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

B.Sc. Physics (Major)

Implemented from

Academic Year 2023-24

Credit Distribution: B.Sc. Physics (Major) 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

B. Sc. Programme Framework: Credit Distribution

Year	Semester	Level	Major											Minor	OE	CC	AEC	VEC	Total
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP		IKS						
I	I	4.5	T	P	T	P	T	P	T	P	T	P		T/P	-	-	-	-	-
I	II	4.5	4	2	-	-	-	2	-	-	-	-	2	03	3	2	2	2	22
			6	-	-	-		2	-	2	-	-	-	03	3	2	2	2	22
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credit core NSQF course /Internship or Continue with Major and Minor																			
II	III	5.0	6	2	-	-		2	-	-	-	2	-	03	3	2	2	-	22
II	IV	5.0	6	2	-	-		-	-	2	-	2	-	03	3	2	2	-	22
Exit Option: Award of UG Diploma in Major with 88 credits and an additional 4 credit core NSQF course /Internship or Continue with major and minor																			
III	V	5.5	8	2	2	2	-	-	-	2	-	2	-	04	-	-	-	-	22
III	VI	5.5	6	2	2	2	-	-	-	2	-	4	-	04	-	-	-	-	22
Exit Option: Award of UG Degree in Major and Minor with 132 credits or continue with Major for a 4-year Degree																			
IV	VII	6.0	8	6	2	2	RM-4		-	-	-	-	-	-	-	-	-	-	-	22

IV	VIII	6.0	8	6	2	2	-	-	-	-	-	4	-	-	-	-	-	-	-	22
Four Year UG Degree(Honours) with Major and Minor with 176 credits																				
IV	VII	6.0	6	4	2	2	RM-4		-	-	-	4	-	-	-	-	-	-	-	-	22
IV	VIII	6.0	6	4	2	2	-	-	0	-	-	8	-	-	-	-	-	-	-	-	22
Four Year UG Degree (Honours with Research) with Major and Minor with 176 credits																				

B. Sc. Programme Framework: Course Distribution

Year	Semester	Level	Major											Minor		OE	CC	AEC	VEC	Total
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP		IKS							
	-	-	T	P	T	P	T	P	T	P	T	P		T	P	-	-	-	-	-
I	I	4.5	2	1	-	-	-	1	-	-	-	-	1	1		1	1	1	1	10
I	II	4.5	2	-	-	-	-	1	-	1	-	-	-	1		1	1	1	1	09
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credit core NSQF course /Internship or Continue with major and minor																				
II	III	5.0	2	1	-	-	-	1	-	-	-	1	-	1		1	1	1	-	09
II	IV	5.0	2	1	-	-	-	-	-	1	-	1	-	1		1	1	1	-	09
Exit Option: Award of UG Diploma in Major with 88 credits and an \additional 4 credit core NSQF course /Internship or Continue with major and minor																				
III	V	5.5	2	1	1	1	-	-	-	1		1	-	1		-	-	-	-	08
III	VI	5.5	2	1	1	1	-	-	-	1		1	-	1		-	-	-	-	08
Exit Option: Award of UG Degree in Major and Minor with 132 credits or continue with Major for a 4-year Degree																				
IV	VII	6.0	3	3	1	1	0	1	-	-	-	-	-	-	-	-	-	-	-	09
IV	VIII	6.0	3	3	1	1	-	-	-	-	-	1	-	-	-	-	-	-	-	09
Four Year UG Degree(Honours) with Major and Minor with 176 credits																				
IV	VII	6.0	2	2	1	1	0	1	-	-	-	1	-	-	-	-	-	-	-	08
IV	VIII	6.0	2	2	1	1	-	-	-	-	-	1	-	-	-	-	-	-	-	07
Four Year UG Degree (Honours with Research) with Major and Minor with 176 credits																				

Programme Framework (Course Distribution): B.Sc. Physics (Major)

Year	Semester	Level	Major											Total	
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/PR		IKS		
			T	P	T	P	T	P	T	P	T	P	T	T	P/PR
I	I	4.5	2	1	-	-	-	1	-	-	-	-	01	03	02
I	II	4.5	2	-	-	-	-	1	-	1	-	-	-	02	02
II	III	5.0	2	1	-	-	-	1	-	-	-	1	-	02	03
II	IV	5.0	2	1	-	-	-	-	-	1	-	1	-	02	03
III	V	5.5	2	1	1	1	-	-	-	1	-	1	-	03	04
III	VI	5.5	2	1	1	1	-	-	-	1	-	1	-	03	04
B.Sc. Honours															
IV	VII	6.0	3	3	1	1	RM-1		-	-	-	-	-	05	04
IV	VIII	6.0	3	3	1	1	-	-	-	-	-	1	-	04	05
B.Sc. Honours with Research															
IV	VII	6.0	2	2	1	1	RM-1		-	-	-	1	-	04	04
IV	VIII	6.0	2	2	1	1	-	-	-	-	-	1	-	03	04

