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 2024-25

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	Python Programming	02

41.	IV	VII	6.0	DSE-06	BS-PH478P	Python Programming 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	Python Programming	02
39.	IV	VII	6.0	DSE-06	BS-PH476P	Python Programming 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. D.K. Sonawane	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.	Prof. (Dr.) Shrikrushna B. Gaikwad	Member (Co-opt)
16.	Dr. 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: Mathematical Methods in Physics – I								
Year: II				**Semester: III**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-6	BS-PH231T	03	00	03	45	30	70	100

Learning Objectives:

1. Explain the algebra for complex numbers.
2. Explain the concept of partial differentiation and use in various cases.
3. Explain the line integrals and surface integrals.
4. Explain the concept of singular points, ordinary points, regular singular points and irregular singular points.

Course Outcomes (Cos):

1. Solve various problems in complex algebra.
2. Use the concept of partial differentiation to solve numerical problems in physics.
3. Apply vector algebra studied in physics to solve various problems.
4. Understand difference between singular, ordinary, regular and irregular points

Unit I: Complex Numbers **(15 Hrs.)**

Introduction to complex numbers, Rectangular, polar and exponential forms of complex numbers, Argand diagram, Algebra of complex numbers using Argand diagram, De-Moivre's Theorem (Statement only), Power, root and log of complex numbers, Trigonometric, hyperbolic and exponential functions, Applications of complex numbers to determine velocity and acceleration in curved motion, Problems.

Unit II: Partial Differentiation and Differential Equation **(15 Hrs.)**

Definition of partial differentiation, Successive differentiation, Total differentiation, Exact differential, Chain rule, Theorems of differentiation, Change of variables from Cartesian to polar co-ordinates, Conditions for maxima and minima (without proof), Degree, order, linearity and homogeneity of differential equation, Concept of Singular points. Example of singular points ($x = 0$, $x = x0$ and $x = \infty$) of differential equation, Problems

Unit III: Vector Algebra and Analysis **(15 Hrs.)**

Introduction to scalars and vectors, dot product and cross product of two vectors and their physical significance (Revision). Scalar triple product and its geometrical interpretation, Vector triple product and its proof, Scalar and vector fields. Differentiation of vectors with respect to scalar, Vector differential operator and Laplacian operator, Gradient of scalar field and its physical significance, Divergence of scalar field and its physical significance, Curl of vector field and its physical significance, Vector Identities, Stokes theorem (statement only) Problems

Suggested Readings/Material:

1. Methods of Mathematical Physics by Laud, Takwale and Gambhir, June 2014.
2. Mathematical Physics by B. D. Gupta, 4th Edition, Vikas Publishing House Pvt. Ltd, 2009.
3. Mathematical Physics by Rajput and Gupta, 3rd Edition, Vikas Publishing House Pvt. Ltd.,2004
4. Mathematical Methods in Physical Science by Mary and Boas, Third Edition, Kaye Pace,2015-16.
5. Vector analysis by Spiegel, Murrey, June 2016
6. Mathematical Methods for Physicists, Arfken and Weber, 5th Edition January 2001
7. Fundamentals of Mathematical Physics, A. B. Gupta, January 2009
8. Vector Analysis by Seymour Lipschutz and Dennis Spellman, June 2009
9. NPTEL Video: https://nptel.ac.in/courses/111/103/111103070/ Complex Number - Prof. P. A. S. Sree Krishna, Department of Mathematics, IIT Guwahati, 2013.
10. NPTEL Video: https://nptel.ac.in/courses/111/107/111107111/ Partial differential equation, Prof. P. N. Agrawal, IIT Guwahati, 2018.
11. NPTEL Video: https://nptel.ac.in/courses/111/106/111106051/ Vector analysis, Prof. K.C. Sivakumar, IIT Madras, 2015

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

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

Title of the Course: Basics of Electronics								
Year: II				**Semester: III**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-7	BS-PH232T	03	00	03	45	30	70	100

Learning Objectives:

1. Explain various basic electronic components and circuits.
2. Explain basic concepts, principles and theorems in electronic circuits.
3. Explain the concept of Boolean algebra, operation and working of logic gates.
4. Explain importance of operational amplifiers in various applications.

Course Outcomes (Cos):

1. Apply laws of electrical circuits to different circuits.
2. Understand the concepts, laws and theorems.
3. Learn basics of number system and Boolean algebra.
4. Understand the properties and working of transistors.

