Bachelor of Science
B.Sc. Physics (Semester- IV)

Course Code	US04MAPHY01	Title of the Course	Electromagnetic Theory and Spectroscopy
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	The students will be benefited by studying: 1. concept of Gradient, Divergence and Curl and different coordinate systems 2. concept of charge its field & it's energy density and Poisson's and Laplace's equation. 3. magnetic field and its force, motion of charged particle in magnetic field, Biot-Savart law and its application to find the magnetic flux & div & curl of B 4. concept of magnetic material 5. investigation and production of spectra and various types of spectra and different Quantum number. 6. the effects of magnetic and electric field on the spectrum of an atom i.e., Zeeman effects, Paschen-Back effects and Stark effects. 7. Production, measurement and diffraction of X - ray radiation and Bragg's Law. The comparison of optical and X-Ray spectra.

Course Content		
Unit	**Description**	**Weightage* (%)**
1	**Differential Calculus:** Brief introduction to Gradient, Divergence and Curl, Line, Surface and Volume integrals, Spherical and Cylindrical Coordinate Systems **Electrostatics:** **Electric field:** Coulomb's Law, The Electric field, Continuous charge distribution, Divergence and curl of Electrostatic fields: Field lines, Flux and Gauss's law, The Divergence of E, Applications of Gauss's law, The Curl of E **Electric Potential:** Introduction to potential, Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution **Work and Energy in Electrostatics:** The work done to move a charge, The energy of a point charge distribution, The energy of a continuous charge distribution [Introduction to Electrodynamics by David J Griffiths, (4thEdition) Prentice-Hall of India Private Ltd. **Vector Analysis:** 2.2, 2.4, 2.5, 3.1, 4.1, 4.2 **Electrostatics:** 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3]	25 %
2	**Magnetostatics:** **The Lorentz Force Law:** Magnetic fields, Magnetic forces, Cyclotron motion, Cycloid motion, Currents **The Biot-Savart law:** Steady currents, The Magnetic field of a steady current and its applications	

	The Divergence and Curl of B: Straight-Line currents, The Divergence and Curl of B, Ampere's law and its applications, Comparison of Magnetostatics and Electrostatics **Magnetic Vector Potential:** The Vector potential **Magnetization:** Diamagnets, Paramagnets, Ferromagnets, Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits, Magnetization [Introduction to Electrodynamics by David J Griffiths, (4th Edition) Prentice-Hall of India Private Ltd, **Magnetostatics:** 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 3.4, 4.1 **Magnetization:** 1.1, 1.2, 1.3, 1.4]	**25 %**
3	**Atomic Spectra:** Investigation of Spectra, Production of Spectra, Types of Spectra, Wave Number, Shortcomings of Bohr theory, Criticism and limitations of old quantum mechanical models, The Spinning Electron, Space Quantization, Quantum Numbers and their Physical Interpretation, Quantum numbers for complete atoms, Fine structure of Hydrogen lines, Spectral terms and their notations, Positronium, Mesonic atoms, L-S Coupling, j-j Coupling, Experimental study of Zeeman Effect, Classical Interpretation of Normal Zeeman Effect, Vector model and normal Zeeman effect, Paschen-Back effect, Stark Effect. [Elements of Spectroscopy by S L Gupta, V Kumar, R C Sharma (31st Edition) Section I: Atomic Spectra: 1.1, 1.2, 1.3, 1.4, 1.14, 2.7, 3.1, 3.2, 3.3, 3.1.1, 3.8, 3.9, 3.10, 3.11, 6.13, 9.1, 9.2, 9.3, 9.4, 9.7, 9.14]	**25 %**
4	**X-ray Spectra:** Production of X-rays, Origin of X-Radiations according to electromagnetic theory, X-rays: Light and Electromagnetic Spectrum, Diffraction of X-Radiations, Bragg's law, Laue spots, Bragg's spectrometer, Continuous X-ray spectrum, Characteristic Emission Spectrum, Characteristic Absorption Spectrum, A Close Survey of Emission Spectrum, Explanation of Emission and Absorption Spectra, Energy levels, Comparison of Optical and X-ray Spectra, Moseley's Law, Application of Moseley's law. [Elements of Spectroscopy by S L Gupta, V Kumar, R C Sharma (31st Edition) Section II: X-Rays and X-Ray Spectra: 1.1, 1.2, 1.3, 1.6, 1.7, 1.8, 1.9, 1.12, 1.13A, 1.13B, 1.14, 1.15, 1.16, 1.17, 1.18]	**25 %**

Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching, Question-Answer Class discussion led by teacher/students Case Studies, Literature review Problem solving activities Debate Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs Concept Mapping

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1.	Internal Continuous Assessment in the form of Internal Written Test, Quizzes, Assignments, Active learning, Viva-voce, Seminars, Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the different type of Electric field, Electric potential theory.
2.	Understand the Magnetostatics and Magnetization theory.
3.	Understand about Production and types of Atomic spectra and effects of magnetic and electric field on it.
4.	Understand the various parameters related with X-Ray Spectra.

Reference Books	
Sr. No	**References**
1.	Introduction to Electrodynamics David J Griffiths, (4th Edition) Prentice-Hall of India Private Ltd.
2.	Elements of Spectroscopy S L Gupta, V Kumar, R C Sharma (31st Edition) Pragati Prakashan
3.	Electricity and Magnetism A S Mahajan and A A Rangwala , Tata McGraw Hill Publishing Company Ltd
4.	Molecular structure and Spectroscopy G Aruldhas, Prentice-Hall of India Private Limited

On-line Resources

https://andrealommen.github.io/PHY309/lectures/divcurlE
https://opentextbc.ca/calculusv3openstax/chapter/cylindrical-and-spherical-coordinates/
https://www.accessengineeringlibrary.com/content/book/9781260120974/chapter/chapter6#
https://en.wikipedia.org/wiki/Magnetostatics#:~:text=Magnetostatics%20is%20the%20study%20of,where%20the%20charges%20are%20stationary.
https://en.wikipedia.org/wiki/Magnetization
https://thefactfactor.com/facts/pure_science/physics/ferromagnetic/4702/
https://www.youtube.com/watch?v=FLQXW6G9P8I
https://www.youtube.com/watch?v=wsCMXfQWnyM
https://en.wikipedia.org/wiki/Zeeman_effect
https://www.youtube.com/watch?v=vSIVDEV1v78
https://www.radiologymasterclass.co.uk/tutorials/physics/x-ray_physics_production

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Bachelor of Science
B.Sc. Physics (Semester-IV)

Course Code	US04MAPHY02	Title of the Course	Classical, Quantum and Solid-State Physics
Total Credits of the Course	04	Hours per Week	04

Course Objectives	This will be helping students to learn: 1. the fundamentals of inverse square law – forces and motions. 2. the concepts of Quantum Mechanics based on Schrödinger wave equation formulation. 3. basic concepts of crystallography and crystal analysis using X- ray diffraction. 4. inter atomic forces responsible for bonding in Solids.

