SRI VENKATESWARA UNIVERSITY
B.Sc. DEGREE COURSE IN PHYSICS (WITH MATHS)
FIRST YEAR - SECOND SEMESTER
(Under CBCS W.E.F. 2020-21)

Course II: WAVE OPTICS
(For Mathematics Combinations)

Work load:60 hrs per semester **4 hrs/week**

Course outcomes:

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

- *Understand the phenomenon of interference of light and its formation in (i) Lloyd's single mirror due to division of wave front and (ii) Thin films, Newton's rings and Michelson interferometer due to division of amplitude.*
- *Distinguish between Fresnel's diffraction and Fraunhoffer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating.*
- *Describe the construction and working of zone plate and make the comparison of zone plate with convex lens.*
- *Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity..*
- *Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields.*
- *Explain about the different aberrations in lenses and discuss the methods of minimizing them.*
- *Understand the basic principles of fibreoptic communication andexplore the field of Holography and Nonlinear optics and their applications.*

UNIT-I Interference of light: (12hrs) Introduction, Conditions for interference of light, Interference of light by division of wave front and amplitude,Phase change on reflection-Stokes' treatment, Lloyd's single mirror,Interference in thin films: Plane parallel and wedge-shaped films, colours in thin films, Newton's rings in reflected light-Theory and experiment, Determination of wavelength of monochromatic light, Michelson interferometer and determination of wavelength.

UNIT-II Diffraction of light:(12hrs)

Introduction, Types of diffraction: Fresnel and Fraunhoffer diffractions, Distinction between Fresnel and Fraunhoffer diffraction,Fraunhoffer diffraction at a single slit, Plane diffraction grating,Determination of wavelength of light using diffraction grating, Resolving power of grating, Fresnel's half period zones, Explanation of rectilinear propagation of light, Zone plate, comparison of zone plate with convex lens.

UNIT-III Polarisation of light:(12hrs)

Polarized light: Methods of production of plane polarized light, Double refraction, Brewster's law, Malus law, Nicol prism, Nicol prism as polarizer and analyzer, Quarter wave plate, Half wave plate, Plane, Circularly and Elliptically polarized light-Production and detection, Optical activity, Laurent's half shade polarimeter: determination of specific rotation.

UNIT-IV Aberrations and Fibre Optics: (12hrs)

Monochromatic aberrations, Spherical aberration, Methods of minimizing spherical aberration, Coma, Astigmatism and Curvature of field, Distortion; Chromatic aberration-the achromatic doublet; Achromatism for two lenses (i) in contact and (ii) separated by a distance.

Fibre optics: Introduction to Fibers, different types of fibers, rays and modes in an optical fiber, Principles of fiber communication (qualitative treatment only), Advantages of fiber optic communication.

UNIT-V Lasersand Holography:(12hrs)

Lasers: Introduction, Spontaneous emission, stimulated emission, Population Inversion, Laser principle, Einstein coefficients, Types of lasers-He-Ne laser, Ruby laser, Applications of lasers; Holography: Basic principle of holography, Applications of holography

REFERENCE BOOKS:

- BSc Physics, Vol.2, Telugu Akademy, Hyderabad
- A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.
- Optics-Murugeshan, S.Chand& Co.
- Unified Physics Vol.IIOptics, Jai PrakashNath&Co.Ltd., Meerut
- Optics,F.A. Jenkins and H.G.White, McGraw-Hill
- Optics, AjoyGhatak,TataMcGraw-Hill.
- Introduction of Lasers – Avadhanulu, S.Chand& Co.
- Principles of Optics- BK Mathur, Gopala Printing Press, 1995

BOS Chairman

SRI VENKATESWARA UNIVERSITY

B.Sc. DEGREE COURSE IN PHYSICS (**WITH** MATHS)

FIRST YEAR - SECOND SEMESTER
(Under CBCS W.E.F. 2020-21)

