SNDT Women's University, Mumbai

Bachelor Of Science
(Physics)

B.Sc. In Physics

As Per NEP – 2020

Semester – III & IV

Syllabus

(WEF. 2025-2026)

Structure with Course Titles

SN	Courses	Type of Course	Credits	Marks	Int	Ext
	Semester III					
30132211	Vector Calculus, and Digital Electronics	Major (Core)	4	100	50	50
30132212	Analog Electronics	Major (Core)	4	100	50	50
30132213	Quantum Mechanics	Major (Core)	4	100	50	50
30332211	Optical Instruments & Boolean Logic	Minor Stream	2	50	0	50
30432211	Fascinating Physics	OEC	2	50	0	50
		AEC (Modern Indian Language)	2	50	50	0
31332201	Field Project-1	FP	2	50	50	0
		CC	2	50	50	0
			22	550	300	250
SN	**Courses**	**Type of Course**	**Credits**	**Marks**	**Int**	**Ext**
	Semester IV					
40132211	Microprocessor-1	Major (Core)	4	100	50	50
40132212	Thermodynamics	Major (Core)	4	100	50	50
40132213	Applied Physics II	Major (Core)	4	100	50	50
40432211	Energy Sources	OEC	2	50	0	50
40732211	Cyber Security	SEC	2	50	0	50
		AEC (Modern Indian Language)	2	50	0	50
41532201	Community Engagement and Service (CE)	CE	2	50	50	0
		CC	2	50	50	0
			22	**550**	**250**	**300**

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

Course Syllabus

Semester: III

3.1 Major (Core)

Course Title	**Vector Calculus, Digital Electronics**
Course Credits	**4 (2L + 2P)**
Course Outcomes	After going through the course, learners will be able to
	1. **Apply** vector calculus techniques such as gradient, divergence, and curl to solve problems in electromagnetic fields and engineering physics.
	2. **Evaluate** the performance of different number systems, logic families, and combinational logic circuits for suitability in specific digital applications.
	3. **Apply** techniques of circuit simplification using Karnaugh maps and Boolean algebra to design efficient digital logic circuits.
	4. **Create** analog and digital circuit prototypes based on specific design requirements using simulation software and electronic hardware tools.
	5. **Evaluate** the functionality and reliability of designed digital circuits through systematic testing and validation against expected outcomes.
Module 1(Credit 1)	**Vector Calculus**
Learning Outcomes	**After learning the module, learners will be able to**
	1. **Apply** line, surface, and volume integral techniques to solve engineering and physics-related problems in various coordinate systems.
	2. **Analyze** the geometric interpretation of the Gradient, Divergence, and Curl theorems to understand the physical significance of vector fields.
	3. **Apply** the Fundamental Theorems of Vector Calculus—Gradient, Divergence, and Curl—to evaluate integrals and verify vector identities in given problems.
	4. **Evaluate** the suitability of Cartesian, cylindrical, and spherical coordinate systems for solving vector calculus problems in specific physical contexts.

	5. **Create** mathematical models using curvilinear coordinates to represent real-world phenomena in fields such as electromagnetics and fluid dynamics.
Content Outline	Line, Surface and Volume Integrals, The Fundamental Theorem of Calculus: The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence, The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done. Curvilinear Coordinates: Spherical Coordinates, Cylindrical Coordinates
Module 2 (Credit 1)	**Digital Electronics**
Learning Outcomes	1. **Understand Flip-Flop Operations** Explain the working principles of various flip-flops including R-S, Clocked R-S, D, and J-K Master-Slave flip-flops, and their use in memory and sequential circuits.
	2. **Analyze and Design Sequential Circuits** Analyze, design, and troubleshoot sequential digital circuits using flip-flops for storage and state transition functions.
	3. **Design Counters Using Flip-Flops** Design and implement both synchronous and asynchronous counters such as 3-bit ripple counters and mod-3 counters, understanding timing and state transition behavior.
	4. **Understand Timing Devices and Their Applications** Describe the internal block diagram and functioning of digital timers, particularly in monostable and astable configurations.
	5. **Implement Digital Timing Circuits** Design practical timing circuits using digital ICs (e.g., 555 timer), and analyze their use in generating pulses or time delays.
Content Outline	Flip-flops and counters: R-S flip flops, Clocked R-S, D Flip flop, J K Master slave flip flop, counters: Synchronous and Asynchronous: 3 bit ripple up counter, mod-3. Timer: Block diagram, Monostable and Astable Operation
References:-	1. Introduction to Electrodynamics 3rd Ed by D.J. Griffith 2. Malvino and Leach (6th Ed) Digital Principles and Applications (TMH). 3. Malvino and Brown (3rd Ed) Digital Computer Electronics. 4. R P Jain (4th Edition) Modern Digital Electronics McGraw Hill 4. A. Anandkumar (6th Edition) Fundamental of Digital Circuits Prentice- Hall
PRACTICAL COURSE (2 Credits)	**PHP301**

Learning Outcomes	**After learning the Practical module, learners will be able to**
	1. ☐ **Apply fundamental concepts of mechanics and elasticity** to determine material properties like Young's modulus using metal beams and flat spiral springs through practical experimentation.
	2. ☐ **Analyze and interpret optical phenomena** such as refraction and resolving power by performing experiments with an optical lever and telescope to derive refractive index and resolving limits.
	3. ☐ **Perform precision measurements using modern optical equipment**, such as determining the wavelength of a He-Ne laser with a diffraction grating, enhancing skills in laser optics and interference.
	4. ☐ **Construct and test basic digital circuits** including pulse generators, binary and decade counters using ICs (e.g., 555, 7490, 7493), and develop an understanding of their practical applications in digital electronics.
	5. ☐ **Interface and troubleshoot display systems** by working with seven-segment displays (common anode and cathode), including their decoding/encoding using IC 7446 and 7448, and analyzing the working of a 3½ digit 7-segment display.
Module 1 (Credit 1)	1. Y by bending (metal beam) Credit 1 2. Flat spiral spring (Y) 3. Optical lever: determination of refractive index of glass (μ) 4. Resolving Power of telescope. 5. Finding moment of inertia of flywheel 6. Determination of wavelength of He-Ne laser using grating
Module 2 (Credit 1)	1. Pulse generator using IC 555 2. Binary Counter using IC 7493 3. Decade Counter using IC 7490 4. Seven-Segment (Common Anode) Display with Decoder 7446 5. Seven-Segment (Common Cathode) Display with Encoder 7448 11 Study of 3 ½ 7 Segment Display

3.2 Major (Core)

Course Title	**Analog Electronics**
Course Credits	**4 (2L + 2P)**
Course Outcomes	**After going through the course, learners will be able to**
	1. Apply the principles of semiconductor device operation to analyze and solve problems related to diode and transistor circuits.
	2. Analyze the performance characteristics of various analog amplifier configurations using small signal models.
	3. Evaluate the frequency response and stability of multi-stage amplifier circuits and feedback amplifiers.
	4. Design and construct analog circuits such as oscillators, amplifiers, and filters to meet specific application requirements.
	5. Develop and simulate analog electronic systems using appropriate tools to demonstrate understanding of real-world applications.
Module 1 (Credit 1)	**Analog Electronics-1**
Learning Outcomes	**After learning the module, learners will be able to**
	1. Apply amplifier performance parameters such as current gain, voltage gain, and power gain to evaluate the efficiency of analog amplifier circuits.
	2. Analyze the effects of input and output resistance on amplifier performance and signal transmission in analog systems.
	3. Evaluate the role of negative feedback in amplifiers by examining its impact on gain stability, bandwidth, linearity, and noise reduction.
	4. Apply the operating principles of JFET and MOSFET devices to design analog circuits like amplifiers, analog switches, and voltage-controlled resistors.
	5. Analyze the transconductance characteristics and biasing techniques of JFETs and MOSFETs to determine suitable operating regions for specific applications.
	6. Create amplifier and switching circuits using JFETs and MOSFETs for use in analog signal processing and control systems.

