

4/PHY-250 Syllabus-2023

2026

(May-June)

FYUP : 4th Semester Examination

PHYSICS

(Optics II and Acoustics)

(PHY-250)

Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions.

Answer any ten questions.

1. (a) Show that $t = \frac{f_1 + f_2}{2}$ for minimum chromatic aberration for two lenses of focal lengths f_1 and f_2 when they are separated by a distance t and they are of the same material. 5½
- (b) Name any four common defects in the images produced by a single lens. 2
2. (a) Explain spherical aberration in a convex lens with a neat diagram. 4½

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(Turn Over)

- (b) Briefly describe any two methods to minimize spherical aberration (avoid mathematical derivations). Briefly describe any two methods to minimize spherical aberration (avoid mathematical derivations). 3
3. (a) Describe the construction of Ramsden eyepiece. Show that the equivalent focal length of the eyepiece is $\frac{3}{4}f$, where f is the focal length of the eye lens. Describe the construction of Ramsden eyepiece. Show that the equivalent focal length of the eyepiece is $\frac{3}{4}f$, where f is the focal length of the eye lens. 3+2½=5½
- (b) State any two points of differences between the Huygens eyepiece and Ramsden eyepiece. State any two points of differences between the Huygens eyepiece and Ramsden eyepiece. 2
4. (a) Determine the wavelength of sodium light by using Newton's rings. Determine the wavelength of sodium light by using Newton's rings. 5
- (b) In the above experiment, the diameter of the 15th ring is 0.590 cm and that of the 5th ring is 0.336 cm. If the radius of the plano-convex lens is 100 cm, calculate the wavelength of light used. In the above experiment, the diameter of the 15th ring is 0.590 cm and that of the 5th ring is 0.336 cm. If the radius of the plano-convex lens is 100 cm, calculate the wavelength of light used. 2½
5. (a) Describe the construction and working of a Fabry-Perot interferometer with a neat diagram. Describe the construction and working of a Fabry-Perot interferometer with a neat diagram. 3+2½+1=6½
- (b) What are Haidinger fringes? What are Haidinger fringes? 1
6. (a) Show that the focal length of a Zone plate is $f_n = r_n^2 / n\lambda$, where the symbols have their usual significances. Show that the focal length of a Zone plate is $f_n = r_n^2 / n\lambda$, where the symbols have their usual significances. 5

- (b) Find the radius of the first zone in a zone plate of focal length 20 cm for light of wavelength 5000 Å. $2\frac{1}{2}$

7. Explain the construction and the mode of action of a diffraction grating. Derive an expression for its resolving power. $2\frac{1}{2}+2+3=7\frac{1}{2}$

8. Describe and explain Fraunhofer diffraction pattern obtained with a narrow slit illuminated by a parallel beam of monochromatic light. $7\frac{1}{2}$

9. (a) What is a quarter-wave plate? Show that

$$t = \frac{\lambda}{4(\mu_e - \mu_o)}$$

where the symbols have their usual significances. $1+2\frac{1}{2}=3\frac{1}{2}$

- (b) What is a half-wave plate? Calculate the thickness of a half-wave plate given that $\mu_e = 1.553$, $\mu_o = 1.544$ and the wavelength of light used is 5000 Å. $1+3=4$

10. (a) What are ultrasonic waves? Describe one method used to detect them. Mention any two of its uses. $1+2+2=5$

- (b) If the amplitude of a sound wave is doubled, find the increase in the loudness. $2\frac{1}{2}$

11. (a) What are the requirements of a good auditorium? 4
(b) What is reverberation time? $1\frac{1}{2}$
(c) Explain decibel in sound intensity. 2
12. (a) A periodic function is given by
$$f(t) = 0 \text{ for } 0 < t \leq \frac{T}{2}$$
$$= 1 \text{ for } \frac{T}{2} < t \leq T$$
Expand $f(t)$ in a Fourier series. $4\frac{1}{2}$
(b) What is noise? Give a brief qualitative description of how noise can be reduced. $1+2=3$
13. (a) Explain double refraction through uniaxial crystal. Discuss the electromagnetic theory of double refraction. $2+3=5$
(b) Give the theoretical explanation of dispersion of light. $2\frac{1}{2}$
14. (a) What is polarization of light? Explain how polarized light is produced by reflection. $1\frac{1}{2}+2=3\frac{1}{2}$
(b) Explain briefly one method each for the detection of plane polarized light and circularly polarized light. $1\frac{1}{2}+2\frac{1}{2}=4$

15. (a) State and explain Brewster's law. Using this law, show that when light is incident on a transparent medium at a polarising angle, the reflected and refracted rays are at right angle.

$$2 + 3\frac{1}{2} = 5\frac{1}{2}$$

(b) Calculate the polarizing angle for a glass medium whose refractive index is 1.52.

2

16. (a) Deduce Sabine formula for the reverberation time of a live room.

5

(b) A room has a volume of 800 m^3 and a total surface area of 500 cm^2 with an average absorption coefficient of 0.2.

Find the reverberation time.

$2\frac{1}{2}$