Course Content		
Unit	**Description**	**Weightage* (%)**
1	**Inverse square law field, potential and Motion in a central force field:** **Inverse Square Law – Field and Potential:** Introduction, Law of gravitational and electrostatic forces, Gravitational and electrostatic fields and potentials, Lines of force and equipotential surfaces, Field equations **Motion in a central Force Field:** Equivalent one body problem, Motion in a central force field, General features of the motion, Motion in an inverse square law force field, Equation of orbit, Kepler's laws of planetary motion. [Introduction to Classical Mechanics by R. G. Takwale and P. S. Puranik: 4.1, 4.2, 4.3, 4.7, 5.1, 5.2, 5.3, 5.4, 5.5 and 5.6]	25 %
2	**Formulation of Schrödinger Equation:** **Towards Quantum Mechanics:** De Broglie's Hypothesis, The motion of a free wave packet: Classical approximation and uncertainty principle. **The Schrödinger Equation:** A free particle in one dimension, Generalization to three dimensions, The operator correspondence and the Schrödinger equation for a particle subject to forces. **Physical Interpretation and Condition on ψ:** Normalization and probability interpretation, Non-normalizable wave functions and box normalization, Conservation of probability, Expectation value and Ehrenfest's theorem, Admissibility conditions on the wave function. A Text Book of Quantum Mechanics by P. M. Mathews and K. Venkatesan (2nd Edition): 1.13, 1.14, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8.]	25 %
3	**Interatomic Forces and Bonding in Solids:** **Interatomic Forces:** Introduction, Force between atoms, Cohesion of atoms and cohesive energy, Calculation of cohesive energy. **Bonding in Solids:** Bonding in solids, Ionic bonding, Bond energy of NaCl molecule, Calculation of lattice energy of ionic crystals, Calculation	

	of Madelung constant of ionic crystals, Calculation of repulsive exponent from compressibility data, The Born-Haber cycle, Properties of ionic solids, Examples of ionic solids, Covalent bond, Saturation in covalent bonds, Directional nature of covalent bond, Hybridization, Properties of covalent compounds, Metallic bond, Properties of metallic crystals, Intermolecular bonds, Dispersion bonds, Dipole bonds, Hydrogen bonds [Solid State Physics by S. O. Pillai (9th Edition): Chapter-3, I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XIV, XVII, XVII, XIX, XX, XXI, XXII, XXIII, XXIV]	25 %
4	**Crystal Physics:** Introduction, Lattice points and space lattice, The basics and crystal structure, Unit Cells and lattice parameters, Unit Cell versus Primitive Cell, Crystal systems, Crystal symmetry (symmetry elements in crystals), The twenty three symmetry elements in a cubic crystal, Combination of symmetry elements, Rotation-inversion axis, Translation symmetry elements, Space groups, The Bravais space lattices, Metallic crystal structures (sc, bcc, fcc, hcp), Relation between the density of crystal material and lattice constant in a cubic lattice, Other cubic structures, Direction planes and Miller Indices, Important features of Miller indices of crystal planes, Important planes and directions in a cubic crystals, Separation between lattice planes in cubic crystal. [Solid State Physics by S. O. Pillai (9th Edition): Chapter-4, I, II, III, IV, V, VI, VII, VIII, X, XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX, XX, XXII]	25 %

Teaching-Learning Methodology	Direct Teaching – Chalk & Duster technique Interrogative sessions Teaching using Audio-Visual aids ICT enabled teaching Problem solving Seminar talks Learning through experiment and models Educational Tours

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1.	Internal Continuous Assessment in the form of Internal Written Test, Quizzes, Assignments, Active learning, Viva-voce, Seminars, Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the concepts of Gravitational & Electrostatic fields and potential. Get the knowledge of inverse square law in terms of motion of planetary objects.
2.	Familiar with the basic concepts of Quantum mechanics and formulation of Schrödinger equation.
3.	Understand the fundamental concepts and terms in crystallography.
4.	Accustomed with the basics of inter atomic forces and bonding in solids.

Reference Books	
Sr. No	**References**
1.	Introduction to Classical Mechanics R. G. Takwale and P. S. Puranik Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2.	Atomic Physics J. B. Rajam (Reprint 2002) S. Chand & Co. Ltd.
3.	A Text Book of Quantum Mechanics P. M. Mathews and K. Venkatesan (2nd Edition) Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4.	Solid State Physics S. O. Pillai (9th Edition) New Age International Publisher

On-line Resources:
https://www.wiziq.com/tutorials/classical-mechanics
https://en.wikipedia.org/wiki/Quantum_mechanics#:~:text=Quantum%20mechanics%20is%20a%20fundamental,technology%2C%20and%20quantum%20information%20science.
https://en.wikipedia.org/wiki/Introduction_to_quantum_mechanics
https://en.wikipedia.org/wiki/X-ray_crystallography
https://www.slideshare.net/yayavaram/crystal-structure-xray-diffraction
http://web.eng.fiu.edu/wangc/EGN3365-2b.pdf

