Appendix- B
AC –02
Item No. – II

As per NEP 2020

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA, SAWANTWADI

Title of the Programme: Science

B.Sc. (Physics)

A: Certificate in Physics: 2023-2024

B: Diploma in Physics: 2024-2025

C: Degree in Physics: 2025-2026

Syllabus for

Sem-I and Sem-II

Reference GR dated 16th May 2023 for Credit structure

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA, SAWANTWADI

(As per NEP 2020)

Sr. No.	Headings	Particulars
1	Title of the Program	Science- Physics
2	Eligibility	H.S.C. Science
	Duration of the Programme	1- Certificate 2- Diploma 3- Advance Diploma 4- Research Degree
	Scheme of Examination	External : 60 Internal: 40 Separate passing in External and Internal examination
	Standard of Passing	40.00%
	Program Academic Level	4.5 Certificate 5.0 Diploma 5.5 Advance Diploma 6.0 Research Degree
	Pattern	Semester Pattern
	Status	New
	To Be Implemented from the academic year	4.6 Certificate 2023-2024 6.0 Diploma 2024-2025 5.5 Advance Diploma 2025-2026 6.0 Research Degree 2026-2027

Preamble

Shri Pancham Khemraj Mahavidyalaya, Sawantwadi is affiliated to University of Mumbai, is awarded academic autonomy by the University Grant Commission (UGC) New Delhi and University of Mumbai, Mumbai in June 2023.

National educational Policy (NEP) – 2020 will be implemented for UG and PG programs from the academic year 2023-2024 as per the guidelines of UGC. Four year under UG programme in Physics has two semester every year. The Mahavidyalaya has implemented Department Specific Structure (DSC). In the proposed structure, due consideration is given to Major subject which comprises Core (Department Specific - Physics) and Elective Courses, Vocational Skill Courses (VSC), On Job Training, Field Projects (FP) and community engagement and service. (CEP). Along with Major subject, student has to earn credits from Minor Course (Other than Physics), Open Elective (OE – course from other faculty), Skill Enhancement Course (SEC), Ability Enhancement Course (AEC), Co-Curricular activity (CC). Continuous assessment is an integral part of the NEP system which will facilitate systematic and thorough learning towards better understanding of the subject. This syllabus is planned to improve the students' understanding of fundamental concepts of Physics and Electronics and their applications along with practical skill required to gain excellence in recent advances of Physics and its applications to society. This course shall inspire students for higher studies in Physics and build-up successful career in several branches of science and technology. At the same time students will become global citizens responsible for responding to recent global challenges.

Aims and Objective

- To recognize the principles behind and importance of many physical phenomena.
- To conduct experiments to understand the principles and laws of physics.
- To use the knowledge and abilities gained to solve real time problems.
- To develop and use a broad variety of computational and analytical problem-solving abilities.

Program Outcomes

A. Learning outcomes that are specific to disciplinary/ interdisciplinary areas of learning. Graduates should be able to demonstrate the acquisition of:

- Comprehensive knowledge of disciplinary/interdisciplinary areas, their relationship with related fields of study and current and emerging developments related to selected disciplinary/interdisciplinary areas of education.

- Practical and vocational knowledge required to perform professional or highly skilled tasks related to the chosen field of study, including knowledge required to undertake self-employment activities and entrepreneurship including enterprise creation.

B. Generic Learning outcomes:

The graduates should be able to demonstrate the capability to solve different kinds of problems in familiar and non-familiar contexts and apply the learning to real-life situations.

The graduates should be able to demonstrate the capability to:

- Analyze and synthesize data from a variety of sources and draw valid conclusions and support them.

The graduates should be able to demonstrate the ability to:

- Create, perform, or think in different and diverse ways about the same objects; deal with problems that do not have simple solutions; adopt innovative, imaginative, lateral thinking, skills and emotional intelligence.

The graduates should be able to demonstrate the skills that enable them to:

- Listen carefully, read texts and research papers analytically and present complex information in a clear and concise manner to different groups/audiences; express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media; identify logical flaws in the arguments of others; confidently share views; construct logical arguments using correct technical language; and convey ideas.

The graduates should be able to demonstrate the capability to:

- Use ICT in a variety of learning and work situations; evaluate and use a variety of relevant information sources, and use appropriate software for analysis of data.

The graduates should be able to:

- Inculcate research aptitude through a keen sense of observation, minor projects, participation in scientific events, study tours etc.
- Map the tasks of a team, motivating and inspiring team members to engage with the formulated vision; work effectively with diverse teams; facilitate cooperative effort on the part of a group; and work efficiently as a member of a team.
- Acquire new knowledge and skills, including ‘learning how to learn skills’; meeting economic, social and cultural objectives; adapting to changing trades and demands of the workplace through knowledge/skill development/reskilling; work independently, identify appropriate resources required for further learning. Also acquire organizational skills and

time management to set self-defined goals and targets with timelines; inculcate a healthy attitude to be a lifelong learner.

- The graduates should be able to demonstrate the acquisition of knowledge and attitude that are required to: Practice constitutional, humanistic, ethical and moral values in life, including universal human values of truth, peace, love, nonviolence, scientific temper and citizenship; follow ethical practices, including avoiding unethical behavior such as falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights, identify ethical issues related to work.

