SNDT Women's University, Mumbai

Bachelor Of Science
(Physics)

B.Sc. In Physics

As Per NEP – 2020

Semester – I & II

Syllabus
(W.E.F. Academic Year 2025-26)

Terminologies

Vertical	Full-form/Definition	Remarks	Related to Major and Minor Courses
Major (Core)	Subject comprising Mandatory and Elective Courses, Major Specific IKS, Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects connected to Major	Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses	Related to the Major
Minor Course	Course from same or different Faculty	Minimum 18-20 Credits to be completed in the first three years of UG Programme	Related to the Minor
OEC	Open Elective Courses/ Generic courses	10-12 credits to be offered in I and/or II year. Faculty-wise baskets of OEC to be prepared	OEC is to be chosen compulsorily from faculty other than that of the Major
VSC	Vocational Skill Courses, including Hands on Training corresponding to the Major and/or Minor Subject	8-10 credits, to be offered in first three years, wherever applicable vocational courses will include skills based on advanced laboratory practical's of Major	Related to the Majoror Minor
SEC	Skill Enhancement Courses	06 credits, to be offered in I and II year, to be selected from the basket of Skill Courses approved by university	Related to the Major or Minor any relevant Skill
AEC	Ability Enhancement Courses	08 credits, to be offered in I and II year, English: 04 Credits to be earned in Sem - I, Modern Indian Language of 04 credits to be offered in II year	NA
VEC	Value Education Courses	Understanding India, Environmental science/education, Digital andtechnological solutions, Health & Wellness, Yoga education, sports, and fitness	NA

IKS	Indian Knowledge System	Generic IKS Course: basicknowledge of the IKS to be offered at First Year level	Major-Specific IKS Courses: advanced information about the major, part of the major credit to be offered at second- or third-year level
OJT	On-Job Training (Internship/Apprenticeship)	Corresponding to the Major Subject	Related to the Major
FP	Field projects	Corresponding to the MajorSubject	Related to the Major
CC	Co-curricular Courses	Health and Wellness, Yoga education sports, and fitness,Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts	NA
CE	Community Engagement andservice		Related to Major
RP	Research Project	corresponding to the MajorSubject	Related to Major

Program Template

Degree		B.Sc.
Programme		Physics
Preamble (Brief Introduction tothe programme)		The B.Sc. Physics program, structured under the National Education Policy (NEP) 2020, is designed to provide studentswith a comprehensive understanding of fundamental and advanced concepts in physics. This program emphasizes a blend of theoretical knowledge and practical skills, ensuring that graduates are well-prepared for both academic pursuits and professional careers. By fostering critical thinking, analytical skills, and a strong foundation in scientific principles,the program aims to cultivate a deep appreciation for the physical sciences and their applications in various technological and interdisciplinary fields. Aligned with the NEP 2020's vision for holistic and multidisciplinary education, the B.Sc. Physics program offersflexibility through multiple entry and exit options, integrationof vocational education, and opportunities for research and innovation. The curriculum is designed to be inclusive and equitable, catering to diverse learning needs and promoting the use of regional languages alongside English to enhance comprehension. Graduates of this program will find diverse employment opportunities in fields such as research and development, education, healthcare, engineering, data science, and information technology. Emphasizing ethical scientific practices and social responsibility, the program seeks to produce graduates who are not only proficient in physics but also capable of contributing to societal and globalchallenges through scientific inquiry and innovation.
Programme Specific Outcomes(PSOs)		After completing this programme, Learners will be able to
	1.	Synthesize core principles across physics disciplines to developa profound understanding, laying the foundation for specialization.
	2.	Apply theoretical and experimental knowledge of physics indiverse contexts, fostering adaptability and innovative problem-solving skills.
	3.	Evaluate complex physics problems critically, employingcreative thinking to generate effective solutions.
	4.	Communicate findings and ideas clearly and logically, demonstrating proficiency in conveying complex physicsconcepts.