Detailed Syllabus:

Unit I: Network Theorem and Power Supply (15 Hrs.)

Krichhoff's Law, Voltage and current Divider Circuit, Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power transfer theorem (With proof in case of DC), Problems, Block diagram of power supply, unregulated and regulated power supply, Problems.

Unit II: Study of Transistor and Operational Amplifiers its Application (15 Hrs.)

Bi-junction Transistor : Revision of bipolar Junction Transistor, Types, Symbol and basic action, Configuration (Common Base, Common Emitter and Common Collector), Current Gain Factors (α and β) and their relations, Input, Output and transfer Characteristic of CE Configuration, Biasing method and Voltage Divider, DC Load line (CE), Operating Point (Q- point), Transistor as a switch, Problems. Uni-Junction Transistor.

Operational Amplifiers: Introduction, Ideal and practical Characteristics, Operational Amplifier: IC741- Pin diagram, Concept of Virtual Ground, Inverting and Non-inverting operational amplifiers with concept of gain, Problems.

Unit III: Number System and Logic Gates (15 Hrs.)

Number System: Binary, Binary coded Decimal (BCD), Octal, Hexadecimal, Addition and Subtraction of binary numbers and binary fractions using ones and two's complement. Basic Logic gates (OR, AND, NOT), Derived gates: NOR, NAND, EXOR, EXNOR, with symbols and truth table, Boolean Algebra, De Morgan's theorem and its verification, Problems.

Suggested Readings/Material:

1. Electronic Principles, Malvino, 7th Edition, Tata Mc-Graw Hills publication, 2007.
2. Principles of Electronics, V.K. Mehta, 12th Edition, S. Chand publication, 2020.
3. Op-amp and Linear Integrated Circuit, Ramakant Gaikwad, 4th edition, Prentice Hall of India Publication.
4. Integrated Circuit, Botkar, 10th edition, Khanna Publication, New Delhi, 2004.
5. Digital Principles and Application, Malvino and Leech, 6yh edition, Tata Mc-Graw Hills publication, 2008.
6. Power supply by B.S. Sonde, McGraw-Hill Education, 1980.
7. NPTEL Video: https://nptel.ac.in/courses/117/106/117106087/ Electronic for signal processing - Prof. K. Radhakrishna Rao, Department of Electrical Engineering, IIT Madras, 2009.
8. NPTEL Video: https://nptel.ac.in/courses/108/102/108102097/ Introduction to the Course and Basic Electrical Quantity, Prof. S.C. Dutta Roy, Department of Electrical Engineering, IIT Delhi, 2015.
9. NPTEL Video: https://nptel.ac.in/courses/108/105/108105113/ Digital Circuits, Prof. Santanu Chattopathyay, IIT Kharagpur, 2018.

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 Laboratory 2A								
Year: II				**Semester: III**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-8	BS-PH233P	00	02	02	60	15	35	50

Learning Objectives:

1. Explain CRO, working of CRO and various knobs for measurments.
2. Explain IV characteristics of various electronic components UJT, BJT, etc. along with the construction.
3. Explain construction, pin diagram and working of IC741 and its applications.
4. Give hand on skills related to Microsoft excel to plot graphs of various functions.
5. Explain various electronic components with their applications in real life.
6. Explain the theoretical concept with the help of experiments.
7. Give hand on skills to conduct the practical.

Course Outcomes (Cos):

1. Use CRO to measure various voltage and frequency.
2. Understand the working of the various electronic components UJT, BJT, etc. through experiments.
3. Uderstand the construction of IC 741 and its applications.
4. Handle various basic electrical measuring instruments.
5. Experimentally analyzed the theory taught during lectures,
6. Experimental tools helps to develop ability to address real world problems.

Detailed Syllabus: Any 12 Experiments

Sr. No.	Title of Experiment
1.	Verifi Thevenin's, Norton's and Maximum Power Transfer Circuit Theorems
2.	Analyze the Input and Output characteristics of Transistor in CE Configuration.
3.	Use CRO to measure AC/DC Voltage measurement, Frequency measurement.
4.	Plot I-V Characteristics of UJT.
5.	Study of zener diode voltage regulator and measure its line and load regulation.
6.	Study of small signal voltage amplifier and plot its frequency response and to obtain bandwidth.
7.	Study of Op-amp as an adder and subtractor.
8.	Use of Op-amp as inverting and non-inverting amplifier.
9.	Study of Phase Shift Oscillator using 741.