Content Outline	**General amplifier characteristics: Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance, general theory of feedback, reasons for negative feedback, loop gain JFET,MOSFET:- Field Effect Transistors: JFET: Basic ideas, Drain Curve, The trans-conductance curve, Biasing in the ohmic region and the active region, Trans-conductance, JFET common source amplifier, JFET analog switch, multiplexer, voltage controlled resistor, Current sourcing. MOSFET: Depletion and enhancement mode, MOSFET operation and characteristics, digital switching.**
Module 2 (Credit 1)	**Analog Electronics-2**
Learning Outcomes	**1. Understand Oscillator Principles** Explain the fundamental concepts of oscillators, including the role of positive feedback, and the essential conditions required for sustained oscillations in electronic circuits.
	2. Analyze and Design Oscillator Circuits Analyze and design various sinusoidal oscillators such as phase shift, Wien Bridge, and Colpitt's oscillators, including their frequency determination and feedback network design.
	3. Comprehend Operational Amplifier Characteristics Understand AC characteristics of operational amplifiers including bandwidth, slew rate, and frequency response, and their effect on circuit performance.
	4. Apply Negative Feedback in OPAMP Circuits Design and evaluate OPAMP-based circuits using negative feedback for improved performance, stability, and linearity.
	5. Implement OPAMP Applications Design and implement practical OPAMP-based applications including summing amplifiers, integrators, differentiators, and comparators, understanding their working principles and limitations.
	6. Develop Problem-Solving Skills in Analog Design Apply analog electronics concepts to solve real-world engineering problems, demonstrating proficiency in circuit analysis, simulation, and performance evaluation.
Content Outline	**Oscillators: Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator.** **Operational Amplifiers: AC analysis, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, OPAMP with Negative feedback, Summing Amplifier,**

	Applications of Summing amplifier, OPAMP Integrator and Differentiator, Comparator
References:-	**1. Electronic devices and circuits – An introduction Allan Mottershed (PHI Pvt. Ltd.–EEE – Reprint – 2013)** **2. Op-amps and linear integrated circuit, Ramakant Gayakwad , 4th Edition, Prentice Hall, 2000** **3. Op Amp Applications Handbook, Walt Jung , Elsevier,2004** **4. Op Amps for Everyone, Bruce Carter , Elsevier.** **5. Design with Operational Amplifiers And Analog Integrated Circuits Sergio Franco, McGraw-Hill Higher Education.** **6. Application, and Troubleshooting D. L. Terrell, OP AMPS Design, , 2nd edition. Butterworth-Heinemann, 1996.**
PRACTICAL COURSE (2 Credits)	**PHP302**
Learning Outcomes:-	1. **Analyze the sensitivity and behavior of a mirror galvanometer** by determining its figure of merit, and measuring its internal resistance using shunt methods, enabling accurate usage in precision experiments.
	2. **Design and evaluate amplifier circuits** including common emitter (NPN) amplifiers and operational amplifier configurations (inverting and non-inverting) to achieve specific voltage gains and understand frequency responses.
	3. **Construct and test active and passive electronic filters** (low-pass and high-pass) to understand frequency-dependent behavior and filtering applications in signal processing.
	4. **Demonstrate understanding of oscillator and multivibrator circuits** such as Colpitt's Oscillator and transistorized astable multivibrator, focusing on waveform generation and frequency determination.
	5. **Apply bridge methods (Ballistic Galvanometer technique)** to accurately determine absolute capacitance, reinforcing concepts of charge, discharge, and transient analysis in capacitive circuits.
Module 1(Credit 1)	1. Figure of merit of a mirror galvanometer. 2. Common emitter transistor (NPN) amplifier 3. Op Amp: Inverting amplifier with different gains 4. Op Amp: Non-inverting amplifier with different gains 5. Passive low pass filter/high pass filter
Module 2(Credit 1)	1. Determination of absolute capacitance using BG 2. Measurement of resistance of galvanometer (G by shunting) 3. Transistorized Astable multivibrator

	4. CE amplifier: variation of gain with load 5. Colpitts's Oscillator

3.3 Major (Core)

Course Title	**Quantum Mechanics**
Course Credits	**4 (2L + 2P)**
Course Outcomes	**After going through the course, learners will be able to**
	1. Discuss the postulates of quantum mechanics and its importance in explaining significant phenomena in Physics.
	2. Use of mathematical operators, setting up Schrodinger time dependent and time independent equation and its interpretations.
	3. Solve Schrodinger equation for wave functions of various simple quantum mechanical potentials (one-dimensional, step, three-dimensional potential) and different application problems.
	4. Examine the barrier tunnelling phenomena for a barrier of finite height and width.
	5. Solve Schrödinger equation to obtain the energy and wave functions of the quantum harmonic oscillator.
Module 1(Credit 1)	**The Schrodinger wave equation**
Learning Outcomes	**After learning the module, learners will be able to**
	1. Analyze the implications of De Broglie's hypothesis and wave-particle duality to understand the behavior of microscopic particles.
	2. Apply the concepts of wave packets, phase and group velocities, and Heisenberg's uncertainty principle to describe the localization and motion of particles.
	3. Evaluate the significance of the Schrödinger wave equation, wave function, and Born's interpretation to explain the probabilistic nature of quantum systems.
	4. Apply quantum mechanical operators to determine eigenvalues and expectation values for observables like position, momentum, and energy.
	5. Analyze and construct solutions of the time-dependent and time-independent Schrödinger equations for stationary states, and interpret the equation of continuity and the superposition principle in quantum systems.

