

SHIVAJI UNIVERSITY, KOLHAPUR

Question bank for March 2022 (summer) Examination

B.Sc. Part II Semester IV

PHYSICS PAPER VIII

DSC D2 – WAVES AND OPTICS II

Subject Code: 78908

Q.I Select the correct alternative from the following (10 Marks)

1. Points correspond to unit angular magnification.

- a) cardinal
- b) principal
- c) nodal
- d) focal

2. There are total..... pairs of cardinal points in the lens system.

- a) Two
- b) Three
- c) Four
- d) Six

3. Cardinal planes with unit lateral magnification are.....

- a) Principal planes
- b) Focal planes
- c) Nodal planes
- d) All the above

4. Newton's formula is given by.....

- a) $x_1 f_1 = x_2 f_2$
- b) $x_1 x_2 = f_1 f_2$
- c) $x_1 f_2 = x_2 f_1$
- d) $x_1 / x_2 = f_1 / f_2$

5. For a lens system in air, the linear magnification is 2. Therefore, the angular magnification is.....

- a) 2
- b) $\frac{1}{2}$
- c) $\frac{1}{4}$

- d) 4
6. For a lens system in air, the linear magnification is 2. Therefore, the axial magnification is.....
- a) 2
 - b) $\frac{1}{2}$
 - c) $\frac{1}{4}$
 - d) 4
7. Any two close objects can be resolved by increasing magnification. This statement is
- a) True
 - b) False
 - c) Partially true
 - d) None of above
8. In telescope and microscope, the image formation is due to.....
- a) Refraction
 - b) Diffraction
 - c) Refraction and diffraction
 - d) Reflection
9. Resolving power of a plane diffraction grating with total number of lines N in order number n is.....
- a) n^2N
 - b) nN
 - c) $1/nN$
 - d) n/N
10. For just resolution of two nearby wavelengths, the central maximum of one should fall at.....
- a) Central maximum of the other
 - b) First minimum of the other
 - c) First secondary maximum of other
 - d) All of the above
11. The resolving power of prism is proportional to.....
- a) Base length of the prism
 - b) Change of refractive index of the material of the prism with wavelength
 - c) Both a and b
 - d) None of these
12. Natural light from any source is.....
- a) Plane polarized

- b) Elliptically polarized
- c) Circularly polarized
- d) Unpolarized

13. The ordinary and extra-ordinary rays produced in a doubly refracting material are.....

- a) Plane polarized in mutually perpendicular direction
- b) Plane polarized parallel to each other.
- c) Unpolarized
- d) Generally elliptically polarized

14. Nicol prism is made up of.....

- a) Natural calcite crystal
- b) Properly cut natural calcite crystal
- c) Natural quartz crystal
- d) Properly cut quartz crystal

15. In Nicol prism, ordinary ray is removed from the emergent beam by.....

- a) Reflection
- b) Refraction
- c) Total internal reflection
- d) Polarization

16. Nicol prism is used as.....

- a) A polarizer
- b) An analyzer
- c) Both polarizer and analyzer
- d) None of these

17. Elliptically polarized light is produced by using.....

- a) A polarizer
- b) Quarter wave plate
- c) A polarizer and a quarter wave plate
- d) A half wave plate and polarizer

18. The plane of polarization of plane polarized light passing through materials gets rotated by certain angle (θ).

- a) Transparent
- b) Crystalline
- c) Optically active
- d) Above all

19. Polarimeter is an instrument used to measure.....
- a) Optical activity
 - b) Angle through which the plane of polarization rotates
 - c) The nature of material viz. right handed or left handed
 - d) All the above
20. Two sources are said to be coherent if they have.....
- a) Same wavelength
 - b) Constant path difference
 - c) Constant phase difference
 - d) All the above
21. For better contrast of the interference fringes, the amplitudes of two waves must be....
- a) Equal
 - b) Unequal
 - c) Zero
 - d) Maximum
22. To obtain two coherent sources,
- a) They must have same wavelength
 - b) They must have same path difference
 - c) They must have same phase difference
 - d) They must be derived from the same original source.
23. In Lloyd's single mirror experiment, the central fringe is observed to be.....
- a) Bright
 - b) Dark
 - c) Faint
 - d) Diffuse
24. If a wave getting reflected from a denser medium, the additional phase difference introduced is.....
- a) 0
 - b) π
 - c) $\pi/2$
 - d) 2π
25. The fringes obtained in wedge shaped thin film are of....
- a) Increasing thickness
 - b) Decreasing thickness
 - c) Equal thickness

d) Above all

26. The centre of Newton's rings due to reflected light is.....

- a) Dark
- b) Bright
- c) White
- d) Coloured

27. Newton's rings are.....

- a) Localized fringes
- b) Non localized fringes
- c) Fringes formed at infinity
- d) Fringes formed at small distance from the film.

