

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's  
New Arts, Commerce, and Science College, Ahmednagar  
(Autonomous)  
(Affiliated to Savitribai Phule Pune University, Pune)**



**National Education Policy (NEP)  
Choice Based Credit System (CBCS)**

**Programme Skeleton and Syllabus of  
Physics (Minor)**

**Implemented from  
Academic Year 2023-24**

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

## **New Arts, Commerce and Science College, Ahmednagar (Autonomous)**

### **Board of Studies in Physics**

Sr. No.	Name	Designation
1.	Prof. (Dr.) Avinash V. Mancharkar	Chairman
2.	Dr. Ashok A. Jadhavar	Member
3.	Dr. Anand A. Surse	Member
4.	Mr. Pankaj P. Bhosale	Member
5.	Miss. Rupin H. Ranu	Member
6.	Mr. Dipak A. Magar	Member
7.	Miss. Vaishali B. Sawane	Member
8.	Miss. Asmita A. Shirsat	Member
9.	Mr. Vishal V. Kapase	Member
10.	Miss. Ashwini S. Jagdale	Member
11.	Miss. Bhagitra D. Chede	Member
12.	Miss. Mayuri A. Late	Member
13.	Dr. Appasaheb Torane	Academic Council Nominee
14.	Dr. Vijay M. Mayekar	Academic Council Nominee
15.	Prof. (Dr.) Arun G. Banpurkar	Vice-Chancellor Nominee
16.	Prof. (Dr.) Nandu B. Chaure	Alumni
17.	Dr. Vinay Hasabnis	Industry Expert
18.	Dr. Shrikrushna B. Gaikwad	Member (Co-opt)
19.	Mr. Dattatray K. Sonwane	Member (Co-opt)
20.	Mr. Dipak S. Shelar	Member (Co-opt)

## **1. Prologue/ Introduction of the programme:**

B.Sc. Physics (Minor) programme is designed and formulated as the undergraduate programme in physics is intended to provide a basic knowledge about the various concepts of the Physics helps students to create brain which can imagine, understand the observed natural phenomenon as well as predicting the future applications in Physics.

B.Sc. (Minor) Physics Program give a systematic, extensive and coherent knowledge and understanding of the basic concepts in Physics with its applications, and links to related disciplinary areas/subjects. This course motivate students for a critical understanding of the established theories, principles and concepts, and of a number of advanced and emerging issues in the field of Physics.

This course is designed such a way that students gain procedural knowledge that creates different types of professionals related to the subject area of Physics, including research and development, teaching and government and public service.

With completion of this course students gain skills in areas related to everyone day-to-day life and current developments in the academic field of Physics. This course includes a critical understanding of the latest developments in the Physics, and an ability to use established techniques of analysis and enquiry within the field of Physics.

This course demonstrate comprehensive knowledge about materials, including current research, scholarly, and/or professional literature, relating to essential and advanced learning areas pertaining to various subfields in Physics, and techniques and skills required for identifying Physics problems and issues in their area of specialization in Physics.

## **2. Programme Outcomes (POs)**

After successful completion of the B.Sc. (Minor) Physics course students can,

1. Demonstrate skills in identifying information needs, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources from the Physics labs around the world, analysis and interpretation of data using methodologies as appropriate to the subject of Physics in the area of his specialization.
2. Use knowledge, understanding and skills in Physics for critical assessment of a wide range of ideas and complex problems and issues relating to the various sub fields of Physics.
3. Communicate the results of studies undertaken in the academic field of Physics accurately in a range of different contexts using the main concepts, constructs and techniques of the subject of Physics.
4. Address one's own learning needs relating to current and emerging areas of study relating to Physics, making use of research,

development and professional materials as appropriate, including those related to new frontiers of knowledge in Physics.

5. Apply one's knowledge and understandings relating to Physics and skills to new/unfamiliar contexts and to identify and analyze problems and issues and seek solutions to real-life problems.
6. Demonstrate subject-related and transferable skills that are relevant to some of the Physics-related jobs and employment opportunities.

**Credit Distribution: B.Sc. Physics including Minor and OE and other courses.**

	Type of Courses	III Yr.	IV Yrs. (Honours)	IV Yrs. Research
Major Marathi	Discipline-Specific Courses (DSC)	46	74	66
	Discipline Specific Elective (DSE)	08	16	16
	Skill Enhancement Courses (SEC)	06	06	06
	Vocational Skill Courses (VSC)	08	08	08
	On-Job Training (OJT)	04	08	04
	Field Project (FP)	04	04	04
	Community Engagement and Service (CEP)	02	02	02
	Research project	00	00	12
	Research Methodology	00	04	04
	Indian Knowledge System	02	02	02
	Total (I, II and III Year)	80	124	124
Minor	Minor	20	20	20
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	12
	Co-Curricular Courses	08	08	08
	Ability Enhancement Courses	08	08	08
	Value Education Courses	04	04	04
	Total	132	176	176

