



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

Course Code	US03CPHY51	Title of the Course	Optics
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	Students will be gain the basic concept of: 1. the different optical system phenomena. 2. the different optical principles and its applications in optical instruments. 3. the fundamental principles of Interference and Diffraction and its applications. 4. polarization and different types of polarized lights. 5. the basic working of Optical fibre system and Optical fibre cable and its applications.
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Course Content		
Unit	Description	Weightage* (%)
1.	<p><u>Geometrical Optics</u> Lens System: Introduction to lenses, Equivalent focal length of two thin lenses, Focal length of the equivalent lens, Distance of equivalent lens from L_2 and L_1, Powers, Cardinal points, Principal point and Principal planes, Focal points and Focal planes, Nodal points and Nodal planes, Construction of image using cardinal points, Newton's formula, cardinal points of a coaxial system of two thin lenses- object at infinity. Lens Aberrations: Introduction, Types of aberration, Spherical aberration, Reducing spherical aberration, Coma, Astigmatism, Curvature of field, distortion, Chromatic aberration, Chromatic aberration in a lens – Object at infinity and Object at finite distance. Eyepieces: Introduction to objective and eyepiece, Huygens eyepiece, Cardinal points of Huygens eyepiece, Ramsden eyepiece, Cardinal points of Ramsden eyepiece, comparison of Ramsden and Huygens eyepiece.</p> <p>[A Textbook of Optics by Subrahmanyam, Brij Lal and Avadhanulu: 4.1, 4.16, 4.17, 4.17.1, 4.17.2, 4.17.3, 4.17.4, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.4, 5.10.1, 5.10.1.2, 9.1, 9.2, 9.5, 9.5.1, 9.6, 9.7, 9.8, 9.9, 9.10, 9.11(B), 10.8, 10.10, 10.10.1, 10.11, 10.11.1, 10.12]</p>	25 %
2.	<p><u>Interference and Diffraction:</u> Interference: Introduction, Techniques for obtaining interference, Fresnel's biprism, Experimental arrangement, Determination of wavelength of light, Interference fringes with white light, Lateral displacement of fringes, Lloyd's single mirror, Determination of wavelength, Newton's ring, Condition for bright and dark rings, Circular fringes, Radii of dark fringes, Dark central spot, Determination of wavelength of light,</p>	