	5.	Demonstrate analytical prowess in data analysis and hypothesis formulation, facilitating proficient research conductacross physics domains.
	6.	Lead and collaborate effectively in interdisciplinary teams, exhibiting adaptability and readiness for leadership roles whilefostering a culture of continuous learning.
	7.	Construct a framework for promoting multicultural competenceand ethical values, fostering sustainability and responsible citizenship in the global physics community.
Eligibility Criteria for Programme		10+2 certificate preferably with Physics as one of the majorsubjects
Intake		120

Structure with Course Title

B.Sc. In Physics

SN	Courses	Type of Course	Credits	Marks	Int	Ext
	Semester I					
10032201	Modern Physics	Major (Core)	2	50	50	0
		Major (Core)	2	50	50	0
		Major (Core)	2	50	50	0
10432211	Electrical and Electronic gadgets for all	OEC	4	100	50	50
10632201	Performing Physics Experiments	VSC S1	2	50	50	0
10732201	Basic Measurements and Calculations	SEC	2	50	0	50
10810111	English For Academic Writing- Paper I (For Students of English Medium)	AEC (English) **(Any One)**	2	50	0	50
10810112	English Language and Literature- I (For Students of Non-English medium)					
11051111	Inception of India Knowledge System	IKS (Generic)	2	50	0	50
10952111	Introduction to Indian Constitution	VEC	2	50	0	50
11450121	Basics of National Service Scheme	CC **(Any One)**	2	50	50	0
11450221	National Cadets Corps. (NCC) Studies- I					
11450322	Health and Wellness					
11450421	Performing Arts Exploration					
			22	**550**	**300**	**250**

SN	Courses	Type of Course	Credits	Marks	Int	Ext
	Semester II					
20032211	Basic Electronics	Major (Core)	2	50	0	50
		Major (Core)	2	50	0	50
		Major (Core)	2	50	0	50
		VSC S2	2	50	50	0
		VSC S3	2	50	50	0
20432211	Physics in Daily Life	OEC	4	100	50	50
20732201	Physicists Exploring through Experiments	SEC	2	50	50	0
20810111	English For Academic Writing- Paper II (For Students of English Medium)	AEC (English) **(Any One)**	2	50	0	50
20810112	English Language and Literature- II (For Students of Non-English medium)					
20952111	Environment Awareness	VEC	2	50	0	50
21450121	Volunteerism and National Service Scheme	CC **(Any One)**	2	50	50	0
21450221	National Cadets Corps. (NCC) Studies- II					
21450323	Yoga Education					
21450421	Fine Art					
			22	**550**	**250**	**300**

Exit with UG Certificate with 4 extra credits (44 + 4 credits)

Syllabus

Semester I

1.1 Major (Core)

Course Title	**Modern Physics**
Course Credits	2
Course Outcomes	After Completion of this course the learners will be able to, 1. Apply knowledge of black body radiation, photoelectric effect, Compton Effect tosolve physics problems. 2. Analyze scientific articles on phenomena to understand their implications inphysics. 3. Evaluate experimental results and theoretical models to refine fundamentalphysical processes. 4. Design experiments to explore principles underlying X-rays, aiming to advancephysics knowledge
Module 1 (Credit1) - Quantum Physics	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply concepts of ultraviolet catastrophe and annihilation in theoretical andexperimental physics
	2. Analyze phenomena like black body radiation and gravitational red shift.
Content Outline	• Black body radiation • Ultraviolet catastrophe Photoelectric effect, • Compton Effect, • Pair production and annihilation, • Gravitational red shift.
Module 2 (Credit1) – Radiant Dynamics	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply the principles underlying the discovery and production of X-rays.
	2. Analyze characteristic X-ray spectra and their applications in various fields

Content Outline	•Discovery of X-ray, •X-ray production, •characteristic x-ray spectra, •applications of X-ray, •X-ray diffraction

Assignment/Activities towards Comprehensive Continuous Evaluation (CCE):

Module - 1

Project 1: DIY Photoelectric Effect Experiment

Students construct a simple photoelectric setup using a shoebox, aluminum foil, and a light source. They measure generated voltage as light hits a metal plate, varying intensity and frequency. They present findings, using scientific terms to explain phenomena and relate to research.

Project 2: Gravity Red Shift Simulation

Using household materials, students create a model to simulate gravitational red shift. They demonstrate how light shifts in wavelength near a massive object. Presenting to the teacher, theyutilize precise scientific language, referencing relevant research to support their conclusions.

Module - 2

Project 3: DIY X-ray Diffraction Simulation

Students use a laser pointer, a ruler, and various objects (like CDs or DVDs) to simulate X-ray diffraction. They observe diffraction patterns by shining the laser on the objects and measuring angles. Presenting findings, they employ precise scientific language, relating observations to X- ray diffraction principles and applications, referencing scientific literature.

