M.C.E. Society's

Abeda Inamdar Senior College of Arts, Science & Commerce, Pune

(Autonomous)

Department of Physics

Syllabus

as per

National Education Policy-2020

NEP: 2.0(2026 pattern)

For

F.Y.B.Sc.

To be implemented from Academic Year:
(2026-2027)

(Under the faculty of Science and Technology)

Structure of Courses: Physics as Minor

As per NEP: 2.0 (2026 Pattern)
Credit Distribution and Title of the Courses

Semester	MinorTheory	MinorPractical	VSC(P)	SEC(P)
I	Mechanics & Properties of Matter (26SBPH11MN) (2 credits)	Physics Practical- I (26SBPH12MN) (2 credits)	----------	Measurement Skills (26SBPH11SE) (2 credits)
II	Electricity & Magnetism (26SBPH21MN) (2 credits)	Physics Practical- II (26SBPH22MN) (2 credits)	Experimental Techniques (26SBPH21VS) (2 credits)	-------
III	Thermal Physics (26SBPH31MN) (2 credits)	Physics Practical- III (26SBPH32MN) (2 credits)	Physical Data Analysis (26SBPH31VS) (2 credits)	-------
IV	Electronics (26SBPH41MN) (2 credits) Optics (26SBPH42MN) (2 credits)	Physics Practical- IV (26SBPH43MN) (2 credits)	----------	----------
V	Basic Mathematical Physics (26SBPH51MN) (2 credits)	------	----------	Optical Skills (26SBPH51SE) (2 credits)
VI	------	-------	Introduction to Fiber Optics & Laser(26SBPH61VS) (2 credits)	Logic Circuits (26SBPH61SE) (2 credits)

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Physics Syllabus as per NEP-2.0 (2026Pattern)

Course/ Paper Title	**Mechanics and Properties of Matter**
Course offered as	**Minor**
Course Code	**26SBPH11MN**
Semester	**I**
No. of Credits	**2**
No. of Hours	**30**

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To understand the basic terms like displacement, velocity, acceleration etc. which are associated with motion.
2.	To demonstrate an understanding of Newton's laws and applying them in calculations of the motion of simple systems
3.	To Understand the concept of energy, work, power and conservation of energy and perform calculations.
4.	To understand the concept of viscosity and Bernoulli's theorem and its real-life applications
5.	To understand the concept of surface tension and elasticity and its applications

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome

1.	Students will understand the basic terms like displacement, velocity, acceleration etc. associated with motion.
2.	Students will apply Newton's laws in calculations of the motion of simple systems
3.	Students will understand the concept of energy, work, power and conservation of energy and perform calculations.
4.	Students will understand the concept of viscosity and Bernoulli's theorem and its real-life applications
5.	Students will understand the concept of surface tension and elasticity and its applications
6.	Students will acquire quantitative problem-solving skills in all the topics covered.

Syllabus

Sr. No.	Title with Contents	No. of Lectures
Unit I	**Motion:**	**7**
	1. Introduction to motion	2
	i. Types of motion	
	ii. Displacement	
	iii. Velocity	
	iv. Acceleration	
	v. Inertia	
	2. Newton's laws of motion with their explanations	3
	i. Various types of forces in nature	
	ii. Frames of reference (Inertial and Non inertial)	
	iii. Laws of motion and its real-life applications	
	iv. 3. Problems	2
Unit II	**Work and Energy**	**7**

	1. Kinetic energy i. Work Energy Theorem ii. Work done with constant force iii. Work done with varying force (spring force) **2. Conservative and non-conservative forces** i. Potential energy ii. Law of energy conservation iii. Gravitational potential energy **3. Problems**	2 3 2
Unit III	**Fluid Mechanics**	**6**
	1. Concept of viscous force and viscosity i. Coefficient of viscosity ii. Steady and Turbulent flow iii. Reynolds number **2. Bernoulli's Theorem** i. Equation of continuity ii. Bernoulli's Principle iii. Application of Bernoulli's Principle: Venturi meter, Pitot tube iv. Applications of viscous fluids **3. Problems**	2 2 2
Unit IV	**Surface Tension and Elasticity**	**10**
	1. Surface tension i. Angle of contact ii. Factors affecting surface tension **2. Jaeger's method for determination of surface tension** i. Applications of surface tension **3. Concept of elasticity** i. Stress and Strain ii. Young's modulus iii. Bulk modulus iv. Modulus of rigidity	1 1 2