10.	Study of logic gates and verification of de Morgan's theorems.
11.	Plotting of various trigonometric functions like sinx, cosx, tanx.
12.	Plotting of conic sections like circle, ellipse, parabola.

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 3A								
Year: II				**Semester: III**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
SEC-3	BS-PH234P	00	02	02	60	15	35	50

Learning Objectives:

1. The objective of Simulation laboratory is to impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters,
2. Study of circuit characteristics using PSPICE
3. It also gives practical exposure to the usage of different circuits with different condition.
4. Explain various basic electronic components and circuits.

Course Outcomes (Cos):

1. At the successful completion of this course, the student is expected to gain the following skills:
2. Become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
3. Become familiar with basic electrical measurement instruments and know how to use them to make different types of measurements;
4. Be able to verify the laws and principles of electrical circuits, understand the relationships and differences between theory and practice;
5. Be able to gain practical experience related to electrical circuits, stimulate more interest and motivation for further studies of electrical circuits; and
6. Be able to carefully and thoroughly document and analyze experimental work.

Detailed Syllabus: Any 12 Experiments

Sr. No.	**Title of Experiment**
1.	Build and test Inverting and Non-inverting Operational Amplifier using PSPICE Simulator
2.	Build and Test Linear Voltage Regulators using PSPICE Simulator
3.	Build and test Switching Voltage Regulators using PSPICE Simulator
4.	Build and test Active Filters using PSPICE Simulator
5.	Build and test Voltage Comparators and Schmitt Triggers using PSPICE Simulator

6.	Built and test RC time constant using timer IC 555 using PSPICE Simulator
7.	Built and test forward and reverse bias of Diode using PSPICE Simulator
8.	Study characteristics of zener diode using PSPICE Simulator
9.	Study LR/LCR Circuit. using PSPICE Simulator
10.	PSPICE Simulation of Nodal analysis For DC Circuits
11.	PSPICE simulation of DC circuit for detremining thevinin's equivalent
12.	PSPICE simulation of maximum power transfer theorem for DC circuits
13.	PSPICE simulation of DC network with sub circuit
14.	PSIPEC simulation of Kirchoff's laws

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
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Syllabus
B.Sc. Physics (Major)

Title of the Course: Field Project 1								
Year: II				**Semester: III**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
FP-01	BS-PH235P	00	02	02	60	15	35	50

Detailed Guidelines will be provided by the committee formed by College Authorities.

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: Sound, Waves & Oscillations								
Year: II				**Semester: IV**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-9	BS-PH241T	03	00	03	45	30	70	100

Learning Objectives:

1. Explain physical characteristics of SHM, damped harmonic & forced oscillators and obtain solution of the oscillator using differential equations.
2. Explain logarithmic decrement relaxation factor and quality factor of a harmonic oscillator.
3. Explain the difference between sound and hearing and describe sound as a wave.
4. Explain mathematical description of travelling & standing waves.
5. Explain the Doppler effect of sound and its application in day to day life.

Course Outcomes (Cos)

1. Apply mathematics to solve problems of SHM, damped harmonic & forced oscillators.
2. Analyze and formulate equations to understand physical content in many applications.
3. Apply the Doppler Effect to solve real life problems.
4. Predict in qualitative terms the frequency change that will occur for a stationary & moving observer.

Detailed Syllabus:

Unit I: Undamped and Damped Oscillations (15 Hrs.)

Different types of equilibria (static, dynamic, stable, unstable, and metastable equilibrium) – definitions only with examples, Definitions of linear Simple Harmonic Motion SHM and angular SHM, Differential equation for linear SHM and it's solution, Composition of two perpendicular linear SHMs. for frequency ratio 1:1 and 2:1 (analytical method), Lissajous figures (optical and electrical method) and applications.

Differential equation for damped harmonic oscillator and it's solution, discussion of different cases, Logarithmic decrement, Average energy of damped harmonic oscillator, Quality factor, Application: LCR series circuit, Problems.

Unit II: Forced Oscillations and Resonance (15 Hrs.)

Introduction, Differential equation for forced oscillations and its solution , Resonance: mechanical, acoustic and electrical, Velocity and Amplitude resonance, Sharpness of resonance and half width, Average energy of forced oscillator, Quality factor of forced oscillator, Relation between quality factor and bandwidth, Application of forced oscillations- LCR series circuit, Helmholtz Resonator Problems

Unit III: Waves and Sound **(15 Hrs.)**

Wave (1D and 3D equation), Transverse Waves on a Stretched String, Equation for longitudinal waves and it's solution (one dimension only), Equation for transverse waves and it's solution (one dimension only), Superposition Principle, Phase Velocity and Group Velocity, Energy density and intensity of a wave.