**Programme Framework (Courses and Credits): B.Sc. Physics (Minor)**

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	MNR-1	BS-PH101T	Fundamentals of Physics	03
2.	I	II	4.5	MNR-2	BS-PH201T	Basic Mathematics in Science	03
3.	II	III	5.0	MNR-3	BS-PH301T	Basics of Thermodynamics	03
4.	II	IV	5.0	MNR-4	BS-PH401T	Atoms, Molecules and Nuclei	03
5.	III	V	5.5	MNR-5	BS-PH501T	Basics of Nano Science	04
6.	III	VI	5.5	MNR-6	BS-PH601T	Solid State Physics	04
							20

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**  
**New Arts, Commerce and Science College, Ahmednagar**  
**(Autonomous)**  
**Syllabus**  
**B.Sc. Physics (Minor)**

Title of the Course: Fundamentals of Physics								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-1	BS-PH101 T/P	02	01	03	60	30	70	100

**Learning Objectives:**

1. Explain the need of measurement and various units of the measurements of the various physical quantities.
2. Explain laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance.
3. Explain the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
4. Explain analogy between translational and rotational dynamics, and application of both motions.
5. Introduce the concept of moment of inertia about the given axis of symmetry for different uniform mass distributions and explain applications of the moment of inertia.
6. Explain need of study of various properties of matter like Young's Modulus, modulus of rigidity, etc. and application.

**Course Outcomes (Cos):**

1. Understand the need of measurement and able to measure the various physical quantities with their various units.
2. Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance.
3. Understand the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
4. Understand analogy between translational and rotational dynamics, and application of both motions.
5. Understand the concept of moment of inertia about the given axis of symmetry for different uniform mass distributions and explain applications of the moment of inertia.
6. Know about the need of study of various properties of matter like Young's Modulus, modulus of rigidity, etc. and application.

**Detailed Syllabus:**

**Unit I: Measurement**

**(06 Hrs.)**

Introduction, International System of Units (SI Units), CGS Unit System, Basic Physical Quantities and relation between SI and CGS Units, Dimensions, Errors, Numerical problems.

## Unit II: Motion

(06 Hrs.)

Introduction, Motion, Position and Displacement, Average Speed and Velocity, Instantaneous Speed and Velocity, Acceleration, Equations of Constant Acceleration, Free fall Acceleration, Graphical Representation of motion, Numerical Problems.

## Unit III: Vectors

(06 Hrs.)

Introduction, Vectors and Scalars, Vector Addition, Components of Vectors, Vector Multiplication, Numerical Problems.

## Unit IV: Force and Motion

(06 Hrs.)

Introduction, Newton's First Law, Mass, Newton's Second Law, Newton's Third Law, Applications of Newton's Laws, Force, Friction, Drag Force, Motion, Types of Motion, Numerical Problems.

## Unit V: Properties of Matter

(06 Hrs.)

Elasticity: Stress and Strain, Hook's law and Coefficient of elasticity, Young's modulus, Bulk modulus, Modulus of rigidity, Work done during longitudinal strain, Volume strain, Shearing strain, Poisson's ratio, Relation between three elastic moduli, ( $Y$ ,  $\eta$ ,  $K$ ), Problems.

### Suggested Readings/Material:

1. Fundamental of Physics, J. Walker, D. Halliday, R. Resnick, 10<sup>th</sup> Ed. Wiley Publication, 2013.
2. Mechanics: D. S. Mathur, S. Chand and Company, New Delhi, 2000.
3. Elements of Properties of Matter: D. S. Mathur, S. Chand, New Delhi, 2010.
4. Concepts of Physics: H. C. Verma, Bharati Bhavan Publisher, 2021.
5. Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir VI Edition. Pearson Education/Prentice Hall International, New Delhi.
6. Properties Of Materials (Nature And Properties Of Materials: III), Prof. Ashish Garg, Department of Materials Science and Engineering, IIT Kanpur, <https://nptel.ac.in/courses/113/104/113104096/>
7. Classical Physics, Prof. V. Balakrishnan, Department of Physics, Indian Institute of Technology, Madras, <https://nptel.ac.in/courses/122/106/122106027/>

### Any 12 Experiments:

Sr. No.	Title of Experiment
1.	Use of Vernier Caliper
2.	Use of Micrometer Screw Gauge
3.	Use of Travelling Microscope
4.	Use of Spectrometer

5.	Determination of Moment of Inertia of Flywheel
6.	Determination of Young's Modulus (Y) by bending method
7.	Study of Modulus of Rigidity of wire using Torsional Oscillations
8.	Determination the height of a building using a Sextant
9.	Determine gravitational constant (g) and velocity for a freely falling body using Digital Timing Technique
10.	Determination of Young's Modulus (Y) by flat spiral spring
11.	Verification of Hook's Law of Elasticity
12.	Measure the viscosity of a sample liquid
13.	Use of travelling microscope

