Appendix- B
AC – 02
Item No. – (ii)

As per NEP 2020

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA, SAWANTWADI

Title of the Programme: Science

B.Sc. (Physics)

A: Certificate in Physics: 2023-2024

B: Diploma in Physics: 2024-2025

C: Degree in Physics: 2025-2026

Syllabus for

Sem-III and Sem-IV

Reference GR dated 16th May 2023 for Credit structure

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA, SAWANTWADI

(As per NEP 2020)

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

Preamble

The University Grant Commission (UGC) in New Delhi and the University of Mumbai in Mumbai granted academic autonomy to the Sawantwadi-based Shri Pancham Khemraj Mahavidyalaya in June 2023. The school is affiliated with the University of Mumbai.

In accordance with UGC recommendations, the National Educational Policy (NEP) - 2020 will be applied to UG and PG programs starting in the academic year 2023–2024. Every year, there are two semesters in the four-year UG program in Physics. The Department of Education has instituted the Department Specific Structure (DSC). The proposed structure takes into account the Major subject, which includes Elective Courses, Field Projects (FP), On the Job Training, Vocational Skill Courses (VSC), Core (Department Specific - Physics), and Community Engagement and Service (CEP). In addition to their major topic, students must receive credits from their co-curricular activities (CC), open electives (OEs, courses taught by faculty members), skill enhancement courses (SEC, AEC), and minor courses (other than physics).

A key component of the NEP system, continuous evaluation will enable methodical and comprehensive learning leading to a deeper comprehension of the material. The goal of this curriculum is to give students a deeper comprehension of the basic ideas of electronics and physics, as well as the practical skills necessary to flourish in the most recent developments in physics and its social applications. This course will prepare students for successful careers in a variety of science and technology fields and encourage them to pursue higher education in physics. Students will simultaneously develop into global citizens with the responsibility of addressing contemporary global issues.

Aims and Objective

- To acknowledge the significance and underlying principles of numerous physical occurrences.
- To learn about the physics rules and principles, undertake experiments.
- To solve challenges in real time with the knowledge and skills acquired.
- To cultivate and apply an extensive range of computational and analytical problem-solving skills.

Program Outcomes

A. Learning objectives unique to disciplinary or multidisciplinary fields of study. Graduates should be able to demonstrate that they have acquired the following: ~ Practical and vocational knowledge required to perform professional or highly skilled tasks related to the chosen field of study; this includes knowledge needed to engage in self-employment and entrepreneurship, including the creation of enterprises; Comprehensive knowledge of disciplinary/interdisciplinary areas, their relationship with related fields of study, and current and emerging developments related to selected disciplinary/interdisciplinary areas of education.

B. Generic Learning outcomes:

- ✓ Graduates should be able to show that they can apply what they've learned to real-world scenarios and solve a variety of challenges in both familiar and unfamiliar contexts.

  The graduates must exhibit the following skills: synthesis and analyse data from several sources, develop reliable findings, and provide evidence for those conclusions.

The graduates must be able to show that they can: think, act, or create in many ways about the same items; solve complex problems; adopt lateral, creative, and innovative thinking skills; and possess emotional intelligence.

- ✓ The graduates must be able to show that they have the following abilities: paying close attention, reading texts and research papers critically, presenting complex information to various groups and audiences in an understandable and succinct manner; effectively expressing ideas in writing and speaking; interacting with others through appropriate media; spotting logical errors in other people's arguments; sharing opinions with confidence; creating logical arguments using proper technical language; and communicating ideas.
- ✓ The graduates ought to be able to show that they are capable of:
- ✓ Utilize ICT in a range of educational and professional contexts; assess and make use of a number of pertinent information sources; and employ the right software for data analysis.
- ✓ The graduates must to be capable of: Developing a sharp observational sense, little projects, involvement in scientific events, study tours, etc. to foster research aptitude.
- ✓ Organize a team's responsibilities, encouraging and motivating members to participate in the developed vision; collaborate well with different teams; support group effort; and perform well as a team member. Learn new skills and gain new knowledge, including "learning how to learn skills"; meet cultural, social, and economic goals; adapt to changing trades and workplace demands through skill development and reskilling; work independently; and identify relevant resources needed for additional learning.
- ✓ Additionally, develop time management and organizing abilities to set self-defined objectives and targets with deadlines; instill a positive outlook to last a lifetime.

Proposed Second Year Credit Structure as per NEP 2020

DEPARTMENT OF PHYSICS

Proposed Structure for Major /Minor/ OE/ VSEC/SEC/ VEC

Semester	Course Code	Course Title	Type	Credits
III (Level 5.0)	S301PHT (Major)	Thermodynamics and Temperature Transducers	**Theory**	**2**
	S302PHT (Major)	Electronics	**Theory**	**2**
	S303PHT (Major)	Mathematical Methods & Applied Physics I	**Theory**	**2**
	S304PHP (Major)	Experimental Physics-III	**Practical**	**2**
	S305PHT (Minor)	Materials Science	**Theory**	**2**
	S306PHT (Minor)	Sensors and Actuators	**Theory**	**2**
	S307PHP (Minor) VSC	Experimental Physics-IV	**Practical**	**2**
	PHOE04 (GE/OE)	Basics of Computer Hardware and Microsoft Office	**Generic Elective/ Open Elective**	**2**
	PHVEC01	Enviromental Physics	**VEC**	**2**
IV (Level 5.0)	S308PHT (Major)	Optics & Applied Physics II	**Theory**	**2**
	S309PHT (Major)	Electrodynamics	**Theory**	**2**
	S310PHT (Major)	Quantum Physics	**Theory**	**2**
	S311PHP (Major)	Experimental Physics - V	**Practical**	**2**
	S312PHT (Minor)	Introduction to Materials Science	**Theory**	**2**
	S313PHT (Minor)	Laser and Fiber Optics	**Theory**	**2**
	S314PHP (Minor) VSC	Experimental Physics -VI	**Practical**	**2**
	PHOE05 (GE/OE)	Acoustic Physics	**Theory**	**2**
	PHSE03	Microprocessor	**Practical**	**2**
	PHVEC02	Applied Environmental Physics	**Theory**	**2**

Syllabus Committee:

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

Letter Grades and Grade points

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

COURSE CODE AND TITLE: S301PHT (MAJOR): THERMODYNAMICS AND TEMPERATURE TRANSDUCERS

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-III

Learning Objectives:

- Understand the fundamentals of thermodynamics.
- Be aware of thermodynamic processes.
- To understand the thermodynamic processes at high and low temperatures.
- To get introduced with thermodynamical reactions.