Programme Framework (Credit Distribution): B.Sc. Physics (Major)

Year	Semester	Level	Major											Total
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/RP		IKS	
			T	P	T	P	T	P	T	P	T	P	**T**	
I	I	4.5	4	2	-	-	-	2	-	-	-	-	02	10
I	II	4.5	6	-	-	-	-	2	-	2	-	-	-	10
II	III	5.0	6	2	-	-	-	2	-	-	-	2	-	12
II	IV	5.0	6	2	-	-	-	-	-	2	-	2	-	12
III	V	5.5	8	2	2	2	-	-	-	2		2	-	18
III	VI	5.5	6	2	2	2	-	-	-	2	-	4	-	18
IV	VII	6.0	8	6	2	2	RM-4	-	-	-	-	-	-	22
IV	VIII	6.0	8	6	2	2	-	-	-	-	-	4	-	22
IV	VII	6.0	6	4	2	2	RM-4	-	-	-	-	4	-	22
IV	VIII	6.0	6	4	2	2	-	-	-	-	-	8	-	22

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

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	DSC-1	BS-PH111T	Mechanics and Properties of Matter	02
2.	I	I	4.5	DSC-2	BS-PH112T	Physics Principles and Applications	02
3.	I	I	4.5	DSC-3	BS-PH113P	Physics Lab 1A	02
4.	I	I	4.5	SEC-1	BS-PH114P	Physics Skill Lab 1A	02
5.	I	I	4.5	IKS-1	BS-PH115T	Astronomy in India- Historical Overview	02
6.	I	II	4.5	DSC-4	BS-PH121T	Heat & Thermodynamics	03
7.	I	II	4.5	DSC-5	BS-PH122T	Electricity and Magnetism	03
8.	I	II	4.5	SEC-2	BS-PH123P	Physics Skill Lab 2A	02
9.	I	II	4.5	VSC-1	BS-PH124P	Vocational Skills in Physics Lab. 1	02
10.	II	III	5.0	DSC-6	BS-PH231T	Mathematical Methods in Physics - 1	03
11.	II	III	5.0	DSC-7	BS-PH232T	Basics of Electronics	03
12.	II	III	5.0	DSC-8	BS-PH233P	Physics Lab 2A	02
13.	II	III	5.0	SEC-3	BS-PH234P	Physics Skill Lab 2A	02
14.	II	III	5.0	FP-01	BS-PH235P	Field Project 1	02
15.	II	IV	5.0	DSC-9	BS-PH241T	Sound, Waves & Oscillations	03
16.	II	IV	5.0	DSC-10	BS-PH242T	Optics	03
17.	II	IV	5.0	DSC-11	BS-PH243P	Physics Lab 2B	02
18.	II	IV	5.0	VSC-2	BS-PH244P	Vocational Skills in Physics Lab. 2	02
19.	II	IV	5.0	CEP-01	BS-PH245P	Community Engagement and Services (Project)	02
20.	III	V	5.5	DSC-12	BS-PH351T	Classical Mechanics	04
21.	III	V	5.5	DSC-13	BS-PH352T	Mathematical Methods in Physics - II	04
22.	III	V	5.5	DSC-14	BS-PH353P	Physics Lab 3A	02
23.	III	V	5.5	DSE-01	BS-PH354T	Computational Physics	02
24.	III	V	5.5	DSE-02	BS-PH355P	Computational Physics Lab	02
25.	III	V	5.5	VSC-3	BS-PH356P	Vocational Skills in Physics Lab. 3	02
26.	III	V	5.5	FP-02	BS-PH357P	Field Project 2	02
27.	III	VI	5.5	DSC-15	BS-PH361T	Quantum Mechanics	03
28.	III	VI	5.5	DSC-16	BS-PH362T	Electrodynamics	03
29.	III	VI	5.5	DSC-17	BS-PH363P	Physics Lab 3B	02
30.	III	VI	5.5	DSE-03	BS-PH364T	Astronomy & Astrophysics	02
31.	III	VI	5.5	DSE-04	BS-PH365P	Astronomy & Astrophysics Lab	02
32.	III	VI	5.5	VSC-4	BS-PH366P	Vocational Skills in Physics Lab. 4	02
33.	III	VI	5.5	OJT-01	BS-PH367P	On Job Training 1	04