Definition of sound Intensity, Loudness, Pitch, Quality and timbre, Reverberation time and reverberation of hall, Sabine's formula, Doppler effect in sound, Expression for apparent frequency in different cases, Asymmetric nature of Doppler effect in sound, Doppler effect in light, Symmetric nature of Doppler effect in light, Applications: Radar, Speed of distant star, Rotational speed of binary star, Red Shift and Width of spectral line, Problems.

Suggested Readings:

1. The Physics of Waves and Oscillations, N. K. Bajaj, 1st Edition ,Tata McGraw- Hill, publication, 2001.
2. Fundamentals of Vibrations and Waves, S. P. Puri, 1st edition, Tata McGraw-Hill publication, 1992.
3. A Text Book of Sound, Subramanyam and Brijlal, Vikas Prakashan, 2nd edition, 2018.
4. Sound – F. G. Mee. Heinemann Educational Books Ltd, 1967.
5. Waves and Oscillations - R.N. Chaudhari, 2nd edition, New Age International (p) ltd., 2010.
6. A Textbook on Oscillations, Waves and Acoustics by M. Ghosh, and D. Bhattacharya, 5th edition, S. Chand and Company Ltd, 2007.
7. NPTEL Video: http://www.nitttrc.edu.in/nptel/courses/video/115104094/L93.html Undamped Oscillation, Prof. Manoj K. Harbola, IIT Kanpur.
8. NPTEL Video: https://nptel.ac.in/courses/122/105/122105023/ Damped and undamped oscillation, Prof. S. Bharadwaj, Department of Physics and Meteorology, IIT Kharagpur, 2009.
9. NPTEL Video: https://nptel.ac.in/courses/115/106/115106119/ Forced oscillation and wave motion, Prof , M.S. Santhanam, Department of Physics IISER Pune, 2019.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

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Syllabus
B.Sc. Physics (Major)

Title of the Course: Optics								
Year: II				**Semester: IV**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-10	BS-PH242T	03	00	03	45	30	70	100

Learning Objectives:

1. Explain the basic of characteruistics of light.
2. Explain construction and ray diagram of various lenses and its uses.
3. Explain the different types of eye –piece and uses.
4. Explain different types of prism and uses.
5. Explain the phenomenon like polarization, diffraction and interference.

Course Outcomes (Cos):

1. Understand Fundamental laws of light and use it to study variaous problems from day to day life.
2. Understand construction of various types of lenses and their uses in different instruments.
3. Use of different eyepiece in spectrometer.
4. Understand the resolving power of different optical instruments.
5. Understand the diffraction, polarization, interference, and application of them.

Detailed Syllabus:

Unit I: Geometrical optics (15 Hrs.)

Introduction to lenses and sign conventions, Thin lenses: Lens equation for convex lens, Lens maker equation, Concept of magnification, deviation and power of thin lens, Equivalent focal length of two thin lenses, Concept of cardinal points, Law of Reflection and Refraction, Total Internal Reflection, Problems.

Unit II: Lens Aberrations and Optical Instruments (15 Hrs.)

Introduction, Types of aberration: Monochromatic and chromatic, Types of monochromatic aberrations and their reductions, Types of chromatic aberrations, Achromatism: lenses in contact and separated by finite distance, Simple Microscope: Principle, construction and working, Compound Microscope: Principle, construction and working, Ramsden's eye piece, Huygens eye piece, Problems

Unit III: Interference, Diffraction and Polarization (15 Hrs.)

Introduction, Phase change on reflection. (Stokes treatment), Interference due to wedge shaped thin film, Newton's ring, Diffraction types: Fresnel's diffraction and Fraunhoffer's diffraction, plane diffraction grating and resolving power of prism.

Brewster's law, Law of Malus, Polarization by double refraction, Polarization by double refraction by uniaxial crystal, Nicol Prism, fabrication of linear polarizer by Nicol prism, Problem.