Proposed First Year Credit Structure as per NEP 2020

DEPARTMENT OF PHYSICS

Proposed Structure for Major / Minor/OE/VSE/SEC/VEC/IKS/VEC

Semester	Course Code	Course Title	Type	Credits
I (Level 4.5)	S101PHT (Major)	Classical Physics	**Theory**	**2**
	S102PHT (Major)	Modern Physics	**Theory**	**2**
	S103PHP (Major)	Experimental Physics-I	**Practical**	**2**
	S104PHT (Minor)	Classical Physics	**Theory**	**2**
	S105PHT (Minor)	Modern Physics	**Theory**	**2**
	PHOE01 (GE/OE)	Solar Energy and Its Applications (सौर ऊर्जा आणि त्याचे उपयोग)	**Generic Elective/Open Elective**	**2**
	PHVS01 (VSC)	Experiments in Classical & Modern Physics	**Vocational Skill Course**	**2**
	PHSE01 (SEC)	Basic Instrumentation & Measurement Skills	**Skill Enhancement Course**	**2**
II (Level 4.5)	S106PHT (Major)	Optics-I	**Theory**	**2**
	S107PHT (Major)	Electricity and Electronics	**Theory**	**2**
	S108PHP (Major)	Experimental Physics-II	**Practical**	**2**
	S109PHT (Minor)	Optics-I	**Theory**	**2**
	S110PHT (Minor)	Electricity and Electronics	**Theory**	**2**
	S111PHT (Minor)	Experimental Physics-III	**Practical**	**2**
	PHOE02	Physics in Everyday Life (दैनंदिन जीवनातिल भौतिकशास्त्र)	**Generic Elective/Open Elective**	**2**
	PHOE03	आकाशाशी जडले नाते (A relationship with the sky)	**Generic Elective/Open Elective**	**2**
	PHSE02 (SEC)	Digital Electronics	**Skill Enhancement Course**	**2**
	PHSE03 (SEC)	Basic Optics	**Skill Enhancement Course**	**2**
	PHIK01	Astronomy and Astrophysics	**IKS**	**2**

Committee for creation of Syllabus

Sr. No.	Name	College Name	Designation	Signature
1.	Dr. Yogesh Arjun Chaudhari	S. P. K. Mahavidyalaya, Sawantwadi	Chairman	
2.	Dr. Sandip Vilasrao Patil	S. P. K. Mahavidyalaya, Sawantwadi	Member	
3.	Ms. Manjiri Mangesh Rawool	S. P. K. Mahavidyalaya, Sawantwadi	Member	
4.	Dr. Namdev Shankar Harale	Department of Physics, SGM College, Vidyanagar, Karad-415124, Dist- Satara, Maharashtra, India	Expert Nominee by AC from other University	
5.	Dr. Ganesh Janardan Navathe	Vivekanand College, Kolhapur	Expert Nominee by AC from other University	
6.	Dr. Meera Rajesh Kale	Department of Physics, Athalye Sapre Pitre College, Devrukh, At Post Devrukh, Tal.- Sangameshwar, Dist.- Ratnagiri	Expert Nominee by VC	
7.	Dr. Rama Vittoba Dhekale	Perfect Electronics, Plot No. B 115 Wai, Dist – Satara	Representative from Industry	
8.	Mr. Amey A. Madgaonkar	Lecturer, Y.B. Polytechnic, ,Sawantwadi	Post Graduate Meritorious Alumni	
9.	Mr. Bhavesh. A. Chavan	Assistant Professor, Department of Physics, SRM College, Kudal, Dist- Sindhudurg	Expert from outside the Autonomous College- Special courses of studies	

Letter Grades and Grade points

Semester GPA/Program CGPA/Semester Program	Percentage of Marks	Alpha- sign / letter grade result
9.00-10.00	90.00-100	O (Outstanding)
8.00-9.00≥	80.0-90.0	A+ (Excellent)
7.00-8.00	70.0-80.0	A(Very Good)
6.00-7.00	60.0-70.0	B+(Good)
5.50-6.00	55.0-60.0	B(Above Average)
5.00-5.50	50.0-55.0	C(Average)
4.00-5.00	40.0-50.0	P(Pass)
Below 4.00	Below 40.0	F(Fail)
AB (absent)		Absent

Course Code and Title: S101PHT (MAJOR): CLASSICAL PHYSICS

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-I

Learning Objectives:

- Be aware of Newton's laws and how to use them in everyday life.
- Understand the fundamentals of friction.
- Understand the relationship between work and energy.
- Understand the concepts of elasticity, viscosity, and fluid dynamics.
- Describe the behavior of actual gases in relation to their thermodynamical reaction.

Learning Outcomes:

On successful completion of this course students will be able to:

- To use Newton's laws to calculate the motion of the simplest systems.
- Apply the Work-to-Energy Equivalence and its applications using the appropriate quantities.
- Apply viscous, elastic, and fluid dynamics to actual circumstances.
- Determine whether actual gases are subject to the principles of thermodynamics.
- Apply mathematical expertise to all topic areas.

Unit - I	**10 Lectures**
1.	**1. Newton's Laws:** 1.1. Newton's Laws. 1.1.1. Newton's first law of motion. 1.1.2. Newton's second law of motion. 1.1.3. Newton's third law of motion. 1.2. Interpretation and applications. 1.3. Pseudo forces. 1.4. Frame of References: 1.4.1. Inertial frame of reference. 1.4.2. Non-inertial frames of references. 1.5. Examples.
2.	**2. Friction:** 2.1. Advantages of friction in daily life. 2.2. Disadvantages of friction in daily life. 2.3. Friction as the component of Contact force. 2.3.1. Kinetic Friction. 2.3.2. Static friction. 2.4. Laws of friction.
3.	**3. Work and Energy:** 3.1. Kinetic Energy. 3.2. Work and Work-energy theorem. 3.3. Potential Energy. 3.4. Conservative and Non Conservative Forces. 3.5. Different forms of Energy. 3.6. Mass Energy Equivalence. 3.7. Examples.
Unit – II	**10 Lectures**
1.	**1. Elasticity**: 1.1. An introduction to Elasticity. 1.1.1. Stress.