	<p>Concept of multiple beam interference, Fabry-Perot interferometer and Etalon, Formation of fringes, Determination of wavelength, Measurement of difference in wavelength, Lummer and Gehrcke plate.</p> <p>Diffraction: Introduction, Distinction between interference and diffraction, Fresnel and Fraunhofer types of diffraction, Diffraction pattern due to a narrow slit, Diffraction due to a narrow wire, Fraunhofer diffraction at a circular aperture, Fraunhofer diffraction at double slit Interference and diffraction maxima and minima</p> <p>[A Textbook of Optics by Subrahmanyam, Brij Lal and Avadhnu:14.1, 14.8, 14.9, 14.9.1,14.9.2, 14.9.3, 14.9.4, 14.10, 14.10.1, 15.6, 15.6.1, 15.6.2, 15.6.3,15.6.6, 15.6.7, 15.11, 15.12, 15.12.1, 15.12.2, 15.12.3, 15.13, 17.1, 17.6, 17.7, 17.11, 17.12, 18.3,18.4]</p>	25 %
3.	<p>Polarization: Introduction, Polarized light, Production of linearly polarized light, Polarization by reflection, Polarization of refraction-pile of plates, Polarization by scattering, Polarization by selective absorption, Polarization by double refraction, Polarizer and analyser, Construction and working of Nicol prism, Polaroid sheets, Effect of polarizer on natural light, Effect of analyser on plane polarized light-Malus' law, Anisotropic crystals, calcite crystal, Optic axis, Principle section, Double refraction, Huygens' explanation of double refraction, o-Ray and e-Ray, Positive crystals and negative crystals, Superposition of waves linearly polarized at right angles, Retarders or Wave plates, Quarter wave plate, Half wave plate, Production and detection of elliptically polarized light, Production and detection of circularly polarized light, Analysis of polarized light, Babinet compensator-construction and production of polarized light, Specific rotation, Laurent's half shade polarimeter, LCDs</p> <p>[A Textbook of Optics by Subrahmanyam, Brij Lal and Avadhanulu: 20.1, 20.3, 20.5.1, 20.6, 20.6.1, 20.6.1.1, 20.6.2, 20.6.3, 20.6.4, 20.6.5, 20.7, 20.8, 20.9, 20.10, 20.10.1, 20.10.2, 20.10.3, 20.11, 20.11.1, 20.11.2, 20.11.3, 20.12, 20.18, 20.19, 20.19.1, 20.19.2, 20.20, 20.20.1, 20.21, 20.21.1, 20.22, 20.23, 20.23.1, 20.23.2, 20.26(5), 20.29, 20.32]</p>	25 %
4.	<p>Fibre Optics : Introduction, Optical fibre, Necessity of cladding, Optical fibre system, Optical fibre cable, Total internal reflection, Propagation of light through an optical fibre, Critical angle of propagation, Acceptance angle, Fractional refractive index change, Numerical aperture, Modes of propagation, Classification of optical fibres, Single mode step Index fibre, Multi-mode step index fibre, Graded index fibre, Materials, All glass fibres, All plastic fibres, PCS fibres, Bandwidth, Characteristics of the fibers, Applications, Illumination and image transmission, Optical communications, Medical applications, Military applications, Fibre optic communication system, Merits and demerits of optical fibers</p> <p>[A Textbook of Optics by Subrahmanyam, Brij Lal and Avadhanulu:</p>	25 %





	24.1, 24.2, 24.2.1, 24.2.2, 24.2.3, 24.3, 24.4, 24.4.1, 24.4.2, 24.5, 24.5, 24.6, 24.8, 24.10, 24.11.1, 24.11.2, 24.11.3, 24.12, 24.12.1, 24.12.2, 24.12.3, 24.17, 24.18, 24.20, 24.20.1, 24.20.2, 24.20.3, 24.20.4, 24.21, 24.22, 24.22.1]	
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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
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the different types of optical Lens system and Lens Aberrations and optical instrument Eyepiece.
2.	Understand the Interference and Diffraction laws and determination of wavelength of light and Fresnel and Fraunhofer diffraction
3.	Learn About Polarization laws and different related crystal Property and production of polarized light and its application like LCD





Suggested References:

Sr. No.	References
1.	A Textbook of Optics, By Subrahmanyam, Brij Lal and Avadhanulu S Chand Publication (24 th Revised addition 2010)
2.	Optics Ajoy Ghatak, McGraw-Hill Publishing Co. Ltd.
3.	Text Book of Light D N Vasudev Atma Ram and Sons, New Delhi
4.	Fundamental of Optics F A Jenkins and H E White Tata McGraw Hill Book Co. Ltd.

On-line resources to be used if available as reference material

On-line Resources

<https://en.wikipedia.org/wiki/Lens#References>

This website contains Lens Basics laws and its different rules and Type of lenses and its working

<https://www.livephysics.com/problems-and-answers/optics/lens-system-image-distance-magnification/>