B.Sc. Physics (Major with Honours)

34.	IV	VII	6.0	DSC-18	BS-PH471T	Statistical Mechanics	03
35.	IV	VII	6.0	DSC-19	BS-PH472T	Atomic and Molecular Physics	03
36.	IV	VII	6.0	DSC-20	BS-PH473Y	Electronics	02
37.	IV	VII	6.0	DSC-21	BS-PH474P	Physics Lab 4A	02
38.	IV	VII	6.0	DSC-22	BS-PH475P	Physics Lab 4B	02
39.	IV	VII	6.0	DSC-23	BS-PH476P	Project 1	02
40.	IV	VII	6.0	DSE-05	BS-PH477T	Laser and Applications	02

41.	IV	VII	6.0	DSE-06	BS-PH478P	Laser and Applications Lab	02
42.	IV	VII	6.0	RM-01	BS-PH479T/P	Research Methodology Theory and Practical	04
43.	IV	VIII	6.0	DSC-24	BS-PH481T	Solid State Physics	03
44.	IV	VIII	6.0	DSC-25	BS-PH482T	Nuclear Physics	03
45.	IV	VIII	6.0	DSC-26	BS-PH483T	Sensors and Transducers	02
46.	IV	VIII	6.0	DSC-27	BS-PH484P	Physics Lab 5A	02
47.	IV	VIII	6.0	DSC-28	BS-PH485P	Physics Lab 5B	02
48.	IV	VIII	6.0	DSC-29	BS-PH486P	Project 2	02
49.	IV	VIII	6.0	DSE-07	BS-PH487T	Nanotechnology	02
50.	IV	VIII	6.0	DSE-08	BS-PH488P	Nanotechnology Lab.	02
51.	IV	VIII	6.0	OJT-02	BS-PH489P	On Job Training 2	04

B.Sc. Physics (Major Honours with Research)

34.	IV	VII	6.0	DSC-20	BS-PH471T	Statistical Mechanics	03
35.	IV	VII	6.0	DSC-21	BS-PH472T	Atomic and Molecular Physics	03
36.	IV	VII	6.0	DSC-22	BS-PH473P	Physics Lab 4A	02
37.	IV	VII	6.0	DSC-23	BS-PH474P	Physics Lab 4B	02
38.	IV	VII	6.0	DSE-05	BS-PH475T	Laser and Applications	02
39.	IV	VII	6.0	DSE-06	BS-PH476P	Laser and Applications Lab	02
40.	IV	VII	6.0	RM-01	BS-PH477T/P	Research Methodology Theory and Practical	04
41.	IV	VII	6.0	RP-01	BS-PH488P	Research Project 1	04
42.	IV	VIII	6.0	DSC-20	BS-PH481T	Solid State Physics	03
43.	IV	VIII	6.0	DSC-21	BS-PH482T	Nuclear Physics	03
44.	IV	VIII	6.0	DSC-22	BS-PH483P	Physics Lab 5A	02
45.	IV	VIII	6.0	DSC-23	BS-PH484P	Physics Lab 5B	02
46.	IV	VIII	6.0	DSE-07	BS-PH485T	Nanotechnology	02
47.	IV	VIII	6.0	DSE-08	BS-PH486P	Nanotechnology Lab.	02
48.	IV	VIII	6.0	RP-02	BS-PH487P	Research Project 2	08

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:

The learning outcomes-based curriculum framework (LOCF) for the B.Sc. Honours undergraduate programs in Physics is intended to provide a broad framework within which programs in Physics helps students to create an academic base and explaining all the observed natural phenomenon as well as predicting the future applications with a global perspective.

The curriculum framework is designed and formulated such a way that students acquire and maintain standards of achievement in terms of knowledge, understanding and skills in Physics. This curriculum also helps for development of scientific attitudes among the students.

This programme also allow for the flexibility and innovation in the UG education. Syllabus for the programme is desgend and formulated with concentrating much on teaching learning process and the assessment procedures. The following steps define the process of learning. Which should form the basis of final assessment of the achievement at the end of the program.

- The accumulation of basic facts of nature and the ability to link the facts to observe and discover the laws of nature i.e. develop an understanding and knowledge of the basic Physics.
- The ability to use this knowledge to analyze new situations and learn skills and tools like mathematics, engineering and technology to find the solution, interpret the results and make predictions for the future developments.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the physical problems in nature and to create new skills and tools for their possible solutions.