	1.1.2. Strain. 1.2. Hooke's Law. 1.3. Moduli of Elasticity and relation between them. 1.4. Examples.
2.	**2. Viscosity**: 2.1. An introduction to Viscosity. 2.2. Flow through a Narrow Tube. 2.2.1. Poiseuille's Equation. 2.3. Stokes' Law. 2.3.1.Terminal velocity 2.3.2. Measuring Coefficient of Viscosity by Stokes' method. 2.3.3. Examples.
3.	**3. Fluid Mechanics:** 3.1. Streamline flow. 3.2. Turbulent flow. 3.3. Equation of Continuity. 3.4. Bernoulli's equation. 3.4.1. Applications of Bernoulli's equation. 3.5. Examples.
Unit – III	**10 Lectures**
1.	**1. Behavior of real gases**: 1.1. An introduction. 1.2. Vander Waals equation of state.
2.	**2. Laws of Thermodynamics:** 2.1. Thermodynamic Systems. 2.2. Zeroth law of thermodynamics. 2.3. Concept of heat. 2.4. Thermodynamic Equilibrium. 2.5. Work: A Path dependent function. 2.6. Internal energy. 2.7. First law of Thermodynamics. 2.8. Internal Energy as a state function. 2.9. Specific heat of gases. 2.10. Applications of First Law of thermodynamics. 2.11. The indicator diagram. 2.12. Work done during Isothermal and Adiabatic processes.
3.	**3. Heat engine:** 3.1. Heat engine and its efficiency. 3.2. Carnot's Ideal heat engine. 3.3. Examples.

References:

1.	HCV: H. C. Verma, Concepts of Physics–Part I (Second Reprint of 2020) Bharati Bhavan Publishers and Distributers.
2.	BSH: BrijLal, Subrahmanyam and Hemne, Heat Thermodynamics and Statistical Physics, S. Chand, Revised, Multi-coloured (Reprint 2019).
3.	Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley & Sons.
4.	D. S. Mathur, P.S Hemne,Mechanics,2012,S. Chand
5.	M.W. Zemansky and R. H. Dittman, Heat and Thermodynamics, McGraw Hill.
6.	Thornton and Marion, Classical Dynamics (5thEd.)
7.	D. S. Mathur, Element of Properties of Matter, S. Chand & Co.
8.	R. Murugeshan and K. Shivprasath, Properties of Matter and Acoustics, S. Chand.

Course Code and Title: S102PHT (MAJOR): MODERN PHYSICS

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-I

Learning Objectives:

- To learn and understand the fundamental ideas of modern physics.

Learning Outcomes:

On successful completion of this course students will be able to:

- Be familiar with nuclear characteristics, nuclear behavior, and numerous nuclear reactions.
- Be familiar with the idea of radioactivity, its uses, and the many types of equilibrium in radioactive elements.
- Recognize the various nuclear detector types and their uses.
- Understand and demonstrate the principles of quantum mechanics.
- Use quantitative problem-solving abilities across all subjects.

Unit - I	**10 Lectures**
1.	**1. Basic properties of nuclei**: 1.1. Nucleus: 1.1.1. Composition. 1.1.2. Charge 1.1.3. Size. 1.1.4. Density. 1.1.5. Spin and Magnetic dipole moment. 1.2. Rutherford's experiment and estimation of nuclear size. 1.3. Mass defect and binding energy. 1.4. Problems.
2.	**2. Radioactivity:** 2.1. Review of properties of α, β and γ-rays. 2.2. Law of Radioactive decay. 2.3. Half-life and mean life. 2.4. Units of radioactivity. 2.5. Statistical nature of radioactivity. 2.6. Successive radioactive disintegration- A to B to C (stable) type. 2.7. Natural radioactive series. 2.8. Radioactive equilibriums. 2.9. Artificial radioactivity. 2.10. Problems.
Unit – II	**10 Lectures**
1.	**1. Radiation Detectors:** 1.1. Interaction between particles and matter. 1.2. Plot of variation of Ionization current with applied voltage. 1.3. Gas filled radiation detectors. 1.3.1. Ionization chamber. 1.3.2. Proportional Counter. 1.3.3. GM Counter.
2.	**2. Nuclear Reactions:** 2.1. Introduction to nuclear reaction. 2.2. Types of nuclear reactions.

	2.3. Conservation laws. 2.4. Concept of compound and direct reaction. 2.5. Q value equation. 2.5.1. Solution of the Q equation. 2.5.2. Threshold energy. 2.6. Problems.
3.	**3. Semiconductor Physics:** 3.1. States of matter 3.2. Introduction 3.3. Intrinsic and semiconductors 3.4. Extrinsic semiconductors 3.4.1. p-type 3.4.2. n -type
Unit – III	**10 Lectures**
1.	Photoelectric effect, Blackbody, Black Body spectrum, Wien's displacement law **1. Origin of Quantum theory**: 1.1. Matter waves. 1.2. De Broglie waves. 1.3. Wave particle duality. 1.4. Davisson Germer experiment.
2.	**2. X-Rays:** 2.1. Production of X-rays. 2.2. Properties of X-rays. 2.3. X-Ray spectra. 2.4. X-Ray Diffraction. 2.4.1. Bragg's Law. 2.5. Compton Effect. 2.6. Pair production. 2.7. Gravitational Red Shift.

References:

1.	AB: Arthur Beiser, Concepts of Modern Physics, 6th Edition.
2.	SBP: S. B. Patel, Nuclear Physics: An Introduction, New Age International Publishers, 2nd Edition.
3.	SNG: S. N, Ghoshal, Nuclear Physics
4.	DCT: D. C. Tayal, Nuclear Physics, Himalaya Publishing House, 5th Edition.
5.	S. L Kakani and Shubhra Kakani, Nuclear and Particle Physics, Viva Books, 2nd Edition.
6.	Kenneth S. Krane, Modern Physics, 4th Edition, Wiley.
7.	Ronald Gautreau, Schaum's Outline of Modern Physics, Second Edition, McGraw Hill Besides reference books, Standard websites are expected to be referred.

Course Code and Title: S103PHP (MAJOR): PRACTICALS OF PHYSICS

Level: 4.5	Credits: 02	Semester-I

Learning Outcome: On successful completion of this course students will be able to:

- To show their practical abilities.
- To learn and put the abilities into practice while performing physics practical.
- To be comfortable using equipment and understanding how it works.
- To connect theoretical physics concepts to practical applications.
- Recognize the ideas behind errors and how to estimate them.