Live conversation about lens and its laws problems and answers

<https://www.thefreedictionary.com/lens+system>

This website contains a glossary of Lens system

<https://languages.oup.com/google-dictionary-en>

Dictionary

<https://www.youtube.com/watch?v=Ib9rCDTOAPU>

Related videos of Huygens eyepiece

<https://www.youtube.com/watch?v=vZjGa49xfI0>

Related videos of Ramsden eyepiece

<https://www.youtube.com/watch?v=oYFEWoxuB1I>

Related videos of Interference and Diffraction





<https://www.youtube.com/watch?v=8YkfEft4p-w>

Related videos of Polarization

https://www.youtube.com/watch?v=GuYX-UWt_bM

Related videos of fibre Optics

https://en.wikipedia.org/wiki/Wave_interference

Basic information about Interference

<https://www.olympus-lifescience.com/en/microscope/resource/primer/lightandcolor/polarization/>

polarization of light

https://en.wikipedia.org/wiki/Optical_fiber

Fibre Optics





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

Course Code	US03CPHY52	Title of the Course	Solid State Electronics
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	Students will gain 1. the basic biasing concepts useful for transistor amplifier circuits. 2. understanding of the single and multi-stage transistor amplifiers along with h-parameter formulations and coupling mechanism. 3. concept of feedback circuits used in electronic circuits and there by learn various electronic oscillator circuits. 4. high-speed switching devices like FET and MOSFET.
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Course Content		
Unit	Description	Weightage* (%)
1.	<u>DC Load Line, Transistor Biasing and Stabilization of Operating Point:</u> Introduction, Basic CE amplifier circuit, DC load line, Bias a Transistor, Selection of operating point, Need for bias stabilization, Requirement of biasing circuit, Different biasing circuits, Fixed bias circuit, Collector to base bias circuit, Bias circuit with emitter resistor, Voltage divider biasing circuit, Approximate analysis, Accurate analysis, Emitter bias circuit, PNP transistor biasing circuit [Basic Electronics and Linear Circuits (2 nd Edition) by N N Bhargava, D C Kulshreshtha and S C Gupta: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.6.1, 7.6.2, 7.6.3, 7.6.4, 7.6.5, 7.7]	25 %
2.	<u>Small Signal Amplifiers, h-parameters and Multi-Stage Amplifiers:</u> Introduction, Single Stage transistor amplifier, Amplifier performance analysis methods, Graphical method, DC and AC load line, Calculation of gain, input and output phase relationship, Equivalent circuit method, Development of transistor AC equivalent circuit, h-parameter equivalent circuit, Amplifier analysis, Requirement of more than one stages, Gain of multi-stage amplifier, Decibel, Gain of multi-stage amplifier in dB, why dB is used. How to couple two stages, Resistance-Capacitance coupling, Transformer coupling, Direct coupling. [Basic Electronics and Linear Circuits (2 nd Edition) by N N Bhargava, D C Kulshreshtha and S C Gupta : 8.1, 8.2, 8.3, 8.3.1, 8.3.2, 8.3.3, 8.4, 8.4.1, 8.4.2, 8.4.3, 9.1, 9.2, 9.2.1, 9.2.2, 9.2.3, 9.3, 9.3.1, 9.3.2, 9.3.3]	25 %





3.	<p><u>Feedback in Amplifiers and Oscillators:</u> Feedback in Amplifiers: Concepts of feedback in amplifiers, Types of feedback, Voltage gain of feedback amplifier, Advantages of negative feedback, Stabilization of gain, Reduction in distortion and noise, Increase in input impedance, Decrease in output impedance, Increase in bandwidth, Amplifier circuit with negative feedback, RC coupled amplifier without bypass capacitor, Emitter follower Oscillators: Need of an oscillator, Classification of oscillators, Tuned circuit for generation of sine waves, Frequency of oscillation in LC circuit, Sustained oscillations, Positive feedback amplifier as an oscillator, The starting voltage, Hartley oscillator, Colpitts oscillator, Basic principles of RC oscillators, Phase shift oscillator, Wien bridge oscillator. [Basic Electronics and Linear Circuits (2nd Edition) by N N Bhargava, D C Kulshreshtha and S C Gupta: 12.1, 12.2, 12.3, 12.4, 12.4.1, 12.4.2, 12.4.3, 12.4.4, 12.4.5, 12.5, 12.5.1, 12.5.2, 13.1, 13.2, 13.3, 13.3.1, 13.3.2, 13.4, 13.4.1, 13.5.3, 13.5.4, 13.6, 13.6.1, 13.6.2, 13.6.3]</p>	25 %
4.	<p><u>FET and MOSFET:</u> FET: Basic ideas, Drain curves, Transconductance curves, Biasing in the ohmic region, Biasing in the active region, Transconductance, JFET amplifiers, The JFET analog switch, Other JFET applications (Multiplexing Chopper amplifiers, Voltage control resistance, Automatic gain control). MOSFET: The depletion mode MOSFET, The enhancement mode MOSFET, The ohmic region, Passive load switching, Active load switching CMOS. [Electronic Principles by A P Malvino (7th Edition: 13-1, 13-2, 13-3, 13-4, 13-5, 13-6, 13-7, 13-8, 13-9, 14-1, 14-2, 14-3, 14-4, 14-5]</p>	25 %

