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.

Course Content		
Unit	Description	Weightage* (%)
1.	**Geometrical Optics** **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. [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]	25 %
2.	**Interference and Diffraction:** **Interference:**Introduction,Techniquesforobtaininginterference,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,	

	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. **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, Fraunhoffer diffraction at a circular aperture, Fraunhoffer diffraction at double slit Interference and diffraction maxima and minima [A Textbook of Optics by Subrahmanyam, Brij Lal and Avadhnulu: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]	25 %
3.	**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 [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]	25 %
4.	**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 [A Textbook of Optics by Subrahmanyam, Brij Lal and Avadhanulu:	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]	

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 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 Fraunhoffer 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 (24th 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

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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.

Course Content		
Unit	Description	Weightage* (%)
1.	**DC Load Line, Transistor Biasing and Stabilization of Operating Point:** 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 (2nd 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.	**Small Signal Amplifiers, h-parameters and Multi-Stage Amplifiers:** 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 (2nd 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.	**Feedback in Amplifiers and Oscillators:** **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]	25 %
4.	**FET and MOSFET:** **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]	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 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 (2nd Edition) N N Bhargava, D C Kulshreshtha and S C Gupta Tata McGraw Hill Publishing Co. Ltd., New Delhi
2.	Electronic Principles (7th 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

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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* (%)
	Section A 1. Determination of 'g' by Kater's pendulum (fixed distance) 2. 'Y' by Koenig's method 3. Cardinal points of two lens system 4. Dispersive curve and power of a prism 5. Resolving power of a telescope 6. Determination of wavelength of monochromatic light using Biprism 7. Velocity of sound by resonance tube 8. Determination of unknown wavelength of spectra using Hartmann's formula 9. Determination of specific rotation of optically active substance using Laurent's half shade Polari meter 10. 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

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

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