A. Regular experiments	
1	Torsional Oscillation: To determine modulus of rigidity η of a material of wire by Torsional oscillations.
2	Bifilar Pendulum: Determination of moment of inertia of rectangular and cylindrical bar about an axis passing through its center of gravity.
3	Moment of inertial of Flywheel.
4	Constant volume air thermometer.
5	Frequency of AC Mains: To determine frequency of AC mains (Sonometer wire).
6	LDR Characteristics: To study the dependence of LDR resistance on intensity of light.
7	Bar Pendulum:- To calculate acceleration due to gravity (g).
B. Regular Experiments:	
8	Study of Logic gates &To verify De Morgan's Theorems.
9	To study EX-OR Gate and verify its truth table.
10	To study half adder and full adder and verify their truth table Ex-OR Gate.
11	To study load regulation of a Bridge Rectifier.
12	To study Zener Diode as Regulator.
13	Study of LASER Beam Divergence.
14	To study charging and discharging of capacitor.
Group C Skill Experiments Skill Experiments.	
1.	Use of Vernier Callipers, Micrometer Screw Gauge and Travelling Microscope.
2.	Graph plotting (Plot BE/A verses A graph for 30 atoms, Plot Packing Fraction graph for 30 atoms).
3.	Spectrometer: Schuster's Method.
4.	To determine the Resistance & Capacitance using Colorcode / Number & verify using Multimeter (Analog/Digital).
5.	Use of digital multimeter.
6.	Absolute and relative error calculation.

Course Code and Title: S106PHT (MAJOR): OPTICS I

Level: 4.5	Credits: 02	Number of Lectures 30	Semester-II

Learning Objectives:

- To acquire knowledge of important fundamental of optics.

Learning Outcomes: After successful completion of the course, the student will be able to:

- Understand a basic understanding of lenses, lens flaws, and how to reduce them.
- The significance of the lens combination that an optical instrument's eyepiece implies.
- Identify light interference using a few well-known instances from everyday life.
- Recognize the uses of lasers and optical fibers in modern life.

	Unit – I: **10 Lectures**
1.	**1. Lenses and Lens Maker's Equation:** 1.1. Introduction to lenses 1.2. Terminology and sign conventions. 1.3. Introduction to Thin lenses. 1.4. Lens equation for single convex lens. 1.5. Lens maker's equation. 1.5.1. Positions of the Principal Foci. 1.5.2. Newton's Lens equation.
2.	**2. Magnification by a lens and power of lens:** 2.1. Magnification. 2.1.1. Lateral Magnification. 2.1.2. Longitudinal Magnification. 2.1.3. Angular magnification. 2.2. Deviation by a thin lens and its power. 2.3. Necessity to combine the lenses. 2.4. Equivalent focal length. 2.5. Power of two thin lenses.
3.	**3. Introduction to Aberration in lenses**: 3.1. Spherical aberration & reduction. 3.2. Chromatic aberration & reduction. 3.3. Examples.
	Unit – II: Introduction to Optical Instruments and Interference in Thin Films **10 Lectures**
1.	**1. Optical Instruments and Eyepieces:** 1.1. Human Eye as an optical instrument. 1.2. Camera and Lenses of Camera. 1.3. Simple Microscope. 1.4. Compound Microscope. 1.5. Concept of eyepiece & its significance. 1.5.1. Huygens Eyepiece. 1.5.2. Ramsden Eyepiece (Principle, Construction, Expression for Equivalent Focal Length, Merits and Demerits). 1.6. Comparison of Huygens Eyepiece and Ramsden Eyepiece.
2.	**2. Interference in Thin Films:** 2.1. Interference due to reflected and transmitted light in plane thin films.

	2.2. Conditions for Maxima and Minima. 2.3. Interference pattern in wedge shaped film. 2.4. Newton's rings. 2.5. Examples.
Unit - III Lasers and Fiber Optics	**10 Lectures**
1.	**1. An Introduction to LASERS:** 1.1. Absorption and Emission. 1.2. Spontaneous and Stimulated Emission. 1.3. Conditions for amplified light. 1.4. Components of laser. 1.5. Types of Lasers: 1.5.1. Ruby laser. 1.5.2. He-Ne Laser. 1.6. Laser Beam Characteristics. 1.7. Applications of Laser.
2.	**2. An Introduction to Optical Fiber:** 2.1. Total Internal Reflection. 2.2. Propagation of light through an Optical fiber. 2.3. Numerical Aperture. 2.4. Classification of Optical fibers. 2.4.1. Single Mode Step Index Fiber. 2.4.2. Multimode Step Index Fiber. 2.4.3. Graded Index Fiber 2.4.4. Optical Fiber applications: Optical fiber based communication system & Optical Fiber based Temperature sensor.

References:	
1.	Dr. N. Subrahmanyam, Brijlal, and Dr. M. N. Avadhanulu, A Textbook of Optics, 25th Revised Edition 2012 (Reprint 2016), S. Chand and Company Pvt. Ltd.
2.	Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.
3.	Ajoy Ghatak, Optics, 6th Edition, McGraw Hill Education (India) Private Limited.
4.	A Textbook Of Engineering Physics M. N. Avadhanulu, and P. G. Kshirsagar
5.	New College Quantum and Laser Physics (A Textbook For K.U For B.Sc Vth Semester) (English, Paperback, R.P Chauhan, Meenu Rani,Dr. S.K. Goyal)

Course Code and Title: S107PHT (MAJOR): ELECTRICITY AND ELECTRONICS

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-II

Learning Outcomes: On effective completion of this course students will be capable of:

- Identify the fundamental ideas behind Alternating Current Theory, AC Bridges, and Circuit Theorems.
- Identify the fundamentals of analogue and digital electronics and apply them in practical scenarios
- Demonstrate quantitative problem.