Learning Outcomes:

After completing this course successfully, students will be able to:

- Understand the fundamental ideas of thermodynamics and how it applies to real-world situations.
- Acquire knowledge of circumstances in cold weather.
- Exhibit hesitant problem-solving abilities in each of the aforementioned domains.

Unit - I	**10 Lectures**
1.	Reversible and irreversible process, Heat Engines, Carnot's cycle, Effective way to increase Efficiency, Carnot's Engines and refrigerator, Coefficient of performance, Second Law of Thermodynamics - Statements, Carnot Theorem, Steam Engine, Otto Engine, Diesel Engine. PV Diagrams of all engines and examples. Maxwell's thermodynamics relations (No derivation required), Applications of Maxwell's thermodynamic relations: Specific Heat Equation, Joule Thomson Cooling, Temperature Change in Adiabatic Process, Clausius – Clapeyron equation
Unit – II	**10 Lectures**
1.	Concept of Entropy, Change in Entropy, Change in Entropy in Adiabatic Process, Change in Entropy in Reversible cycle, Principle of increase of Entropy, Change in Entropy in Irreversible Process, T – S diagram, Physical Significance of Entropy, Entropy of a perfect gas, Kelvin's thermodynamic Scale of temperature, (Omit alternative method using Carnot cycle), The size of a Degree, Zero of Absolute scale, Identity of perfect Gas Scale and Absolute scale. Third Law of thermodynamics, Zero-point energy, Negative temperatures (Not possible), Heat Death of the Universe..
Unit – III	**10 Lectures**
1.	Temperature Transducers: Introduction to Temperature Transducers, Resistance Temperature Detector (RTD), Platinum Thin Film Sensors, Resistance Thermometer: its types, working principles and applications, Thermistors, Thermocouple, Semiconductor Diode Temperature Sensor, IC Type Sensor, Pyrometers, Total Radiation Pyrometer (TRP), Infrared Pyrometers, Optical Pyrometer, Ultrasonic Temperature Transducer.

References:

1.	BSH: Brijlal, Subramanyam and Hemne, Heat Thermodynamics and Statistical Physics, S Chand, Revised, Multi-coloured,2007 Ed.
2.	HSK: Electronic Instrumentation. 3rd edition, H. S. Kalsi, Tata McGraw Hill Education Private Limited, New Delhi.
3.	M W Zemansky and R H Dittman, Heat and Thermodynamics, McGraw Hill.
4.	D K Chakrabarti, Theory and Experiments on Thermal Physics, (2006 Ed) Central books.
5.	Evelyn Guha, Basic Thermodynamics (Narosa Publications)
6.	Philip M. Morse, Thermal Physics (W. A. Benjamin Inc, New York)
7.	ABG: AB Gupta and H. Roy, Thermal Physics, Book and Allied (P) Ltd, Reprint 2008, 2009

COURSE CODE AND TITLE: S302PHT (MAJOR): ELECTRONICS

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-III

Learning Objectives:

- To learn and understand the fundamentals and characteristics of analog electronics.
- To learn and understand the fundamentals of oscillator circuits.
- To learn and understand the basics of digital electronics.

Learning Outcomes:

Students who successfully complete this course will be able to describe:

- The amplifiers and various feedback amplifier circuits.
- Determine each oscillator's frequency using a calculation.

Unit – I: Analog Electronics	**10 Lectures**
1.	Faithful amplification, Transistor Biasing, Inherent Variations of Transistor Parameters, Essentials of a Transistor Biasing Circuit, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Circuit analysis of Emitter Bias, Voltage Divider Bias Method. General amplifier characteristics, Concept of amplification, Amplifier notations, Current gain, Voltage gain, Power gain, Input resistance, Output resistance, Frequency response, Decibel gain and Band width, Importance of feedback General theory of feedback, Reasons for negative feedback, Loop gain and examples.
Unit – II : Analog Electronics	**10 Lectures**
2.	2.1. Oscillators, Introduction, Effect of positive feedback, Requirements for oscillations, Phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator and examples Introduction to Operational Amplifiers, Schematic symbol of OPAMP, Output voltage from OPAMP, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, Virtual ground concept- gain, offset voltage and current, OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower and Examples.
Unit – III Digital Electronics	**10 Lectures**
1.	Flip Flops: RS Flip-Flops (only NOR gate latch, NAND gate latch), Gated Flip Flops, Edge-Triggered RS Flip-Flop, Edge- Triggered D Flip-Flop, Edge Triggered J-K Flip-Flop, JK Master-Slave Flip-Flops. Types of registers: SISO, SIPO, PISO, PIPO [in this chapter the teacher should make all IC specific diagrams into general diagrams ie. Ignore pin numbers and IC numbers].

References:

1.	Principles of Electronics – V. K. Mehta, Rohit Mehta. (S.Chand –Multicolour revised edition)
2.	Electronic devices and circuits – An introduction Allan Mottershead (PHI Pvt. Ltd.– EEE – 1986)
3.	Principles of Electronics – V. K. Mehta and Rohit Mehta. (S. Chand –edition)
4.	Digital Principles and Applications - Leach, Malvino, Saha_ 6th ed.

COURSE CODE AND TITLE: S303PHT (MAJOR): MATHEMATICAL METHODS & APPLIED PHYSICS I

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-III

Learning Objectives:

- Determine the order and degree of a differential equation.
- Distinguish between ordinary and partial differential equations.
- To find the solutions of differential equations.

Learning Outcome:

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

- The capacity to use physics concepts to find solutions to novel and unusual issues.
- Gain exposure to the key concepts of differential equations and learn the mathematical technique
- Necessary to understand physical processes at the undergraduate level.
- Use simple methods to solve partial differential equations and non-homogeneous differential equations.
- Explain and identify the various kinds of differential equations used in the programme.
- Understand the fundamental ideas of mathematics and how to apply them in real-world scenarios.
- Relevant real-life scenarios will be presented to the students.

Unit – I: Differential Equations	**10 Lectures**
.	Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous differential equations with variable coefficients, Variable separable method, Exact differentials equation, General first order Linear Differential equation with constant coefficients, Second-order homogeneous differential equations with constant coefficients. Problems depicting physical situations like LC and RL circuits, examples on Newton's law of cooling, growth of current and decay in LR, CR circuits.
Unit – II : Differential Equations	**10 Lectures**
	Second-order non homogeneous equations with constant coefficients, Partial differential equations, Some important partial differential equations in physics, Method of separation of variables, Applications of Partial differential Equation: Modeling of vibrating stretched string and two dimensional heat flow equation, Laplace's equation in two dimensions, Solution of wave equation, Helmholtz's equation.
Unit III:	**10 Lectures**
	Acoustics of Buildings: Reverberation, Explanation and Importance of Sabine's formula, Absorption Coefficient, Acoustics of Buildings, Factors Affecting Acoustics of Buildings, Sound Distribution in an Auditorium, Radio communication: Basics of Communication: Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, base band and broad band communication. Noise concept and types, signal to noise ratio, noise figure, noise temperature, Amplitude Modulation: Need of modulation, concept of modulation, AM waveform, Mathematical expression of AM, AM Receiver: TRF and super heterodyne receiver.