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Bachelor of Science
B.Sc. Physics (Semester- IV)

Course Code	US04MAPHY03	Title of the Course	Physics Practical
Total Credits of the Course	04	Hours per Week	08

Course Objectives	The course aims at developing the following abilities in the learner: 1. acquire knowledge and develop understanding of concepts, fundamental laws, principles and processes in the area of physics so that relationship between cause and effects of physical phenomenon can be understood; 2. Experimental skills (like taking observations, manipulation of equipment) and communicative skills such as reporting of observations and experimental result. 3. problems solving ability e.g., analyzing a situation or data and ensure the justification of results. 4. Scientific temper of mind by making judgment on verified facts and not opinions, by showing willingness to accept new ideas and discoveries.

Course Content	
Description	**Weightage* (%)**
Section A 1. Determination of 'g' by Kater's pendulum (variable distance) 2. Characteristics of FET 3. Study of a Hartley Oscillator 4. Study of a Colpitts Oscillator 5. Frequency Response of RC Coupled amplifier (with negative feedback) 6. Inductance L by Anderson's Bridge 7. Study of L-C-R parallel resonance circuit 8. Hybrid parameters of a BJT (CE configuration) 9. Verification of Stefan's law 10. Numerical Integration	**50%**
Section B 1. Miller Indices using X-Ray diffraction pattern 2. de-Broglie Relation using electron diffraction pattern 3. Wave length of a monochromatic light 'λ' using double slit Method 4. Study of a Thermocouple 5. Wave length of a monochromatic light 'λ' using Lloyd's mirror 6. Cauchy's Constants 7. Absorption co-efficient of liquid using photocell 8. Identification of chemical elements using absorption spectra 9. To study double refraction in Calcite OR Quartz prism 10. Error analysis	**50%**

Note:

[1] To provide flexibility, up to the maximum of **20%** of total experiments can be replaced/added by college to this list prepared by the Board of Studies.
[2] A minimum of **80%** experiments must be performed in practical course.
[3] To maintain uniformity in assessment of practical examination the below mentioned marks distribution pattern is followed:

Sr. No.	Work done	Weightage as per 100 Marks
1.	Writing Principle / Statement/ Formula with explanation ofsymbols and units	16 Marks
2.	Diagram/Circuit Diagram / Expected Graph	16 Marks
3.	Setting up of the experiment + Tabular Columns + taking readings	28 Marks
4.	Calculations (explicitly shown) + Graph	20 Marks
5.	Accuracy of results with units	08 Marks
6.	Round the year Performance/ Records (to be valued at the time of practical Examination through oral viva)	12 Marks
		100 Marks

Note:

- Weightage of both the sections A and B are 50%. Students are required to obtain 40% of total marks.
- Wherever explicit setting up of experiments does not exist like in the case of spectral charts or pre–acquired data is involved, the marks for setting up of experiment may be provided for additional graphs and formulae.

Teaching- Learning Methodology	Direct Teaching through Demonstration, Chalk Walk and Talk ICT enabled teaching Question-Answer Group discussion led by teacher/students Problem solving activitics Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Viva voce Blended Learning designs

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1.	Internal Continuous Assessment in the form of Practical Examination, Quizzes, Assignments, Active learning, Viva-voce, Seminars, Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: On the successful completion of the course, the students will be able to	
1.	Apply the various procedures and techniques for the experiments.
2.	Use the different measuring devices and meters to record the data with precision
3.	Apply the mathematical concepts/equations to obtain quantitative results
4.	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Reference Books	
Sr. No.	**References**
1.	Advanced Practical Physics for students B. L. Worsnop and H. T. Flint Methuen and Co, Ltd., London.
2.	B. Sc. Practical Physics C. L. Arora S. Chand & Co. Ltd., New Delhi.
3.	Advanced Practical Physics M. S. Chauhan and S. P. Singh Pragati Prakashan, Meerut.
4.	Advanced Practical Physics S. L. Gupta and V. Kumar Pragati Prakashan, Meerut.