Teaching-Learning Methodology	<p>Direct Teaching – <i>Chalk & Duster technique</i> Interrogative sessions Teaching using Audio-Visual aids ICT enabled teaching Problem solving Seminar talks Learning through experiment and models Educational Tours</p>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%





2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to

1.	Understand the concepts of Transistor biasing using various biasing circuits
2.	Get familiarize with small signal amplifiers based on h-parameter analysis
3.	Acquire knowledge of Feedback in amplifier circuits and Oscillators
4.	Learn importance of FET and MOSFET in electronic circuits

Suggested References:

Sr. No.	References
1.	Basic Electronics and Linear Circuits (2 nd Edition) N N Bhargava, D C Kulshreshtha and S C Gupta Tata McGraw Hill Publishing Co. Ltd., New Delhi
2.	Electronic Principles (7 th Edition) A P Malvino Tata McGraw Hill Publishing Co. Ltd., New Delhi
3.	Basic Electronics (Solid State) B L Theraja S Chand, New Delhi
4.	Principle of Electronics V K Mehta and Rohit Mehta S Chand & Co., New Delhi
5.	Electronic Devices and Circuits- An Introduction Allen Mottershead PHI Learning Pvt. Ltd., New Delhi

On-line resources to be used if available as reference material

On-line Resources

<https://www.freebookcentre.net/Electronics/Solid-State-Devices-Books.html>
<https://www.electronics-tutorials.ws/amplifier/transistor-biasing.html>
https://www.electronics-tutorials.ws/amplifier/amp_2.html
<https://www.electronics-tutorials.ws/oscillator/oscillators.html>
https://en.wikipedia.org/wiki/Field-effect_transistor





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

Course Code	US03CPHY53	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* (%)
	<p style="text-align: center;"><u>Section A</u></p> <ol style="list-style-type: none">1. Determination of 'g' by Kater's pendulum (fixed distance)2. 'Y' by Koenig's method3. Cardinal points of two lens system4. Dispersive curve and power of a prism5. Resolving power of a telescope6. Determination of wavelength of monochromatic light using Biprism7. Velocity of sound by resonance tube8. Determination of unknown wavelength of spectra using Hartmann's formula9. Determination of specific rotation of optically active substance using Laurent's half shade Polari meter10. Numerical differentiation	50%





Section B		
	1. Load line and determination of Q-point for BJT 2. Frequency response of a RC coupled amplifier (without feedback) 3. Study of transformer parameters 4. Variation of I_c and V_{ce} with temperature for Fixed bias/ Potential divider circuit 5. Impedance by voltage drop method 6. Inductance L by Maxwell's bridge 7. Study of L-C-R series resonance circuit 8. RC Phase shift oscillator 9. Planck's constant 'h' using photocell 10. Exponential least square fitting	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 **Sixteen (16)** 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 Laboratory/Panel discussion led by teacher/students Case Studies Problem solving activities Collaborative and Co-operative Learning Think Pair Share Project Based Learning Concept Mapping
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