References:

1.	Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4th Edition (2006)
2.	Mathematical Physics, Sathya Prakash, Sultan Chand, 6th edition (2014)
3.	Mathematical Physics Rajput, Pragathi Prakasan Pub., (2017)
4.	Mathematical Physics, H.K. Dass, S. Chand & Co., Eighth edition (2018)
5.	Mechanics and mathematical methods by R Murugeshn, S Chand. Elements of mechanics by Gupta.
6.	Mathematical physics- Piyoosh Kumar Tyagi, RBSA Publishers
7.	Mathematical Methods for Physicists: A concise introduction, - Tai L. Chow Cambridge University Press.
8.	Properties of matter and Acoustics – R Murugeshan and K. Shivaprasath, S Chand & Co. Ltd
9.	Electronic Communication Systems George Keneddy , Bernard Devis, Fourth Edition, TMH Publications
10.	Communication Electronics: Principles and applications by Louis E Frenzel, 3rd edition TMH Publications.
11.	Telecommunication Switching Systems and Network by Vishwanathan and Thiagarajan, PHI Publication.

COURSE CODE AND TITLE: S304PHT (MAJOR): EXPERIMENTAL PHYSICS

Level: 5.0	Credits: 02	Semester-III

Instructions:

All measurements and readings must be recorded using the SI system exclusively and with the appropriate units.

- Following the completion of the necessary number of experiments for the semester and their documentation in journal, the student must obtain journal certification and present the certified journal during the practical assessment.
- The circuit/ray diagram, observations, tabular representation, experimental skills and technique, graph, calculation, and result should all be taken into consideration while evaluating the practical.
- The ability to conduct the experiment and comprehend physics ideas have to be prioritized over the precision of the outcome.

Learning Outcomes:

- Improve in practical and experimental skills.
- Understand the need of apparatus and their use in different practical experiments.
- Develop practical skills and correlate outcomes with theory.
- Self-ability of carrying out the experimental procedures and correlate the outcomes with corresponding theoretical results.

Learning Outcomes:

Students who successfully complete this course will be able to:

- Understand the material and put it into practice while conducting experiments.
- Recognize how to use equipment and do it without hesitation or fear.
- Link the ideas of physics theory to real-world applications.
- Recognize the idea of errors and how to estimate them.

Group A	
1	Helmholtz resonator- determination of unknown frequency
2	Young's modulus by Koenig's method / Y by bending.
3	Flat spiral spring (Y)
4	Flat spiral spring (n)
5	Determination of acceleration due to gravity using BAR pendulum
6	Log Decrement using Simple Pendulum
7	LCR parallel resonance
8	Verification of Stefan's law (electrical method)
Group B	
1	Resistance of Galvanometer By shunting method
2	Thevenin's Theorem: To verify the theorems for DC circuits
3	Norton's Theorem: To verify the theorems for DC circuits
4	Opamp: Inverting amplifier with different gains & Non-inverting amplifier with

	different gains & Voltage Follower (BB)
5	CE amplifier: determination of bandwidth
6	CE amplifier: variation of gain with load
7	To verify the Reciprocity Theorems
8	Phase shift oscillator /Wien bridge oscillator
9	Colpitt's oscillator/ Hartley oscillator
Group C	
1.	Square wave oscillator using NOT gates
2.	Study of MS-JK flip flop
3.	MOD 2 , MOD 5 & MOD 10 counter using IC 7490
4.	Half adder and full adder (7486, 7408)
5.	Opamp – Difference Amplifier /Opamp- Summing Amplifier
6.	Opamp: Differentiator
7.	Opamp: Integrator
8.	Shift register- SIPO
	Group D: Skill Experiment
1	Soldering technique
2	Wiring of a simple circuit using bread board
3	Use of DMM- for component testing- diode and transistor
4	Use of oscilloscope- for phase-shift measurement
5	Radius of Sphere (single pan balance)
6	PC simulations: graph, curve fitting, etc

COURSE CODE AND TITLE: S305PHT (MINOR): MATERIALS SCIENCE

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-III

Learning Objectives:

- To offer the basics of materials science.
- To understand about the crystals and properties of crystals.
- To offer the magnetic concepts and their applications, which are essential for understanding processing and magnetic property, to the graduate.

Learning Outcomes:

After completing this course successfully, students will be able to:

- Students can explain crystal systems, Bravais Lattices and Reciprocal space. Symmetry Elements, Defines Atomic packing, Crystal, Lattice, Unit cell and Translation vectors.
- Students can Explains Crystal systems, Crystal planes and directions, Miller indices, Diffraction of waves by crystals and Bragg's law.
- Understand semiconductor concepts and brief knowledge about superconductor.
- Understand the Magnetic materials and types of magnetic materials.

Unit - I Crystal Physics-I	**10 Lectures**
1.	Crystalline and Non Crystalline materials, Bravais Lattices, Crystal Systems, Symmetry Elements, Simple Crystal structures like simple cubic ,body centered cubic ,face centered cubic and hexagonal close packed ,Packing factor for SC, BCC and FCC, HCP structures, Miller Indices, Imperfections in Crystals Bragg's Law and X ray diffraction methods to study crystal structures.
Unit – II Semiconductors	**10 Lectures**
1.	Semiconductors, types of semiconductors: Intrinsic and extrinsic semiconductors, Energy Band and Charge Carriers: Energy bands in semiconductors, Carrier concentration: Fermi Level, Electron and hole concentration equilibrium, Temperature dependence of carrier concentration, Compensation and charge neutrality. Conductivity and mobility, Effect of temperature.
Unit – III Photonics	**10 Lectures**
1.	Photonics: LED: Radiative transition, Emission spectra, Luminous efficiency and LED materials, Solar cell and photodetectors: Ideal conversion efficiency, Fill factor, Equivalent circuit, V_{oc}, I_{sc} and load resistance, Spectral response. Reverse saturation current in photodetector.