On-line resources to be used if available as reference material
On-line Resources:
https://www.futurelearn.com/courses/teaching-practical-science-physics

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Bachelor of Science
B.Sc. Physics (Semester- IV)

Course Code	US04MIPHY01	Title of the Course	Physics of Solids
Total Credits of the Course	02	Hours per Week	02

Course Objectives	This will be helping students to learn: 1. basic concepts of crystallography and crystal analysis using X- ray diffraction. 2. inter atomic forces responsible for bonding in Solids.

Course Content		
Unit	**Description**	**Weightage* (%)**
1	**Interatomic Forces and Bonding in Solids:** **Interatomic Forces:** Introduction, Force between atoms, Cohesion of atoms and cohesive energy, Calculation of cohesive energy. **Bonding in Solids:** Bonding in solids, Ionic bonding, Bond energy of NaCl molecule, Calculation of lattice energy of ionic crystals, Calculation of Madelung constant of ionic crystals, Calculation of repulsive exponent from compressibility data, The Born-Haber cycle, Properties of ionic solids, Examples of ionic solids, Covalent bond, Saturation in covalent bonds, Directional nature of covalent bond, Hybridization, Properties of covalent compounds, Metallic bond, Properties of metallic crystals, Intermolecular bonds, Dispersion bonds, Dipole bonds, Hydrogen bonds [Solid State Physics by S. O. Pillai (9th Edition): Chapter-3, I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XIV, XVII, XVII, XIX, XX, XXI, XXII, XXIII, XXIV]	50%
2	**Crystal Physics:** Introduction, Lattice points and space lattice, The basics and crystal structure, Unit Cells and lattice parameters, Unit Cell versus Primitive Cell, Crystal systems, Crystal symmetry (symmetry elements in crystals), The twenty three symmetry elements in a cubic crystal, Combination of symmetry elements, Rotation-inversion axis, Translation symmetry elements, Space groups, The Bravais space lattices, Metallic crystal structures (sc, bcc, fcc, hcp), Relation between the density of crystal material and lattice constant in a cubic lattice, Other cubic structures, Direction planes and Miller Indices, Important features of Miller indices of crystal planes, Important planes and directions in a cubic crystals, Separation between lattice planes in cubic crystal. [Solid State Physics by S. O. Pillai (9th Edition): Chapter-4, I, II, III, IV, V, VI, VII, VIII, X, XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX, XX, XXII]	50%

Teaching-Learning Methodology	Direct Teaching – Chalk & Duster technique Interrogative sessions Teaching using Audio-Visual aids ICT enabled teaching Problem solving Seminar talks Learning through experiment and models Educational Tours

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1.	Internal Continuous Assessment in the form of Internal Written Test, Quizzes, Assignments, Active learning, Viva-voce, Seminars, Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the concepts of Gravitational & Electrostatic fields and potential. Get the knowledge of inverse square law in terms of motion of planetary objects.
2.	Familiar with the basic concepts of Quantum mechanics and formulation of Schrödinger equation.
3.	Understand the fundamental concepts and terms in crystallography.
4.	Accustomed with the basics of inter atomic forces and bonding in solids.