Suggested Readings/Material:

1. Fundamental of Physics, J. Walker, D. Halliday, R. Resnick, 10th Ed. Weily Publication, 2013.
2. Optics by A. R. Ganesan, 4th edition, Pearson Education, E. Hetch, 2008.
3. A Textbook of Optics, N Subhramanyam, Brijlal, M. N. Avadhanulu, 23rd revised edition, S. Chand Publication, 2006.
4. Physical Optics, A.K. Ghatak, McMillan, New Delhi, 2017.
5. Optics, A.K. Ghatak, 1st edition, Graw-Hill International, 2017
6. Fundamental of Optics, F. A. Jenkins, H. E. White, 4th Edition, Mc Graw-Hill International edition, 2017.
7. Principles of Optics, D. S. Mathur, 2nd Edition, Gopal Press, Kanpur, 1996.
8. NPTEL Video: https://nptel.ac.in/courses/122/107/122107035/ , Geometrical optics, Prof. G.D. Verma, Prof. M. K. Srivastava ,Prof. B. K. Patra & Prof. Rajdeep Chatterjee, Department of physics, IIT Roorkee, 2009.
9. NPTEL Video: https://nptel.ac.in/courses/108/106/108106161/ , Lens Aberrations, Department of Electrical and Electronics Engineering, IIT Madras, 2019.

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: Physics Laboratory 2B								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-11	BS-PH243P	00	02	02	60	15	35	50

Learning Objectives:

1. Given hands on skill for the experiment in optics.
2. Explain the theoretical concept with the help of experiments.
3. Motivate and encourage students to solve real life problems through experiments.
4. Explain physics behind musical instrument and musical scales.

Course Outcomes (Cos)

1. Hands on Experiments help students to learn various concepts of optics.
2. Experimentally analyzed the theory taught during lectures.
3. Experimental tools help to develop ability to address real world problems.
4. Understand physics behind musical instrument.

Detailed Syllabus: Any 12 Experiments

Sr. No.	Title of Experiment
1.	Determination of logarithmic decrement and damping coefficient of oscillations in air or water.
2.	Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
3.	Use of goniometer to determine cardinal points and focal length.
4.	Study of Lissajous figures and determin unknown frequency using CRO.
5.	Determine velocity of sound by Phase shift method.
6.	Newton's Ring: Determination of wavelength of monochromatic light source (λ).
7.	Study of directional characteristics of Microphone.
8.	Determine dispersive power of glass prism.
9.	Determine the refractive index and type of crystal using double refracting prism.
10.	Study of diffraction at the edge of a razor blade.
11.	Determine the velocity of sound in air at room temperature with Kundt's Tube.
12.	Determine the frequency of an electrically maintained tuning fork by stroboscopic method.

13.	Total internal reflection using LASER beam and glass prism.
14.	Optical activity of sugar solution using polarimeter.

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
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Syllabus
B.Sc. Physics (Major)

Title of the Course: Vocational Skills in Physics Lab. 2								
Year: II				**Semester: IV**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
VSC-2	BS-PH244P	00	02	02	60	15	35	50

Learning Objectives:

1. Given hands on skill for the practical related to house hold circuit.
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.	Testing of single and three phase supply
2.	Identify different types of cables and test them. Prepare terminals, skin the wires/cables using wires tripper and cutter.
3.	Identify different types of connectors, switches, fuses, relays and bread boards. Utilize them in different applications.
4.	Study of different active and passive electronic components and devices. Identify the various voltage regulator ICs.
5.	Perform soldering and de-soldering of various electronics components and devices on general purpose PCB.
6.	Study fuses, MCBs and importance of Earthing.
7.	Design series and parallel connections to control of lamp through switch.
8.	Design electricity distribution board
9.	Measurement of energy using single phase energy meter.
10.	Study and Test of the earthing connection.

11.	Study and use of various wiring connections such as staircase
12.	Identify the different types of LEDs, Displays, and design a circuit using the same.
13.	Residential house wiring using fuse, switch, indicator, lamp and energy meter.
14.	Ceiling fan connections
15.	Surface wiring
16.	Concealed wiring
17.	Measurement of electrical quantities-voltage current, power & power factor in RLC circuit.
18.	To study house wiring: batten, cleat, casing-caping, conduit wirings and staircase wiring.
19.	Design an electronic circuit for power supply and test the functioning.
20.	Test the lighting installation for open circuit, short circuit, polarity, insulation resistance and earth fault.

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: Community Engagement and Services								
Year: II					**Semester: III**			
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
CEP-01	BS-PH245P	00	02	02	60	15	35	50

Detailed Guidelines will be provided by the committee formed by College Authorities for project on Community Engagement and Services.