D 130253 **(Pages : 2)** **Name.....**

Reg. No.....

FIFTH SEMESTER (CBCSS—U.G.) DEGREE EXAMINATION
NOVEMBER 2025

Physics/Applied Physics

PHY 5B 08/APH 5B 08—OPTICS

(2019 Syllabus)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

(*Answer* **all** *questions in two* **or** *three sentences, each correct answer carries a maximum of 2 marks*)

1. Refractive index of glass is 1.5 and that of water is 1.33. If a biconvex lens of glass is immersed in water, will it act as a converging lens ?Justify your answer.
2. Does intensities of waves obey superposition principle ? Justify your answer.
3. Two monochromatic waves of same intensity I and same wavelength λ interfere at a point.

   If the two waves are completely incoherent, what will be the resultant intensity ?
4. State the condition for constructive interference for a Michelson interferometer and explain the terms therein.
5. How does a Fresnel diffraction differ from a Fraunhoffer diffraction ?
6. For a plane wave front of monochromatic light, what is the difference in areas of nth and $(n-1)^{th}$ Fresnel half period zones ?
7. Discuss optical activity briefly.
8. How does a hologram differ from a photograph ?
9. What role does a reconstruction beam have in holography ?
10. What are the essential parts of an optical fiber ?

Turn over

11. Display the plot of refractive index of a step index fiber as a function of its radius.

12. Explain pulse dispersion in an optical fiber and list the different mechanisms causing it.

(Ceiling : 20)

Section B (Paragraph/Problem Type)

(*Answer* **all** *questions in a paragraph of about half a page to* **one page**, *each correct answer carries a maximum of* 5 *marks*).

13. A biconvex lens of refractive index 1.5 has radii of curvatures of 50 cm. and 100 cm. Find the distance to the object if the image has to be formed at 60 cm. from the lens.

14. Wavelength of the light used in a Young's double slit experiment is 500 nm, distance between the slits is 0.5 cm. and the perpendicular distance any slit to the screen is 1 meter. Find the bandwidth.

15. A lamp emits light of different wavelengths the shortest being 500 nm. What is the next higher wavelength that can be resolved at first order using a grating of width 1 inch with 15000 rulings.

16. Velocity of E-ray along the optic axis of a calcite crystal is 1.81×10^8 ms^{-1} and its velocity perpendicular to the optic axis its 2.02×10^8 ms^{-1}. Find the velocity of E-ray along an axis that is at 45° angle with the optic axis.

17. For light of wavelength 589 nm, the ordinary and extraordinary refractive indices for a quartz crystal are 1.544 and 1.553. Find the thickness of a quarter wave plate made of quartz.

18. Explain qualitatively what a hologram is and how it is made.

19. Derive an expression for numerical aperture of an optical fiber.

(Ceiling : 30)

Part C (Essay Type)

(*Essays - Answer in about* **two pages**, *any* **one** *question. The question carries* 10 *marks*)

20. Obtain the conditions for maximum and minimum of interference pattern on a parallel thin film.

21. Derive the intensity distribution for diffraction due to N identical slits.

(1 × 10 = 10 marks)

D 110236 **(Pages : 2)** **Name.....**

Reg. No.....

FIFTH SEMESTER (CBCSS–UG) DEGREE EXAMINATION, NOVEMBER 2024

Physics/Applied Physics

PHY 5B 08/APH 5B 08—OPTICS

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings

Section A — Short Answer type.

Answer **all** *questions in two or three sentences, each correct answer carries a maximum of 2 marks.*

1. Define a thin lens.
2. Define first principal focus of a lens.
3. Define lateral magnification.
4. Explain interference.
5. Explain coherence.
6. Define Fiber Bragg Gratings.
7. Explain colours of thin film.
8. Write down the equation for resolving power of a grating.
9. Define Huygene's explanation of double refraction.
10. Define polarization.
11. What is hologram ?
12. Give two applications of holography .

(Ceiling 20)

Section B - Paragraph / Problem type

Answer **all** *questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks.*

13. Explain the interference by a plane parallel film when illuminated by a plane wave.
14. Derive cosine law.
15. Write a note on non reflecting films.

Turn over

16. With necessary figure, explain interference by a plane parallel film illuminated by a point source.
17. Derive the equation for width of principal maxima of an N slit Fraunhofer diffraction.
18. Define double refraction. Explain Laurent's half-shade polarimeter.
19. With figure explain Fresnels half period zone.

(Ceiling 30)

Section C - Essay type

Essays - Answer in about two pages, any **one** *question.*
The question carries 10 marks.

20. Briefly derive and the intensity distribution of interference pattern
21. Explain with figure, single slit diffraction pattern. Explain the positions of maxima and minima

(1 × 10 = 10 marks)

D 30586 **(Pages : 2)** **Name.....**

Reg. No.....