Unit - I Electricity	**10 Lectures**
1.	**1. Alternating current theory:** 1.1. Review: Concept of L, R, and C. 1.2. AC circuit containing pure R, pure L and pure C. 1.3. Representation of sinusoids by complex numbers. 1.4. Series L-R circuit. 1.5. Series C-R circuit. 1.6. Series LCR circuits. 1.7. Resonance in LCR circuit (both series and parallel). Examples.
2.	**2. AC bridges:** 2.1. General AC Bridge. 2.2. Maxwell's Inductance Bridge. 2.3. Maxwell's L/C Bridge. 2.4. De-Sauty Bridge. 2.5. Wien Bridge oscillator.
Unit - II Analog Electronics	**10 Lectures**
1.	**1. Circuit Theorems:** 1.1. (Review: Ohm's law, Kirchhoff's laws). 1.2. Ideal Current source. 1.3. Ideal Voltage Source. 1.4. Thevenin's Theorem. 1.5. Norton's Theorem. 1.6. Maximum Power Transfer Theorem. 1.7. Problems related to circuit analysis using the above theorems.
2.	**2. DC Power Supply:** 2.1. Block diagram of a dc power supply– concept of a transformer. 2.2. Half wave rectifier. 2.3. Full wave rectifier. 2.4. Bridge rectifier, Efficiency and Ripple factor of full wave rectifier. 2.5. Capacitor Filter. 2.6. Need for voltage regulation - Zener diode as voltage stabilizer. 2.7. Examples.
Unit - III Digital Electronics	**10 Lectures**
1.	**3. Number Systems – Binary number system:** 3.1. Binary to decimal conversion. 3.1.1. Decimal to binary conversion. 3.1.2. Hexadecimal number system:

	3.2. Hexadecimal to decimal Conversion. 3.2.1. Decimal to hexadecimal conversion, 3.2.2. Hexadecimal to binary conversion. 3.2.3. Binary to hexadecimal conversion.
2.	**3. Derived Gates:** 3.1. Review: Basic Logic gates. 3.2. NAND and NOR as Universal Building blocks 3.3. Ex-OR gate: logic expression, logic symbol, truth table. 3.4. Half adder 3.5. Full adder.

References:

1.	B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology Vol.I, S. Chand Publication
2.	R. L. Boylestad and L. Nashelsky, Electronic devices and Circuit Theory 10th Edition, Pearson
3.	Leach, Malvino, Saha, Digital Principles and Applications– 6th Edition. Tata McGraw Hill
4.	Tokheim: Digital Electronics, Principles and Applications,6th Edition, McGraw Hill Edition
5.	Albert Malvino, David Bates, Electronic Principles, 8th Edition,Tata McGraw Hill

Course Code and Title: S108PHP (MAJOR): PRACTICALS OF PHYSICS

Level: 4.5	Credits: 02	Practical Credits: 02	Semester-II

Instructions:

- All the measurements and readings should be written with proper units in SI system only.
- After completing all the required number of experiments in the semester and recording them in journal, student will have to get their journal certified and Produce the certified journal at the time of practical examination.
- While evaluating practical, weight age should be given to circuit/ ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
- Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Learning Outcome:

- To understand and practice the skills while doing physics practical.
- To understand the use of apparatus and their use without fear.
- To correlate their physics theory concepts through practical.
- Understand the concepts of errors and their estimation.

Note: Exemption of two experiments from section A and /or B and/or C may be given if student carries out any one of the following activity.

- Collect the information of at least five Physicists with their work or any three events on physics, report that in journal.
- Execute a mini project to the satisfaction of teacher in-charge of practical.
- Participate in a study tour or visit & submit a study tour report.
- For practical examinations, the learner will be examined in two experiments (one from each group).
- Each experiment will be of three lecture hours' duration.
- A Minimum 4 from each group and in all minimum 8 experiments must be reported in journal.
- All the skill experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments. A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester II as per the minimum requirements.

GROUP A	
1	Young's Modulus of a wire material by method of vibrations
2	Spectrometer : To determine of angle of Prism
3	Spectrometer: To determine refractive index of prism material
4	Combination of Lenses :To determine equivalent focal length of a lens system by magnification Method
5	Newton's Rings: To determine radius of curvature of a given convex lens using Newton's rings.
6	Determination of diameter of thin wire using Wedge Shaped Film
7	To calculate Refractive index of water.
GROUP B	
8	To study NAND/NOR gates as Universal Building Blocks
9	LR Circuit: To determine the value of given inductance and phase angle
10	CR Circuit: To determine value of given capacitor and Phase angle
11	Transistor configurations: CB/CE/CC(study of input-output characteristics)
12	LCR series Resonance: To determine resonance frequency of LCR series circuit
13	To study Thermistor characteristics: Resistance vs. Temperature
14	To study maximum power transfer theorem.
15	To Study and verify Thevenin's theorem.
GROUP C: DEMONSTRATION EXPERIMENT	
1	Radius of ball bearings(single pan balance)
2	Use of Oscilloscope: Waveforms at output of half wave, bridge rectifiers with and without Capacitor filter, Ripple
3	Use of PC for graph plotting
4	I-V Characteristics of LED
5	Testing of components (Resistors, Diode, Transistor, capacitor)
6	Study of I-V characteristics of solar cell.

Note: Minimum 8 experiments (Four From each group) and 4 Demo experiments should be completed and reported in the journal, in the first semester. **Certified Journal is a must**, to be eligible to appear for the semester end practical examination.

EXAMINATION PATTERN FOR MAJOR SUBJECTS

A) Continuous Internal Assessment (40 Marks):

Sr. No.	Particular	Marks
1	One offline class test.	20
2	One assignment	10
3	Attendance in routine class/practical's.	05
4	Overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	05
	Total Marks	40

B) Semester End Examination (60 Marks):

Question Paper Pattern:

1. These examinations shall be of **Two Hours** duration. Maximum marks **60**.
2. There shall be four questions each of **15 marks**.
   - **Questions 1** will be based on all three units consist of multiple choice questions, match the pairs, one sentence answers, true or false type questions.
   - **Question -2, 3 and 4** will be based on **Unit-II, III and IV respectively carrying 15 Marks each.** These question contains one long question and one short questions with 50 % option.
   - All questions shall be compulsory.