References:

1.	C. Kittel, Introduction to Solid State Physics, 8th ed., Wiley, 2005.
2.	B.S. Mitchell, An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, 1st ed., Wiley- Interscience, 2003
3.	S. O. Pillai, Solid State Physics
6.	Material Sc for Engg- Rajendran ,Marikeni
7.	Material Sc for Engg ----Vijaya and Rajendran
8.	Material Sc and Engg --Raghavan ,PHI,New Delhi ,1993

COURSE CODE AND TITLE: S306PHT (MINOR): SENSORS AND ACTUATORS

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-III

Learning Objectives:

- To offer the sensor concepts and their applications, which are essential for understanding processing to the graduates.

Learning Outcomes:

Students who successfully complete this course will be able to describe:

- Define what is sensor.
- Understand sensor concepts and brief knowledge about working and types.
- Know the importance of sensors in society.

Unit – I: Sensors	**10 Lectures**
1.	Difference between sensor, transmitter and transducer - Primary measuring elements -selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Photo-resistive sensor.
Unit – II : ACTUATORS	**10 Lectures**
2.	Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors.
Unit – III: MICRO SENSORS AND MICRO ACTUATORS	**10 Lectures**
1.	Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

References:

1.	Robert H Bishop, “The Mechatronics Hand Book”, CRC Press, 2002.
2.	Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.
3.	Massood Tabib and Azar, “Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures”, First edition, Kluwer academic publishers, Springer, 1997.
4.	Manfred Kohl, “Shape Memory Actuators”, first edition, Springer.

COURSE CODE AND TITLE S307PHP (VSC): EXPERIMENTAL PHYSICS - IV

Level: 5.0	Credits: 02	Number of Lectures 30	Semester-III

Instructions:

1. All measurements and readings must be recorded using the SI system exclusively and with the appropriate units.
2. Following the completion of the necessary number of experiments for the semester and their documentation in journal, the student must obtain journal certification and present the certified journal during the practical assessment.
3. The circuit/ray diagram, observations, tabular representation, experimental skills and technique, graph, calculation, and result should all be taken into consideration while evaluating the practical.
4. The ability to conduct the experiment and comprehend physics ideas have to be prioritized over the precision of the outcome.

Learning Outcomes:

- Improve in practical and experimental skills.
- Understand the need of apparatus and their use in different practical experiments.
- Develop practical skills and correlate outcomes with theory.
- Self-ability of carrying out the experimental procedures and correlate the outcomes with corresponding theoretical results.

Learning Outcomes:

Students who successfully complete this course will be able to:

- Understand the material and put it into practice while conducting experiments.
- Recognize how to use equipment and do it without hesitation or fear.
- Link the ideas of physics theory to real-world applications.
- Recognize the idea of errors and how to estimate them.

Group A	
1	Verification of Stefan's law by electrical method.
2	Maximum Power Transfer Theorems.
3	Op-amp as an Integrator.
4	Bridge rectifier: Ripple, Load regulation.
5	Measurement of resistance of galvanometer-G by shunting.
6	Lissajous figures using CRO.
Group B	
1	To study Zener Diode as voltage regulator
2	To verify Thevenin's theorem for DC circuits
3	Bar pendulum: determination of g.
4	Young's modulus by Koenig's method.
5	Surface Tension of biological solutions
6	Surface Tension of liquids.
Group C	
1.	Moment of Inertia of compound pendulum by method of coincidence.

2.	Study of divergence of LASER beam.
3.	Determination of wavelength of LASER light by plane diffraction grating.
4.	R.P. of grating.
5.	Determination of Couchy's constants.
6.	Comparison of capacitor using DeSauty's method.
	Group D: Skill Experiment
1	Soldering technique
2	Wiring of a simple circuit using bread board
3	Use of DMM- for component testing- diode and transistor
4	Use of oscilloscope- for phase-shift measurement
5	Radius of ball bearings (single pan balance)
6	PC simulations: graph, curve fitting, etc.

COURSE CODE AND TITLE PHOE04 (GE/OE): BASICS OF COMPUTER AND MICROSOFT OFFICE

Level: 5.0	Credits: 02	Number of Lectures 30	Semester-II

Learning Objectives:

- M.S. Office course trains students how to use MS Office applications use in office work such as creating professional-quality documents.
- Store, organize and analyze information; arithmetic operations and functions.
- Create dynamic slide presentations with animation, narration, images, and much more, digitally and effectively.

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

- Identify the basic hardware components of computer
- Create Microsoft Word documents and effectively use it for various applications.
- Create Microsoft Powerpoint and able to create attractive presentations
- Create and effective use of Microsoft Excel

Unit I: Introductions to Computer **10 Lectures**
Introductions to Computer: Basics of computer, Organization of computer, Software and hardware, Input/output devices, Memory and classification of memory.
Unit-II: Microsoft office **10 Lectures**
MS WORD Text Basics, Text Formatting and saving file, Working with Objects, Header & Footers, Working with bullets and numbered lists, Tables, Styles and Content, Merging Documents, Sharing and Maintaining Document, Proofing the document, Printing. MS POWERPOINT Setting Up PowerPoint Environment, Creating slides and applying themes, Working with bullets and numbering, Working with Objects, Hyperlinks and Action Buttons, Working With Movies and Sounds, Using SmartArt and Tables, Animation and Slide Transition, Using slide Master, Slide show option, Proofing and Printing.
Unit-III MS EXCEL **10 Lectures**
Introduction to Excel, Formatting excel work book, Perform Calculations with Functions, Sort and Filter Data with Excel, Create Effective Charts to Present Data Visually, Analyze Data Using PivotTables and Pivot Charts, Protecting and Sharing the work book, Use Macros to Automate Tasks, Proofing and Printing, Payroll sheet and inventory.

References:

1	Essential Computer Hardware Second Edition, The Illustrated Guide to Understanding Computer Hardware (Computer Essentials) Kevin Wilson.
2	Computer Hardware, T. Balaji Publications.
3	Mastering PC Hardware And Networking, Ajit Mittal, Ajay Rana.
4	Modern Computer Hardware Course, Manahar Lotia.

COURSE CODE AND TITLE PHVEC01: ENVIROMENTAL PHYSICS AND CLIMATIC SCIENCE

Level: 5.0	Credits: 02	Number of Lectures 30	Semester-III

Learning Objectives:

- Understand many other different topics of our environment.

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

- To acquire knowledge, competent professionals with a strong foundation of Environmental Science and application to be suitable for vital positions in the academia, industry and government and non-government institutions as skilled manpower.
- The learners will be able to become effective scientific communicators/collaborators in multidisciplinary teams providing technical leadership to engage with the challenging environmental problems of local, national and global nature.
- They can opt for higher studies in plant and animal sciences as the environmental science is multidisciplinary in nature.