Content Outline	**Matter waves-De Broglie hypothesis, Wave particle duality, Concept of wave packet, phase velocity, group velocity, Heisenberg's uncertainty principle, The Schrodinger wave equation: Concept of wave function, Born interpretation of 8L wave function, Normalization of wave function, Concepts of operator in quantum mechanics examples – position, momentum and energy operators., Eigenvalue equations, expectation values of operators.** **Schrodinger`s Time dependent equation, Postulates of quantum Mechanics. Schrodinger`s time independent (Steady State) equation, Stationary State. Superposition principle. Equation of continuity and its physical significance.**
Module 2 (Credit 1)	**Applications of Schrodinger steady state equation - I**
Learning Outcomes	**1.** Apply the boundary conditions to determine the quantized energy levels and corresponding wave functions of a particle confined in a one-dimensional infinite potential well.
	2. Analyze the behavior of a quantum particle encountering a potential step or finite potential barrier to explain concepts like reflection, transmission, and tunneling.
	3. Evaluate the tunneling effect through potential barriers to understand its role in quantum phenomena such as alpha particle emission in radioactive decay.
	4. Apply the Schrödinger equation to a particle in a three-dimensional rigid box to determine energy eigenvalues and interpret the concept of degeneracy of energy states.
	5. Analyze the energy quantization and physical significance of wave functions in a one-dimensional quantum harmonic oscillator system.
Content Outline	**Wave Function of a Free particle, Particle in infinitely deep potential well (one - dimension). Step potential. 10L Particle in three-dimension rigid box, degeneracy of energy state.** **Potential barrier (Finite height and width), penetration and tunnelling effect (No derivation of approximate transmission probability), Theory of alpha particle decay from radioactive nucleus. Simple one-dimensional Harmonic oscillator (one-dimension concept and result)**

References:-	1. A. Beiser (6th Ed.) Concepts of Modern Physics –Tata McGraw Hill. 2. S P Singh, M K Bagade, Kamal Singh, - S. Chand: 2004 Ed. Quantum Mechanics 3. R. Eisberg and R. Resnik Nuclei and particles. - Published by Wiley. 4. D. Griffiths Introduction to Quantum Mechanics. - Published by Prentice Hall. 5. Ghatak and Lokanathan Quantum Mechanics. - Published by Mc. Millan. 6. L. I. Schiff Quantum Mechanics. -. (4th edition Tata McGraw Hill) 7. Powell and Crasemann, Quantum Mechanics. - Wesley Pub. Co.
PRACTICAL COURSE (2 Credits)	**PHP303**
	1. **Determine and interpret material properties and wave behavior** by experimentally verifying Young's modulus using Koenig's method and exploring diffraction and interference phenomena (e.g., single-slit diffraction, cylindrical obstacle, R.P. of grating).
	2. **Understand the principles of polarization and optical signal transmission** by verifying Brewster's and Malus's laws and examining the working of optical fibers for signal propagation.
	3. **Analyze semiconductor behavior and energy band structures** through the experimental determination of band-gap energy, reinforcing concepts of solid-state physics.
	4. **Design and implement analog electronic circuits** using operational amplifiers to build log amplifiers, Schmitt triggers, and filters, focusing on signal conditioning and waveform shaping.
	5. **Construct and evaluate oscillator circuits** such as the Wein Bridge Oscillator using Op-Amps, gaining insights into feedback mechanisms and frequency generation in analog systems.
Module 1(Credit 1)	1. Young's modulus by Koenig's method. 2. Optical fiber: transmission of signal 3.Brewster's/ Malus's law verification 4. R.P. of grating 5. Cylindrical obstacle: determination of λ 6. Single slit diffraction
Module 2 (Credit 1)	1. Band-gap Energy 2. Log Amplifier using OP Amp 3. First Order Active High/Low Pass Filter 4. Schmitt Trigger using OPAMP

	5.Wein Bridge Oscillator-OPAMP

3.4 Minor Stream

Course Title	**Optical Instruments & Boolean Logic**
Course Credits	**2**
Course Outcomes	**After going through the course, learners will be able to**
	1. **Apply** the principles of geometric and wave optics to operate and analyze the performance of optical instruments such as telescopes, microscopes, and optical levers.
	2. **Analyze** digital logic circuits using Boolean algebra and truth tables to simplify expressions and design basic combinational and sequential circuits.
	3. **Evaluate** the resolving power and efficiency of optical instruments through experimental data and compare with theoretical expectations.
	4. **Assess** the functionality and limitations of display systems and logic counters using standard ICs, and **evaluate** their suitability for various digital applications.
	5. **Create** optimized logic circuits and display modules by integrating multiple ICs (e.g., 7446, 7448, 7490, 7493), demonstrating innovative problem-solving in digital electronics.
Module 1(Credit 1)	**Introduction to Optical Instruments**
Learning Outcomes	**After learning the module, learners will be able to**
	1. ☐ **Apply** the principles of optics to explain the working of the human eye, camera, and various types of microscopes and telescopes used in optical instrumentation.
	2. ☐ **Analyze** the construction and functioning of simple and compound microscopes, and distinguish their magnification capabilities and applications.
	3. ☐ **Evaluate** the design and functionality of Huygens and Ramsden eyepieces by deriving expressions for equivalent focal length and comparing their optical performance.
	4. ☐ **Compare and contrast** different optical instruments such as refracting and reflecting telescopes, including their merits, limitations, and qualitative working principles.
	5. ☐ **Assess** the significance of eyepiece design in enhancing image quality and functionality in optical devices by examining their principles, construction, and practical applications.

Content Outline	Optical Instruments and Eyepieces: Human Eye as an optical instrument, Camera and Lenses of Camera, Simple Microscope & Compound Microscope, Concept of eyepiece & its significance: Huygens Eyepiece and Ramsden Eyepiece (Principle, Construction, Expression for Equivalent Focal Length, Merits and Demerits), Comparison of Huygens Eyepiece and Ramsden Eyepiece [Gauss Eyepiece, Refracting Astronomical Telescope (Construction and Working), Reflecting Telescope](Qualitative)
Module 2 (Credit 1) Boolean Logic	
Learning Outcomes	**After learning the module, learners will be able to**
	1. ☐ **Apply** the concepts of basic logic gates to construct derived gates like NAND, NOR, and Ex-OR, and understand their truth tables, logic expressions, and symbols.
	2. ☐ **Analyze** the universality of NAND and NOR gates by designing and implementing other logic gates using them as fundamental building blocks.
	3. ☐ **Implement** Ex-OR gate circuits using basic gates and explain its functional role in digital systems such as parity generators and checkers.
	4. ☐ **Evaluate** the design and working of combinational logic circuits like Half Adder and Full Adder using basic and derived gates for binary arithmetic operations.
	5. ☐ **Create** functional digital circuits using derived gates for specific applications like addition and error detection, demonstrating circuit design and logical reasoning skills.
Content Outline	Derived Gates(Review: Basic Logic gates), NAND and NOR as Universal Building blocks, Ex-OR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications–Parity generator and checker, Half adder and Full adder.
References: -	1. SBA: Dr. N. Subrahmanyam, Brijlal, and Dr. M. N. Avadhanulu, A Textbook of Optics, 25th Revised Edition 2012(Reprint2016), S. Chand and Comp. Pvt. Ltd. 2. Jenkins and White,Fundamentals of Opticsby (4thEd.), Mc Graw Hill International 3. AjoyGhatak,Optics,6thEdition,McGrawHill Education(India)Private Limited 4. LMS: Leach, Malvino, Saha, Digital Principles and Applications– 6th Edition. Tata Mc Graw Hill 5. Tokheim: Digital Electronics, Principles and Applications, 6thEdition, McGraw Hill Edition. 6.AD:AlbertMalvino,DavidBates,ElectronicPrinciples,8thEdition,TataMcGrawHill

Format of Question Paper: for the final examination For Minor Course:

Internal – No Internal Examination

External – 50 Marks (2 Credits) which includes ,Question paper may carry 8 questions out of which

Learner has to attempt any 5. It should cover both modules.