Reference Books	
Sr. No	**References**
1.	Solid State Physics S. O. Pillai (9th Edition) New Age International Publisher
2.	Solid State Physics M. A. Wahab (2nd Edition) Narosa Publishing House

On-line Resources:
https://en.wikipedia.org/wiki/X-ray_crystallography
https://www.slideshare.net/yayavaram/crystal-structure-xray-diffraction
http://web.eng.fiu.edu/wangc/EGN3365-2b.pdf

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SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar, Gujarat

Re-accredited with 'A' Grade by NAAC (CGPA 3.11)

Syllabus with effect from the Academic Year 2024-2025

Bachelor of Science
B.Sc. Physics (Semester- IV)

Course Code	US04MIPHY02	Title of the Course	Physics Practical
Total Credits of the Course	02	Hours per Week	04

Course Objectives	The course aims at developing the following abilities in the learner: 1. acquire knowledge and develop understanding of concepts, fundamental laws, principles and processes in the area of physics so that relationship between cause and effects of physical phenomenon can be understood; 2. Experimental skills (like taking observations, manipulation of equipment) and communicative skills such as reporting of observations and experimental result. The problems solving ability, e.g., analyzing a situation or data and ensure the justification of results. 3. Scientific temper of mind by making judgment on verified facts and not opinions, by showing willingness to accept new ideas and discoveries.

Course Content	
Description	**Weightage* (%)**
1. Determination of 'g' by Kater's pendulum (variable distance) 2. Characteristics of FET 3. Study of a Hartley/Colpitts Oscillator 4. Study of L-C-R series/parallel resonance circuit 5. Verification of Stefan's law 6. Numerical Integration 7. Miller Indices using X-Ray diffraction pattern 8. de-Broglie Relation using electron diffraction pattern 9. Cauchy's Constants 10. Absorption co-efficient of liquid using photocell 11. Error analysis	**100%**

Note:

[1] To provide flexibility, up to the maximum of **20%** of total experiments can be replaced/added by college to this list prepared by the Board of Studies.

[2] A minimum of **80%** experiments must be performed in practical course.

[3] To maintain uniformity in assessment of practical examination the below mentioned marks distribution pattern is followed:

Sr. No.	Work done	Weightage as per 100 Marks
1.	Writing Principle / Statement/ Formula with explanation of symbols and units	08 Marks
2.	Diagram/Circuit Diagram / Expected Graph	08 Marks
3.	Setting up of the experiment + Tabular Columns + taking readings	14 Marks
4.	Calculations (explicitly shown) + Graph	10 Marks
5.	Accuracy of results with units	04 Marks
6.	Round the year Performance/ Records (to be valued at the time of practical Examination through oral viva)	06 Marks
		50 Marks

Note:

- Wherever explicit setting up of experiments does not exist like in the case of spectral charts or pre–acquired data is involved, the marks for setting up of experiment may be provided for additional graphs and formulae.

Teaching- Learning Methodology	Direct Teaching through Demonstration, Chalk-Walk and Talk ICT enabled teaching, Question-Answer Group discussion led by teacher/students Problem solving activities Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Viva voce Blended Learning designs

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1.	Internal Continuous Assessment in the form of Practical Examination, Quizzes, Assignments, Active learning, Viva-voce, Seminars, Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: On the successful completion of the course, the students will be able to	
1.	Apply the various procedures and techniques for the experiments.
2.	Use the different measuring devices and meters to record the data with precision
3.	Apply the mathematical concepts/equations to obtain quantitative results
4.	Develop basic communication skills through working in groups in performing thelaboratory experiments and by interpreting the results.

Reference Books	
Sr. No.	**References**
1.	Advanced Practical Physics for students B. L. Worsnop and H. T. Flint, Methuen and Co, Ltd., London.
2.	B. Sc. Practical Physics C. L. Arora, S. Chand & Co. Ltd., New Delhi.
3.	Advanced Practical Physics M. S. Chauhan and S. P. Singh, Pragati Prakashan, Meerut.
4.	Advanced Practical Physics S. L. Gupta and V. Kumar, Pragati Prakashan, Meerut.

On-line resources to be used if available as reference material
On-line Resources:
https://www.futurelearn.com/courses/teaching-practical-science-physics

Bachelor of Science
B.Sc. Physics (Semester -IV)

Course Code	US04SEPHY01	Title of the Course	Transducers and Sensors
Total Credits of the Course	02	Hours per Week	02

Course Objectives	1. To familiarize and acquaint the students with different types of analog transducers used for measurements of temperature at different levels. 2. To familiarize the students about characteristics of sound and construction of different types of microphones. 3. To make the students aware of different types of optical fibre sensors used for measurements of various physiological parameters like blood pressure, blood flow rate, oxygen saturation in blood etc.