	v. Hooke's law **4. Work done during longitudinal strain** i. Volume strain ii. Shearing strain iii. Poisson's ratio **5. Relation between three elastic moduli, (Y, η, K)** i. Applications of elasticity **6. Problems**	2 2 2

References:

1. Resnick, Halliday& Walker, Physics Wiley.
2. Sears and Zemanski, University Physics, Pearson Education.
3. D. S. Mathur, Mechanics, S. Chand and Company, NewDelhi.
4. D. S. Mathur, Elements of Properties of Matter, S. Chand, NewDelhi.
5. H. C. Verma, Concepts of Physics, BharatiBhavan Publisher.
6. P. K. Srivastava , Problems in Physics , Wiley Eastern Ltd.
7. Mott Robert Applied Fluid Mechanics, Pearson Education/Prentice Hall International, New Delhi.
8. J C Upadhyaya, Fundamentals of Mechanics, Himalaya Publishing House.
9. D. S. Mathur, Revised by P. S. Hemne, Mechanics, S. Chand and Company, NewDelhi.
10. D H Bergey; John G Holt, Bergey's manual of determinative Bacteriology, 9th Edition. , Baltimore: Williams & Wilkins, 1994.

Course Outcomes (COs)

After successful completion of the course, the learner will be able to:

CO1 (Motion & Laws of Motion)

- Understand and explain different types of motion and related physical quantities such as displacement, velocity, acceleration, and inertia.

- Apply **Newton's laws of motion** to analyze real-life situations and solve numerical problems using appropriate frames of reference.

CO2 (Work and Energy)

- Define and compute **work, kinetic energy, and potential energy** for different physical systems.
- Apply the **Work–Energy Theorem** and **law of conservation of energy** to solve problems involving conservative and non-conservative forces.

CO3 (Fluid Mechanics)

- Explain the concepts of **viscosity, flow types, and Reynolds number**.
- Apply **Bernoulli's theorem** and **equation of continuity** to practical applications such as Venturi meter, Pitot tube, and fluid flow systems.

CO4 (Surface Tension)

- Describe surface tension, angle of contact, and factors affecting surface tension.
- Explain and analyze **Jaeger's method** for determination of surface tension and its applications in daily life and technology.

CO5 (Elasticity)

- Understand stress, strain, and different elastic moduli (Young's, Bulk, Rigidity).
- Analyze elastic behavior of materials using **Hooke's law**, **Poisson's ratio**, and relations among elastic constants.

CO6 (Problem-solving Skills)

- Solve numerical problems related to **motion, energy, fluids, surface tension, and elasticity** using proper physical laws, mathematical reasoning, and units.

Program Outcomes (POs)

On completion of the program, students will be able to:

PO1: Scientific Knowledge

- Apply fundamental concepts and principles of physics to understand natural phenomena and mechanical systems.

PO2: Problem Analysis

- Identify, formulate, and solve physics problems using appropriate laws, equations, and assumptions.

PO3: Analytical and Critical Thinking

- Analyze physical situations critically and interpret experimental and theoretical results logically.

PO4: Practical and Experimental Skills

- Understand experimental methods related to mechanics, fluids, and material properties, and relate theory to practical observations.

PO5: Mathematical and Computational Skills

- Use mathematical tools and graphical methods to model physical problems and interpret solutions.

PO6: Application to Real-Life Situations

- Apply physics concepts to real-world problems in engineering, technology, and everyday life.

PO7: Lifelong Learning

- Develop curiosity and self-learning ability for advanced studies in physics and allied disciplines.

