

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 2024-25

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

Board of Studies in Physics

Sr. No.	Name	Designation
1.	Prof. Dattatray K. Sonwane	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.	Miss. Vaishali B. Sawane	Member
7.	Miss. Asmita A. Shirsat	Member
8.	Mr. Vishal V. Kapase	Member
9.	Miss. Ashwini S. Jagdale	Member
10.	Dr. Appasaheb Torane	Academic Council Nominee
11.	Dr. Vijay M. Mayekar	Academic Council Nominee
12.	Prof. (Dr.) Arun G. Banpurkar	Vice-Chancellor Nominee
13.	Prof. (Dr.) Nandu B. Chaure	Alumni
14.	Dr. Vinay Hasabnis	Industry Expert
15.	Dr. Shrikrushna B. Gaikwad	Member (Co-opt)
16.	Dr. 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 Foundation of Physics	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: Basics of Thermodynamics								
Year: II				Semester: III				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-3	BS-PH301 T/P	02	01	03	60	30	70	100

Learning Objectives:

1. Introduce basic concepts of thermodynamics, the first and the second law of thermodynamics, etc.
2. Explain the concept of entropy and the associated theorems, their physical interpretations.
3. Explain the real gas equations, Van der Waal equation of state.
4. Explain basic aspects of kinetic theory of gases.
5. Explain working principle, construction of various temperature measuring instruments.

Course Outcomes (Cos)

1. Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics,
2. Understand the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.
3. Learn about the real gas equations, Van der Waal equation of state, Joule-Thompson effect.
4. Learn the basic aspects of kinetic theory of gases.
5. Understand working principle, construction of various temperature measuring instruments.

Detailed Syllabus:

Unit I: Basics of Heat and Thermodynamics

(15 Hrs.)

Introduction, Heat, Temperature, Boyle's law, Charles law and ideal gas law - Thermal Properties of Matter, Heat capacity and specific heat capacity - Thermal Properties of Matter Thermal expansion of solids, liquids and gases, expansion of water.

Change of state, Calorimetry, Heat transfer, Newton's law of cooling, Laws of Heat Transfer, Stefan Boltzmann law - Laws of Heat Transfer, Wien's displacement law - Laws of Heat Transfer, Zeroth Law of Thermodynamics, Internal Energy (U), First law of thermodynamics, Quasi-static process, Work done in volume changes - Internal Energy (U), PV diagram - Internal Energy (U), Numerical Problems.

Unit II: Thermodynamic Processes and Heat Engines

(15 Hrs.)

Isothermal process, Adiabatic process, Isobaric process, Isochoric process, Cyclic processes and PV diagram for a cyclic process, Limitations of first law of thermodynamics, Reversible process – Thermodynamics, Conversion of heat into work and its converse, Entropy and second law of thermodynamics, Temperature - entropy diagram, Principle of thermometry, scales & inter-conversions.

Heat Engine, Carnot’s ideal heat engine, Efficiency of a Carnot engine, Otto cycle & its efficiency, Diesel cycle, Refrigerator, Air Conditioning, Green House Effect, Numerical Problems.

Suggested Readings:

1. Concept of Physics: H. C. Verma, Bharati Bhavan Publisher, 2021.
2. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand and Company Ltd., 2008.
3. Heat and Thermodynamics: (SPECIAL INDIAN EDN), 8th Ed. Mark W. Zemansky, Richard H. Dittman, 7th Edition, Mc-Graw Hill Education, 2017.
4. Fundamental of Physics, J. Walker, D. Halliday, R. Resnick, 10th Ed. Wiley Publication, 2013.
5. Thermodynamics and Statistical Physics: J. K. Sharma, K. K. Sarkar, Himalaya Publishing House, 2018.
6. Thermal Physics, A. B. Gupta, H. Roy, Books & Allied Ltd, 3rd Ed. Calcutta, 2010.
7. Instrumentation: Devices & Systems, Rangan, Mani, and Sarma, McGraw Hill Education, 2nd Ed., 2011.
8. Concepts Of Thermodynamics, Prof. Suman Chakraborty, Department of Mechanical Engineering and Prof. Aditya Bandyopadhyay, Department of Cryogenic Engineering, IIT Kharagpur, <https://nptel.ac.in/courses/112/105/112105266/>
9. Thermodynamics, Prof. S.R Kale, Department of Mechanical Engineering, IIT Delhi, <https://nptel.ac.in/courses/112/102/112102255/>
10. Laws Of Thermodynamics, Prof. Sankar Kumar Som, Department of Mechanical Engineering and Prof. Suman Chakraborty, Department of Mechanical Engineering, IIT Kharagpur, <https://nptel.ac.in/courses/112/105/112105220/>

Any 12 Experiments:

Sr. No.	Title of Experiment
1.	Determination of Thermal Conductivity by Lee’s Method.
2.	Determination of Thermal Conductivity by Forbe’s Method
3.	Determination of coefficient of linear expansion of metal.
4.	Verification of Newton’s law of cooling.