This programme strongly focused on the problems solving, project work, research project work, on job training, filed projects, etc. such way that students should acquire some the skills like demonstrate, problem solver, etc.

2. Programme Outcomes (POs)

After successfully completing B.Sc. Honours degree, students should acquire following attributes.

1. **Disciplinary knowledge and skills:**
   Capable of demonstrating
   (i) good knowledge and understanding of major concepts, theoretical principles and experimental findings in Physics including broader interdisciplinary subfields like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology etc.

(ii) Ability to use modern instrumentation and laboratory techniques to design and perform experiments is highly desirable in almost all the fields of Physics.

2. **Skilled communicator:**
   Ability to transmit complex technical information relating all areas in Physics in a clear and concise manner in writing and oral ability to present complex and technical concepts in a simple language for better understanding.
3. **Critical thinker:**
   Ability to employ critical thinking and efficient problem solving skills in all the basic areas of Physics.
4. **Sense of inquiry:**
   Capability for asking relevant/appropriate questions relating to the issues and problems in the field of Physics, and planning, executing and reporting the results of a theoretical or experimental investigation.
5. **Team player/worker:**
   Capable of working effectively in diverse teams in both classroom, laboratory, Physics workshop and in industry and field-based situations.
6. **Skilled project manager:**
   Capable of identifying/mobilizing appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and laboratory hygiene regulations and practices.
7. **Digitally Efficient:**
   Capable of using computers for simulation studies in Physics and computation and appropriate software for numerical and statistical analysis of data, and employing modern e-library search tools like Inflibnet, Shodhganga, etc.
8. **Ethical awareness / reasoning:**
   The graduate should be capable of demonstrating ability to think and analyze rationally with modern and scientific outlook and identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, and adopting objectives, unbiased and truthful actions in all aspects of work.
9. **National and international perspective:**
   The graduates should be able to develop a national as well as international perspective for their career in the chosen field of the academic activities.
10. **Lifelong learners:**
    Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling in all areas of Physics.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Physics (Major)

Title of the Course: Mechanics and Properties of Matter								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-1	BS-PH111T	02	00	02	30	15	35	50

Learning Objectives:

1. Explain Laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance.
2. Explain and demonstrate various types of motion.
3. Explain concept of conservation of energy, momentum, angular momentum.
4. Explain the moment of inertia about the given axis of symmetry for different uniform mass distributions.
5. Explain the phenomena of collisions and idea about center of mass and laboratory frames and their correlation.
6. Describe elasticity through the study of Young Modulus and modulus of rigidity.

Course Outcomes (Cos):

After going through the course, the student should be able to

1. Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance.
2. He / she will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
3. Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping.
4. Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.
5. Understand the phenomena of collisions and idea about center of mass and laboratory frames and their correlation.
6. Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.

Unit I: Fundamental of Dynamics (06 Hrs.)

Introduction, Types of motion, Distance and Displacement, Speed and Velocity, Acceleration, Equation of motion with constant acceleration, Newton's laws of motion and it's real life applications, Law of Conservation of total Linear Momentum, Force, components of the force vector, types of forces, Frames of reference, Problems.

Unit II: Work and Energy (05 Hrs.)

Work, Work done by a constant force and variable force. Energy, Types of Energy, Law of conservation of energy, Work Energy Theorem, Power, Problems.

Unit III: Motion of System of Particles **(06 Hrs.)**

Center of Mass of a Rigid Body and its motion, Definition of Torque, Torque about an Axis, Angular Momentum, Relation between Torque and Angular Momentum, Moment of Inertia (Definition Unit and Dimensions), Moment of Inertia of a Rod, Ring, Disc, Radius of Gyration, Problems.

Unit IV: Elasticity **(05 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, η, K), Problems.

Unit V: Properties of Fluids **(08Hrs)**

Fluid Mechanics: Pascal's law and its applications, Viscosity, Reynold's number, Equation of continuity. Surface Tension: Intermolecular forces, Factors affecting the surface tension of a liquid, Excess of pressure inside a liquid drop, Jaeger's method for determination of surface tension, Capillarity, Bernoulli's Theorem and its applications, Problems.

Suggested Readings/Material:

1. Fundamental of Physics, J. Walker, D. Halliday, R. Resnick, 10th Ed. Weily 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/

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Physics (Major)

Title of the Course: Physics Principles and Applications								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-2	BS-PH112T	02	00	02	30	15	35	50

Learning Objectives:

1. Explain historical development of the atomic models and corresponding theory.
2. Explain construction and working of the LASER with properties.
3. Explain the real life applications of the LASER in various fields.
4. Explain the electromagnetic spectrum in details.
5. Explain various applications of the electromagnetic spectrum for human being.