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Course Offered as	**Minor**
Course/ Paper Title	**Physics Practical - I**
Course Code	**26SBPH12MN**
Semester	**I**
No. of Credits	**2**
No of Hours	**60**

Sr. No.	Course Objectives
1	To understand the fundamentals of mechanics and its physical significance.
2	To understand the concept of properties of matter and their measurements.
3	To understand the use of instruments for measuring fundamental quantities.
4	To apply the techniques for proper applications in day to day life.

Sr. No.	Learning Outcomes
1.	To acquire skills of measuring fundamental quantities of simple objects.
2.	To find the most accurate values of quantities.
3.	To understand the importance of errors.
4.	To acquire skills of handling instrument.

Sr. No.	Section I
1.	Verification of Hooke's law.

2.	Determination of center of gravity of an irregular lamina
3.	Determination of Poisson's ratio of given material.
4.	Determination of terminal velocity and coefficient of viscosity using Stokes method.
5.	Determination of Viscosity by Poiseullie's method.
6.	Determination of Surface Tension by Jaeger's method.
7.	Determination of acceleration due to gravity by using bar pendulum.
8.	Determination of Young's Modulus 'Y' by uniform bending method
9.	Determination of Surface Tension of mercury by Quincke's method.
10.	Determination of Surface Tension of mercury by method of ripples.
11.	Determination of Young's Modulus 'Y' of Flat Spiral Spring
12.	Determination of Modulus of Rigidity 'η' of Flat Spiral Spring
13.	Determination of modulus of Rigidity 'η' by torsional oscillations.
14.	Determination of coefficient of friction using inclined plane method..
15.	Study of damping in oscillatory motion and calculation of damping constant.
16.	Study of coupled oscillations.

Sr. No.	**Section II**
1.	Mini project with report and completion certificate.
2.	Industrial visit/Field visit /study tour with report.
3.	Use of computer for plotting graphs of any three experiments using Ms-Excel.
4.	Any two computer aided demonstration of Mechanics and properties of matter.

Note: The student is expected to perform at least 12 experiments from section I and three activities from section II

Course Outcomes (COs) – Practical Course

CO No.	Course Outcome
CO1	Perform experiments related to elasticity, viscosity, surface tension, oscillations, and friction by following standard laboratory procedures safely and accurately.
CO2	Verify fundamental physical laws such as Hooke's law and determine elastic constants like Young's modulus, modulus of rigidity, and Poisson's ratio of materials.
CO3	Determine physical parameters such as coefficient of viscosity, surface tension, acceleration due to gravity, terminal velocity, and coefficient of friction using appropriate experimental methods.
CO4	Analyze oscillatory systems including damping, torsional oscillations, and coupled oscillations, and calculate relevant physical constants.
CO5	Record observations systematically, plot graphs, analyze errors, and interpret experimental data using manual and computer-based tools such as MS-Excel.
CO6	Prepare structured laboratory reports, mini-project reports, and field/industrial visit reports demonstrating scientific writing and documentation skills.
CO7	Relate experimental results to theoretical concepts of mechanics and properties of matter and explain their real-life and industrial applications.

Program Outcomes (POs)

PO No.	Program Outcome
PO1	Apply fundamental principles of physics to perform and analyze experiments in mechanics and properties of matter.
PO2	Conduct experiments systematically, take accurate measurements, and analyze data to obtain reliable results.
PO3	Use mathematical and graphical techniques, including computer tools, for data representation and interpretation.
PO4	Demonstrate experimental skills, safe laboratory practices, and proper handling of instruments and apparatus.
PO5	Communicate experimental findings effectively through laboratory records, project reports, and presentations.
PO6	Relate experimental physics to real-world applications through industrial visits, field studies, and demonstrations.
PO7	Develop teamwork, observational skills, and an attitude of inquiry supporting lifelong learning in science.