3.5 OPEN ELECTIVE COURSE (OEC)

Course Title	**Fascinating Physics**
Course Credits	**2**
Course Outcomes	After going through the course, learners will be able to
	6. **Apply** the principles of classical and modern physics to solve real-world problems involving motion, energy, and electromagnetism. (Bloom's Level: Apply)
	7. **Analyze** the behavior of physical systems using conceptual and mathematical models in areas such as optics, thermodynamics, and quantum mechanics. (Bloom's Level: Analyze)
	8. **Evaluate** the effectiveness of scientific methods and experimental data in explaining physical phenomena and validating theories. (Bloom's Level: Evaluate)
	9. **Create** innovative solutions or devices by integrating interdisciplinary physics concepts with technology and engineering tools. (Bloom's Level: Create)
	10. **Evaluate** current advancements in physics and assess their implications on society, technology, and the environment.
Module 1(Credit 1)	**Physical Science**
Learning Outcomes	**After learning the module, learners will be able to**
	6. **Explain** the fundamental ideas and goals of science and its role in shaping human understanding of the natural world. (Understanding level)
	7. **Describe** the key concepts of Aristotelian science and contrast them with the principles of modern scientific thinking. (Understanding/Analyzing level)
	8. **Trace** the historical development of science from ancient civilizations to the present, highlighting key contributions and shifts in perspective. (Understanding/Applying level)
	9. **Define** physics and **illustrate** its scope by citing real-life examples and applications across various domains. (Understanding/Applying level)
	10. **Justify** the importance of studying physics in the context of technological advancement, critical thinking, and

	societal development. (Evaluating level)
Content Outline	Introduction, Aristotelian science, Science - tracing back its origin, what is physics, why physics, the three fundamental entities of reality –Space, time and matter.
Module 2 (Credit 1)	**Space**
Learning Outcomes	**After learning the module, learners will be able to**
	6. **Explain** the evolution of cosmological thought from early worldviews to twentieth-century models and recent advancements in understanding the universe. (Understanding level)
	7. **Analyze** the structure and significance of the Big Bang model, including the concept of a fine-tuned universe and the law of cause and effect. (Analyzing level)
	8. **Evaluate** various tools and techniques used in modern cosmology and astronomy to observe, measure, and interpret celestial phenomena. (Evaluating level)
	9. **Describe** major discoveries in the solar system and **compare** the characteristics of exoplanets and other celestial bodies. (Understanding/Analyzing level)
	10. **Interpret** the life cycle of massive stars, including phenomena such as supernovae and black holes, and their role in shaping the cosmos. (Applying/Understanding level)
Content Outline	1. Universe by design: From backyard to the big bang – A brief history of cosmology; worldviews in science and cosmological models, twentieth century cosmology, more recent developments in cosmology, tools for explaining the universe, the big bang model, fine-tuned universe, the law of cause and effect, A pale blue dot but a privileged planet. 2. Frontiers of Astronomy: From dawn to dusk, exploring the night sky, recent discoveries in the solar system, other worlds, cosmological distance and measurements, death of massive stars – supernova and black holes
References:-	1. Aslamazov, L. G., Varlamov, A. (2001). The Wonders of Physics. Singapore: World Scientific Publishing Company. 2. Hoyle, F. (1955). Frontiers of Astronomy. United Kingdom: Harper. 3. Concepts of Matter in Science Education. (2013). Netherlands: Springer Netherlands

Format of Question Paper: for the final examination For OE:

Internal – No Internal Examination

External – 50 Marks (2 Credits) which includes ,Question paper may carry 8 questions out of which

Learner has to attempt any 5. It should cover both modules.

3.7 Field Project-1

Course Title	**Field Project-1**
Course Credits	**2**
Course Outcome	After the successful completion of the Course, the learner will be able to:
	1. Make students aware with recent research and work culture in research laboratories / industries.
Content Outline	1. Visit to nearby research institutes. 2. Industrial visit. 3. Night sky gazing / visit to observatories. Report writing/presentation based on these visits,

Course Syllabus

Semester: IV

4.1 Major (Core)

Course Title	**Microprocessor 1**
Course Credits	**4 (2L + 2P)**
Course Outcomes	After going through the course, learners will be able to
	1. Apply the concepts of microprocessor architecture and instruction sets to develop basic assembly language programs for arithmetic and logical operations.
	2. Analyze the timing diagrams and instruction execution cycles to understand the internal operations and performance of microprocessors.
	3. Evaluate the suitability of various interfacing techniques and peripheral devices for microprocessor-based system design.
	4. Create assembly language programs to interface input/output devices such as LEDs, switches, and displays with the microprocessor.
	5. Design and evaluate microprocessor-based systems for specific applications, ensuring functional correctness and efficiency in real-time scenarios.
Module 1(Credit 1)	**Introduction to 8085**
Learning Outcomes	**After learning the module, learners will be able to**
	1. Apply the knowledge of 8085 microprocessor architecture to identify the function of various internal blocks such as ALU, registers, and control unit.
	2. Analyze the role and functioning of system buses (address, data, and control) in memory and I/O operations of a microprocessor-based system.
	3. Apply assembly language programming techniques to write simple 8085 programs using arithmetic, logical, and branch instructions.
	4. Evaluate different addressing modes and instruction types of the 8085 microprocessor to determine their appropriate usage in program development.
	5. Create basic applications involving interfacing of memory and I/O devices with the 8085 microprocessor using suitable programming and interfacing techniques.

Content Outline	Microprocessors, Microprocessor architecture and its operations microprocessor, memory buses, input output devices The 8085 microprocessors: introduction to assembly language programming, Instruction set and addressing modes.
Module 2 (Credit 1)	**Assembly Language Programming**
Learning Outcomes	**After learning the module, learners will be able to**
	1. Apply the 8085 programming model to write programs utilizing registers, accumulator, program counter, and stack pointer effectively.
	2. Analyze the classification of 8085 instructions based on operation types such as data transfer, arithmetic, logical, control, and branching.
	3. Develop assembly language programs using arithmetic and logical instructions to perform basic computational tasks.
	4. Evaluate the execution of branching instructions in control flow by tracing program logic and predicting outcomes.
	5. Create efficient assembly language routines integrating multiple instruction types to solve real-world problems like sorting, searching, and delay generation.
Content Outline	8085 programming model, instruction classification 8085 Microprocessor programs with arithmetic and logical, data transfer, branching instructions.
References:-	1.Microprocessor Architecture, programming and Applications with 8085 – Ramesh Gaonkar, 5th Edition, Prentice Hall of India (RG) 2. 8085 Microprocessor: Architecture and Programming, P. B. Borole Ane Books, 2015 3. Microprocessor – I, V. J. Vibhute & P. B. Borole, Tech – Max Publications.
PRACTICAL COURSE (2 Credits)	**PHP401**
	1. **Develop proficiency in 8085 microprocessor programming** by executing arithmetic and logical operations (addition, subtraction, multiplication, carry handling, and comparisons) and applying them to solve real-time problems like sorting and memory block transfer.
	2. **Interpret and manipulate data efficiently in low-level programming**, including operations on 8-bit and 16-bit numbers, understanding register usage, flags, and memory addressing techniques.

