. Determination of R.I. by i-d Curve Using Spectrometer,
8. Determination of Wavelength of Sodium Light by Newton's Ring,
9. Resolving Power of Prism.

* **Note:** Minimum six experiments should be performed, by each student.

B.Sc. II Year, Semester-III
Course Code: U-PHY-338
Physics Laboratory Course-IV
Credits: 2 No. Of Periods/Wk: 3
Marks: 50 –End Sem.: 30 & In Sem.: 20

Learning Objectives:

(1) Develop the understanding of the various Electronics, Electrical and Nuclear Physics Experiments.

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Compare capacities of given two condensers by Method of Mixture using Spot Galvanometer,

(2) Determine maximum velocity of electron using Photocell,

(3) Draw the characteristics of LED-LDR, Photodiode, BJT transistor,

(4) find the value of high Resistances by Leakage of a Condenser (Using B.G.),

(5) Estimate the Self Inductance by Maxwell's Bridge,

(6) Determine Operating Voltage of G. M. tube.

List of Experiments:

1. C_1/C_2 by Method of Mixture (Using Spot Galvanometer).
2. Maximum Velocity of Electron Using Photocell.
3. LED-LDR Characteristics.
4. Photo Diode Characteristics.
5. BJT Transistor Characteristics (C-B Mode).
6. High Resistances by Leakage of a Condenser (Using B.G.).
7. Self-Inductance by Maxwell's Bridge.
8. Determination of Operating Voltage of G. M. tube.

* **Note:** Minimum six experiments should be performed, by each student.

B.Sc. II Year, Semester-IV

Course code: U-PHY-435

Nuclear Physics and Relativity-VII

Credits: 2 No. Of Periods/Wk: 3 Periods: 45

Marks: 50 –End Sem.: 30 & In Sem.: 20 (UT: 15 & AT: 05)

Learning Objectives:

(1) Develop understanding of the basic nuclear structure,

(2) Inculcate idea of forces that hold the nucleus together and under what circumstances it might break apart,

(3) Develop understanding of the concept of nuclear binding energy and binding energy for different nuclei,

(4) Introduce different types of Radioactive decays and information about computation of the daughter nuclei for these decays,

(5) To develop knowledge of fission and fusion basics,

(6) To develop knowledge of special theory of relativity.

Course Outcomes:

By the end of the course students will be able to:

(1) Demonstrate knowledge and broad understanding of Nuclear Physics,

(2) Demonstrate knowledge of fundamental aspects of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter,

(3) Discuss fission and fusion process,

(4) Understand of the basic principles of the special theory of relativity.

Unit I: Nuclear Structure And General Properties: [10 Periods]

Introduction, Nuclear Mass And Binding Energy, Importance of Accurate Determination of Atomic Masses, Systematic of Nuclear Binding Energy, Nuclear Size, Measurement of the Charge Radius: Electron Scattering Experiment, Measurement of Potential Radius, Nuclear Spin, Parity of Nuclei, Numerical Problems. **[Book-1, Ch.2]**

Unit II: Nuclear Fission and Fusion: [12 Periods]

Introduction, The Discovery of Nuclear Fission, Fission Cross Section and Thresholds, The Fission Products, The Mass and Energy Distribution of Fission Products, Energy Released in Fission The Neutron Emission in Fission, The Energy Distribution of Neutron Emitted in

Fission, The Energy Release in Fission, The Theory of Fission Process, Nuclear Fusion and Thermonuclear Reactions, Numerical Problems. **[Book-2, Ch.19; Book-1, Ch.14]**

Unit III: Radioactivity: [12 Periods]

Introduction, Discovery of Radioactivity, Radioactive Disintegration and Displacement Law, Growth and Decay of Radioactivity , Successive Disintegration , Radioactive Equilibrium, Discovery of Radium , Radon Gas, Unit of Radioactivity, Mean Life Time of a Radioactive Substance , Measurement of Decay Constant , Half Lives for Complex Decay, Age of Minerals and Rocks, Numerical Problems..**[Book-1, Ch.3]**

Unit IV: Special Theory of Relativity: [11 Periods]

Introduction, Frame of Reference, Postulates of Special Theory of Relativity, Galilean Transformation Equations, Lorentz Transformation Equations, Length Contraction, Time Dilation, Velocity Addition, Relativity of Mass, Mass-Energy Relation, Numerical Problems. [**Book-3, Ch.1]**

Recommended Books:

[1] Nuclear Physics- S.N. Ghoshal (S. Chand and Company, Ltd)

[2] Nuclear Physics –Irving Kaplan (Narosa Publishing House, New Delhi)

[3] Modern Physics- R. Murugeshan (S. Chand and Company Ltd, XI Edition)

Reference Books:

[4] Nuclear Physics-D. C. Tayal (Himalaya Publishing House)

[5] Perspective of Modern Physics- Arthur Beiser

[6] Atomic Physics- J.B. Rajam, (S. Chand and Company Ltd)

[7] Nuclear Physics – An Introduction–Patel S.B.

[8] Nuclear Physics- S.P. Sahu

[9] Atomic and Nuclear physics - V.W. Kulkarni.

B.Sc. II Year, Semester-IV

Course: U-PHY-436

Waves, Oscillations and Acoustics-VIII

Credits: 2 No. Of Periods/Wk: 3 Periods: 45

Marks: 50 –End Sem.: 30 & In Sem.: 20 (UT: 15 & AT: 15)

Learning Objectives:

(1) To acquaint students with the fundamentals of vibrations and acoustics,

(2) Improve students' knowledge of physics related to the fields of acoustics and oscillations,

(3) To develop understanding among the students about sound waves.