Course Content		
Unit	**Description**	**Weightage* (%)**
1	**Temperature Measurements** Introduction, Temperature scale, Measurements of Temperature, Non-Electrical Methods: Bimetallic Thermometer, Electrical Methods: Electrical Resistance Thermometer, Metallic Resistance Thermometers, Semiconductor Resistance Sensors(thermistor), Thermoelectric Sensors, Laws of thermoelectricity) Thermoelectric materials Radiation Methods (Pyrometry): Total radiation pyrometer, Selective radiation pyrometer. [D C Nakra and K K Chaudhary:12.1, 12.3, 12.4, 12.4.1, 12.5, 12.5.1, 12.5.2, 12.6, 12.6.1, 12.6.2]	50%
2	**Acoustic Measurements and Optical Fiber Sensors** **Acoustic Measurements:** Characteristics of sound, sound pressure, power and intensity levels, sound pressure level, sound power level, sound intensity level, Microphones: Condenser or Capacitor type microphone, Piezo-electric crystal type microphone, Electrodynamic type microphone, **Optical Fiber Sensors**: Optical fibre sensors, Advantages of Optical Fiber Sensors, Types of Optical Fiber Sensors, Photometric, Physical and chemical sensors. [B C Nakra and K K Chaudhary: 14.1, 14.2, 14.2.1, 14.2.2, 14.2.3, 14.5, 14.5.1, 14.5.3, 14.5.4, R S Khandpur: 3.8, 3.8.1, 3.8.2]	50%

Teaching-Learning Methodology	Direct Teaching – Chalk & Duster technique Interrogative sessions Teaching using Audio-Visual aids ICT enabled teaching Problem solving, Seminar talks Learning through experiment and models Educational Tours

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1.	Internal Continuous Assessment in the form of Internal Written Test, Quizzes, Assignments, Active learning, Viva-voce, Seminars, Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: After the successful completion of the course, the students will be able to	
1.	Understand the different working methods for temperature measurements.
2.	Understand the different characteristics of sound.
3.	Acquire working knowledge and use of microphones for particular applications.
4.	Understand how to use optical fibre as sensors for various physiological parameters like blood pressure, blood flow rate, oxygen saturation in blood and etc.

Reference Books	
Sr. No.	**References**
1.	Basic Electronics and Linear Circuits N N Bhargava, D C Kulshreshtha and S C Gupta TMH Publishing Company Limited, New Delhi,
2.	Instrumentation Measurement and Analysis (3rd Edition) B C Nakra and K K Chaudhary, Tata McGraw Hill, New Delhi
3.	Modern Electronic Instrumentation and Measurement Techniques W D Cooper and A D Helfrick, PHI (Prentice Hall of India) learning Pvt. Ltd, New Delhi
4.	A Basic Electronics (Solid State) B L Theraja, S. Chand Pub. Ltd, New Delhi

On-line Resources:

1. https://www.youtube.com/watch?v=cQdksgPgMgw
2. https://www.youtube.com/watch?v=9EsOFiP1J2E
3. https://www.youtube.com/watch?v=t1sKM74gOJU
4. https://www.youtube.com/watch?v=pUqgbtKlTVk
5. https://www.youtube.com/watch?v=dXb1DbSTKeg
6. https://www.pdhonline.com/courses/e166/e166content.pdf
7. https://web.mst.edu/~cottrell/me240/resources/temperature/temperature.pdf
8. https://www.rcet.org.in/uploads/academics/rohini_48741650119.pdf
9. https://mx.nthu.edu.tw/~yucsu/3271/p08.pdf
10. https://www.youtube.com/watch?v=SXAFkRKkeYg
11. https://www.youtube.com/watch?v=o-JDMOKgCaM
12. https://www.youtube.com/watch?v=cBVm0Q75C3U
13. https://www.youtube.com/watch?v=W5dUz5eEAOk
14. https://www.youtube.com/watch?v=m9IIkcBKQ5w
15. https://www.youtube.com/watch?v=zxYeJW9v6OU&list=PLwymdQ84KI-w5DwDzqO_4hWsB2Jc4_eBy

