## P.R. Government College (A), Kakinada

**II B.Sc., PHYSICS- SEMESTER-III Paper – III**
w.e.f. 2018 - 19 ADMITTED BATCH

**OPTICS**

**Course Code : PH3202** **No. of credits : 03**

**4 Hours/Week** **Total Hours : 60**

**1) Module – 1 The Matrix methods in paraxial optics: (8)**

Introduction, the matrix method(L), **optical direction cosine -** effect of translation, effect of refraction(T), System matrix - System matrix and lens formula for thick & thin lenses (L) – System marix for the combination of two thin lenses in contact & seperated by a distance (T).

**2) Module – 2 Interference: (10)**

Principle of superposition(L) – coherence – Theory of interference fringes(L) - conditions for Interference of light(L)

**Interference by division of wave front**: Fresnel's biprism – determination of wave length of light(T). Determination of thickness of a transparent material using Biprism (L)– Lloyd's mirror experiment(S).

**3) Module – 3 Interference: (12)**

**Interference by division of amplitude**: Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (Cosine law)(T) – Colours of thin films – Non reflecting films(L) – Determination of diameter of wire-Newton's rings in reflected light with contact between lens and glass plate(T) – Determination of wave length of monochromatic light (S)– Michelson Interferometer (Theory only) – Determination of wavelength of monochromatic light(S).

**4) Module – 4 Diffraction: (12)**

Introduction – Distinction between Fresnel and Fraunhoffer diffraction(L) - Fraunhoffer diffraction- Diffraction due to single slit (L) – Fraunhoffer diffraction due to double slit(S)

Resolving Power of grating – Determination of wave length of light in normal and oblique incidence methods using diffraction grating(L).

**Fresnel diffraction**:-

Fresnel's half period zones(L) – area of the half period zones –zone plate – Comparison of zone plate with convex lens – difference between interference and diffraction(S).

**5) Module – 5 Polarization (12)**

Polarized light : Methods of Polarization(L), Polarization by reflection(T), refraction, Double refraction, selective absorption,– Brewster's law(L) – Malus law – Nicol prism polarizer and analyzer(L) – Quarter wave plate(L), Half wave plate (L)– Optical activity(L), analysis of light by Laurent's half shade polarimeter(S).

**6) Module – 6 Laser (06)**

Lasers: Introduction – Spontaneous emission – Stimulated emission – Population inversion(L) . Laser principle – Einstein coefficients(T) – Types of Lasers – He-Ne laser (L)– Ruby laser (L)– Applications of lasers(S).

**Textbooks**


1. **Optics** by Ajoy Ghatak. *The McGraw-Hill companies.*
2. **Optics** by Subramaniyam and Brijlal. *S. Chand & Co.*
3. **Fundamentals of Physics**. Halliday/Resnick/Walker.*C. Wiley India Edition 2007.*
4. **Optics and Spectroscopy**. R. Murugeshan and Kiruthiga Siva Prasath. *S. Chand & Co.*
5. **Second Year Physics** – *Telugu Academy.*
6. **Modern Physics** by R. Murugeshan and Kiruthiga Siva Prasath (for statistical Mechanics) *S. Chand & Co.*


**Reference Books**


1. **Modern Physics** by G. Aruldhas and P. Rajagopal, *Eastern Economy Education.*
2. **Modern Engineering Physics** by A.S. Vasudeva. *S.Chand & Co. Publications.*
3. **Feyman's Lectures on Physics** Vol. 1,2,3 & 4. *Narosa Publications.*
4. **Fundamentals of Optics** by Jenkins A. Francis and White E. Harvey, *McGraw Hill Inc.*

**II B.Sc. - III SEMESTER END EXAMINATION**
**PHYSICS – PAPER III (Model Paper) Semester III**
w.e.f. 2018 - 19 ADMITTED BATCH

**OPTICS**

**Course Code : PH3202** **No. of credits : 03**

**Note:-** Set the question paper as per the blue print given at the end of this model paper.

Time: 21/2 Hrs. Max. Marks: 60

| Section | Questions to be given | Questions to be answered | Marks |
|---|---|---|---|
| A | 5 | 3 | 3 x 10M = 30M |
| B | 9 | 6 | 6 x 5 M = 30M |
| Total | 14 | 9 | 60M |

## Blue Print

| Module | Essay Questions 10 marks | Short Questions 5 marks | Problems 5 marks | Marks allotted |
|---|---|---|---|---|
| I | -- | 1 | 1 | 10 |
| II | 1 | 1 | -- | 15 |
| III | 1 | 1 | 1 | 20 |
| IV | 1 | 1 | 1 | 20 |
| V | 1 | 1 | 1 | 20 |
| VI | 1 | -- | -- | 10 |
| **Total Marks** | | | | 95 |

Note: At least ONE problem should be answered.