Unit-I Fundamentals of environmental physics	**10 Lectures**
Basic concepts of light and matter; spectroscopic concepts: Introduction to the concept of absorption and emission spectrum and transmission of light, Beer-Lambert law; scattering of light, Rayleigh and Mia scattering.	
Unit-II: Fundamentals of environmental physics	**10 Lectures**
Concept of system, Basic concepts of pressure, force, work and energy; Laws of thermodynamics; Concept of enthalpy, entropy, Free energy. Heat transfer - conduction, convection and radiation, Concept of black body and Planck's constant. Carnot engine and its application in simple engine. Energy efficiency. Gas laws: Charles' law, Boyle's law, Avogadro's law.	
Unit-III: Climate Science	**10 Lectures**
Concept of Albedo, solar constant, Heat budget of the earth atmospheric system. Types of forces and their relation, pressure gradient, viscous, gravitational, centripetal and centrifugal force.	

References:

1. Environmental Physics: Sustainable Energy and Climate Change, Wiley Boeker, E. & Grondelle, R. 2011.
2. Renewable Energy: Power for Sustainable Future, Boyle G., 2004. Oxford University Press
3. Environmental Physics: Sustainable Energy and Climate Change, Egbert Boeker , Rienk van Grondelle,
4. Environmental Physics (Routledge Introductions to Environment: Environment and Society Texts) by Clare Smith

COURSE CODE AND TITLE: S308 PHT (MAJOR): OPTICS & APPLIED PHYSICS II

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-IV

Learning Objectives:

- To acquire knowledge of applied Optics and Electronics.

Learning Outcomes:

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

- Understand the diffraction, polarization processes and applications of them in physical situations.
- Understand the applications of interference in design and working of interferometers.
- Understand the resolving power of different optical instruments.
- To develop assembly language programming skills and learn the real time applications of microprocessor.
- Demonstrate quantitative problem solving skill in all the topics covered.

Unit - I Diffraction and Polarization	**10 Lectures**
1.	**Fresnel diffraction:** Introduction, Huygens-Fresnel's theory, Fresnel's assumptions, Distinction between interference and diffraction, Fresnel and Fraunhoffer types of diffraction, Diffraction pattern due to straight edge: positions of maximum and minimum intensity and examples. **Fraunhoffer diffraction**: Introduction, Fraunhoffer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhoffer diffraction at double slit, Distinction between single slit and double slit diffraction patterns and examples **Polarization**: Introduction, Malus' Law, Production of Polarized light: The wire grid polarizer and a Polaroid, Polarization by Reflection, Polarization by Double Refraction Interference of Polarized light: Quarter wave plates and half waveplates, Ordinary and Extra Ordinary Rays, Positive and Negative crystals.
Unit –II Interferometers and Resolving Power	**10 Lectures**
	Michelson's Interferometer: Principle, construction, working, circular fringes, localized fringes, White light fringes, Visibility of fringes, Applications of Michelson Interferometer: Measurement of wavelength, Determination of the difference in the wavelength of two waves, Thickness of a thin transparent sheet, Determination of the refractive index of gases. **Resolving Power:** Introduction, Rayleigh's criterion, Resolving power of optical instruments, Criterion for resolution according to Lord Rayleigh, Resolving power of a telescope, Resolving power of a prism, Resolving power of a plane transmission grating and examples.
Unit – III Microprocessors	**10 Lectures**
1.	Building Concept of Microprocessor: Introduction, Study of Memory, Input Device, Output Device, Input/output Device, Central Processing Unit 8085 Microprocessor: Introduction, Features of Inter 8085, Pin Diagram of 8085, 8085 CPU Architecture ,Arithmetic and Logical Group, Register Group, Interrupt Control , Serial I/O Control Group , Instruction Register , Decoder and Control Group.

	8085 Instruction Set: Introduction, Flowchart, Classification of Instruction, Notations used in Instructions and Opcode, Data Transfer Group ,Program Examples for Data Transfer Group , Arithmetic Operation Group , Branch Group , Logical Group ,Addressing Modes, 8085 Programmers Model.

References:

1.	Dr. N. Subrhmanyam, Brijlal, and Dr. M. N. Avadhanulu A Textbook of Optics, 25TH Revised Edition (2012) S. Chand.
2.	Ajoy Ghatak, Optics 6E Mc Graw Hill Education
3.	G: Microprocessor Architecture, programming and Applications with the8085 by Ramesh Gaonkar, 5th Edition, Prentice Hall of India.
4.	Microprocessor, Principles & Applications by Gilmore (2nd Ed) TMH
5.	Microprocessor and Applications by V.J. Vibhute& P.B. Borole, Fifth Revised Edition, Technova Publications, Pune.

COURSE CODE AND TITLE: S309 PHT (MAJOR): ELECTRODYNAMICS

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-IV

Learning Objectives:

Students who successfully complete this course will be able to:

1. Apply vector algebra, vector calculus both differentiation and integration to solve problems.
2. Discuss orthogonal curvilinear co-ordinates such as spherical polar and cylindrical coordinates and their use in solving problems related to electrostatics and magnetostatistics.

Learning Outcomes:

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

- Analyse vector and scalar fields, including their differentiation and integration.
- Describe and clarify magnetic and electric fields that are static.
- Gauss's and Ampere's laws of electromagnetics in integral and differential forms: an interpretation and application
- To address static electromagnetics problems, use vector calculus.
- Determine the common static electromagnetic phenomena that are applicable in practical settings.

Unit - I Electrodynamics and Vector calculus	**10 Lectures**
	Line, surface, Volume integrals, Fundamental thermos of Gradient, Curvilinear co-ordinates, Divergence and Curl and Examples.
Unit II Electromagnetism (Electrostatics & Magnetostatics)	**10 Lectures**
	Coulomb's law, Comments on potential, Poisson's equation and Laplace's equation. Solution and properties of 1D Laplace equation. Properties of 2D and 3D Laplace equation (without proof). First & Second Uniqueness theorem and examples.
Unit III Magnetostatics	**10 Lectures**
	Magnetization, The Divergence and Curl of B, Ampere's law in magnetized materials, Comparison of Magnetostatics and Electrostatics, Bound currents and their physical interpretation, Magnetic susceptibility and permeability and examples.

References:

1.	Introduction to Electrodynamics: David J. Griffiths (3rd Ed) Prentice Hall of India.
2.	Introduction to Electrodynamics: A. Z. Capria and P. V. Panat. Narosa Publishing House.
3.	Engineering Electrodynamics: William Hayt Jr. & John H. Buck (TMH).
4.	Electricity and Magnetism: Navina Wadhwani (PHI – 2010).

COURSE CODE AND TITLE: S310PHT (MAJOR): QUANTUM PHYSICS

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-IV

Learning Objectives:

- Introducing the postulates of quantum mechanics for physical systems.
- To present the notions of measurements for physical systems in quantum mechanics.
- Describe the impact of quantum mechanics on the development of the universe's physical systems.