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Course Offered as	**Skill Enhancement Course (SEC)**
Course/ Paper Title	**Measurement Skills**
Course Code	**26SBPH11SE**
Semester	I
No. of Credits	2
No of Hours	60

Aims & Objectives of the Course:

Sr. No.	Objectives
1	To get hands on training of measuring instruments
2	To understand concept of errors and least count.
3	To understand the use of basic instruments for measuring fundamental quantities.
4	To apply the techniques for basic measurements in experiments

Expected Course Specific Learning Outcome:

Sr. No.	Learning Outcome
1.	To acquire skills of measuring fundamental quantities of simple objects
2.	To find the most accurate values of quantities
3.	To understand the importance of errors.

List of Practicals (Minimum 15 Practicals to be conducted)	
1.	Importance of Measurement: Concept of Precision, Accuracy, Least count, Range

2.	Errors in Measurement: Classification and Estimation
3.	Dimensional Measurement Using Vernier Calliper
4.	Fine Scale Measurement Using Micrometer Screw Gauge
5.	LinearMeasurement with Travelling Microscope
6.	Mass Determination Using Physical and Electronic Balance
7.	Measurement of Fundamental Quantities
8.	Measurement of Temperature Using Thermometric Devises
9.	Measurement of Periodic Time and Estimation of Frequency
10.	Techniques for Measurement of Long Distance
11.	Determination of Density of Different Materials
12.	Pressure Measurement using Manometer
13.	Sound Measurement Using Sound Pressure Level Meter
14.	Electrical Measurements Using Multimeter
15.	Measurement of AC voltage, current.
16.	Measurement of DC voltage, current.
17.	Measurement of Humidity Using Hygrometer
18.	Optical Measurements Using Spectrometer
19.	Demonstration of Weather Monitoring Devices
20.	Study of Traditional and Ancient Measurement Tools

References and Reference Books:

https://instrumentationtools.com/accuracy-resolution-range/

https://ncert.nic.in/textbook/pdf/kegy308.pdf

https://ncert.nic.in/ncerts/l/keph102.pdf

https://www.niser.ac.in/sps/sites/default/files/basic_page/support%20manual%20for%20spectrometer.pdf

https://en.wikipedia.org/wiki/List_of_human-based_units_of_measurement

https://www.sciencelearn.org.nz/resources/1855-measurement-systems

1. Physical Methods, Instruments And Measurements - Measurements Of Electrical Quantities - JánŠalig G. L. Squires Practical Physics, Third edition, Cambridge editions
2. Practical Physics for Engineers, V. Rajendran,, A. Marikani, J. Poongodi, Second Edition, Tata McGraw-Hill Publishing Company.

Course Outcomes (COs) – Measurement & Instrumentation Practicals

CO No.	Course Outcome
CO1	Explain the importance of measurement and demonstrate understanding of precision, accuracy, least count, range, and errors in physical measurements.
CO2	Identify different types of errors in measurement and estimate them using appropriate statistical and graphical methods.
CO3	Perform linear and dimensional measurements using Vernier caliper, micrometer screw gauge, and travelling microscope accurately.
CO4	Measure mass, density, pressure, temperature, humidity, and sound levels using appropriate physical and electronic measuring instruments.
CO5	Measure electrical quantities such as AC and DC voltage and current using multimeter and suitable electrical measuring techniques.
CO6	Measure time, frequency, long distances, and fundamental physical quantities using standard laboratory and field measurement techniques.
CO7	Carry out optical measurements using spectrometer and interpret results related to wavelength and angular measurements.
CO8	Demonstrate awareness of modern, traditional, and ancient measurement tools and explain their relevance in weather monitoring and scientific development.

Program Outcomes (POs)

PO No.	Program Outcome
PO1	Apply fundamental principles of physics and measurement science in laboratory and field experiments.
PO2	Select and use appropriate instruments for accurate measurement of physical quantities.
PO3	Analyze experimental data by estimating errors and uncertainties to ensure reliability of results.
PO4	Use modern electronic instruments and digital tools safely and effectively for measurements.
PO5	Present experimental observations and results clearly through tables, graphs, and reports.
PO6	Relate measurement techniques to real-life, industrial, and environmental applications.
PO7	Develop scientific attitude, observational skills, and appreciation of the evolution of measurement systems supporting lifelong learning.