Distribution of external 60 marls

Qn.	Sub-Qn	Particulars	Unit	Marks with options	Total Marks for qn
1	**A**	Multiple choice questions	**I, II, III**	05	05
	B	One sentence answers	**I, II, III**	05	05
	C	True or False or Match the pairs	**I, II, III**	05	05
2	**A**	Answer the following (Attempt **any One out of two)**	**I**	20	10
	B	Answer the following (Attempt **any One out of two)**		10	05
3	**A**	Answer the following (Attempt **any One out of two)**	**II**	20	10
	B	Answer the following (Attempt **any One out of two)**		10	05
4	**A**	Answer the following (Attempt **any One out of two)**	**III**	20	10
	B	Answer the following (Attempt **any One out of two)**		10	05
		Total		**105**	**60**

C) Semester End Practical Examination (100 marks):

Scheme of examination:

- There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Physics as per the minimum requirement.
- The practical examination will be conducted in **TWO SESSIONS** of three hours each.
- The learners will be evaluated based on the experiments performed during the examination.
- The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Physics.

Distribution of marks in practical examination

Sr. No.	Particulars	Marks (100 marks)
1	Experiment	40
2	Viva voce	05
3	Certified journal	05
	Total Marks	**50**

D) Open Elective/Generic Elective (OE/GE) Assessment:

Internal Assessment of 20 Marks:

Sr. No.	Particulars	Marks
1	One Assignment/test	10
2	Class attendance	05
3	One subject based activity/viva based on the course	05
	Total Marks	20

External Assessment of 30 Marks:

Sr. No.	Particulars	Marks
1	One theory test	30
	Total Marks	30

E) VSEC/SEC Assessment:

Semester End Practical Examination (50 marks):

- There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Physics as per the minimum requirement.
- The practical examination will be conducted in **ONE SESSIONS** of three hours each.
- The learners will be evaluated based on the experiments performed during the examination.

Sr. No.	Particulars	Marks (50 marks)
1	Experiment	40
2	Viva voce	05
3	Certified journal	05
	Total Marks	**50**

F) IKS Assessment:

Internal Assessment:

Sr. No.	Particulars	Marks
1	One assignment/test	10
2	Class attendance	05
3	Subject based activity	05
	Total Marks	20

External Assessment:

Sr. No.	Particulars	Marks
1	One offline test	30
	Total Marks	30

Course Code and Title: PH0E01 (GE/OE): SOLAR ENERGY AND ITS APPLICATIONS
सौर ऊर्जा आणि त्याचे उपयोग

Level: 4.5	Credits: 02	Lectures: 30 L

Learning Outcomes

- ऊर्जा हा शब्द आणि त्याचे जागतिक महत्त्व समजून घ्या.
- हरित ऊर्जेचे महत्त्व समजून घेणे.
- भारतातील उर्जा स्त्रोतांचे विश्लेषण करणे.
- सौर ऊर्जेचे महत्त्व समजून घेणे

युनिट-**I:** सौर विकिरण (10 तास)

ऊर्जेचा स्त्रोत म्हणून सूर्य, सौर विकिरण, पृथ्वीच्या पृष्ठभागावरील सौर विकिरण, सौर किरणोत्सर्गाचे मापन-पायरोहेलिओमीटर, पायरोमीटर, सनशाइन रेकॉर्डर, उपलब्ध सौर किरणोत्सर्गाचा अंदाज, सौर ऊर्जा-महत्त्व, सौर उर्जेची साठवण, सौर तलाव.

युनिट –**II:** सौर फोटोव्होल्टेइक प्रणाली (10 तास)

सौर ऊर्जेचे विजेमध्ये रूपांतर - फोटोव्होल्टेइक इफेक्ट, सोलर फोटोव्होल्टेइक सेल आणि त्याचे कार्य तत्त्व, विविध प्रकारचे सौर सेल, मालिका आणि समांतर कनेक्शन, फोटोव्होल्टेइक ऍप्लिकेशन्स: बॅटरी चार्जर, घरगुती प्रकाश, रस्त्यावरील प्रकाश आणि पाणी पंपिंग

युनिट –III: सौर यंत्रणा (10 तास)

सोलर वॉटर हीटर, सोलर ट्रॅफिक लाइट, सौरऊर्जेवर चालणारे कॅल्क्युलेटर, सौर उर्जेवर चालणारे पंप, सोलर कार, सोलर बस, रुफटॉप सोलर पॉवर, स्मार्ट ग्लास.

संदर्भ

1. सौर ऊर्जा तत्त्वे, थर्मल कलेक्शन आणि स्टोरेज, S.P. सुखात्मे: Tata McGraw Hill Pub., New Delhi.
2. अपारंपरिक ऊर्जा स्रोत, जी.डी.राय, नवी दिल्ली.

Course Code and Title: PH0E02 (GE/OE): PHYSICS IN EVERYDAY LIFE

दैनंदिन जीवनात भौतिकशास्त्

Level: 4.5	Credits: 02	Lectures: 30 L

Learning Outcomes:

- न्यूटनचे गतीचे नियम आणि गतीचा अंदाज लावण्यात त्यांची भूमिका समजून घ्या आणि यांत्रिकीमधील परिमाणवाचक समस्या सोडवण्यासाठी त्यांचा वापर करा.
- ऑप्टिकल घटनेमागील तत्त्व समजून घ्या.
- विजेच्या मूलभूत संकल्पना समजून घ्या आणि विजेचे दैनंदिन वापर समजून घेण्यासाठी ज्ञानाचा अवलंब करा
- ध्वनी आणि प्रकाशाचे लहरी स्वरूप आणि वर्तन समजून घ्या आणि लागू करा.

युनिट **I :** गती: वेग**,** प्रवेग**,** संवेग: (10 तास)

गती: वेग, प्रवेग, संवेग - जडत्व - बल - गतीचे नियम. न्यूटनचा गुरुत्वाकर्षणाचा नियम - गुरुत्वाकर्षणामुळे होणारा प्रवेग - वस्तुमान आणि वजन, वजनहीनता.