	3. **Design and implement digital-to-analog and analog-to-digital conversion circuits** using weighted resistor networks and IC-based DAC/ADC to bridge digital systems with analog environments.
	4. **Analyze the characteristics of a common-emitter (CE) amplifier**, including frequency response and impedance measurements, to evaluate the amplifier's performance in analog signal applications.
	5. **Understand and implement digital logic circuits**, including logic gates, half adder, full adder, and Boolean simplification techniques (SOP & POS), enhancing skills in combinational logic design.
Module 1(Credit 1)	1. Study of 8085 microprocessor kit and commands 2. 8 -bit addition, subtraction and display 3. 8 -bit addition, subtraction with carry and display 4. 8 –bit multiplication 5. 16-bit addition 6. Memory block transfer from one location to another. 7. Find largest /smallest number in given block. 8. Arrange given number in ascending/descending order.
Module 2(Credit 1)	1. 4-bit D-to-A converter using weighted resistors 2. 4-bit DAC using IC 3. 4-bit ADC using IC 4. CE amplifier, frequency response, input and output impedance 5. Logic gates + half adder, Full adder 6. Sum of product and product of sum method.

4.2 Major (Core)

Course Title	**Thermodynamics**
Course Credits	**4 (2L + 2P)**
Course Outcomes	After going through the course, learners will be able to
	1. Apply the first and second laws of thermodynamics to analyze the performance of closed and open systems in engineering applications.
	2. Analyze thermodynamic cycles such as Carnot, Rankine, and Otto to determine efficiency and work output under various conditions.
	3. Evaluate the properties of pure substances using property tables, charts, and equations of state to support thermodynamic calculations.
	4. Create thermodynamic models for practical systems like engines, compressors, and refrigerators to predict performance and optimize efficiency.
	5. Analyze and evaluate entropy changes in reversible and irreversible processes to assess system feasibility and energy degradation.
Module 1(Credit 1)	Laws of thermodynamics
Learning Outcomes	**After learning the module, learners will be able to**
	1. Apply the Zeroth and First Laws of Thermodynamics to determine thermal equilibrium and energy interactions in closed and open systems.
	2. Analyze the Carnot cycle and its significance to heat engine efficiency, comparing it with real-world engines like the Steam Engine, Otto Cycle, and Diesel Engine.
	3. Evaluate entropy changes in ideal and real processes using T-S diagrams, and interpret the physical significance of entropy for gases and steam.
	4. Analyze the thermodynamic temperature scale (Kelvin), its relationship with the perfect gas scale, and the concept of absolute zero and degree size.
	5. Evaluate the implications of the Third Law of Thermodynamics, including concepts like zero-point energy and the theoretical "heat death" of the universe, and formulate informed predictions about entropy trends in isolated systems.
Content Outline	Zeroth law, First law, Carnot cycle, Carnot theorem, Steam Engine, Internal Combustion Engine (Otto Cycle), Diesel Engine ENTROPY The TS Diagram, Physical Significance of Entropy, Entropy of a Perfect gas, Entropy of a Steam , Kelvin's

	Thermodynamic scale of Temperature , The Size of a Degree , Zero of absolute thermodynamic Scale ,Identity of Perfect gas Scale and absolute Scale Third Law of Thermodynamics, Zero Point Energy, Negative Temperature (Not Possible) Heat Death of Universe
Module 2 (Credit 1)	Thermodynamical Relationships
Learning Outcomes	**After learning the module, learners will be able to**
	1. Apply the concepts of extensive and intensive thermodynamic variables to differentiate system properties and formulate relationships between them.
	2. Analyze Maxwell's thermodynamic relations and their derivations to solve problems involving changes in entropy, temperature, pressure, and volume.
	3. Evaluate the Joule-Thomson effect, including cooling and heating behavior of gases like hydrogen and helium, and determine inversion temperatures using the Joule-Thomson coefficient.
	4. Apply the Clausius-Clapeyron and Clapeyron equations using both thermodynamic relations and Carnot cycle concepts to analyze phase transitions and latent heat.
	5. Evaluate the significance of thermodynamic potentials and T-dS equations in describing equilibrium and spontaneous processes, and formulate expressions for internal energy in ideal and real gases using Clausius inequality and the Second Law of Thermodynamics.
Content Outline	Thermodynamic Variables , Extensive and Intensive Variables, Maxwell's Thermodynamical Relations, Applications of Maxwell's Relations , Joule-Thomson Cooling, Joule-Thomson Coefficient , Temperature of Inversion , Heating Effect for Hydrogen and Helium at Room temperature , Clausius-Clapeyron's Equation , Thermodynamic Potentials , Significance of Thermodynamic Potentials , Relation of Thermodynamical Potentials with Their Variables , The T-dS Equations , Clapeyron's Latent Heat Equation (Using Thermodynamical Relations) 'Clapeyron's Latent Heat Equations (Using Carnot's Cycle) , Adiabatic Stretching of a Wire, Internal Energy of Ideal and Real Gases , Clausius Inequality , Entropy and the Second Law of Thermodynamics .
References:-	1. Heat Thermodynamics and Statistical Physics – Brijlal and Subrahmanyam 2. University Physics , 13th edition – Sears and Zemansky 3. Thermal Physics – A.B. Gupta and H.P. Roy
PRACTICAL COURSE (2 Credits)	**PHP402**
	1. **Demonstrate understanding of interference and diffraction phenomena** through experiments such as Newton's rings, wedge-shaped film, biprism, and single slit diffraction using LASER, reinforcing wave nature of light.

	2. **Analyze the concept of resolving power** by experimentally determining the resolution limits of optical instruments like telescopes and grating spectrometers.
	3. **Investigate thermal properties of materials and systems** by determining mechanical equivalent of heat (J) using the electrical method, and measuring thermal conductivity using Lee's disc method.
	4. **Understand thermometric principles and gas laws** through the use of a constant volume air thermometer, linking pressure, volume, and temperature relations in thermodynamics.
	5. **Explore and verify the fundamental laws of thermodynamics** through dedicated experiments, with emphasis on the First Law, energy conservation, and heat-work equivalence in closed systems.
Module 1(Credit 1)	1.Newton's rings 2 Wedge shaped film 3 Biprism 4 Single slit diffraction using LASER 5 Resolving power of telescope 6 Resolving power of grating spectrometer
Module 2(Credit 1)	1. J by Electrical Method. 2. Heat conductivity by Lee's method. 3. Constant Volume Air Thermometer. 4. Experiments on laws of thermodynamics 5. First law of thermodynamics

4.3 Major (Core)

Course Title	**Applied Physics II**
Course Credits	**4 (2L + 2P)**
Course Outcomes	After going through the course, learners will be able to
	1. Apply fundamental concepts of nanoscience to explain the unique physical, chemical, and mechanical properties of nanomaterials compared to bulk materials.
	2. Analyze various synthesis methods of nanomaterials, such as sol-gel, chemical vapor deposition, and ball milling, to determine their suitability for specific applications.
	3. Evaluate the structural, optical, and electrical characteristics of nanomaterials using advanced characterization techniques like XRD, SEM, TEM, and AFM.
	4. Create basic nanostructures or nanocomposites through laboratory-scale synthesis, demonstrating control over particle size and morphology.
	5. Evaluate the environmental, ethical, and societal implications of nanomaterials and design potential solutions for sustainable and safe applications in areas such as medicine, electronics, and energy.
Module 1(Credit 1)	**Synthesis of Nanomaterials**
Learning Outcomes	**After learning the module, learners will be able to**
	1. Apply physical synthesis techniques such as high-energy ball milling and melt mixing to produce nanomaterials with desired structural properties.
	2. Analyze various vapor-phase techniques like Physical Vapor Deposition (PVD), Ionized Cluster Beam Deposition, and Laser Ablation to understand their mechanisms and material outputs.
	3. Evaluate the advantages, limitations, and suitability of chemical synthesis methods such as sol-gel, micro-emulsions, and the Langmuir-Blodgett method for nanoparticle fabrication.
	4. Analyze the nucleation and growth processes in colloidal systems to predict particle size distribution and morphology during nanoparticle formation.
	5. Create nanomaterials using both physical and chemical synthesis routes in laboratory settings, selecting appropriate methods based on desired applications and material properties.