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA-3.11)

Syllabus with effect from the Academic Year 2024-2025

Bachelor of Science B.Sc.
Physics Semester IV

Course Code	**US04SEPHY02**	**Title of the Course**	**Experimental techniques in Physics**
Total Credits of the Course	**02**	**Hours per Week**	**04**

Course Objectives:	1. The aim of this course is to enable the students to handle physics instruments and basic experimental techniques. 2. To familiarize and experience students with various electrical, electronic and optical tools. 3. To understand the basic concept of physics involving critical thinking. 4. Gain the knowledge of various phenomena using hands on experiments.

Description	**Weightage (%)**
1. Calculation of periodic time at different lengths for simple pendulum 2. Study of logic behavior of NAND and NOR gates 3. Construction of EX-OR gate using basic gates and verify its truth table 4. Resolving power of diffraction grating 5. Study of Photo diode / optocoupler 6. To study the characteristics of thermistor 7. Verification of maximum power transfer theorem 8. Study of Parallel LC circuit 9. Linear harmonic oscillator (Kinetic energy and potential energy) 10. Determination of unknown data using extrapolation method	100 %

Note:

[1] To provide flexibility, up to the maximum of 20% of total experiments can be replaced/added by college to this list prepared by the Board of Studies.

[2] A minimum of 80% experiments must be performed in practical course.

[3] To maintain uniformity in assessment of practical examination the below mentioned marks distribution pattern is followed:

Sr. No.	Work done	Weightage as per 50 Marks
1.	Writing Principle / Statement/ Formula with explanation of symbols and units	08 Marks
2.	Diagram/Circuit Diagram / Expected Graph	08 Marks
3.	Setting up of the experiment + Tabular Columns + taking readings	14 Marks
4.	Calculations (explicitly shown) + Graph	10 Marks
5.	Accuracy of results with units	04 Marks
6.	Round the year Performance/ Records (to be valued at the time of practical Examination through oral viva)	06 Marks
	Total for Practical	**50 Marks**

Note:
Wherever explicit setting up of experiments does not exist like in the case of spectral charts or pre–acquired data is involved, the marks for setting up of experiment may be provided for additional graphs and formulae.

Teaching Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Class discussion led by teacher/students Case Studies Literature review Problem solving activities Debate Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Practical Examination (As per CBCS R.6.8.3)	50%
2.	University Examination	50%

Course Outcomes: On the successful completion of the course, the students will be able to

1. Apply the various procedures and techniques for the experiments.
2. Use different measuring devices and meters to record the data with precision.
3. Apply the mathematical concepts/equations to obtain quantitative results.
4. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Suggested References	
Sr. No.	References
1.	B.Sc. Practical Physics C L Arora S. Chand & Co. Ltd., New Delhi (2018)
2.	A text book in Electrical Technology; B L Theraja, S. Chand & Co. Ltd., New Delhi
3.	Electronic Devices and Circuits; S. Salivahanan & N. S.Kumar, Tata Mcgraw Hill
4.	Electrical Measurements And Measuring Instruments; R.K. Rajput, (S. Chand)
5.	Basic Electronics; J.B. Gupta, S.K. Kataria & Sons 3rd Edition (2015)
6.	Practical Physics with Viva Voce; Dr. S. L. Gupta, Dr. V. Kumar, Pragati Prakashan, 3rd Edition

On-line resources to be used if available as reference material
On-line Resources:
https://www.electronics-tutorials.ws/
https://www.electronicshub.org/tutorials/
http://www.allaboutcircuits.com/
https://nptel.ac.in/courses/115/105/115105110