पदार्थाचे गुणधर्म: पदार्थाचे वेगवेगळे टप्पे - पृष्ठभागावरील ताण, स्निग्धता- केशिका वाढ उष्णता, तापमान-भिन्न तापमान स्केल: डिग्री सेल्सिअस, फॅरेनहाइट आणि केल्विन ट्रान्सव्हर्स आणि रेखांशाच्या लाटा, ध्वनी लहरी.

युनिट **II:** प्रकाश आणि लेन्स: **(**10 तास)

प्रकाश आणि लेन्स: परावर्तन, अपवर्तन, विवर्तन, हस्तक्षेप, विखुरणे (केवळ प्राथमिक कल्पना) - आकाशाचा निळा रंग, ताऱ्यांचे चमकणे. मृगजळ -इंद्रधनुष्य अवतल आणि बहिर्वक्र लेन्स - फोकल लांबी, लेन्सची शक्ती, डोळ्यातील अपवर्तक निर्देशांक-दोष - मायोपिया, हायपरमेट्रोपिया, प्रिस्बायोपिया आणि दृष्टिवैषम्य आणि लेन्सद्वारे त्यांची दुरुस्ती.

युनिट III : वीज: (10 तास)

वीज: व्होल्टेज आणि करंट, ओम्स कायदा. इलेक्ट्रिक पॉवर (EB बिल), इलेक्ट्रिक उपकरणांच्या ऊर्जेच्या गरजेची गणना - ट्रान्सफॉर्मर, जनरेटर. चुंबकत्व: इलेक्ट्रोमॅग्नेटिक इंडक्शन-सुपर कंडक्टिविटी-मेस्नर इफेक्ट-मॅगलेव्ह ट्रेन.

संदर्भ:

1. एलिमेंट्स ऑफ प्रॉपर्टीज ऑफ मॅटर, डी.एस. माथूर, एस.चंद अँड कंपनी (2010).
2. आर्थर बीझरच्या अनुप्रयोगांसह भौतिकशास्त्राची मूलभूत तत्त्वे.
3. अजय घटक, टाटा मॅकग्रॉ-हिल प्रकाशन कंपनी लिमिटेड, नवी दिल्ली (1998) द्वारे ऑप्टिक्स.
4. विद्युत आणि चुंबकत्व, ए एस महाजन, ए आरंगवाला, मॅकग्रा हिल, नवी दिल्ली (2017).
5. खगोल भौतिकशास्त्राचा परिचय, बैद्यनाथ बसू, तनुका चट्टोपाध्याय, सुधींद्र नाथ बिस्वास, दुसरी आवृत्ती (2010), पीएचआय लर्निंग प्रायव्हेट लिमिटेड.

Course Code and Title: PH0E03 (GE/OE): A RELATIONSHIP WITH THE SKY
आकाशाशी जडले नाते

Level: 4.5	Credits: 02	Lectures: 30 L

Learning Outcomes:

- ग्रहमालेतील अद्‌भुत दृश्ये ग्रहमालेची व्याप्ती , ग्रहांच्या गतीचे विज्ञान ,सूर्यमालेची उत्पत्ती, ग्रहमालेतल्या टकरी जानुन घेणे..
- गुरुत्वाकर्षण , विद्‌युच्चुंबकीय शास्त्र समजून घेणे.
- विजेच्या मूलभूत संकल्पना समजून घ्या आणि विजेचे दैनंदिन वापर समजून घेण्यासाठी ज्ञानाचा अवलंब करा
- ध्वनी आणि प्रकाशाचे लहरी स्वरूप आणि वर्तन समजून घ्या आणि लागू करा.

युनिट I : धरणीमातेला सोडून जाताना (10 तास)

जेव्हा सूर्य पश्चिमेकडे उगवला, काव्याकुट्ट आकाशात तळपणारा सूर्य कुठे असेल ?, चंद्रावरून आकाशदर्शन ,ग्रहमालेतील अद्‌भुत दृश्ये ग्रहमालेची व्याप्ती , ग्रहांच्या गतीचे विज्ञान

युनिट II : भौतिकशास्त्राचा पाया (10 तास)

काही ऐतिहासिक किस्से सूर्यमालेची उत्पत्ती, ग्रहमालेतल्या टकरी, हे विश्वचि प्रयोगांचे घर, गुरुत्वाकर्षण , विद्‌युच्चुंबकीय शास्त्र ,तीव्र आणि मंद क्रिया, दुर्बिणींच्या पूर्वी, गॅलिलिओची दुर्बिण.

युनिट III दुर्बिणींच्या जगात व तारे (10 तास)

हर्शल ते केक्: दुर्बिणींचा वाढता आवाका, दृश्यप्रकाशाची छाननी करणारी साधने, रेडिओ दुर्बिणी ताऱ्यांच्या जगात , ताऱ्यांचे गुणधर्म ,ताऱ्यांचा जन्म सूर्य का प्रकाशतो ? ,राक्षस तारे , मूलद्रव्यांची निर्मिती श्वेतबटूंचे विश्व जेव्हा ताऱ्याचा स्फोट होतो ,

आकाशाशी जडले नाते, डॉ. जयंत नारळीकर, राजहंस प्रकाशन

Course Code and Title: PHSE01 (SEC): BASIC INSTRUMENTATION AND MEASUREMENT SKILLS

Level: 4.5	Credits: 02	Practical : 60

Learning Outcomes

- To understand the basic concepts related to measurement.
- To understand the principles of various instruments.
- To learn how to note the accurate measurements using digital instruments.
- To understand the block diagram of various instruments

Practicals:

Sr. No.	Name of the Experiment
1.	To determine the diameter of a given wire using a screw gauge
2.	Thermister characteristics – Thermal study.
3.	Thermistor Characteristics- Electrical study.
4.	Measurement of frequency using CRO.
5.	Frequency measurement of sine wave using function generator.
6.	Frequency measurement of square wave using function generator.
7.	To calculate the frequency of Wien bridge oscillator.
8.	To calculate the frequency using Lissajeous figures.
9.	To study the Cathode Ray Oscilloscope (CRO).
10.	Study of digital multimeter: Testing of components and identification.
11.	To study the I-V characteristics of diode using DMM.
12	To study reverse bias characteristics of diode

Text Books

[1]. A Course in Elec. & Electronics Measurements & Instrumentation: A K. Sawhney.
[2]. Modern Electronic Instrumentation and Measurement Techniques: Helfrick & Cooper.
[3]. Electrical Measurement and Measuring Instruments - Golding & Waddis.