### **Additional Activity**

Study Tour Visit Report / Minimum 2 Graph Plotting in Excel / Science Exhibition Participation or any other activity related to this course is equivalent to **Two** practical.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**  
**New Arts, Commerce and Science College, Ahmednagar**  
**(Autonomous)**  
**Syllabus**  
**B.Sc. Physics (Minor)**

Title of the Course: Basic Mathematics in Sciences								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-2	BS-PH201 T/P	02	01	03	60	30	70	100

**Learning Objectives:**

1. Providing a common base of general mathematical techniques used in the development of the basic and applied sciences.
2. Give qualitative introduction of Algebra, Calculus, Complex Numbers, Hyperbolic Functions and Vector Algebra.
3. Give a mathematical base to Science students for the analysis of their curriculum.
4. Give a real life mathematical situation wherever possible from a physical point of view.
5. Motivate students to solve numerical problems base on the Algebra, Calculus, Complex Numbers, Hyperbolic Functions and Vector Algebra.

**Course Outcomes (Cos)**

1. Construct common base of general mathematical techniques used in the development of the basic and applied sciences.
2. Gain qualitative introduction of Algebra, Calculus, Complex Numbers, Hyperbolic Functions and Vector Algebra.
3. Analysis of their curriculum on the mathematical base.
4. Analyze a real life mathematical situation using the mathematical processes.
5. Solve numerical problems base on the Algebra, Calculus, Complex Numbers, Hyperbolic Functions and Vector Algebra.

**Detailed Syllabus:**

**Unit I: Preliminary Algebra**

**(06 Hrs.)**

Simple functions and equations, Trigonometric identities, Coordinate geometry, Partial fractions, Binomial expansion, Properties of binomial coefficients, Some particular methods of proof, Numerical Problems.

**Unit II: Preliminary Calculus**

**(08 Hrs.)**

Differentiation: Definition, Derivative of some of the elementary functions, Differentiation of products, Chain rule, Differentiation of quotients, Implicit differentiation, Logarithmic differentiation.

Integration: Definition, Integration as the inverse of differentiation, Integrations of some of the elementary functions, Integration of sinusoidal functions, Logarithmic integration, Integration using partial fractions, Integration by parts, Numerical Problems.



### Unit III: Complex Numbers and Hyperbolic Functions

(08 Hrs.)

Introduction, Argand diagram, Addition and subtraction, Modulus and argument, Multiplication, Complex conjugate, Division, Polar representation, de Moivre's theorem, Finding the  $n$ th roots of unity, Numerical Problems.

Definitions, Hyperbolic–trigonometric analogies, Identities of hyperbolic functions, Inverses of hyperbolic functions, Numerical Problems.

### Unit IV: Vector Algebra

(08 Hrs.)

Multiplication by a scalar, Basis vectors and components, Magnitude of a vector, Scalar product, Vector product, Scalar triple product, Vector triple product, Equations of lines, planes and spheres, Use of vectors to find distances, Reciprocal vectors, Numerical Problems.

#### Suggested Readings/Material:

1. Mathematical Methods for Physics and Engineering, K.F. Riley, M.P. Hobson, S. J. Bence, Third Edition, Cambridge, 2016.
2. Mathematical Methods for Physicists, G.B. Arfken, H.J. Webber and F.E. Harris seventh Ed., Academic Press of Elsevier, 7<sup>th</sup> Ed., 2012.
3. Linear Algebra: Finite-Dimensional Vector Spaces, Paul R. Halmos The Mathematical Association of America, 2020.
4. Advanced Engineering Mathematics, H. K. Das, S. Chand & Company Pvt. Ltd., 2013.
5. Higher Engineering Mathematics, H.K.Das, R. Verma, S. Chand & Company Pvt., 2014.
6. Complex Variable, M.R. Spiegel, Schaum's Outline.
7. Advanced Calculus, R.C. Wrede, M.R. Spiegel, Schaum's Outline.
8. Discrete mathematics, S.Lipschutz, M.L. Lipson, Schaum's Outline.

#### Any 12 Experiments:

Sr.No.	Title of Experiment
1.	Use of Scientific Calculator
2.	Introduction of MS-Excel and use it for mathematical operations
3.	Simple arithmetic operations in MS-Excel by inserting functions
4.	Decision making using IF, SUMIF, Countif, etc. in MS-Excel
5.	Draw XY Scattered graph in MS-Excel
6.	Linear fitting in MS-Excel
7.	Draw Coloum and Bar Chart in Excel
8.	Complex numbers addition in MS Excel
9.	Calculate the Area Under a Plotted Curve in MS-Excel
10.	Use of multimeter
11.	Use of voltmeter, Ammeter (AC, DC ranges and Least count)

<b>12.</b>	Study of resistance of resistor using color code method
<b>13.</b>	Study of Dispersion of Light
<b>14.</b>	Study of charging and discharging of capacitor

### **Additional Activity**

Study Tour Visit Report / Science Exhibition Participation / Avishakr Competition Participation or any other activity related to this course is equivalent to **Two** practical.