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION, NOVEMBER 2022

Physics/Applied Physics

PHY 5B 08/APH 5B 08—OPTICS

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 *marks.*

1. State the laws of reflection.
2. Explain the law of cosine square for the intensity distribution in the interference of two waves of the same amplitude.
3. List any four conditions for obtaining a distinct well-defined interference pattern.
4. Explain the origin for the colours of thin films.
5. Give an expression for the intensity distribution in Fraunhofer diffraction due to N slits and explain the terms involved.
6. Give the grating equation and explain the terms involved.
7. What do you mean by the resolving power of a grating ? Give an expression for the same explaining the terms involved.
8. Give a figure illustrating the Huygens wave surfaces produced by a point source embedded in a negative doubly refracting crystal.
9. What do you mean by the optical activity of certain substances ? Give two examples of optically active substances.
10. Mention the applications of holography.
11. What do you mean by a graded index fiber ? Draw its refractive index profile.
12. What do you mean by pulse dispersion in optical fiber ?

(Ceiling - 20 marks)

Turn over

Section B (Paragraph/Problem Type)

Answer **all** *questions in a paragraph of about* **half a page to one page.**
Each correct answer carries a maximum of 5 *marks.*

13. What do you mean by a thin lens? Write down the thin lens formula and explain the terms involved.

14. Interference fringes are observed with a biprism of refracting angle 1° and refractive index 1.5 on a screen 0.8 m from it. If the distance between the source and the biprism is 0.2 m, estimate the fringe width when a light of wavelength 690 nm is used.

15. Obtain the radii of the first two dark rings of the Fraunhofer diffraction pattern produced by a circular aperture of radius 0.02 cm at the focal plane of a convex lens of focal length 20 cm. Given, the wavelength λ = 600 nm.

16. Consider a diffraction grating having 15000 lines per inch. Obtain the angular separation of the D_1 and D_2 lines of sodium in the second order spectra.

17. Determine the radius of the first zone in a zone plate of focal length 20 cm for light of wavelength 500 nm.

18. Using a suitable figure, explain the reconstruction of image in holography.

19. A step index fiber has a core of refractive index 1.55 and cladding of refractive index 1.5. Determine the numerical aperture of the fiber. Assume that light enters the fiber from air.

(Ceiling - 30 marks)

Section C (Essay Type)

Answer in about **two** *pages, any* **one** *question.*
Correct answer carries 10 *marks.*

20. Using a suitable figure, discuss the principle, construction and working of a Michelson interferometer. Discuss the condition for obtaining brightness in circular rings.

21. Using suitable figures, explain the optical activity of substances. Discuss the Fresnel's explanation of optical rotation.

(1 × 10 = 10 marks)

D 10683 **(Pages : 2)** **Name.....**

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5B 08/APH 5B 08—OPTICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Explain Fermat's principle of stationary time.
2. Discuss the principle of superposition of waves.
3. Explain the terms coherence time and coherence length.
4. Discuss the Rayleigh criterion of resolution.
5. Write down the conditions for maxima and minima for the Newton's rings in the reflected system.
6. Distinguish between Fresnel and Fraunhofer kinds of diffractions.
7. Show a figure illustrating the Huygens wave surfaces produced by a point source embedded in a positive doubly refracting crystal.
8. How is an elliptically polarized light produced ?
9. Distinguish between dextrorotatory and laevorotatory substances.
10. Discuss the basic steps in holography.
11. Distinguish between step index and graded index optical fibers.
12. Discuss the basic parts of a fiber optic sensor.

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Obtain the Newtonian lens formula.

Turn over

14. Determine the separation between the coherent sources formed by a biprism whose inclined faces make angles of 2° with its base and the slit is 0.1 m away from the biprism. Given, the refractive index of the material of the prism is 1.5.

15. Calculate the radius of the first dark ring of the Fraunhofer diffraction pattern produced by a circular aperture of radius 0.02 cm at the focal plane of a convex lens of focal length 20 cm. Assume that the wavelength of light used is 600 nm.

16. Consider a Fresnel zone plate with radii $r_n = 0.1 \sqrt{n}$ cm. For $\lambda = 5 \times 10^{-5}$ cm, calculate the positions of the foci.

17. Determine the thickness of a half-wave plate of quartz for a wavelength 500 nm. Given, the refractive indices of the extra-ordinary and ordinary rays are $\mu_e = 1.553$ and $\mu_o = 1.544$, respectively.

18. Discuss the applications of holography.

19. Calculate the numerical aperture and hence the acceptance angle of an optical fiber having core and cladding refractive indices 1.45 and 1.40 respectively.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Discuss the interference by a plane parallel film when illuminated by a plane wave and obtain the conditions for maxima and minima.

21. Obtain an expression for the intensity distribution for the Fraunhofer diffraction due to a single slit.

(1 × 11 = 11 marks)