Appendix- B
AC –2
Item No. –(ii)

As per NEP 2020

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA (AUTONOMOUS), SAWANTWADI

Title of the Programme: Science

B.Sc. (Physics): Three Major Credit Structure

A: Certificate in Physics: 2024-2025

B: Diploma in Physics: 2025-2026

C: Degree in Physics: 2026-2027

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 (AUTONOMOUS), 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 2024-2025 6.0 Diploma 2025-2026 5.5 Advance Diploma 2026-2027 6.0 Research Degree 2027-2028

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)	Introduction to Mechanics	**Theory**	**2**
	PHP01 (Major Pract.)	Physics Practicals-I	**Major Practical**	**2**
	PHVS01 (VSC)	Experimental Physics-II	**Vocational Skill Course**	2
	PHSE01 (SEC)	Basic Instrumentation & Measurement Skills	**Skill Enhancement Course**	**2**
	PHIK01 (Major)	Astronomy and Astrophysics	**IKS**	**2**
	PHVE01	Enviromental Physics-I	**VEC**	**2**
II (Level 4.5)	S102PHT (Major)	Optics-I	**Theory**	**2**
	PHP02 (Major Pract.)	Physics Practicals-III	**Major Practical**	**2**
	PHVS01 (VSC) (Major)	Experimental Physics-IV	**Vocational Skill Course**	**2**
	PHSE03 (SEC)	Basic Optics	**Skill Enhancement Course**	**2**
	PHOE01 (GE/OE)	Solar Energy and its Applications (सौर ऊर्जा आणि त्याचे उपयोग)	**Generic Elective/Open Elective**	**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): INTRODUCTION TO MECHANICS

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

Course Objectives (CO)

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

- Explain Newton's laws of motion, friction, work, energy and able to solve numericals using them.
- Learn the mechanics of multi-particle system using concepts of center of mass and conservation laws.
- Study the mechanics of undamped and damped oscillations.
- Explain the qualitatively how undamped and damped oscillations are implemented in physical problems such as torsional, compound, and simple pendulums.
- Demonstrate quantitative problem solving skills in all the topics covered in the syllabus.

Course Outcomes (OC)

After successful completion of this course the learner will be able to:

- Understand Newton's laws of motion, friction, work, energy and able to solve problems using them.
- Comprehend Work and Energy equivalence and its applications through suitable numerical.
- Understand mechanics of multi-particle system using concepts of center of mass and conservation laws.
- Understand mechanics of undamped/ (simple harmonic motion, uniform circular motion) and damped oscillations.
- Understand how undamped and damped oscillations are implemented in physical problems.
- Demonstrate quantitative problem solving skills in all the topics covered

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. Understanding friction at atomic levels. 2.5. Examples.
Unit - II	**10 Lectures**
1.	**1. Work and Energy:** 1.1. Kinetic Energy. 1.2. Work and Work-energy theorem. 1.3. Potential Energy. 1.4. Conservative and Non Conservative Forces. 1.5. Different forms of energy. 1.6. Energy Mass Equivalence. 1.7. Examples.
2.	**2. Many Particles System:** 2.1. Centre of Mass of solid objects 2.2. Conservation of momentum in a system of particle 2.3. Angular momentum of a particle and system of particle 2.4. Conservation of angular momentum
Unit – III	**10 Lectures**
1.	1. **Oscillations:** 1.1. Simple Harmonic Oscillator 1.2. Uniform Circular Motion. 1.3. Relation between Simple Harmonic Motion and Uniform Circular Motion 1.4. Damped Harmonic Motion 1.5. Forced Oscillations and Resonance 1.6. Two Body Oscillations. 1.7. Examples of Simple Harmonic oscillations 1.8. Simple Pendulum 1.9. Torsional Pendulum and Compound pendulum (Qualitative study)

References:

1.	HCV: H. C. Verma, Concepts of Physics–Part I (Second Reprint of 2020) Bharati Bhavan Publishers and Distributers.
2.	RH:Resnick and Halliday: Physics – I , 5th Edition
3.	Mechanics – H. S. Hans and S. P. Puri, Tata McGraw Hill (2nd ED.)

COURSE CODE AND TITLE: PHP01: PHYSICS PRACTICALS-I

Level: 4.5	Credits: 02	Semester-I

Instructions

1) All the measurements and readings should be written with proper units in SI system only.
2) 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.
3) While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
4) Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

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 activities.