Course Outcomes (Cos):

After going through the course, the student should be able to

1. Gets an idea about basics of the atoms using different atomic models.
2. Understand the types of LASER and their applications in real life.
3. Inculcate the basics of molecule structure, various bonds.
4. Learn about the history and general properties of Electromagnetic radiations.
5. Demonstrate quantitative problem solving skills

Detailed Syllabus:

Unit I: Physics of Atoms **(08 Hrs.)**

Introduction to Atom, Atomic Models, Thomson's Atomic Model, Rutherford's Atomic Model, Bohr's Atomic Model, Atomic Spectra: Emission line Spectrum, Absorption line, Uses of Atomic Spectra, Classical planetary model of Hydrogen Atom, The Bohr Theory of the Hydrogen Atom, The Hydrogen Spectrum, Frank-Hertz experiment Problems

Unit II: LASERS & Applications **(07 Hrs.)**

Introduction to LASERS, Basic Principle of Lasers: Three Processes, Characteristics of Lasers: brief explanation, Boltzmann Distribution Law, Population Inversion and Pumping, Types of Lasers: He-Ne Laser, Ruby Laser, Applications of Lasers, Problems

Unit III: Physics of Molecules **(07 Hrs.)**

Introduction to Bonding Mechanisms, Forces between Atoms, Types of Bonding: Ionic Bonds, Covalent Bonds, van der Waal's Bonds, Hydrogen Bond, Metallic Bond,

Rotation energy levels of a diatomic molecule, Vibration energy levels of a diatomic molecule, Problems.

Unit IV: Sources of Electromagnetic Waves (08 Hrs.)

Introduction to Electromagnetic Waves: Historical Perspective, General properties of Electromagnetic radiations, Electromagnetic spectrums and its sources, Production of Electromagnetic waves: Hertz experiment, Plank's hypothesis of Photons, Applications of various waves in electromagnetic spectrum, Microwave oven, Solar cell and its types.

Suggested Readings/Material:

1. Concepts of Modern Physics: Special Indian Edition, A Beiser (6th Ed., McGraw Hill, 2009
2. Modern Physics: 3rd Ed., Raymond A. Serway, Clement J. Moses, Curt A. Moyer, 2012.
3. Sears and Zemansky's University Physics: H.D. Young R. A. Freedman, Sandin, 14th Ed. Pearson Education, 2015.
4. An Introduction to Lasers- Theory and Applications, M N Avadhanulu & Dr. P S Hemne, S Chand Publishing, 2001.
5. Atomic and Molecular Physics, Professor Amal Kumar Das, : IIT Kharagpur, https://nptel.ac.in/courses/115/105/115105100/
6. Laser: Fundamentals And Applications, Prof. Manabendra Chandra, Department Of Chemistry, IIT Kanpur, https://nptel.ac.in/courses/104/104/104104085/
7. Electromagnetic Fields - Prof. Harishankar Ramachandran, Department of Electrical Engineering, IIT Madras, https://nptel.ac.in/courses/108/106/108106073/
8. Electromagnetic Theory, Prof. Pradeep Kumar K, Department of Electrical and Electronic Engineering, https://nptel.ac.in/courses/108/104/108104087/

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Physics (Major)

Title of the Course: Physics Lab 1A								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-3	BS-PH113P	00	02	02	60	15	35	50

Learning Objectives:

1. Explain various measuring instruments with their applications in real life.
2. Explain the theoretical concept with the help of experiments.
3. Give hand on skills to conduct the practical.
4. Motivate and encourage students to solve real life problems through experiments.

Course Outcomes (Cos):

1. Handling of the various basic measuring instruments.
2. Experimentally analyzed the theory taught during lectures,
3. Hands on Experiments help students to learn various concepts of Physics.
4. Experimental tools helps to develop ability to address real world problems.

Detailed Syllabus: Any 12 Experiments

Sr. No.	Title of Experiment
1.	Determination of Moment of Inertia of Flywheel
2.	Determination of Modulus of Rigidity of wire using Torsional Oscillations
3.	Determination of 'Y' by bending method
4.	Determination of Young's Modulus (Y) by flat spiral spring
5.	Determination of modulus of Rigidity of wire using flat spiral spring
6.	Determination the height of a building using a Sextant
7.	Determine gravitational constant (g) and velocity for a freely falling body using Digital Timing Technique
8.	Determination of diameter of wire using LASER
9.	Determination of refractive indices of different colors using spectrometer
10.	Study of IV characteristics of solar cell
11.	Divergence of LASER

12.	Determination of Surface Tension of liquid using Jaeger's method
13.	Determination of Modulus of Rigidity of a Wire by Maxwell's needle
14.	Determination of Elastic Constants of a wire by Searle's method

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 (Major)

Title of the Course: Physics Skill Lab 1A								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
SEC-1	BS-PH114P	00	02	02	60	15	35	50

Learning Objectives:

1. Explain various measuring instruments with their applications in real life.
2. Explain the theoretical concept with the help of experiments.
3. Give hand on skills to conduct the practical.
4. Motivate and encourage students to solve real life problems through experiments.

