3-3-116

B.Sc. PHYSICS

(For Mathematics Combinations)

III SEMESTER – W.E.F.2016-17

OPTICS & LASER PHYSICS

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

UNIT-I (8hrs)

1. Aberrations:

Introduction – 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.

UNIT-II (14hrs)

2. Interference

Principle of superposition – coherence-temporal coherence and spatial coherence-conditions for interference of light. Fresnel's bi-prism-determination of wavelength of light –change of phase on reflection. Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (cosine law) –colors of thin films- Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Michelson interferometer, Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer.

UNIT-III (14hrs)

3. Diffraction

Introduction, distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction –Diffraction due to single slit-Fraunhoffer diffraction due to double slit-Fraunhoffer diffraction pattern with N slits (diffraction grating).Resolving power of grating, Determination of wavelength of light in normal incidence and minimum deviation methods using diffraction grating, Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-difference between interference and diffraction.

UNIT-IV(10 hrs)

4. Polarisation:

Polarized light: methods of polarization polarization by reflection, refraction, double refraction, scattering of light-Brewster's law-Mauls law-Nicol prism polarizer and analyzer-Quarter wave plate, Half wave plate-optical activity, determination of specific rotation by Laurent's half shade polarimeter-Babinet's compensator - idea of elliptical and circular polarization

UNIT-V (14hrs)

5. Lasers and Holography

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-Gabor hologram and its limitations, Applications of holography.

6. Fiber Optics

Introduction- different types of fibers, modes in an optical fiber, fiber material, principles of fiber communication (qualitative treatment only), advantages of fiber optic communication.

REFERENCE BOOKS:

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.
3. Unified Physics Vol.II Optics & Thermodynamics – Jai Prakash Nath&Co.Ltd., Meerut
4. Optics, F..A. Jenkins and H.G. White, Mc Graw-Hill
5. Optics, Ajoy Ghatak, Tata Mc Graw-Hill.
6. Introduction of Lasers – Avadhanulu, S.Chand& Co.
7. Principles of Optics- B.K Mathur, Gopala Printing Press, 1995

Practical Paper III: Optics & Laser Physics

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

Minimum of 6 experiments to be done and recorded

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

Suggested student activities

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

Examples

Seminars :- A topic from any of the Units is given to the student and asked to give a brief seminar presentation.

Group discussion :- A topic from one of the units is given to a group of students and asked to discuss and debate on it.

Assignment :- Few problems may be given to the students from the different units and asked them to solve.

Field trip :- Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.

Study project :- Web based study of different satellites and applications.

Domain skills:

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

***** Documental evidence is to be maintained for the above activities.**

MODEL PAPER

THREE YEAR B.Sc DEGREE EXAMINATION

CHOICE BASED CREDIT SYSTEM

THIRD SEMESTER: PART II: PHYSICS

Paper III : Optics and Laser Physics

(With Mathematics Combination)

Time: 3 Hours Max. Marks: 75

Section-A (Essay type)

Answer All questions **Marks :5X10 = 50**

1.a) Explain Chromatic aberration . Explain the condition for removal of Chromatic aberration using two lenses separated by a distance.

OR

b) What is meant by spherical aberration? Deduce the condition for minimum spherical aberration in a combination of two lenses separated by a distance.

2. a) Describe the experimental arrangement of biprism to find the wavelength of light.

OR

b) Explain the formation of Newton's rings in reflected light. Explain the experimental determination of wave length of monochromatic light using Newton's rings.

3.a) Discuss the Fraunhoffer diffraction pattern due to single slit. Obtain expression for intensity distribution , position of the Maxima and Minima.

OR

b) Explain how do you determine the wavelength of light using a grating in the normal incidence position .

4. a) Describe the construction and working of a Nicol prism.

OR

b) Define specific rotation. Describe how specific rotation of sugar solution is determined experimentally.

5. a) What is the principle of Laser. Explain the construction and working of ruby laser.

OR

b) What is total internal reflection? Describe an optical fiber and explain how a light ray propagates in it. Write its uses.

Section-B (Short answer type)

Answer any three questions **Marks: 3X5 = 15**

6. Explain the defect coma and how it is eliminated.
7. Explain the formation of colours in thin films.
8. Explain the construction and working of a zone plate.
9. What is double refraction explain.
10. What is Holography? Write its applications.

Section-C

Answer any two questions **Marks: 2X5 = 10**

11. An achromatic lens of focal length 20 cm is to be made out of 2 thin crown and flint glass lenses in contact. If the dispersive power of crown and flint glasses are 0.2 and 0.4 respectively. Find the focal lengths of the lenses used.

12. In a Newton's rings experiment the diameter of the 16^{th} ring was found to be 0.590 cm and that of 6^{th} ring was 0.336cm if the wavelength of tight used $5893\,\overset{0}{A}$. Find the radius of the Plano convex lens used.

13. A plane diffraction grating in the second order shows an angle of diffraction 40^0 at the mercury blue line of wavelength $4360\,\overset{0}{A}$. Calculate the number of lines per centimeter of the grating plate.

14. Determine the specific rotation of the given sample of sugar solution, if the plane of polarization is turned through 26^0. The length of tube containing 20% of sugar solution is 20 cm.

15. An optical fiber has a core refractive index of 1.50 and a cladding refractive index of 1.45. Determine the critical angle at the core-cladding interface.