Content Outline	Synthesis of Nano-materials – Physical Methods: Introduction, Mechanical Methods – High Energy Ball Milling, Melt Mixing; Methods based on Evaporation – Physical, Vapor Deposition, Ionized cluster beam deposition, Ablation (laser vaporization), Laser Pyrolysis, Chemical Vapor Deposition Synthesis of Nano-materials – Chemical Methods Introduction, Colloids & Colloids in Solution, Nucleation& Growth of Nanoparticles, Langmuir-Bodgett (LB) Method, Micro-emulsions, Sol-Gel Method
Module 2 (Credit 1)	**Analysis techniques**
Learning Outcomes	**After learning the module, learners will be able to**
	1. Apply the principles of green chemistry to synthesize nanomaterials using biological systems such as microorganisms and plant extracts.
	2. Analyze the role of biomolecules like proteins and enzymes in controlling the shape, size, and stability of biologically synthesized nanoparticles.
	3. Evaluate the efficiency, sustainability, and biocompatibility of different biological methods for nanoparticle synthesis compared to conventional physical and chemical methods.
	4. Analyze the structural and functional roles of natural templates such as DNA and S-layers in directing the self-assembly and synthesis of nanomaterials.
	5. Create biologically derived nanoparticles using DNA templating and plant-based methods for applications in medicine, environmental remediation, or biosensing.
Content Outline	Synthesis of Nanomaterials – Biological Methods Introduction, Synthesis using Microorganisms, Synthesis using Plant extracts, Use of Proteins, Templates like DNA, S-Layers, etc., Synthesis of Nanoparticles using DNA
References: -	1. Sulabha Kulkarni – Nanotechnology Principles and Practices (SK).
PRACTICAL COURSE (2 Credits)	**PHP403**
	1. **Explore optical phenomena such as polarization and double refraction** by verifying Brewster's law and studying birefringence, enhancing understanding of light's vector nature and anisotropic materials.
	2. **Determine physical constants using diffraction and precision instruments** by measuring the wavelength of a monochromatic source through single slit diffraction and using the optical lever method for detecting small displacements.
	3. **Evaluate the resolving capabilities of optical instruments** by experimentally determining the resolving

	power of a prism spectrometer, linking angular dispersion and wavelength resolution.
	4. **Investigate damped and forced oscillations** through experiments like logarithmic decrement, resonance pendulum, and LCR circuit resonance, understanding energy dissipation and resonance conditions in mechanical and electrical systems.
	5. **Analyze transient and steady-state behavior in RLC circuits** by studying series and parallel LCR resonance and observing LCR transients, gaining insights into phase relations, damping, and time-dependent circuit responses.
Module 1(Credit 1)	1.Double refraction 2 Brewster's law 3. Wavelength of monochromatic source using Single slit diffraction pattern 4.Optical lever 5. Resolving power of prism spectrometer
Module 2(Credit 1)	1. Logarithmic decrement 2. Resonance pendulum 3. LCR series resonance 4. LCR parallel resonance 5. LCR transients

Modality of Assessment

Theory Examination Pattern: (for Discipline Specific **Major(Core)** papers)

A. **Internal Assessment**- 50%- 50 Marks per paper

Sr. No.	Evaluation Type	Marks
1	Assignment/ Case study/ field visit report/ presentation/ project	25
2.	Assignment/ Case study/ field visit report/ presentation/ project	25
	Total	50

B. **External Examination**- 50%- 50 Marks per course (for Discipline Specific **Major(Core)** courses)

Semester End **Theory Examination**:
1. Duration - These examinations shall be of two hours duration.
2. Theory question paper pattern:
a) There shall be total 4 questions out of which, first 3 questions each of 15 marks with different levels of difficulty and the last question carries 5 marks
b) All questions shall be compulsory with at least 50% internal choice within the questions. (For example, 4 out of 6 sub-questions to be solved).
c) All units will be given equal weightage.

Modality of Assessment
Practical Examination Pattern: (for Discipline Specific **Major (Core)** Courses)

75% experiments must be completed for the journal certification. Without certified journal, learner will not be allowed to appear for the practical examination.

A. Internal Assessment- 50%- 50 Marks per paper

Sr. No.	Evaluation Type	**Marks**
1	Journal	**30**
2	**Viva**	**20**
	Total	**50**

B. External Assessment- 50%- 50 Marks per paper

Sr. No.	Evaluation Type	**Marks**
1	Experiment no 1 from module 1	**25**
2	Experiment no 2 from module 2	**25**
	Total	**50**

4.4 Open Elective Course (OEC)

Course Title	Energy Sources
Course Credits	**2**
Course Outcomes	After going through the course, learners will be able to
	☐ **Apply** the principles of physics to explain the working mechanisms of conventional and non-conventional energy sources such as thermal, hydro, solar, wind, and nuclear energy.
	☐ **Analyze** the efficiency, advantages, and limitations of different energy conversion systems and technologies used in harnessing renewable and non-renewable energy.
	☐ **Evaluate** the environmental impact, sustainability, and economic feasibility of various energy sources through scientific reasoning and data interpretation.
	☐ **Compare** energy storage methods and distribution systems to determine optimal solutions for energy management in different contexts.
	☐ **Create** basic models or conceptual frameworks for alternative energy systems that demonstrate innovative use of clean and sustainable energy technologies.
Module 1(Credit 1)	Wind and Tidal Energy harvesting
Learning Outcomes	**After learning the module, learners will be able to**
	1. **Apply** the fundamental principles of wind energy to understand the working of wind turbines and identify the role of different electrical machines used in wind power generation.
	2. **Analyze** the function of power electronic interfaces and various grid interconnection topologies in integrating wind energy into the electrical grid efficiently and safely.
	3. **Evaluate** the comparative potential of ocean energy sources against wind and solar energy, based on availability, consistency, and environmental impact.
	4. **Interpret** wave and tide characteristics using statistical data to assess their suitability and efficiency for energy conversion.
	5. **Examine** the working principles and technological aspects of wave energy devices, tidal energy systems, and ocean thermal energy conversion (OTEC) systems for harnessing marine energy.
Content Outline	1. Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. 2. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.
Module 2 (Credit 1)	Geothermal and Hydro-energy
	After learning the module, learners will be able to