PRACTICAL COURSE II: WAVE OPTICS

Work load: 30 hrs **2 hrs/week**

Course outcomes (Practicals):

On successful completion of this practical course the student will be able to,

1. *Gain hands-on experience of using various optical instruments like spectrometer, polarimeterand making finer measurements of wavelength of light using Newton Ringsexperiment, diffraction grating etc.*
2. *Understand the principle of working of polarimeter and the measurement of specific rotatory power of sugar solution*
3. *Know the techniques involved in measuring the resolving power of telescope and dispersive power of the material of the prism.*
4. *Be familiar with the determination of refractive index of liquid by Boy's methodand the determination of thickness of a thin wire by wedge method.*

Minimum of 6 experiments to be done and recorded

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Study of optical rotation –polarimeter.
4. Dispersive power of a prism.
5. Determination of wavelength of light using diffraction grating-minimum deviation method.
6. Determination of wavelength of light using diffraction grating-normal incidence method.
7. Resolving power of a telescope.
8. Refractive index of a liquid-hallow prism
9. Determination of thickness of a thin wire by wedgemethod
10. Determination of refractive index of liquid-Boy'smethod.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

- Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
- Student seminars (on topics of the syllabus and related aspects (individual activity)
- Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
- Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

- Group Discussion
- Visit to Research Stations/laboratories and related industries

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

- The oral and written examinations (Scheduled and surprise tests),
- Practical assignments and laboratory reports,
- Efficient delivery using seminar presentations,
- Viva voce interviews.

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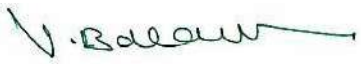

BOS Chairman

SRI VENKATESWARA UNIVERSITY
B.Sc. DEGREE COURSE IN PHYSICS (WITH MATHS)

FIRST YEAR - SECOND SEMESTER
(Under CBCS W.E.F. 2020-21)

COURSE II: WAVE OPTICS
[For Mathematical Combination]

MODEL QUESTION PAPER

Time: 3 hrs Max. Marks: 75

SECTION-A
(Short Answer Type Questions)

Answer any five out of the following ten questions **5x5=25**

1. Explain the conditions for interference of light.
2. In an experiment with Michelson interferometer it is found that 40 tings to merge the centre, the mirror had to be moved through 0.01 mm. calculate the wavelength of the light used.
3. What is diffraction of light and discuss its types.
4. Write a short note on Fresnel's half period zones.
5. Explain law of Malus.
6. A half wave plate is construct for a wavelength of 6000 A^0. For what wavelength does it work as a quarter wave plate.
7. Find the focal lengths of the two component lenses of an achromatic doublet of focal length 25 cm. the dispersive powers of the crown and flint glasses are 0.022 and 0. 044 respectively.
8. Explain the advantages of optical fibres in communication systems.
9. Distinguish between spontaneous and stimulated emission.
10. State some applications of holography.

SECTION–B
(Essay type questions)

Answer All questions with internal choice from each Unit **5x10=50**

11. What is meant by phase change on reflection. Describe an experimental arrangement for observation and measurement of Lloyd's mirror fringes.

    Or

    Describe Newton's rings experiment to determine the wavelength of monochromatic light.

12. Discuss the fraunhoffer diffraction at a single slit and deduce intensity distribution.

    Or

    Explain construction and working of Zone plate. Derive the formula for its focal length.

13. Describe the construction and working of a Nicol's prism. Explain how it can be used as a polarizer and analyser.

    Or

    Describe the construction and working of Laurent's half shade polarimeter. Determine the specific heat of rotation of sugar solution.

14. Explain chromatic aberration. Obtain an expression for chromatic aberration of a thin lens when the object situated at infinity.

    Or

    What is an optical fibre and describe different types of fibres based on refractive index.

15. Define Einstein coefficients and obtain relationship between them.

    Or

    What is holography? Describe the basic principle of holography