5.	Study of Peltier effect and Seebeck effect.
6.	Determine the specific heat capacity of solids.
7.	Determine specific heat capacity of liquids.
8.	Determination of thermal conductivity of rubber.
9.	Determination of temperature coefficient of resistance.
10.	Determination of specific heat of Graphite .
11.	Graphical representation of Carnot's cycle.
12.	Determination of the thermal conductivity of copper by Searle's Method.
13.	Determination of the specific enthalpy and verify Clausius Clapeyron equation.

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: Atoms Molecules & Nuclei								
Year: II				Semester: IV				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-4	BS-PH401 T/P	02	01	03	60	30	70	100

Learning Objectives:

1. Give early ideas in atomic theory and atomic theory after nineteenth century.
2. Explain electromagnetic particles and constituents
3. study composition structure and behavior of matter.
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. Describe the structure of atoms in terms of protons, neutrons and electrons
2. Understand what is meant by chemical element and their properties
3. Hands on Experiments help students to learn various concepts of Physics.
4. Construct common base of general mathematical techniques used in the development of the atomic and molecular sciences.
5. Analyze a real life mathematical situation using the mathematical processes.

Detailed Syllabus:

Unit I: Atomic Structure and Molecules

(15 Hrs.)

Theories of atoms-Dalton,,Thomson, Rutherford, Bohr, Interior of atom-Structure,Mass, Dimension, Problems, Subatomic Particles-Electrons, Protons, Neutrons and their properties,

Defintion-Molecule,Molecular formation, bonds-ionic,Covalent, few molecules and its properties-H₂O,N₂, CaO,O₃. Elemental Molecule and Compound Molecule, Physical Properties of Molecules, Complex molecular Formation, Energy Levels of a Molecule-Rotational ,Vibrational

Unit II: Atomic Nuclei

(15 Hrs.)

Constituents of Nucleus - Proton, Neutron, Leptons and Quarks (Introduction), units of measuring masses of atoms and subatomic particles –atomic mass unit, size of nuclei-Problems,Types of Forces- Nuclear Force –Range and order, Isotopes, Isotones & Isobars, Atomic and Nuclear Masses,Size, Density, Mass defect, Binding Energy, Radiocativity, Decay –Alpha, Beta, Gamma, Numerical Problems.

Suggested Readings/Material:

1. R. Murugesan, Er. K. Sivaprasath, Modern Physics, S. Chand, 2014, Revised edition
2. Robert Eiseberg, Robert Resnik, Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Wiley, 2016, 2nd edition
3. G. Aruldhas, Molecular structure and Spectroscopy, PHI, 2015, 2nd edition
4. Colin Banwell, Elaine McCash, Fundamentals of Molecular Spectroscopy, Tata Mec.Hill, 4 th ed
5. Arthur Baiser, Concepts of Modern Physics , McGraw Hill International, 4th edition
6. White H. E, Introduction to Atomic spectra, McGraw Hill International
7. Atomic and Molecular Physics. Prof. Amal Kumar Das, Department of Physics, IIT Khargapur, <https://nptel.ac.in/courses/115/105/115105100/>

Any 12 Experiments:

Sr.No.	Title of Experiment
1.	Determine the value of Rydbergs Constant using Hydrogen Spectra
2.	Determine line spacing in Sodium Spectra
3.	Study interference using a single slit and finding wavelength
4.	Find stopping potential for different wavelengths of light used
5.	Determine ionic conductivity of NaCl
6.	Determine Refractive Index of Glass.
7.	Determination of slit width using a LASER beam
8.	Determine the dissociation energy of iodine molecule
9.	Study the size of Lycopodium powder using LASER beam.
10.	Distinguish between line and band spectrum
11.	Obtain the refractive indices of different wavelengths using prism
12.	Find Grating Element of a Grating

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.