Learning Outcomes:

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

- Utilize quantum mechanical concepts to compute observables for specified wave functions.
- For basic systems such as a simple harmonic oscillator, a hydrogen atom, a particle in a box, etc., solve the Schrodinger equation.

Unit - I The Schrodinger wave equation	**10 Lectures**
1.	Concept of wave function, Born interpretation of wave function. Concepts of operator in quantum mechanics examples – position, momentum and energy operators. Eigenvalue equations, expectation values of operators. Schrodinger equation. Postulates of Quantum Mechanics. Analogy between Wave equation and Schrodinger equation. Time dependent and time independent (Steady State) Schrodinger equation, Stationary State, examples.
Unit II Applications of Schrodinger steady state equation-I	**10 Lectures**
1.	Free Particle. Particle in infinitely deep potential well (one - dimension). Particle in finitely deep potential well (one - dimension).Step potential. Particle in three dimension rigid box, degeneracy of energy state.
Unit III Applications of Schrodinger steady state equation –II	**10 Lectures**
1.	Potential barrier (Finite height and width) penetration and tunneling effect (derivation of approximate transmission probability) Theory of alpha particle decay from radioactive nucleus. Harmonic oscillator (one-dimension), correspondence principle.

References:

1.	Concepts of Modern Physics – A. Beiser (6th Ed.) Tata McGraw Hill.
2.	Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.
3.	Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and particles. - By R. Eisberg and R. Resnik Published by Wiley.
4.	Introduction to Quantum Mechanics. - By D. Griffiths Published by Prentice Hall.
5.	Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.
6.	Quantum Mechanics. - By L. I. Schiff.
7.	Quantum Mechanics. - By Powell and Crasemann, Addison-Wesley Pub.

COURSE CODE AND TITLE: S311PHP (MAJOR): EXPERIMENTAL PHYSICS-V

Level: 5.0	Credits: 02	Semester-IV

Instructions:

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

Learning Outcomes:

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

- Understand & practice the skills while performing experiments.
- Understand the use of apparatus and their use without fear & hesitation.
- Correlate the physics theory concepts to practical application.
- Understand the concept of errors and their estimation.

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

- Collect the information of at least five Physicists with their work or any three events on physics, report that in journal.
- Execute a mini project to the satisfaction of teacher in-charge of practical.
- Participate in a study tour or visit & submit a study tour report.
- For practical examinations, the learner will be examined in two experiments.
- Each experiment will be of three lecture hours' duration.
- A Minimum 4 from each group and in all minimum 12 experiments must be reported in journal.
- All the skill experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments.

A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester I as per the minimum requirements.

Sr. No.	Name of Experiment
	GROUP A
1	Optical level: determination of R.I. of Prism
2	Cylindrical obstacle: determination of λ/ Fresnel's bi-prism: determination of λ
3	Determination of Couchy's constants of Prism
4	R.P. of telescope/ R.P. of grating
5	Brewster's law: determination of μ
6	Polarimeter: Determination of specific rotation of sugar solution

7	Determination of wavelength of laser using grating
8	Determination of R.I. of liquid by laser
GROUP B	
1	To determine self inductance of a coil by Maxwell bridge.
2	Plank's Constant using LED (Red colours)
3	Figure of merit of a mirror galvanometer
4	Passive (RC) low pass & High Pass filter
5	Passive band pass filter
6	C_1/ C_2 by De Sauty's Bridge
7	C_1/ C_2 by BG/ Determination of Absolute capacitance using BG
8	LCR Transient
GROUP C	
1	Study of 8 Bit D latch
2	Study of 8 Bit Unidirectional Buffer/ Bidirectional Buffer
3	Verification of Inverse square law using LUX meter
4	Gauss Meter: Determination of Magnetic Field with change in current in electromagnet
5	Diode as a temperature sensor
6	16-bit Data manipulation (Addition, subtraction) Display result on Address field.
7	Write An ALP: a) To Evaluate simple arithmetic Expression (like Y= a x b + c x d where a, b, c and d are 8-bit HEX numbers) / b) To Add parity bit to 7-bit ASCII characters.
8	Write ALP for Addition/ Subtraction/Multiplication of two, 8-bit hex, numbers
Demonstrations	
1	Wave form generation using OPAMP- Square wave, triangular wave
2	Slew rate of OPAMP
3	Fresnel diffraction-straight edge, cylindrical obstacle using LASER
4	Fraunhoffer diffraction- Single slit, Double slit, Diffraction grating, reflection grating (steel ruler, CD, etc.), transmission grating (wire gauge, fabric, etc.)
5	Total internal reflection using LASER
6	Concept of beats
7	Coupled oscillations and resonance

Note: Minimum 12 experiments (Four From each group) and 4 Skill experiments should be completed and reported in the journal, in the first semester. Certified Journal is a must, to be eligible to appear for the semester end practical examination.

References:

1.	Advanced course in Practical Physics D. Chattopadhya, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2.	B.Sc Practical Physics – Harnam Singh S.Chand & Co. Ld. 2001
3.	A test book of advanced practical Physics, Samir Kumar Ghosh, New Central Book Agency (3rd edition).
4.	B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.

5.	Practical Physics CL Squires (3rd Edition) Cambridge University
6.	University Practical Physics – DC Tayal. Himalaya Publication
7.	Advanced Practical Physics – Worsnop & Flint.

COURSE CODE AND TITLE: S312 PHT (MINOR): INTRODUCTION TO MATERIALS SCIENCE

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-IV

Learning Objectives:

- This course aims to explore the knowledge in fundamentals of materials science, Studying with good knowledge about the semiconductors, solid solutions, Phase diagrams, mechanical properties, optical and magnetic properties of materials are very, essential for materials scientists and engineers..

Learning Outcomes:

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

- The fundamental concepts of materials science in the aspects of structure of atoms, quantum states, bonding characteristics, alloys, phase diagrams, semiconductors, mechanical, optical and magnetic properties of materials and able to solve the issues in practical engineering applications.