Project 4: X-ray Diffraction Simulation

Using household materials, students create a model to simulate X-ray diffraction. They explore how X-rays interact with crystal lattices, observing diffraction patterns. Presenting findings, theyemploy accurate scientific language, explaining the principles and applications of X-ray diffractionwith reference to scientific literature.

References:

1. Beiser, A., Mahajan, S., & Choudhury, S. R. (2017). Concepts of modern physics (SIE) (7thed.). McGraw Hill Education.

2. Thornton, S., & Rex, A. (2012). Modern physics for scientists and engineers (International ed.,4th ed.). Brooks/Cole

3. Murugeshan, R., & Sivaprasath, K. (2019). Modern physics (18th ed.). S Chand Publishing

4. Theraja, B. L. (2002). Modern physics (5th ed.). S Chand & Company

1.4 Open Elective Courses/ Generic (OEC)

Course Title	**Electrical and Electronic gadgets for all**
Course Credits	4
Course Outcomes	After Completion of this course the learners will be able to,
	1. Identify conducting and non-conducting materials, and estimate electricitybills accurately.
	2. Apply principles of electricity to understand lighting sources and coolingdevices effectively.
	3. Apply knowledge to effectively use digital devices and analyze differencesbetween digital and analog data.
	4. Design strategies for safe online interactions considering AI advancementsand transactions.
Module 1 (Credit 1) - Basics of Electricity	
Learning Outcomes	After learning the module, learners will be able to,
	1. Identify conducting and non-conducting material
	2. Estimate the Electricity bill of any user based on rating and usage pattern
Content Outline	• Concept of electricity, voltage, current, power, energy. Types of • Conducting materials. Electrical ratings of various appliances, and • Electrical billing calculations.
Module 2 (Credit 1) - Basic Home devices	
Learning Outcomes	After learning the module, learners will be able to,
	1. Apply principles of electricity to understand LED, CFL, tube lights, andhalogen lamps
	2. Analyze the efficiency of dry ice storage, coolers, air-conditioning, andrefrigerators
Content Outline	• Understanding light sources and units – LED, CFL, tube lights, halogen lamps, • Understanding cooling devices – dry ice storage, coolers, air-conditioning,refrigerator

Module 3 (Credit 3) - Digital devices and circuits	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply knowledge to effectively use mobile phones, PCs, laptops, tablets,
	and smart TVs
	2. Analyze the differences between digital and analog data and variouscommunication media.
Content Outline	• Mobile phone, PC, laptop, tablets, smart TV, Digital camera: – DSLR/Mirrorless/Mobile camera • Digital and analog data. Electronic signals and communication media - wired and wireless communications. Wi-Fi, Bluetooth, satellite communication. LAN, WAN, and larger networks. Internet and World Wide Web.
Module 4 (Credit 4) - Mobile networks and AI tools	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply understanding of bandwidth, data compression, and file formats in4G/5G networks
	2. Design strategies for safe online interactions considering AI advancementsand transaction
Content Outline	• Concept of bandwidth and data compression, various file formats, 4G/5Gnetworks. • Various Social media platforms and online communication etiquette • Artificial intelligence, AI tools Online transactions and safety issues

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1: Energy Consumption Analysis

Students will calculate the energy consumption for different settings such as houses, offices, and public places. They will analyze various heating technologies to understand their advantages and disadvantages. Through practical exercises and research, students will exploreconcepts of electricity, voltage, current, power, and energy. They will also learn about different types of conducting materials and electrical ratings of appliances, gaining insights into electrical billing calculations and energy-efficient practices.

Module 2: Photography and Networking

In this workshop, students will learn to use digital cameras and mobile cameras effectively to capture high-quality images and videos. They will also probe into various network parameters to understand their functions and implications in digital communication. Through hands-on activities and demonstrations, students will explore wired and wireless technologies such as Wi-Fi, Bluetooth, and satellite communication. Additionally, they will gain knowledge about bandwidth, data compression methods, and file formats, optimizing data transmission efficiency for 4G/5G networks.

Module 3: Online Communication

Students will design strategies for engaging in online communication and social media platforms while adhering to proper etiquette. They will explore various social media platforms and learn about online communication etiquette to ensure respectful and effective interactions.Through case studies and role-playing exercises, students will develop skills for navigating

online environments responsibly, understanding the importance of privacy, security, and digital citizenship.