**QUESTION BANK**

**SUBJECT: PHYSICS** **PAPER: III** **SEMESTER: III**

**OPTICS**

**UNIT: 1 – Matrix methods in paraxial optics**

**Short questions – 5 M**

1. Obtain system matrix for thin lens.
2. Obtain translation matrix in paraxial optics
3. Obtain refraction matrix in paraxial optics
4. Find the focal length when two thin lenses in contact.
5. Find the focal length when two thin lenses separated by a distance.

**Problems – 5 M**

6. A lens of thickness 2 cm and refractive index 1.5 placed in air has radii of curvature 8 cm and -8 cm. Find the system matrix and focal length of this thick lens.
7. Two thin converging lenses of powers 5 and 4 diopters are placed coaxially 10 cm apart. Find the focal length of the combination.
8. Obtain the system matrix for a thin lens placed in air and made of glass of refractive index 1.5 and radii of curvature100 cm each. What is the focal length of the lens?
9. The radius of curvature of the surfaces of a double convex lens are R1 = R2 = 50 cm. The refractive index of the material of the lens is 1.5. Find the optical power of the lens.

**UNIT: 2 - Interference (Division of Amplitude)**

**Essay questions-10 M**

10. Derive the expression for fringe width in biprism experiment.
11. Describe an experimental arrangement for the observation and measurement of Lioyd's mirror fringes.

**Short questions – 5 M**

12. Write conditions for interference of light?
13. Give the theory of interference fringes of light.
14. Describe how the thickness of a transparent material can be determined using Biprism.

**UNIT: 3 - Interference (Division of Wave front)**

**Essay questions-10 M**

15. Describe the Newton's ring method for measuring the wave length of monochromatic light. Give the necessary theory.
16. Describe the construction and working of Michelson interferometer?

**Short questions – 5 M**

17. Explain Cosine law.
18. Explain the formation of colours in thin films.
19. What is non-reflecting film? Explain its need.

**Problems - 5 M**

20. A non-reflecting film of refractive index 1.2 is minimising the reflection for a light of wavelength 5000 $A^0$. Find the wavelength of the film
21. In Newton's rings experiment, the diameter of $10^{th}$ dark ring is 0.433 cm. Find the wave length of incident light, if the radius of curvature of the lens is 70 cm
22. In a Newton's ring experiment, the diameter of the $5^{th}$ ring was 0.3 cm and the diameter of $25^{th}$ ring was 0.8 cm. If the radius of curvature of Plano-convex lens is 100 cm. Find the wave length of light used.

## UNIT: 4 - Diffraction

**Essay questions - 10 M**

23. Discuss Fraunhofer diffraction due to a single slit. Explain the distribution of intensity of light in the diffraction pattern.
24. What are Fresnel's half period zones? Show that the resultant intensity is one-fourth that due to the first half period zone acting alone.
25. Explain the construction and working of zone plate? Derive the formula for its focal length.

**Short questions - 5 M**

26. Distinguish between Fresnel's and Fraunhofer diffractions.
27. Distinguish between Interference and Diffraction.
28. Find the expression for resolving power of a grating when the light is incident normally on the grating.

**Problems - 5 M**

29. A parallel beam of sodium light is allowed to be incident normally on a plane grating having 4250 lines per cm and a second order spectral line is observed to be deviated through $30^0$. Calculate the wavelength of spectral line.
30. A zone plate has a focal length of 60 cm for wavelength of 5893 $A^0$. Find the radii of first and hundredth circles of the zone plate.
31. Find the radius of the first zone in a zone plate of focal length 20 cm for a light of wavelength 500 nm.

## UNIT: 5 - Polarisation

**Essay questions - 10 M**

28. Describe the construction and working of Nicols prism. And mention it uses.
29. Describe the construction and working of Laurent's half shade Polarimeter.

**Short questions - 5 M**

30. State and prove Brewster's law.
31. State and explain Malus law.
32. Write a note on Quarter wave plate.
33. Write a note on Half wave plate.
34. Write a note on Babinet's compensator.

**Problems - 5 M**

35. Calculate the specific rotation if the plane of polarisation is turned through $26.4^0$ traversing 20 cm length of 20% sugar solution?
36. A glass slab is to be used as a polariser. Find the angle of polarisation for it. Also find the angle of refraction. Given μ for glass = 1.54
37. Calculate the thickness of (a) a quarter wave plate (b) half wave plate given $\mu_e$=1.533, $\mu_0$=1.544 and $\lambda$=5000A$^o$

**UNIT: 6 – LASERS**

**Essay questions - 10 M**

38. What do you mean by LASER? Describe the construction and working of Ruby LASER
39. Describe the construction and working of He-Ne laser? Give any 3 applications of LASER