Course Outcomes:

At the end of the course students will be able to:

(1) Assess fluctuations and acoustic processes in nature and technology in various forms,

(2) Analyze the mechanism and the machinery noise levels,

(3) Distinguish between different sounds and noise levels in the environment.

Unit I: Free, Forced and Resonant Vibrations: [09 Periods]

Introduction, Free Vibrations, Undamped Vibration, Damped Vibrations, Forced Vibrations, Resonance and Sharpness of Resonance, Phase of Resonance, Quality Factor, Examples of Forced and Resonant Vibrations, Numerical Problems. **[Book-1, Ch.-4]**

Unit II: Wave Motion: [14 Periods]

Introduction of Wave Motion, Types of Wave Motion, Characteristics of Wave Motion, Definitions: Wavelength, Amplitude, Time Period, Vibration Phase and Frequency, Relational Between Frequency and Wavelength, Properties of Longitudinal Progressive Waves, Differential Equation of Wave Motion , Particle Velocity and Wave Velocity, Energy of Plane Progressive Wave, Equation of Motion of Vibrating String (Transverse Vibration of String), Velocity of Transverse Waves Along a String, Frequency and Period of Vibration of String, Numerical Problems. **[Book-1, Ch.4, 7, Book-2, Ch.3, 4]**

Unit III: Stationary Waves: **[10 Periods]**

Introduction, Stationary Waves, Properties of Stationary Longitudinal Waves, Analytical Treatment of Stationary Wave:

Case-I: Closed End Organ Pipe or String Fixed at the Other End.

Case-II: Open End Organ Pipe or String Free at the Other End.

Energy of Stationary Waves, Numerical Problems. **[Book-1, Ch. 6, Book-2, Ch.7]**

Unit IV: Acoustics And Ultrasonics: **[12 Periods]**

Acoustics:

Introduction, Noises and Musical Sounds, Characteristics of Musical Sound, Intensity of Sound, Measurement of Intensity of Sound-Decibel Bel And Phone, Doppler's Effect: I) Observer at Rest, Source in Motion, Ii) Source at Rest and Observer in Motion, Iii) When both in Motion. **[Book-1, Ch.7, 8; Book-2, Ch.11]**

Ultrasonics:

Piezo-Electric Effect, Piezo-Electric Generator for Ultrasonic Waves, Applications of Ultrasonic Waves, Magnetostrection Effect and Magnetostrection Oscillator, Numerical Problems. **[Book-2, Ch.22]**

Recommended Books:-

[1] Waves and Oscillations- N. Subrahmanyam and Brij Lal. (Vikas Publishing House PVT. LTD)

[2] A Text Book of Sound- D.R. Khanna and R.S. Bedi. (Atma Ram and Sons Delhi)

Reference Books:

[3] A Textbook of Oscillations, Waves and Acoustics- M. Ghosh and D. Bhattacharya (S. Chand and Company LTD.)

[4] A Textbook of Sound – R.L. Saihgal (S. Chand and Company LTD.)

B.Sc. II Year, Semester-IV
Course Code: U-PHY-437
Physics Laboratory Course-V
Credits: 2 No. Of Periods/Wk: 3
Marks: 50 –End Sem.: 30 & In Sem.: 20

Learning Objectives:

The objectives of present Laboratory Course are to perform the various experiments based on Mechanics, Light, Heat, Sound Waves and Lasers.

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Determine Elastic properties (Y and η) of material by Searle's Method,

(2) Determine Thermal Conductivity of rubber tube, Resolving Power of grating, Resolving power of Telescope,

(3) Determine speed of Sound by Helmholtz Resonator,

(4) Determine wavelength of LASER by Diffraction Grating.

List of Experiments:

1. Y And η by Searle's Method.
2. Diffraction Grating: Normal Incidence.
3. Resolving Power of Telescope.
4. Resolving Power of Grating.
5. Thermal Conductivity by Searle's Method.
6. Speed of Sound by Helmholtz Resonator.
7. Poisson's Ratio of Rubber.
8. Wavelength of LASER by Diffraction Grating.

* **Note:** Minimum six experiments should be performed, by each student.

B.Sc. II Year, Semester-IV
Course Code: U-PHY-438
Physics Laboratory Course-VI
Credits: 2 No. of Periods/Wk: 3
Marks: 50 – End Sem.: 30 & In Sem.: 20

Learning Objectives:

To perform the Basic Experiments of Electronics, Electricity and Solar Energy.

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Draw the characteristics of Phototransistor, Series Resonance in LCR circuit,

(2) Explain of Line and Load Regulation of Zener diode,

(3) Find Current and Voltage Sensitivity of Moving Coil B.G.

(4) Determine h/e using Photo Cell, Planks constant using Solar Cell, Self Inductance by Andersons Bridge.

(5) Explain the working and use of C.R.O.

List of Experiments:

1. Characteristics of Photo Transistor.
2. Series Resonance in LCR Circuit.
3. Zener Shunt Regulator (Line and Load Regulation).
4. Current and Voltage Sensitivity of Moving Coil B.G.
5. h/e by Photo Cell.
6. Planks Constant Using Solar Cell.
7. Self-Inductance by Andersons Bridge.
8. Study of C.R.O.

* **Note:** Minimum six experiments should be performed, by each student.