Module 4: Introduction to Artificial Intelligence

In this project, students will gain an understanding of the fundamentals of artificial intelligence(AI) tools and their applications. They will explore different AI technologies and their impacton various industries, including online transactions and safety issues. Through discussions, presentations, and hands-on activities, students will develop insights into the capabilities and limitations of AI, learning how to leverage these technologies effectively in the digital age.

References:

1. Theraja, B. L., & Theraja, A. K. (1959). Electrical technology -i (23rd ed.). S Chand.

2. Hoerner, T. (2007). Basic electricity & practical wiring (4th ed.). Hobar Publications.

3. Davidson, H. (2004). Troubleshooting & repairing consumer electronics without aschematic (3rd ed.). McGraw-Hill Education

1.5 Vocational Skill Courses (VSC)

Course Title	**Performing Physics Experiments**
Course Credits	2
Course Outcomes	After completion of this course, the learner will be able to,
	1. Analyze electronic circuits including bridge rectifiers, L-R, and C-R circuits forrectification and impedance characteristics
	2. Evaluate the maximum power transfer theorem for optimizing circuit efficiencyand performance
	3. Investigate the characteristics and applications of Zener diodes in voltageregulation circuits.
	4. Experimentally verify fundamental physics principles such as black body radiation,photoelectric effect, Compton scattering, and gravitational red shift.
Module 1 (Credit 1) Rectification	
Learning Outcomes	After learning this module , learner will be able to
	1. Analyze rectification, load regulation, and ripple factor in circuits.
	2. Optimize circuit designs for efficient power transfer
	3. Apply Zener diodes in voltage regulation and protection circuits."
Content Outline	• Bridge Rectifier, rectification, load regulation, ripple factor. • Maximum power transfer theorem • Zener Diode Characteristics. • L- R circuit C-R circuit
Module 2 (Credit 1) - Number system and Geometry	
Learning Outcomes	After learning this module, learner will be able to
	1. Analyze spectral data to verify Planck's Law in black body radiationexperiments.
	2. Verify gravitational redshift by observing wavelength changes in agravitational field.

Content Outline	• Black Body Radiation: Spectral Analysis and Planck's Law Verification • Photoelectric Effect: Frequency Dependence of Photoelectron Emission • Compton Scattering: Wavelength Shift of X-rays in Target Materials • Experimental Verification of Gravitational Red Shift: Observing WavelengthChanges in a Gravitational Field

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Project 1: Measuring Instruments Workshop

Hands-on sessions for using basic measuring tools. Skills include component identification andDMM usage. Graph plotting proficiency emphasized.

Project 2: Electronics Experiment Showcase

Demonstrate understanding of Bridge Rectifier, Zener Diode, and more. Presentations highlightpractical applications.

Project 3: Logic Gates and Transistors

Explore logic gates, De-Morgan's Theorem, and transistor characteristics. Build digital circuits
like Half Adders and Full Adders.

Project 4: Scientific Article Analysis

Analyze articles on electronics. Enhance research skills and apply knowledge to real-worldscenarios

Reference Books:

1. Beiser, A., Mahajan, S., & Choudhury, S. R. (2017). Concepts of modern physics (SIE) (7thed.). McGraw Hill Education.

2. Thornton, S., & Rex, A. (2012). Modern physics for scientists and engineers (Internationaled., 4th ed.). Brooks/Cole.

3. Murugeshan, R., & Sivaprasath, K. (2019). Modern physics (18th ed.). S Chand Publishing.

4. Theraja, B. L. (2002). Modern physics (5th ed.). S Chand & Company.

5. Theraja, B. L. (2006). Basic electronics (solid state) in multicolor ed. (Multicolor ed.). SChand.

6. Kothari, D. P., & Nagrath, I. J. (2017). Basic electronics (2nd ed.). McGraw Hill Education.

7. Bhagyashree, S. R., Guruprasad, K. N., & Kumar, P. Y. (2021). Basic electronics (1st ed.).Notion Press**.**

1.6 Skill Enhancement Courses (SEC)

Course Title	**Basic Measurements and Calculations**
Course Credits	2
Course Outcomes	After Completion of this course, the learner will be able to,
	1. Apply various measuring instruments for precise measurements.
	2. Analyze measurement uncertainties, enabling effective data evaluation.
	3. Construct and interpret graphs, determining slopes and converting non-linear relationships.
	4. Evaluate experimental data, making informed decisions in scientificinvestigations.
Module 1 (Credit 1) - Electronic Meters	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply techniques to analyze data, making inferences and interpretations.
	2. Create solutions and recommendations, utilizing their analytical andevaluative skills.
Content Outline	• Measuring size: travelling microscope, micrometer screw, Vernier calipers • Time measurement: using stop-watch • Mass measurement: single pan balance • Use of Digital multimeter for measurement of various electrical parameters • Measurement of internal resistance of voltmeter, current-meter and loadingeffect • Measurement of output impedance of signal generator • Constant voltage source: current capacity and internal resistance • Constant current source: internal resistance
Module 2 (Credit 1) - Measurement Errors	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyze uncertainties, sources and types, propagate identifying a nd uncertainties effectively.

	2. Plot linear graphs, mastering slope determination, interpolation, andextrapolation techniques.
Content Outline	• Uncertainty analysis: sources of uncertainties, types of uncertainties • Propagation of uncertainties • Graph plotting I: linear (slope, interpolation, extrapolation) • Graph plotting II: Non-linear graphs (slope at given point,interpolation), converting non-linear to linear from known equation • Statistical analysis of data

Assignment/Activities towards Comprehensive Continuous Evaluation (CCE):

Project 1: Parameter Exploration

Create a comprehensive list of parameters for various measuring instruments, including size,time, and mass measurements. Discuss their importance and applications.

Project 2: Hands-on Measurement

Utilize basic measuring instruments to measure physical quantities such as size, time, andmass. Document measurements and compare with theoretical values.

Project 3: Digital Multimeter Workshop

Hands-on session using digital millimeter for electrical parameter measurements. Exploretechniques for measuring internal resistance and loading effect.

Project 4: Uncertainty Analysis and Graph Plotting

Explore types of uncertainties in measurements and learn to plot graphs accurately. Performstatistical analysis of data to understand uncertainties better

Reference books:

1. Sawhney, A. K. (2021). A course in electrical and electronic measurements andinstrumentation. Shree Hari Publications.

2. Venkateshan, S. P. (2015). Mechanical measurements (2nd ed.). VISIONIAS.

Semester II

2.1 Major (Core)

Course Title	**Basic Electronics**
Course Credits	2
Course Outcomes	After Completion of this course the learners will be able to
	1. Apply binary and Boolean algebra logic to design digital circuits.
	2. Analyze diode circuits and filter for effective voltage regulation.
	3. Evaluate Zener diode applications in voltage stabilization and circuit design
	4. Design voltage regulation systems and digital circuits
Module 1(Credit 1) – Zener Diode	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply the principles of Zener diodes as voltage stabilizers in electronic circuits
	2. Analyze different types of diode biasing and their applications in bridgerectifier circuits
Content Outline	• Types of diode biasing (review), Bridge rectifier-ripple factor • Types of filter circuits • Zener diode-Zener diode as a voltage stabilizer • Zener diode circuits.
Module 2 (Credit 1) – Digital logics	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply binary, octal, and hexadecimal number systems for datarepresentation and conversion.
	2. Analyze and interpret boolean algebra rules to construct digital circuitseffectively.

Content Outline	• Binary number system- Decimal to binary conversion- • Binary to decimal conversion-octal number system-hexadecimal number system- binary coded decimal code (BCD)-binary addition and binary subtraction using 2's complement.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

No Internal Examination.

Reference Books:

a. Theraja, B. L. (2006). Basic electronics (solid state) in multicolor ed. (Multicolor ed.). SChand.

b. Kothari, D. P., & Nagrath, I. J. (2017). Basic electronics (2nd ed.). McGraw Hill Education.

c. Bhagyashree, S. R., Guruprasad, K. N., & Kumar, P. Y. (2021). Basic electronics (1st ed.).Notion Press.