- 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 ONE experiment (from any group).
- 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 I as per the minimum requirements.

Group A	
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	Young's Modulus of a wire material by method of vibrations
5	LDR Characteristics: To study the dependence of LDR resistance on intensity of light.
6	Bar Pendulum: - To calculate acceleration due to gravity (g).
7	Study of LASER Beam Divergence.
Group B	
8	Study of Logic gates &To verify De Morgan's Theorems.
9	Frequency of AC Mains: To determine frequency of AC mains (Sonometer wire).
10	To study Thermistor characteristics: Resistance Vs Temperature
11	To study EX-OR Gate and verify its truth table.
12	To study half adder and full adder and verify their truth table Ex-OR Gate.
13	To study load regulation of a Bridge Rectifier.
14	To study Zener Diode as Regulator.
15	To study charging and discharging of capacitor.
Group C : 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.

Note:

In Semseter- I the minimum 8 experiments (4 from each group) and 4 Skill experiments should be completed and reported in the journal. A Certified Journal is a must, to be eligible to appear for the semester end practical examination.

COURSE CODE AND TITLE: PHP01 (VSC): EXPERIMENTAL PHYSICS-II

Level: 4.5	Credits: 02	Semester-I

Course Objectives

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

- Learn to identify and testing of electronic components.
- Detecting faults in circuits and troubleshooting them.
- Repair of different types of laboratory power supplies.
- Learn Maintenance of basic laboratory equipment's.

Course Objectives practical's

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

- Identify different types of wires, power cables, probes, fuses etc.
- Identify, measure and testing of various types passive components and semiconductor devices.
- Understand Soldering and desoldering given circuit on PCB and testing
- Learn about of A.C & D.C. power supply & troubleshooting.

Course Outcomes

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

- Gain knowledge of the different electronic components
- Establish a basis for honing their practical electronics skills
- Develop a lucrative and advanced profession in electronics.
- Understand maintenance of basic laboratory equipment's

Course Outcomes Practicals

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

- Comprehend to identify and testing of electronic components.
- Understand to identify faulty components and troubleshoot circuits
- Acquire skills of circuit Soldering and desoldering of electronic components in a given circuit
- Comprehend hands on experience in handling and maintaining laboratory/electronic equipment.

Group A	
1	To identify different types of Wires, power cables, probes, fuses used in the laboratory and check their continuity using DMM.
2	Identification of various types passive components - resistors, capacitors and inductors used in laboratory.
3	Measurement of resistors using colour codes & DMM and testing of capacitors and inductors.
4	Identification of various types of semiconductor devices: diode, bipolar junction transistors, Field effect transistors etc.
5	Testing of semiconductor devices: diode, bipolar junction transistors, Field effect transistors etc.
Group B	
1	Soldering and desoldering of electronic components in a given circuit.
2	Mounting simple circuit on PCB and testing.
3	Troubleshooting a given circuit.

4	Study of a.c power supply & troubleshooting
5	Study of d.c power supply and troubleshooting
Group C	
1	Surface Tension of biological soap solutiuon/liquid.
2	Calculate the wavelength of laser using grating.
3	Optical leveling of spectrometer.
4	Refractive index of water,
5	Study of Cathode ray oscilloscope.

COURSE CODE AND TITLE: PHSE01 (SEC): BASIC INSTRUMENTATION AND MEASUREMENT SKILLS

Level: 4.5	Credits: 02	Practical : 60

Course Objective

- Generate awareness among students about handling different laboratory instruments scientifically.
- Develop concepts of accuracy precision, resolution, range and errors/uncertainty in measurement.
- Understand various types of electronic components and devices so as to construct simple circuits.
- Expose students to systematic of scientific calculator.

Course Outcome

- Accomplish desired skills to handle different laboratory instruments scientifically.
- Acquire knowledge about precision and accuracy in measurements.
- Develop basic electronic circuit using different techniques.

Practicals:

Sr. No.	Name of the Experiment
1.	Study and use of Vernier Callipers & Micrometer Screw Gauge
2.	Study and use of Travelling Microscope.
3.	Study and use of Spectrometer.
4.	Study and determination of Focal length of a convex lens
5.	Soldering electronic circuits
6.	Study and use of Thevenin's theorem
7.	Building Electronic Circuits using Breadboard
8.	Fundamentals of Electronic Component- Resistor, potentiometer, Capacitor, Inductor, Diode, Transistor, LED, Zener diode
9.	Use of Multimeter (analog, Digital), Voltmeter, Ammeter
10.	To determine the diameter of a given wire using a screw gauge
11.	Thermister characteristics – Thermal study.
12.	Thermistor Characteristics- Electrical study.
13.	Measurement of frequency using CRO.
14.	Frequency measurement of sine wave using function generator.
15.	Frequency measurement of square wave using function generator.