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

Suggested References:	
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	US04CPHY51	Title of the Course	Electromagnetic Theory and Spectroscopy
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<p>The students will be benefited by studying:</p> <ol style="list-style-type: none"> 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. 8. comparison of optical and X-Ray spectra.
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Course Content		
Unit	Description	Weightage* (%)
1	<p><u>Electrostatics</u> Electric field: Brief introduction to Gradient, Divergence and Curl, Line, Surface and Volume integrals, Spherical and Cylindrical Coordinate Systems, The Dirac delta function, 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, Boundary conditions, 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</p> <p>[Introduction to Electrodynamics by David J Griffiths, (3rd Edition) Prentice-Hall of India Private Ltd. Electrostatics: 1.2.2, 1.2.4, 1.2.5, 1.3.1, 1.4.1, 1.4.2, 1.5.1, 1.5.2, 1.5.3, 2.1.2, 2.1.3, 2.1.4, 2.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.5, 2.4, 2.4.1, 2.4.2, 2.4.3]</p>	25 %





2.	<p><u>Magnetostatics</u> 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, Boundary conditions, Magnetization: Diamagnets, Paramagnets, Ferromagnets, Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits [Introduction to Electrodynamics by David J Griffiths, (3rd Edition) Prentice-Hall of India Private Ltd, Magnetostatics: 5.1,5.1.1, 5.1.2, 5.1.3, 5.2, 5.2.1, 5.2.2, 5.3, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.4, 5.4.1, 5.4.2, 6.1, 6.1.1, 6.1.2, 6.1.3]</p>	25 %
3.	<p><u>Atomic Spectra</u> 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, Fine structure of Hydrogen atom, 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 (29th 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]</p>	25 %
4.	<p><u>X-ray Spectra</u> Production of X-rays, Origin of X-Radiations according to electromagnetic theory, X-rays, Light and Electromagnetic Spectrum, Measurement of X-Radiations, 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, The Fluorescence yield and Auger Effect, Satellites. [Elements of Spectroscopy by S L Gupta, V Kumar, R C Sharma (29th Edition) Section II : X-Rays and X-Ray Spectra: 1.1, 1.2, 1.3, 1.4, 1.6, 1.7, 1.8, 1.9, 1.12, 1.13A, 1.13B, 1.14, 1.15, 1.16, 1.17, 1.21, 1.22]</p>	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
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

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.

Suggested References:	
Sr. No.	References





1.	Introduction to Electrodynamics David J Griffiths, (3 rd Edition) Prentice-Hall of India Private Ltd.
2.	Elements of Spectroscopy S L Gupta, V Kumar, R C Sharma (29 th 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 Aruldas, Prentice-Hall of India Private Limited

On-line resources to be used if available as reference material

On-line Resources

<https://andrealommen.github.io/PHY309/lectures/divcurlE>

Divergence and Curl and Gauss's law related theory

<https://opentextbc.ca/calculusv3openstax/chapter/cylindrical-and-spherical-coordinates/> Spherical and Cylindrical coordinate system

<https://www.accessengineeringlibrary.com/content/book/9781260120974/chapter/chapter6#>

work and energy in electrostatics

<https://en.wikipedia.org/wiki/Magnetostatics#:~:text=Magnetostatics%20is%20the%20study%20of,w here%20the%20charges%20are%20stationary.>

Magnetostatics and related theory

<https://en.wikipedia.org/wiki/Magnetization>

Magnetization and related theory

https://thefactfactor.com/facts/pure_science/physics/ferromagnetic/4702/

Diamagnetic, Paramagnetic and ferromagnetic materials

<https://www.youtube.com/watch?v=FLQXW6G9P8I>

Related videos of spherical and cylindrical coordinate system

<https://www.youtube.com/watch?v=wsCMXfQWnyM>

Related videos of Work and energy in electrostatics

https://en.wikipedia.org/wiki/Zeeman_effect

Zeeman effect

<https://www.youtube.com/watch?v=vSIVDEV1v78>

Atomic spectra absorption and emission spectra

https://www.radiologymasterclass.co.uk/tutorials/physics/x-ray_physics_production