2.6 Open Elective Courses/ Generic (OEC)

Course Title	**Physics in Daily Life**
Course Credits	4
Course Outcomes	After Completion of this course the learner will be able to
	1. Analyze renewable energy sources for addressing global energychallenges.
	2. Evaluate energy consumption patterns and their climate changeimplications.
	3. Apply energy use quantification and carbon footprint concepts.
	4. Design strategies for minimizing energy use and adopting electricvehicles.
Module 1 (Credit 1) - Energy basics	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyze renewable energy sources like solar, wind, thermal, andhydroelectric power.
	2. Connect some daily life Conduct analysis of energy bills to understandconsumption patterns and conservation measures
Content Outline	• Basics of renewable energy solar, wind, thermal, and hydroelectricpower. • Energy consumption patterns and global energy challenges. • Importance of energy conservation in addressing climate change andsustainability goals, Analysis of energy bills
Module 2 (Credit 1) - Energy and Climate change	
Learning Outcomes	After learning the module, learners will be able to
	1. Quantify energy use in easily understandable terms
	2. Assess carbon footprint implications.
Content Outline	• Quantifying energy use in simple terms • carbon footprint • Climate change has happened
Module 3 (Credit 1) - Energy use and Carbon emission	
Learning	After learning the module, learners will be able to

Outcomes	1. Recognize energy as both a challenge and a solution.
	2. Develop strategies to achieve a one-third reduction in energy usageand produce the remaining energy locally through solar power
Course Content	• Energy as a problem and as a solution • energy use minimization by 1/3rd • Minimizing energy use by 1/3rd • Generating the remaining 1/3rd of energy locally by solar
Module 4 (Credit 1) - Introduction to Eclectic Vehicle	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply knowledge of electric vehicle components for practicalunderstanding
	2. Analyze environmental differences between battery electric andconventional vehicles.
Course Outcomes	• Electric vehicles: battery electric vehicles (BEVs) • Basic components and functionality of electric vehicles: electric motors,batteries, power electronics, and charging infrastructure. • Comparison of environmental impacts between conventional vehicles andelectric vehicles

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

Module 1

In the first project, students embark on a Renewable Energy Showcase. Armed with materials like models or diagrams representing solar panels, wind turbines, thermal power plants, and hydroelectric dams, they delve into the analysis of renewable energy sources. Through meticulous data collection and analysis, they evaluate the feasibility and advantages of each source in different geographical contexts. Following thorough research and experimentation, students compile their findings into a comprehensive report detailing the potential contributionsof renewable energy to the global energy mix, providing valuable insights for sustainable energyplanning.

Module 2

The second project entails a Carbon Footprint Audit. Equipped with energy consumption data such as electricity bills and carbon footprint calculators or spreadsheets, students conduct a meticulous examination of their own energy usage patterns. Through diligent data collection and analysis, they quantify their carbon footprint and identify areas of high energy consumption. Armed with these findings, students devise strategies for reducing carbon emissions, documenting their journey and insights in a detailed report. This hands-on experience empowersstudents to take

ownership of their energy consumption and contribute to climate change mitigation efforts.

Module 3

In the third module focused on Energy Use and Carbon Emission, students undertake an EnergyReduction Challenge. Armed with energy consumption data and simulation tools, they develop strategies to achieve a one-third reduction in energy usage while promoting local solar energy generation. Through data-driven analysis and simulation, students explore the feasibility of integrating energy-efficient technologies and solar power solutions into their daily lives. Their

efforts culminate in a comprehensive report outlining their strategies, findings, and recommendations for achieving sustainable energy consumption patterns and promoting renewable energy adoption within their communities.

Module 4

In this case, students engage in Electric Vehicle Component Analysis. Utilizing electric vehicle components, diagrams, and demonstration models, they delve into the intricacies of electric vehicle technology. Through hands-on exploration and analysis, students dissect the basic components and functionality of electric vehicles, comparing environmental impacts between battery electric vehicles (BEVs) and conventional vehicles. Their findings are meticulously documented in a detailed report, providing valuable insights into the potential of electric vehiclesto mitigate climate change and revolutionize the transportation sector. This project empowers students to become informed advocates for sustainable transportation solutions.