16.	To calculate the frequency of Wien bridge oscillator.
17.	To calculate the frequency using Lissajeous figures.
18	To study the Cathode Ray Oscilloscope (CRO).
19.	Study of digital multimeter: Testing of components and identification.
20.	To study the I-V characteristics of diode using DMM.
21.	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: PHIK01: (IKS): ASTRONOMY AND ASTROPHYSICS

Level: 4.5	Credits: 02	Number of Lectures : 30

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.

COURSE CODE AND TITLE: PHVE01: ENVIRONMENTAL PHYSICS-I

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

Learning Objectives:

- This paper aims to build on conceptual understanding of students by exposing them to the basic principles behind various environmental processes.
- The paper has been divided into two sections, with the view to introduce students to the concepts of physics and chemistry associated with particle movement, chemical processes and pollutant chemistry.

UNIT 1:

Fundamentals of environmental physics, Basic concepts of light and matter; corelation between energy, wavelength and frequency, black body radiation, Kirchhoff's law, Stephan-Boltzmann equation, Wein's Displacement law, absorption and transmission of light, scattering of light, Rayleigh and scattering.

UNIT 2:

Photoelectric effect and solar photovoltaic cells. Basic concepts of pressure, force, work and energy; types of forces and their relation (pressure gradient, viscous, Coriolis, gravitational, centripetal, and centrifugal force).

UNIT 3:

Atomic structure, electronic configuration, periodic properties of elements; types of chemical bonds; mole concept, molarity and normality; quantitative volumetric analysis. Thermodynamic systems.

EXAMINATION PATTERN FOR EXTERNAL AND INTERNAL EXAMINATION

A) Internal Assessment (20 Marks):

Sr. No.	Particular	Marks
1	One offline class test.	10
2	Subject based activities	05
3	Attendance in routine class/practical's.	05
	Total Marks	20

B) Semester End Examination (30 Marks):

Question Paper Pattern:

1. These examinations shall be of **One Hours** duration. Maximum marks **30**.
2. There shall be **Three** questions each of **10 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 and 3** will be based on **Unit-I, II and III respectively carrying 10 Marks each.** These questions contain one long question and one short question with 50 % option.
   - All questions shall be compulsory.

Distribution of external 40 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/True or False/Match the pairs	**I, II, III**	05	05
2		Answer the following (Attempt **any Two out of Four)**	**I, II, III**	10	10
3		Answer the following (Attempt **any Two out of Four)**	**I, II, III**	10	10
		Total		**30**	**30**

Semester End Practical Examination (50 marks):

- 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 SESSION** of TWO 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 (50 marks)
1	Experiment	30
2	Viva voce	10
3	Certified journal	05
4	Practical Attendance	05
	Total Marks	**50**

A) VSEC/SEC Assessment:

Semester End Practical Examination (50 marks):

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 SESSION** of TWO hours each.

The learners will be evaluated based on the experiments performed during the examination.

Sr. No.	Particulars	Marks (50 marks)
1	Experiment	30
2	Viva voce	05
3	Certified journal	10
4	Routine Practical Attendance	05
	Total Marks	**50**

B) 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: S106PHT (MAJOR): OPTICS I

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

Course Objectives (CO)

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

- Explain the nomenclature used in lenses, lens equations for single convex lenses, and sign convention. Lens maker's equation, Newton's lens equation and principal foci positions.
- Describe Lateral, Longitudinal and Angular magnification, Equivalent focal length and power of two thin lenses, Concept of cardinal points and their significance.
- Explain qualitatively Spherical aberration & reduction, chromatic aberration & reduction.
- Study of Fresnel and Fraunhoffer type of diffraction and Fraunhoffer diffraction pattern due to a single slit and double slit.
- Learn Michelson's Interferometer and its Applications.
- Describe Polarization and types of Polarization.

Course Outcomes (OC):

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

- Understand the nomenclature used in lenses, lens equations for single convex lenses, and sign convention. Lens maker's equation, Newton's lens equation and principal foci positions.
- To Understand Lateral, Longitudinal and Angular magnification, Equivalent focal length and power of two thin lenses, Concept of cardinal points and their significance
- To comprehend qualitatively Spherical aberration & reduction, chromatic aberration & reduction.
- To understand Fresnel and Fraunhoffer type of diffraction and Fraunhoffer diffraction pattern due to a single slit and double slit.