Unit - I Introduction to Materials	**10 Lectures**
1.	Understanding of Materials: An introduction to basic concepts of materials science and engineering, development of materials, classification of materials and their characteristics, uses of materials, selection of materials in view of service and fabrication requirements and economics; chemical, physical and mechanical properties of materials, factor influencing properties, scope and application of materials science and engineering.
Unit –II: Solid Materials	**10 Lectures**
1.	Types of Solid Materials: Metal, polymer, ceramics, composites, semiconductor, crystalline & amorphous solids. Solidification of Materials: Introduction, Nucleation and growth of Crystal, Homogeneous and heterogeneous nucleation, Types of Solid solution, Ordered and disordered solid solution, Grain and grain boundaries, Effect of cooling rate on grain size and mechanical properties.
Unit – III Diffusion in Solids	**10 Lectures**
1.	Diffusion in Solids: Diffusion mechanisms, steady-state & non-steady-state diffusions, factors that influence diffusion, other diffusion path. Defects in Solid: Introduction, Types of defect, Point and Schotky defects. Electrical and Thermal Properties of Materials: Ohm's law, electrical conductivity, energy band structures in solids, Electrical conduction in metals, semiconductor and alloys, Electron mobility, Electrical characteristics of ceramics & polymers, Heat capacity, Thermal expansion, Thermal conductivity and thermal stresses.

References:

1.	William D. Callister, Materials Science & Engineering – An Introduction
2.	William F. Smith, Foundation of Materials Science and Engineering
3.	L.H. Van Vlack, Elements of Materials Science and Engineering
4.	R.B. Gupta Materials Science.
5.	J.C. Anderson, K.D. Leaver, Materials Science.

COURSE CODE AND TITLE: S313PHT (MINOR): LASER AND FIBER OPTICS

Level: 5.0	Credits: 02	Number of Lectures: 30	Semester-IV

Learning Objectives:

Students who successfully complete this course will be able to:

- To realize the significance of optical fiber communications.
- To understand the construction and characteristics of optical fiber cable.

Learning Outcomes:

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

- Understand and analyze the constructional parameters of optical fibers.
- Be able to design the optical system.
- Estimate the losses due to attenuation, absorption, scattering and bending.
- Compare various optical detectors and choose suitable one for different applications.

Unit - I : Laser	**10 Lectures**
	Laser: Absorption and emission of light-Absorption-spontaneous emission and stimulated emission, Einstein relations, Population inversion- Active medium-Pumping, different pumping methods, Resonators – plane mirror and confocal resonators – Metastable state, Three level and Four level Laser systems.
Unit II: Types of Lasers	**10 Lectures**
	Ruby Laser, He-Ne laser, Semiconductor Laser, Laser beam Characteristics, coherence. Applications of Laser, Holography.
Unit III Fiber Optics	**10 Lectures**
	Propagation of light in a fiber -acceptance angle, numerical aperture, V-number, single mode and multimode step index fiber –graded index fiber- attenuation- application of fiber-optical fiber communication – advantages.

References:

1.	Optics by N. Subramanayam, Brijlal, M. N. Avadhanulu
2.	Semiconductor physics and optoelectronics- V. Rajendran, J. Hemaletha and M. S. M. Gibson

COURSE CODE AND TITLE: S314PHP (MINOR) (VSC): EXPERIMENTAL PHYSICS-VI

Level: 5.0	Credits: 02	Semester-IV

Instructions:

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

Learning Outcomes:

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

1. Understand & practice the skills while performing experiments.
2. Understand the use of apparatus and their use without fear & hesitation.
3. Correlate the physics theory concepts to practical application.
4. Understand the concept of errors and their estimation.

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

- Collect the information of at least five Physicists with their work or any three events on physics, report that in journal.
- Execute a mini project to the satisfaction of teacher in-charge of practical.
- Participate in a study tour or visit & submit a study tour report.
- For practical examinations, the learner will be examined in two experiments (one from each group).
- Each experiment will be of three lecture hours' duration.
- A Minimum 4 from each group and in all minimum 12 experiments must be reported in journal.
- All the skill experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments.

A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester I as per the minimum requirements.

Sr. No.	Name of Experiment
	GROUP A
1	Determination of ‘g’ by Kater’s pendulum.
2	Surface tension of soap solution.
3	Elastic constants of a rubber tube.
4	R. I. by total internal reflection.

5	Shift register
6	Angle of prism
GROUP B	
1	Band gap energy of diode
2	I V Characteristics of solar cell
3	Ramp generator
4	Design and study of Wien bridge oscillator
5	Refractive index
6	R I of water
GROUP C	
1	Charging and discharging of capacitor
2	Op-amp Non inverting amplifier
3	Frequency of AC mains
4	Thermistor characteristics
5	Double refraction
6	Lens combination
Demonstrations	
1	Wave form generation using OPAMP- Square wave, triangular wave
2	Slew rate of OPAMP
3	Fresnel diffraction-straight edge, cylindrical obstacle using LASER
4	Fraunhoffer diffraction- Single slit, Double slit, Diffraction grating, reflection grating (steel ruler, CD, etc.), transmission grating (wire gauge, fabric, etc.)
5	Total internal reflection using LASER
6	Concept of beats
7	Coupled oscillations and resonance

Note: Minimum 12 experiments (Four From each group) and 4 Skill experiments should be completed and reported in the journal, in the first semester. Certified Journal is a must, to be eligible to appear for the semester end practical examination.

References:

1.	Advanced course in Practical Physics D. Chattopadhya, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2.	B.Sc Practical Physics – Harnam Singh S.Chand & Co. Ld. 2001.
3.	A test book of advanced practical Physics Samir Kumar Ghosh, New Central Book Agency (3rd edition).
4.	B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.
5.	Practical Physics CL Squires (3rd Edition) Cambridge University
6.	University Practical Physics – DC Tayal. Himalaya Publication
7.	Advanced Practical Physics – Worsnop & Flint.

COURSE CODE AND TITLE PHSE03 (MAJOR): 8085 MICROPROCESSOR

Level: 5.0	Credits: 02	Number of Lectures 30	Semester-IV

Learning Objectives:

- To acquire knowledge of Microprocessor.

Learning Outcomes:

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

- Understand & practice the skills while performing experiments.
- To understand basic of processor and microprocessor and interfacing with real world.
- To study basic of programming.

List of Experiments:-

1. Block diagram of 8085 Microprocessor
2. Instruction set of 8085 i) Data Copy instruction ii) Arithmetic Instruction
3. Instruction set of 8085 iii) Logical instruction ii) Branching Instruction
4. Write a program to add two hexadecimal & decimal numbers
5. Write a program to subtract two hexadecimal & decimal numbers
6. Write a program to perform multiplication of two 8 bit numbers using bit addition method
7. Write a program to perform division of two 8 bit numbers using Repeated Subtraction method.
8. Write a program to transfer block of data in the memory / 8085 programming
9. Write a program to check whether the given number is even or odd

References:

1.	Microprocessor Architecture, Programming and Applications with 8085/8080A – Ramesh S. Gaonkar, Wiley Eastern Limited.
2.	Fundamentals of Microprocessor and Microcomputers--B.RAM, Dhanpat Rai Pub
3.	The Intel Microprocessors 8086/8080, 186/286,386,486, Pentium and Pentium Pro Processor Architecture. Programming and Interfacing--Barry R. Brey, PHI

COURSE CODE AND TITLE PHOE05 (GE/OE): ACOUSTIC PHYSICS

Level: 5.0	Credits: 02	Number of Lectures 30	Semester-IV

Learning Objectives:

- Understand the properties of sound.
- Know that sound requires a medium to travel.
- Understand that sound waves are longitudinal in nature.
- Explain the characteristics of sound.
- Gain knowledge about reflection of sound.