Course Outcomes (Cos):

1. Handling of the various basic measuring instruments.
2. Experimentally analyzed the theory taught during lectures,
3. Hands on Experiments help students to learn various concepts of Physics.
4. Experimental tools help to develop ability to address real world problems.

Detailed Syllabus: 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.	Calibration of Spectrometer
5.	Determination of angle of minimium deviation
6.	Determination of Refractive Index of glass with the help of Prism
7.	Study of Diffraction of Light using different obstacles (Gratings Wire)
8.	Characteristics of LASER
9.	Laws of Reflection of Light
10.	Measurement of Field Strength B along the Axis of Circular Coil
11.	Introduction of MS-Excel and its uses for mathematical operations
12.	Simple arithmetic operations in MS-Excel by inserting functions
13.	Logical operations in MS-Excel/Gnuplot

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 (Major)

Title of the Course: Astronomy in India- Historical Overview								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
IKS-1	BS-PH115P	02	00	02	30	15	35	50

Learning Objectives:

1. This course will explain the strong and ancient tradition of astronomy which seamlessly merges with the current activities in astronomy and astrophysics in the country.
2. This particular course designed, formulated and concentrates on selected aspects of historical development of astronomy in this country.
3. In this course, we deal with the development of ancient Indian astronomy and the development of calculus for the Astronomy.
4. Introduce Optical Astronomy, Relativistic Astrophysics, Space Astronomy and Radio Astronomy, Indian calendar, Dates and Nakshatra etc.
5. Discuss and interpret the importance of Indian Calendrical system.
6. Discuss and explain astronomical references in religious scriptures.
7. This course will introduce famous Indian astronomers and their work.

Course Outcomes (Cos)

1. Students get familiar with strong and ancient tradition of astronomy, which seamlessly merges, with the current activities in astronomy and astrophysics in the country.
2. Read and analyze the Indian calendar.
3. Understands the importance of Indian Calendrical system and its relation with the astronomy.
4. Develop the scientific attitude towards the astronomical events.
5. Got to know about great Indian astronomers and their contribution for the development of the Indian Astronomy and Astrophysics.
6. Motive and inspire to continue and share their interest in astronomy and pursue carrier in the filed of Astronomy.

Detailed Syllabus:

Unit I: Astronomy in India - An Overview (09 Hrs.)

Introduction, Astronomy: the foremost auxiliary of the Veda, Time Period of Vedas, Purpose of Astronomy, Astronomical references in Vedas, Mention of Naksatras, Mention of Planets (Nav Greha), Names of the Parts of a day, Tithi, Calendrical Awareness. Qualifications of an astronomer in 500 AD.

Unit II: Vedanga Jyotisa and Sindhantas (07 Hrs.)

Introduction, Commentaries on Vedang Jyotish, Period of Vedang-Jyotish, What is there in Vedang- Jyotish, Writer of Vedang-Jyotish, Yajurveda Vedang Jyotish, Concept of Yuga. Madhyamadhikara (Mean Positions, Spastadhikara (True Positions), Triprasnadhikara, Chandra and Surya Grahanadhikara

Unit III: Astronomical References in Religious Scriptures (08 Hrs.)

Introduction, Manusamriti, Astronomy Related References in Ramayana, Astronomy Related References in Mahabharata, Astronomy related references in Religious Literature of Jains, Astronomy in Buddhist Scriptures

Unit IV: Famous Astronomers and Their Works (06 Hrs.)