Course Code and Title: PHSE02 (SEC): BASIC OPTICS

Level: 4.5	Credits: 02	Practical: 60 L

Learning Outcomes

- To understand the basics of digital electronics.
- To construct the truth tables of gates by experiential learning.
- To experience the working of basic gates.
- To learn the working of half adder and full adder.
- To understand the basic De-Morgan's theorem.

Practicals:

Sr. No.	Name of the Experiment
1.	To Study basics of Spectrometer and its least count
2.	To study Optical and Mechanical levelling of spectrometer
3.	To find angle of prism
4.	To determine angle of minimum deviation and refractive index
5.	Equivalent Focal length of the combination of lenses
6.	To determine the wavelength of Laser light
7.	Divergence of laser beam
8.	R.I. of Water using laser.
9.	To calculate wavelength of sodium light by step slit
10.	To calculate wavelength of sodium light by 'A' pattern
11.	Determination of wave length of the constituent colours of the mercury spectrum
12.	To determine radius of curvature of convex lens

References:

1.	Dr. N. Subrahmanyam, Brijlal, and Dr. M. N. Avadhanulu, A Textbook of Optics, 25th Revised Edition 2012 (Reprint 2016), S. Chand and Company Pvt. Ltd.
2.	Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.
3.	Ajoy Ghatak, Optics, 6th Edition, McGraw Hill Education (India) Private Limited.
4.	Practical Optics PB 01 Edition (English, Paperback, Menn M).
5.	NEP PRACTICAL PHYSICS Demonstrative Aspects of Optics and Lasers Practical Physics V Sem. B.Sc-III/V Sem (Paperback, S. L. Gupta, V. Kumar).

Course Code and Title: PHIK01: (IKS): ASTRONOMY AND ASTROPHYSICS

Level: 4.5	Credits: 02	Number of Lectures : 30

Preamble:

The proposed syllabus (NEP) to the teachers and students on the basis of Indian knowledge system, I am extremely happy to state that for the first-time efforts have been made to seek inputs of all my colleagues to make it more relevant. The new course that will be effective from the academic year 2023-2024. Indian knowledge system course syllabus including Basic Parameters of vedic physics and stars.

Physics is a study of matter and its motion, along with related concepts such as energy and force. The Vedas and Puranas have given the path to Vedic Physics it's called "Vedic Physics" or "Bouthika Shastram'. In Classical Physics is generally concerned with matter and energy on the normal scale of observation, while much of modern physics is concerned with the behavior of matter and energy under extreme conditions or on a very large or very small scale. For example, atomic and nuclear physics studies matter on the smallest scale at which chemical elements can be identified. Vedic Sages Went To Deep Meditation, Concentration, Contemplation and Discovered A Large Number of Permanent Laws about Vedic Physical Sciences. Vedas, Upanishads, Puranas, Shad-Darshanas (among them Sankhya, Vaishesika, Nyaya Darshanas) had postulated many theories about Universe and its Atomic Structure in their own perspective.

Learning Outcomes

After completing this course, student will gain an understanding of,

• Basic concepts of positional astronomy and astronomical coordinate systems

• Astronomical instruments and the modern telescopes

• Measurement of astronomical parameters such as distance, stellar brightness, stellar mass, radii, temperature and spectra

• The different layers of solar atmosphere and basic results of solar magneto-hydrodynamics

• Basic structure of different galaxies and rotation of the Milky Way galaxy

Unit I: Vedic Physics (10 Hours)

The Expanding Universe, The Birth of Gods, The Dead Egg, The Lord of Expansion, Puruṣa and Aditi, Agastya and Lopāmudra, Edge of the Universe, Indra and Vṛtra, Frog Who Drank All the Waters, Electric Force, Surface Tension, Slaying of Varāha, Bubbles and Voids in Space, Deeds of Indra, Indra, the Bull,Mighty Hercules, Serpent as Evil.

Unit – II - Basic Parameters of Stars **(10 Hours)**

Sources of stellar energy, measurement of astronomical distances (stellar parallax, aberration, proper motion), measurement of brightness, radiant flux and luminosity (apparent and absolute magnitude scales; distance modulus); determination of stellar mass (visual binaries, eclipsing binaries, spectroscopic binaries); measurement of stellar temperature and radius; stellar spectra, dependence of spectral types on temperature; Stellar classification (Harvard and modern Morgan-Keenan classification schemes), H-R diagram.

Unit – III - Sun (10 Hours)

Solar parameters, Sun's internal structure, solar photosphere, solar atmosphere, chromosphere, corona, solar activity, basics of solar magneto-hydrodynamics.

Physics of galaxies: Basic structure and properties of different types of Galaxies; Nature of rotation of the Milky Way: Differential rotation of the Galaxy and Oort constants, rotation curve of the Galaxy and the dark matter, virial theorem Cosmology: Standard Candles (Cepheids and SNe Type1a); cosmic distance ladder; expansion of the Universe, Cosmological Principle, Newtonian Cosmology and Friedmann Models.

References:	
1	Fundamental Astronomy, H. Karttunen et al., Springer Berlin, Heidelberg
2	Modern Astrophysics, B. W. Carroll and D. A. Ostlie, Addison-Wesley Publishing Co.
3	Introductory Astronomy and Astrophysics, M. Zeilik and S. A. Gregory, Saunders College Publishing.
4	Astronomy in India: A Historical Perspective, T. Padmanabhan, Springer
5	Foundation of Astrophysics, B. Ryden and B. M. Peterson, Cambridge University Press.
6	Vedic Physics: Scientific Origin of Hinduism, by Raja Ram Mohan Roy 1999.