References:

1. Solanki, C. S. (2019). Energy Swaraj: My Experiments with Solar Truth (1st ed.). NotionPress.

2. Rasheed, H. (2022). An introduction to energy: Sources, uses, impact and solutions.Lulu.com.

3. Rao, K. M. (2019). An introduction to electric vehicles (1st ed.). Notion

4. Swayam - https://onlinecourses.swayam2.ac.in/aic22_ge31/preview

5. https://www.youtube.com/watch?v=7ihCH0p2oXM&list=PLYklMEpaP9zGIouFBCimG98d7YH 4ChKq0

2.7 Skill Enhancement Courses (SEC)

Course Title	**Physicists Exploring through Experiments**
Course Credits	2
Course Outcomes	1. Analyze lens aberrations using an optical bench setup to understand optical systemperformance. 2. Apply optimized mobile camera settings across various lighting conditions to improveimage quality. 3. Measure illuminance in different environments using a lux meter, demonstratingproficiency in light measurement. 4. Explore different combinations of lenses and optical systems to understand theireffects on imaging
Module 1 (Credit 1) - Optical Insight	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply optimal settings across various devices for diverse lighting conditions
	2. Analyze optical aberrations and characterize electronic components inexperimental setups.
Content Outline	• Thermocouple: Calibration and Measurement of Temperature using aThermocouple. • Lens Aberrations: Investigation of Lens Aberrations using an Optical Bench. • Mobile Camera Settings: Optimization of Mobile Camera Settings for DifferentLighting Conditions. • Lux Meter: Measurement of Illuminance in Different Environments using a LuxMeter. • Spectrometer (μ): Measurement of Wavelengths in Spectral Lines using aSpectrometer. • Lens Combinations: Exploration of Lens Combinations and Optical Systems. • LASER Divergence: Measurement of LASER Beam Divergence using a BeamExpander. • LDR Characteristics: Characterization of Light Dependent Resistors (LDRs)under Different Lighting Conditions. • Surface Tension of Biological Fluid: Determination of Surface Tension ofBiological Fluids using Capillary Rise Method. • Frequency of AC Mains: Measurement of Frequency of AC Mains using aFrequency Counter
Module 2 (Credit 1) - Mechanical Dynamics	
Learning	After learning the module, learners will be able to

Outcomes	1. Analyze fluid viscosityvelocity in a fluid via Stoke's Method, observing sphere terminal
	2. Apply principles of rotational inertia and energy storage, examining theFlywheel's impact.
Content Outline	• Viscosity by Stoke's Method: Measurement of viscosity of a fluid by observing the terminal velocity of a sphere falling through it. • Flywheel: Study of rotational inertia and energy storage in a rotating massby observing its effect on rotational motion. • Torsional Oscillations: Investigation of the torsional spring constant anddamping effects in torsional oscillations. • Bifilar Pendulum: Determination of moment of inertia of a body by observingits oscillations about two perpendicular axes. • Y by Vibrations: Determination of Young's modulus of a material byanalyzing its vibrational modes and frequencies. • Thermocouple: Calibration and measurement of temperature using thethermoelectric effect in a thermocouple device.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. Thermocouple Calibration: Students calibrate a thermocouple by me asuring known temperatures and recording corresponding voltage readings.
2. Lens Aberrations: Students investigate lens aberrations using an optical bench, analyzingdistortions and anomalies in optical systems.
3. Mobile Camera Settings: Students optimize mobile camera settings for different lightingconditions, experimenting with exposure, white balance, and ISO settings.
4. Lux Meter: Students measure illuminance in different environments using a lux meter,assessing light intensity for various applications.
5. Spectrometer (μ): Students measure wavelengths in spectral lines using a spectrometer,analyzing the dispersion of light for spectroscopic studies.
6. Lens Combinations: Students explore lens combinations and optical systems, studying theeffects of combining different lenses on image formation.
7. Lens Combinations: Students explore lens combinations and optical systems,

studying theeffects of combining different lenses on image formation.

8. LASER Divergence: Students measure LASER beam divergence using a beam expander,analyzing the spread of the laser beam over distance.

9. LDR Characteristics: Students characterize light-dependent resistors (LDRs) under differentlighting conditions, studying their resistance variation with light intensity.

10. Surface Tension of Biological Fluid: Students determine the surface tension of biological fluids using the capillary rise method, exploring fluid dynamics in biological systems.

11. Frequency of AC Mains: Students measure the frequency of AC mains using a frequencycounter, analyzing electrical power distribution systems.

References:

1. Sawhney, A. K., & Aakash. (2022). A Course in Electrical and Electronic Measurements andInstrumentation (NVB++++ ed.). VISIONIAS.
2. Purkait, P., Biswas, B., & Koley, C. (2017). Electrical and Electronics Measurements andInstrumentation. McGraw Hill Education.
3. Gupta, J. B. (2013). A Course in Electrical & Electronics Measurement & Instrumentation(Reprint 2013 ed.). S K Kataria and Sons.