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:	**10 Lectures**
1.	**1. Fresnel diffraction:** 1.1. Introduction 1.2. Huygens-Fresnel's theory 1.3. Fresnel's assumptions 1.4. Distinction between interference and diffraction 1.5. Fresnel and Fraunhoffer types of diffraction
2	**2. Fraunhoffer diffraction:** 2.1. Introduction 2.2. Fraunhoffer diffraction at a single slit 2.3. Intensity distribution in diffraction pattern due to a single slit 2.4. Fraunhoffer diffraction at double slit 2.5. Distinction between single slit and double slit diffraction patterns.
Unit - III	**10 Lectures**
1.	**1. Michelson's Interferometer:** 1.1. Principle, construction, working, Applications of Michelson Interferometer 1.1.1. Measurement of wavelength 1.1.2. Determination of the difference in the wavelength of two waves 1.1.3. Determination of the refractive index of gases.

2.	**2. Polarization:** 2.1. Introduction 2.2. Polarization 2.3. Types of Polarization

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

COURSE CODE AND TITLE: PHP02 (MAJOR PRACTICAL): PRACTICAL PHYSICS-III

Level: 4.5	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, weightage 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.

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 activities.

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 ONE experiment (one from any group).

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

GROUP A	
1	Study of LASER Beam Divergence
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	
1	To study NAND/NOR gates as Universal Building Blocks
2	Study of Logic gates & To verify De Morgan's Theorems
3	To study EX-OR Gate and verify its truth table
4	To study half adder and full adder and verify their truth table Ex-OR Gate
5	To study half adder and full adder and verify their truth table Ex-OR Gate
6	To study Zener Diode as Regulator
7	Transistor configurations : CB/CE/CC (study of input-output characteristics)
8	LR Circuit: To determine the value of given inductance and phase angle
9	CR Circuit: To determine value of given capacitor and Phase angle
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.

COURSE CODE AND TITLE: PHVS03 (VSC): EXPERIMENTAL PHYSICS - IV

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.

Group A	
1	To study I-V characterstics of pn junction diode.
2	To study total internal reflection using LASER light.
3	To study I-V characterstics of LED.
4	To study Thermal characterstics of thermister.
5	To study solar cell characterstics
Group B	
1	To study electrical characterstics of thermister.
2	To study input characterstics of transistors.
3	To study output characterstics of transistors
4	LR Circuit: To determine the value of given inductance and phase angle
5	
Group C: Demonstration Experiment	
1	Graph plotting.
2	To study function generator and CRO.
3	Study of power supply.
4	Caliberation of CRO, meters

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: 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.

EXAMINATION PATTERN FOR EXTERNAL AND INTERNAL EXAMINATION

A) Internal Assessment (20 Marks):

Sr. No.	Particular	Marks
1	One offline class test.	10
2	Subject based activities	05
3	Attendance in routine class/practical's.	05
	Total Marks	20

B) Semester End Examination (30 Marks):

Question Paper Pattern:

1. These examinations shall be of **One Hours** duration. Maximum marks **30**.
2. There shall be **Three** questions each of **10 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 and 3** will be based on **Unit-I, II and III respectively carrying 10 Marks each.** These questions contain one long question and one short question with 50 % option.
   - All questions shall be compulsory.

Distribution of external 40 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/True or False/Match the pairs	**I, II, III**	05	05
2		Answer the following (Attempt **any Two out of Four)**	**I, II, III**	10	10
3		Answer the following (Attempt **any Two out of Four)**	**I, II, III**	10	10
		Total		**30**	**30**

Semester End Practical Examination (50 marks):

- 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 SESSION** of TWO 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 (50 marks)
1	Experiment	30
2	Viva voce	10
3	Certified journal	05
4	Practical Attendance	05
	Total Marks	**50**

C) VSEC/SEC Assessment:

Semester End Practical Examination (50 marks):

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 SESSION** of TWO hours each.

The learners will be evaluated based on the experiments performed during the examination.

Sr. No.	Particulars	Marks (50 marks)
1	Experiment	30
2	Viva voce	05
3	Certified journal	10
4	Routine Practical Attendance	05
	Total Marks	**50**

D) 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

E) 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