Arya Bhatta-I, Varahamihira, Bhaskaracharya-I (629CE), Brahma Gupta, Uttpal, Bhaskar Acharya-II

Suggested Readings/Material:

1. Indian astronomy, A source book (based primarily on Sanskrit texts) ,B.V. Subbarayappaand K.V. Sarma,Neharu Centre, Bombay, 1985
2. Astronomy in India: A Historical Perspective, Thanu Padmanabhan, Indian National Science Academy Platinum jubilee special volume, ISBN 978-81-8489-998-6 (eBook) ,Springer, 2010
3. The Story Of Astronomy In India, Chander Mohan, Publisher: Pothi.com, January 2015
4. Hindu Astronomy,W.Brennand,Chas.Straker and Sons,Ltd.,1986

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Physics (Major)

Title of the Course: Heat & Thermodynamics								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-4	BS-PH121T	03	00	03	45	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: Fundamentals of Heat **(08 Hrs.)**

Introduction, Heat, temperature, Zeroth Law of Thermodynamics, Temperature measurement and scales, Ideal gas law and Van der Waal Law, Heat capacity and specific heat capacity, Concept Thermal expansion of solids, liquids and gases, Heat transfer Mechanism, Newton's law of cooling, Joule-Thompson effect. Laws of Heat, transfer, Problems.

Unit II: Thermodynamic Processes **(11 Hrs.)**

Thermodynamic state, Internal Energy (U), First law of thermodynamics, Internal Energy (U), Indicator (PV) diagram, Quasi-static process, Cyclic processes, Reversible process and PV diagram, Thermodynamics Processes and work done: Isothermal process, Adiabatic process, Isobaric process, Isochoric process, Limitations of first law of thermodynamics, Problems.

Unit III: Applied Thermodynamics **(10 Hrs.)**

Conversion of heat into work and it's converse, Entropy and second law of thermodynamics, Temperature - entropy diagram, Heat Engines: Carnot's cycle & its efficiency, Otto cycle & its efficiency, Diesel cycle & its efficiency, Refrigerator: Principle and it's applications, Air Conditioning: Principle and it's applications, Problems.

Unit IV: Kinetic Theory of Gases: **(08 Hrs.)**

Assumptions of Kinetic theory of gases, Mean free path, Transport phenomenon, Viscosity, Thermal conductivity and diffusion, Problems

Unit V: Thermometry **(08 Hrs.)**

Principle of thermometry, scales & inter-conversions, Principle, Construction and Working: (Liquid thermometers, Liquid filled thermometers, Gas filled thermometers, Bimetallic thermometers, Platinum resistance thermometer, Thermocouple), 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. Weily 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/

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
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Syllabus
B.Sc. Physics (Major)

Title of the Course: Electricity and Magnetism								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-5	BS-PH122T	03	00	03	45	30	70	100

Learning Objectives:

1. Explain the basics of electrostatics with the help of numerical problems.
2. Explain electric and magnetic field in details.
3. Explain basic theory of dielectrics.
4. Teach use of Coulomb's law and Gauss' law for the electrostatic force
5. Explain Ampere's law, Faraday's law of induction with the help of problems.

Course Outcomes (Cos):

1. Understand Fundamental laws and concepts in electricity and magnetism,
2. Learn properties of static electric and magnetic fields and how they arise.
3. Analyze different problems in electromagnetism using mathematical methods.
4. Understand various magnetic properties of the magnetic materials.
5. Understand applications of magnetic materials.

Detailed Syllabus:

Unit I: Electrostatics **(09 Hrs.)**

Revision **of** Coulomb's law: Statement, Variation of forces with distances, Superposition principle: Statement, Explanation with illustration, Energy of system of charges, Concept of electric field, Due to point charge, Due to group charges, Electrical lines of forces and its properties, Concept of electric flux, Gauss's law in electrostatics, Problems.

Unit II: Dielectrics **(08 Hrs.)**

Introduction to dielectric materials, Electric Dipole, Electric dipole, Dipole moment, Electric potential and intensity at any point due to dipole, Polar and non-polar molecules, Electric polarization of dielectric material, Gauss' law in dielectric, Electric vectors and its relation, Applications of Gauss's Law, Problems

Unit III: Magntostatics **(08 Hrs.)**

Introduction to magnetization, Magnetic Induction and Intensity of magnetization, Biot- Savart's law: Statement, Long straight conductor, Circular Coil, Ampere's circuital law: Statement, Field of Solenoid, Field of Toroid, Gauss law for magnetism, Applications of Ampere's circuital law, Problems

Unit IV: Magnetization **(07 Hrs.)**

Introduction to magnetization, magnetic materials, Types of magnetic materials Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic, Bohr's Magneton, Problems

Unit IV: Magnetic Properties of Materials **(08 Hrs.)**

Definitions: Magnetization (M), Magnetic Intensity (H), Magnetic Induction (B), Magnetic Susceptibility, Magnetic Permeability, Relation between B, M and H, Hysteresis and Hysteresis Curve, Hard Magnet, Soft magnet, Problems

Suggested Readings/Material:

1. Fundamental of Physics, J. Walker, D. Halliday, R. Resnick, 10th Ed. Weily Publication, 2013.
2. Electromagnetics: B. B. Laud. Foundations of Electromagnetic theory: Reitz, Milford, Christey, 3rd Ed. New Age International Private Limited, 2011.
3. Electricity and Electronics: D.C. Tayal, Himalaya Publishing House, Mumbai, 2019.
4. Introduction to Electrodynamics: D.G. Griffith, 4th Ed., Pearson Education India Learning Private Limited, 2015..
5. Electricity and Magnetism: Brij Lal, Subramanyan, Ratan Prakashan (Revised edition,1997).
6. Electricity and Magnetism: Khare, Shrivastav (Revised edition, 1997).
7. Electromagnetism, Prof. Nirmal Ganguli, Department of Physics, IISER Bhopal, https://nptel.ac.in/courses/115/106/115106122/
8. Electromagnetic Fields - Prof. Harishankar Ramachandran, Department of Electrical Engineering, IIT Madras, https://nptel.ac.in/courses/108/106/108106073/
9. Electromagnetic Theory, Prof. Pradeep Kumar K, Department of Electrical and Electronic Engineering, https://nptel.ac.in/courses/108/104/108104087/
10. Electrodynamics - Web course, Prof. Amol Dighe, Theoretical Physics, TIFR, https://nptel.ac.in/courses/115/101/115101004/
11. Mod-01 Lec-08 Summary of classical electromagnetism, on Classical Physics by Prof.V.Balakrishnan, Department of Physics, IIT Madras, https://www.youtube.com/watch?v=bsybS5fZGjY

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Physics (Major)

Title of the Course: Physics Skill Lab 2A								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
SEC-2	BS-PH123P	00	02	02	60	15	35	50

Learning Objectives:

1. Given hands on skill for the practical of heat and thermodynamics.
2. Explain the various thermodynamically concepts through experiments.
3. Explain use of various instruments like Voltmeter, Ammeter and Multimeter.
4. Explain various important characteristics of electrical devices.

Course Outcomes (Cos)

1. Hands on Experiments help students to learn various concepts of Physics.
2. Experimental tools help to develop ability to learn physics through experiments.
3. To motivate students for participation in scientific events, study visits, etc.
4. Understand scientific and technological aspects of experimental Physics.

Detailed Syllabus: Any 12 Experiments

Sr. No.	Title of Experiment
1.	Use of multimeter
2.	Use of voltmeter, Ammeter (AC, DC ranges and Least count)
3.	Measurment of resistance using color code method
4.	Study of signal generator
5.	Measurement of earth's magnetic field using tangent galvanometer
6.	Characteristics of PN junction diode
7.	Determination of RC time constant of capacitor
8.	Decision making using IF, SUMIF, Countif, etc. in MS-Excel
9.	Draw XY Scattered graph in MS-Excel/Gnuplot
10.	Linear Fitting in MS-Excel/Gnuplot
11.	Draw Coloum and Bar Chart in Excel/Gnuplot
12.	Study of total internal reflection using LASER

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 (Major)

Title of the Course: Vocational Skills in Physics Lab. 1								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
VSC-1	BS-PH124P	00	02	02	60	15	35	50

Learning Objectives:

1. Given hands on skill for the practical of heat and thermodynamics.
2. Explain the various thermodynamically concepts through experiments.
3. Explain use of various instruments like Voltmeter, Ammeter and Multimeter.
4. Explain various important characteristics of electrical devices.

Course Outcomes (Cos)

1. Hands on Experiments help students to learn various concepts of Physics.
2. Experimental tools help to develop ability to learn physics through experiments.
3. To motivate students for participation in scientific events, study visits, etc.
4. Understand scientific and technological aspects of experimental Physics.

Detailed Syllabus: Any 12 Experiments.

Sr. No.	Title of Experiment
1.	Determination of temperature coefficient of resistance
2.	Determination of specific heat of Graphite
3.	Study of thermocouple and determination of inversion temperature
4.	Graphical representation of Carnot's cycle
5.	Study of thermal conductivity by Lee's method
6.	Study of Kirchhoff's law
7.	Determination of frequency of AC mains
8.	Study of LR circuit
9.	Study of LCR circuit
10.	Comparison of capacitance using De Sauty's method
11.	Draw and analyze the Pie chart in MS-Excel/Gnuplot

12.	Draw and analyze the Pivote chart in MS-Excel/Gnuplot
13.	Make a Straight Line Fit using Excel and determine slope
14.	Make a Non-linear Fit using Excel/Gnuplot

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.