Production of X-ray and X- Radiation





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

Course Code	US04CPHY52	Title of the Course	Classical, Quantum and Solid-State Physics
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<p>This will be help students to learn:</p> <ol style="list-style-type: none"> 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.
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Course Content		
Unit	Description	Weightage* (%)
1.	<p><u>Inverse square law field, potential and Motion in a central force field:</u> 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, Fields and potentials of dipole and quadrupole, 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, 4.4, 4.7,5.1, 5.2, 5.3, 5.4, 5.5 and 5.6]</p>	25 %
2.	<p><u>Formulation of Schrödinger Equation:</u> Quantum theory of radiation: Introduction, Black body radiation, Wien’s law, Rayleigh Jean’s law, Planck’s radiation formula, Compton Effect. Towards Quantum Mechanics: De Broglie’s Hypothesis, The motion of a free wave packet: Classical approximation and uncertainty principle, Uncertainties introduced in the process of measurement, Approximate classical motion in slowly varying fields. 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.</p>	25 %





	A Text Book of Quantum Mechanics by P. M. Mathews and K. Venkatesan (2 nd Edition): 1.13, 1.14, 1.15,1.16, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 ,2.8.]	
3.	<p><u>Crystal Physics:</u> 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, 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.</p> <p>[Solid State Physics by S. O. Pillai (7th Edition): Chapter-4, I, II, III, IV, V, VI, VII, VIII, X, XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX, XX, XXII]</p>	25 %
4.	<p><u>Interatomic Forces and Bonding in Solids:</u> 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, Covalent bond, Saturation in covalent bond, Directional nature of covalent bond, Hybridization, Properties of covalent compounds, Metallic bond, Properties of metallic crystals, intermolecular bonds, Dispersion bonds, Dipole bonds, Hydrogen bonds, Van der Waals bonding, Atomic size, Ionic radii, Empirical ionic radii, variation of ionic radii, Covalent radii, Metallic radii, Van der Waals radii.</p> <p>[Solid State Physics by S. O. Pillai (7th Edition): Chapter-3, I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIV, XV, XIV, XVII, XVII, XIX, XX, XXI, XXII, XXIII, XXIV, Solid State Physics by M. A. Wahab (2nd Edition): 2.11, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11]</p>	25 %

Teaching-Learning Methodology	Direct Teaching – <i>Chalk & Duster technique</i> Interrogative sessions Teaching using Audio-Visual aids ICT enabled teaching Problem solving Seminar talks Learning through experiment and models Educational Tours
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

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.

Suggested References:	
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 (2 nd Edition) Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4.	Solid State Physics S. O. Pillai (7 th Edition) New Age International Publisher
5.	Solid State Physics M. A. Wahab (2 nd Edition) Narosa Publishing House





On-line resources to be used if available as reference material

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>





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

Course Code	US04CPHY53	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* (%)
	<u>Section A</u>	
	<ol style="list-style-type: none">1. Determination of 'g' by Kater's pendulum (variable distance)2. Characteristics of FET3. Study of a Hartley Oscillator4. Study of a Colpitts Oscillator5. Frequency Response of RC Coupled amplifier (with negative feedback)6. Inductance L by Anderson's Bridge7. Study of L-C-R parallel resonance circuit8. Hybrid parameters of a BJT (CE configuration)9. Verification of Stefan's law10. Numerical Integration	50%





Section B		
<ol style="list-style-type: none"> 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 **Sixteen (16)** 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.





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Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2021-2022

Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Laboratory/Panel discussion led by teacher/students Case Studies Problem solving activities Collaborative and Co-operative Learning Think Pair Share Project Based Learning Concept Mapping
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

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

Suggested References:

Sr. No.	References
1.	Advanced Practical Physics for students B. L. Wosnop 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>