Learning Outcomes	1. ☐ **Apply** the principles of thermodynamics and fluid mechanics to explain the extraction and utilization of energy from geothermal resources using various geothermal technologies.
	2. ☐ **Analyze** the working of hydropower systems by studying hydropower resources, types of turbines, and energy conversion technologies involved.
	3. ☐ **Evaluate** the environmental and socio-economic impacts of hydropower projects, including effects on ecosystems, water usage, and displacement issues.
	4. ☐ **Assess** the role and effectiveness of carbon capture technologies in reducing greenhouse gas emissions and supporting sustainable energy systems.
	5. ☐ **Compare** different energy storage solutions such as electrochemical cells and batteries, and **examine** patterns of power consumption for efficient energy management.
Content Outline	Geothermal Resources, Geothermal Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Carbon captured technologies, cell, batteries, power consumption
References: -	1. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University. 2. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich(USA). 3. http://en.wikipedia.org/wiki/Renewable_energy

Evaluation:-
Internal – No Internal Evaluation for OEC
External- 50 marks

4.5 Skill Enhancement Course (SEC)

Course Title	Cyber Security
Course Credits	**2**
Course Outcomes	After going through the course, learners will be able to
	1. **Apply** fundamental concepts of cyber security to identify potential threats, vulnerabilities, and risks in digital systems and networks.
	2. **Analyze** various types of cyber attacks and malware to determine appropriate defense mechanisms and mitigation strategies.
	3. **Evaluate** the effectiveness of security protocols, encryption techniques, and access control methods in protecting information and communication systems.
	4. **Investigate** ethical, legal, and policy issues in cyber security to ensure compliance with data protection laws and best practices.
	5. **Design** secure system architectures and implement basic security solutions to enhance the resilience of networks and information systems.
Module 1(Credit 1)	Introduction to Cyber Crime & Cyber Offences
Learning Outcomes	**After learning the module, learners will be able to**
	1. **Explain** the concept of cyberspace and the growing need for cyber security in safeguarding digital assets, personal data, and organizational infrastructure.
	2. **Identify** various types of cyber crimes and classify them based on intent and method, including cyberstalking, social engineering, and system-based attacks.
	3. **Analyze** the planning and execution stages of a cyber attack—such as reconnaissance, passive/active attacks, scanning, and access gaining—to understand the mindset and tactics of cybercriminals.
	4. **Evaluate** the legal framework surrounding cyber crime in India, especially with reference to the **Information Technology Act 2000**, and its role in combating digital offenses.
	5. **Apply** organizational strategies and preventive measures to address mobile device security issues, enhancing awareness of self-protection in the digital environment.
Content Outline	Introduction to Cyber Space, Need for Cyber Security, Cyber Crime: Definition and origin of the word; Cyber Crime and Information Security; Cybercriminals; Classification of Cyber

	Crimes; Cyber Crime: The Legal Perspective; Cyber Crime and Indian ITA 2000. Categories of Cyber Crime; How criminal plan the attack: Reconnaissance, Passive attack, Active attack, Scanning and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access); Social Engineering; Cyberstalking: Types of Stalkers, Case reported on Cyberstalking, How Stalking Works, Real-life Incident Stalking. Self-Learning Topic: Organizational measures for handling mobile-device related security issues
Module 2 (Credit 1)	**Cyber Crime using Mobile and Wireless Devices**
Learning Outcomes	**After learning the module, learners will be able to**
	1. ☐ **Explain** the risks and methods of credit card fraud in the smartphone and wireless computing era, and recognize the evolving nature of financial cybercrime.
	2. ☐ **Analyze** the security challenges associated with mobile devices, including threats from unauthorized access, data leakage, and malware attacks.
	3. ☐ **Evaluate** the effectiveness of authentication services and mobile security protocols in preventing attacks on mobile platforms and ensuring secure user identity.
	4. ☐ **Assess** the security implications of mobile device usage within organizations and outline appropriate policies and countermeasures to safeguard sensitive information.
	5. ☐ **Apply** best practices and security frameworks for protecting mobile payment platforms like **Unified Payments Interface (UPI)** and managing mobile device-related risks in organizational environments.
Content Outline	Credit Card Fraud in Smart Phone and Wireless Computing Era; Security challenges posed by Mobile devices; Authentication Service Security; Attacks on Mobile; Mobile Devices: Security implication for Organizations; Organizational Security polices and Measures in Mobile Computing Era, UPI Security. Self-Learning Topic: Organizational measures for handling mobile-device related security issues
References: -	1. N. Godbole, S. Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2011. 2. A. Basta, N. Basta, M. Brown, R. Kumar, Cyber Security and Cyber Laws, Cengage, 2018. 3. W. Stallings and L. Brown, Computer Security: Principles and Practice, 4th ed. Pearson, 2018. 4. R. Meeuwisse, Cybersecurity for Beginners (2nd ed.). Cyber Simplicity Ltd., 2017. 5. T. Singh, The Indian Cyber Law. Universal Law Publishing, 2016.

4.7 Community Engagement and Service (CE)

Course Title	**Community Engagement and Service (CE)**
Course Credits	**2**
Course Outcomes	**After going through the course, learners will be able to**
	1. Gain an understanding of rural life, Indian culture, and social realities. Develop empathy and bonds of mutuality with the local community. Appreciate the significant contributions of local communities to Indian society and economy. Learn to Value local knowledge and wisdom. ♣ Identify opportunities to contribute to the community's socioeconomic improvement
	2. Gain an understanding of rural life, Indian culture, and social realities. Develop empathy and bonds of mutuality with the local community. Appreciate the significant contributions of local communities to Indian society and economy. Learn to Value local knowledge and wisdom. Identify opportunities to contribute to the community's socioeconomic improvement
	3. Gain an understanding of rural life, Indian culture, and social realities. Develop empathy and bonds of mutuality with the local community. Appreciate the significant contributions of local communities to Indian society and economy. Learn to Value local knowledge and wisdom. Identify opportunities to contribute to the community's socioeconomic improvement
	4. Gain an understanding of rural life, Indian culture, and social realities. Develop empathy and bonds of mutuality with the local community. Appreciate the significant contributions of local communities to Indian society and economy. Learn to Value local knowledge and wisdom. Identify opportunities to contribute to the community's socioeconomic improvement
	5. Gain an understanding of rural life, Indian culture, and social realities. Develop empathy and bonds of mutuality with the local community. Appreciate the significant contributions of local communities to Indian society and economy. Learn to Value local knowledge and wisdom. Identify opportunities to contribute to the community's socioeconomic improvement
Module 1(Credit 1) and livelihood	**Understanding Rural Society rural and local economy**
	After learning the module, learners will be able to

Learning Outcomes	**1. Understanding the Structure and Dynamics of Rural Society** 1. Gained insight into **joint family systems**, **caste and gender relations**, and **community-based living**, which play a pivotal role in shaping social interactions and decision-making in rural India. 2. Learned how **rural values** like cooperation, respect for elders, and collective identity strengthen community bonds.
	2. Exploring Rural Culture, Resources, and Environmental Connections 3. Understood the close relationship between **rural culture and nature**, including the significance of **public resources** like ponds, forests, and grazing lands in sustaining livelihoods and traditions. 4. Studied the role of **ponds and fisheries** as both cultural and economic assets, especially in terms of sustainable water use and biodiversity.
	3. Appreciating Gandhi's Vision – "The Soul of India Lies in Its Villages" • Reflected on how rural life embodies the **soul of India**, with its deep connection to land, culture, and self-reliant economies. • Recognized the importance of **rural infrastructure** such as roads, electricity, health services, and education in bridging the rural-urban divide.
	4. Learning Rural Livelihood Patterns and Entrepreneurship • Analyzed diverse livelihoods such as **agriculture**, **animal husbandry**, **farming**, and **artisan-based occupations**, along with the challenges of **land ownership** and **water management**. • Explored the emergence of **rural entrepreneurs** and **non-farm livelihoods** contributing to local economic development and employment.
	5. Investigating Socio-Economic Transitions and Innovations • Understood the impact of **rural-to-urban migration**, especially the role of **migrant labor** in shaping both rural and urban economies. • Explored **social innovation projects** that address rural issues like education, health, and livelihood enhancement through participatory and inclusive models.
Content Outline	Rural lifestyle, rural society, joint family, caste and gender relations, rural values with respect to community, rural culture nature and public resources, ponds and fisheries, elaboration of soul of India lies in villages' rural infrastructure,

	Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihood and artisan's rural entrepreneurs, rural markets, migrant labour, social innovation projects
Module 2 (Credit 1) Rural, Local Institution and National development programmers	
Learning Outcomes	**After learning the module, learners will be able to**
	1. Understanding Traditional and Modern Rural Governance Structures • Gained knowledge of **traditional rural institutions** and the evolution of **community organizations** into formal structures like **Gram Panchayats**, **Nagar Palikas**, and **Municipalities**. • Developed an understanding of **Panchayati Raj Institutions (PRIs)** as the backbone of **decentralized planning and local self-governance** in rural India.
	2. Empowerment through Self-Help Groups (SHGs) and Civil Society • Recognized the role of **Self-Help Groups (SHGs)** and **local civil society organizations** in promoting financial inclusion, women's empowerment, and grassroots development. • Learned how SHGs serve as catalysts for **social change, community entrepreneurship**, and local leadership development.
	3. Awareness of Key Rural Development Programs and Missions • Studied major **national programs** like **MGNREGA**, **NRLM**, **Sarva Shiksha Abhiyan**, **Beti Bachao Beti Padhao**, and **Ayushman Bharat**, understanding their objectives, implementation mechanisms, and impact on rural communities. • Analyzed how these schemes contribute to **poverty alleviation**, **education**, **healthcare access**, and **social equity**.
	4. Promotion of Sustainable and Inclusive Development Models • Learned how missions like **Swachh Bharat**, **Jal Jeevan Mission**, **PM Awas Yojana**, and **Mission Antyodaya** aim to improve **rural infrastructure, sanitation, water security, and housing**. • Explored the vision of **Atmanirbhar Bharat** and **Digital India** in enabling **technology-driven self-reliance** and inclusive growth in rural areas.
	5. Encouraging Innovation, Skill Development, and Rural Entrepreneurship

	• Gained insight into schemes such as **Skill India**, **Start-Up India**, **Stand-Up India**, and **SFURTI**, promoting **skill training**, **entrepreneurship**, and the **revival of traditional industries**. • Understood how these initiatives foster **employment generation**, **economic diversification**, and **youth participation** in rural development.
Content Outline	Traditional rural and community organization, self-help groups, decentralized planning, panchayat raj institutions Gram panchayat, Nagarpalika and Municipalities, local Civil Society, Local administration, National rural, Livelihood Mission [NRLM], Mahatma Gandhi National Rural Employment. Guarantee [MGNREGA]. History of rural development and current National Programms in India: Sarva shiksha Abhiyan, Beti BachaoBeti Padhao, Ayushman Bharat, eShram Swachh Bharat, PM Awas yojana, Skill India, Digital India, Start-Up India, Stand-Up India, Scheme of Fund for Regeneration of Traditional Industries (SFURTI), Jal Jeevan Mission, Mission Antyodaya, ATMANIRBHAR Bharat, etc.
References:-	

Teaching/Learning/Methodology

Classroom discussions Field visit Individual /Group conference Report/journal submission & VIVA

Recommended field-based activities (Tentative):

♣ Participate in Gram Sabha meetings, and study community participation;
♣ Visit to Swachh Bharat Mission project sites, conduct analysis and initiate problem solving measures;
♣ Interaction with Self Help Groups (SHGs) women members, and study their functions and challenges; planning for their skill-building and livelihood activities;
♣ Visit Mahatma Gandhi National. Rural Employment Guarantee Act 2005 (MGNREGS) project sites, interact with beneficiaries and interview functionaries at the work site;
♣ surveys on Mission Antyodaya to support under Gram Panchayat Development Plan
♣ Visit Rural Schools/mid-day meal centres, study academic and infrastructural resources, digital divide and gaps;
♣ Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries;
♣ Visit to local Nagarpalika office and review schemes for urban informal workers and migrants;
♣ Attend Parent Teacher Association meetings, and interview school drop outs;
♣ Visit local Anganwadi and observe the services being provided;
♣ Visit local NGOs, civil society organisations and interact with their staff and beneficiaries; ♣ Organize awareness programmes, health camps, Disability camps and cleanliness camps; ♣ Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys and building solar powered village;
♣ Understanding of people's impacts of climate change, building up community's disaster preparedness;
♣ Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers, promotion of traditional species of crops and plants and awareness against stubble burning;

♣ Formation of committees for common property resource management, village pond maintenance and fishing;
♣ Identifying the small business ideas (handloom, handicaraft, khadi, food products, etc.) for rural areas to make the people self-reliant.
♣ Interactive with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization;
Financial Literacy Awareness Programme
♣ Digital Literacy Awareness Programme
♣ Education Loan Awareness Programme
♣ Entrepreneurship Awareness Programme
♣ Awareness Programmes on Government Schemes
♣ Products Market Awareness
♣ Services Market Awareness
♣ Consumer Awareness Programme
♣ Accounting Awareness Programme for Farmers
♣ Accounting Awareness Programme for Street Vendors etc.

IMPORTANT RULES AND REGULATIONS FOR CEP:

Concurrent Fieldwork: Students must conduct comprehensive studies on various challenges that they face in their chosen field. Every work relevant to the subject matter should be compiled and documented. Students should keep separate fieldwork diary or maintain journal in order to record their fieldwork experiences i.e. reading, e- contents, tasks, planning and work hours have to be recorded in the diary. Detailed work records report on students' fieldwork experiences and activities to be submitted and should be presented. The fieldwork conference is part of the timetable and is mandatory. Faculty should hold a fieldwork conference FOREIGHTNIGHTLY for all students. In addition to the principal curriculum, the students engage in a variety of community development-related activities. They are encouraged to plan and carry out programs, processions, and events for social causes. These activities seek to enhance students' personal and professional skills as well as foster self- development. "Rural Camp" should be embedded in the curriculum for first-year students to be held in the backward and neglected areas of District's Concurrent Fieldwork is the core curriculum activity in the CEP course. Hence, 100% attendance of the students is mandatory in case of absence on any student, supplementary fieldwork must be arranged and accomplished with the approval of the faculty supervisor.

EVALUATION/ASSESSMENT SCHEME:

Students should keep a Field Diary / journal to record, content, readings and field visit planning. The assessment pattern is internal only.
Internal continuous Assessment: Participation in concurrent field visits 40%; individual/group field project conference, report/journal submission 40%.
Presentation of field project findings (VIVA) should be assigned 20%

20+20+10= 50 Marks