Learning Outcomes:

- The student will understand the physical parameters of sound.
- The student will understand and speech acoustics;
- The student will understand sound transmission and room acoustics, and be able to measure sound levels and calculate reverberation time in a room.

Unit I: Fundamentals of Sound

Fundamentals of Sound: Velocity of sound in fluids; Acoustic standards and reference conditions; Decibel scales: Intensity level (IL), Sound pressure Level (SPL), Sound Power Level (PWL); Problem-solving; Sound fields: Near, far, reverberant, and free. Speech, Hearing and Community Noise Criteria: Voice mechanism, acoustic power output of speech; Mechanism of hearing, thresholds of the ear; Equivalent continuous sound pressure level (LAeq); Perceived noise level (LEPN); Audiometry

Unit II: Architectural Acoustics and Audio Rooms

Architectural Acoustics and Audio Rooms: Reverberation time: Concept and measurement, problem-solving relating to reverberation time; Management of sound absorption: porous absorbers, effect of density, thickness, airspace, acoustic tiles, foam board insulation, carpet absorption; Anechoic chamber; Haas effect and delay; Room modes: concept and room mode calculation; Room acoustics: Sound Transmission Class (STC), high-loss acoustic frame walls, acoustic floor, and ceiling systems

Unit III: Resonators, Filters and Active Noise Control

Resonators, Filters and Active Noise Control: Helmholtz resonator; Acoustic, electrical, and mechanical analogues; Expansion chamber muffler, Active noise control: Noise Cancellation, Pros and cons of headphones, earphones, earbuds, Bioacoustics and Music: Animal sounds: Bird songs, whale sounds - FFT and Wavelet Analysis (introductory) with examples; Pitch and timbre; Characteristics of musical notes: Vibrato, Tremolo, Portamento; Musical Instruments Digital Interface (MIDI).

Reference Books:

1.	Fundamentals of Acoustics, L.E. Kinsler and A. R. Frey, Wiley Eastern.
2.	Audio and Video Systems, R. G. Gupta, Tata McGraw Hill, 2010.
3.	Acoustics, W.W. Seto, Schaum's Outline Series, McGraw Hill, 1970.
4.	Handbook of Sound Engineers, G.M. Ballou, Academic Press.
5.	Basic Acoustics, D.E. Hall, Oxford University Press.
6.	Design for good Acoustics and Noise Control, J. E. Moore, Univ. Press.

COURSE CODE AND TITLE PHVEC02 (MAJOR): ENVIROMENTAL POLLUTION

Level: 5.0	Credits: 02	Number of Lectures 30	Semester-IV

Learning Objectives:

- To demonstrate the importance of air for human health by defining its characteristics and main dangerous pollutants.
- To define what air is and its characteristics.
- To describe the main air pollutants and their effects on human health.
- To develop an activity where the student puts into practice the knowledge acquired.

Learning Outcomes:

- The course deals with the definition of pollution and pollutants, principles of environmental pollution and its relationship to the ecosystem, types of air, water, soil and food pollution, physical contaminants.
- Understand major concepts and terminology in the field of environmental pollutants, its interconnections and direct damage to the wildlife, in addition to, human communities and ecosystems.

Unit I: Basic Concepts of Air Pollution

Basic Concepts of Air Pollution: Definition, Sources (Natural and Anthropogenic), Chemistry of Air Pollutants, Classification-Primary Air Pollutants, Secondary Air Pollutants & their Adverse Effects of Air Pollutants, Air quality standards and Index, Environmental Segments and Structure of the Atmosphere. Global Problems Associated with Air Pollution: Ozone Layer Depletion, Green House Effect, Global Warming and Climatic Changes, EL-Nino and LA-Nino, Acid Rain, Photochemical Smog, Indoor Air Pollution and Vehicular air pollution, Air Pollution Episode Air Pollution Control Technology: Methods of Control of Air pollution, Air Pollution Control Equipment (Gravity Settling Chamber, Electrostatic Precipitator, Cyclone Collector, and Wet Scrubbers).

Unit II: Basic Concepts of Noise Pollution

Basic Concepts of Noise Pollution: Sources of Noise Pollution, Properties of Sound, Sound Pressure and Intensity Levels, Measurement of Noise, Measurement and Analysis of Sound, Equipment Used for Noise Measurements, Effects of Noise Pollution, Approaches for Noise Control Basic Concepts of Water Pollution: Sources and Effects of Water Pollution, Types of Water Pollutions, Marine pollution, Self-Purification of rivers, Oxygen Sag Curve, Zones of Pollution.

Unit III: Water Pollutants

Water Pollutants: Water Sampling, Objectives, Selection of Sampling Site, Types of Water Samples, Sampling Equipment, Classification of Water Quality Parameters (Organic, Inorganic, Nutrient & Heavy metals), Basic Concept, Significance and Measurement of DO, BOD, COD, Phenol, Polynuclear Aromatic hydrocarbon (PAH) in Water and Wastewater, Bacteriological and Biological examination of water, Approaches to Prevent & Control of Water Pollution, Legislative Measures, Rain Water Harvesting methods for water conservation. Thermal Pollution: Definition, Sources, Effects of Thermal Pollution, Control Measures and Method.

References:

1.	H.S. Bhatia, Text Book on Environmental Pollution and Control 2022.
2.	H.S. Khopkar, Environmental Pollution Analysis

EXAMINATION PATTERN FOR MAJOR SUBJECTS

A) Continuous Internal Assessment (40 Marks):

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

B) Semester End Examination (60 Marks):

Question Paper Pattern:

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

Distribution of external 60 marls

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

4	**A**	Answer the following (Attempt **any One out of two)**	**III**	20	10
	B	Answer the following (Attempt **any One out of two)**		10	05
		Total		**105**	**60**

Semester End Practical Examination (100 marks):

Scheme of examination:

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

Distribution of marks in practical examination

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

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

Internal Assessment of 20 Marks:

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

External Assessment of 30 Marks:

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

D) VSEC/SEC Assessment:

Semester End Practical Examination (50 marks):

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

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