28. In Newton's rings experiment, the plano-convex lens is kept with its..... face on the horizontal glass surface.

- a) Any one
- b) Plane
- c) Convex
- d) Concave

29. A path difference of $\lambda/2$ is equivalent to a phase difference of.....

- a) $\pi/4$
- b) $\pi/2$
- c) π
- d) 2π

30. In parallel faced thin film the path difference between successive bands is.....

- a) $2\mu t \sin(r)$
- b) $2\mu t \cos(r)$
- c) $\mu t \sin(r)$
- d) $\mu t \cos(r)$

31. In Fraunhofer diffraction with respect to the obstacle.....

- a) Both source and screen are at finite distance
- b) Both source and screen are effectively at infinity
- c) Source is at finite distance and screen is at infinity
- d) Screen is at finite distance and source is at infinity

32. In Fresnel diffraction, with respect to the obstacle.....

- a) Both source and screen are at finite distance

- b) Both source and screen are at infinite distance
- c) Source and screen are very close to the obstacle
- d) Source and screen are at very large distance from obstacle

33. In Fraunhofer diffraction, the incident and diffracted wavefronts are.....

- a) Plane
- b) Spherical
- c) Cylindrical
- d) Circular

34. The bending of light around the edge of an obstacle is called.....

- a) Interference
- b) Refraction
- c) Diffraction
- d) Reflection

35. In plane transmission grating with white light as source.....

- a) The central fringe is red
- b) The central fringe is yellow
- c) The central fringe is violet
- d) The central fringe is white

36. In plane transmission grating with white light as source, the first coloured fringe nearer the central fringe in each order of spectrum is.....

- a) Red
- b) Yellow
- c) Violet
- d) Blue

37. In grating, to obtain sharp spectral lines.....

- a) Total number of lines (N) on grating should be large
- b) The width (N.d) of the grating should be large
- c) Angle of diffraction should be small
- d) All the above

38. In zone plate area of each zone with respect to a point at a perpendicular distance of b is.....

- a) $2\pi b\lambda$
- b) $\pi b\lambda$
- c) $\pi b\lambda/2$
- d) $\pi/b\lambda$

39. Corresponding to a wavelength (λ), the focal length (f) of zone plate is a
- a) $f \propto \lambda$
 - b) $f \propto 1/\lambda$
 - c) $f = \lambda$
 - d) $f = 5\lambda$
40. In straight edge diffraction pattern, fringes are
- a) Formed in illuminated region
 - b) Formed in geometrical shadow region
 - c) Equispaced
 - d) Of equal brightness
41. the limit of resolution..... is the resolving power of the optical instrument.
- a) Smaller, higher
 - b) Higher, smaller
 - c) Higher, zero
 - d) Infinity, smaller
42. Resolving power of telescope is for larger aperture.
- a) Larger
 - b) Smaller
 - c) Zero
 - d) None of these
43. Magnifying power of optical instruments increases with in the aperture width of the objective.
- a) Increase
 - b) Decrease
 - c) Either increase or decrease
 - d) None of above
44. Unpolarized light from any source can be polarized by.....
- a) Reflection
 - b) Refraction
 - c) Selective absorption
 - d) Above all
45. rays obeys Snell's laws.
- a) Ordinary
 - b) Extraordinary

- c) Both ordinary and extraordinary
- d) None of above

46. rays have same velocity in all directions.

- a) Ordinary
- b) Extraordinary
- c) Both ordinary and extraordinary
- d) None of above

47. Optic axis is a direction along which both ordinary and extraordinary rays have velocity.

- a) Different
- b) Same
- c) Zero
- d) Above all

48. Calcite crystal is crystal

- a) Negative
- b) Positive
- c) Either negative or positive
- d) Neither negative nor positive

49. Quartz crystal is crystal

- a) Negative
- b) Positive
- c) Either negative or positive
- d) Neither negative nor positive

50. Positive crystal is one for which....

- a) $\mu_o > \mu_E$
- b) $\mu_o < \mu_E$
- c) $\mu_o = \mu_E$
- d) Above all

51. Negative crystal is one for which....

- a) $\mu_o > \mu_E$
- b) $\mu_o < \mu_E$
- c) $\mu_o = \mu_E$
- d) Above all

Q. II Long answer questions (Attempt any two of the following) (20 Marks)

1. With the help of cardinal points and cardinal planes, explain the graphical method of constructing the image.
2. What do you mean by cardinal points? Obtain the relation between first and second focal lengths of a lens system.
3. What is resolving power of optical instruments? Derive an expression for resolving power of grating.
4. What is resolving power of optical instruments? Derive an expression for resolving power of prism.
5. What is Polarimeter? Explain how it is used to measure the optical activity (specific rotation) of optically active materials.
6. What is polarization? Explain the method of detection of elliptically and circularly polarized light.
7. What do you mean by polarization? Explain how circularly and elliptically polarized lights are produced.
8. What is specific rotation? Explain how Polarimeter is used to measure it.
9. What is interference? Obtain the conditions for interference bands (bright and dark) due to light reflected from wedge shaped film.
10. How Newton's rings are formed? Obtain the expression for the radius of n^{th} dark ring.
11. Describe Newton's rings experiment for the determination of wavelength (λ) of the light used.
12. What is interference? Discuss Newton's rings experiment to measure the refractive index of the given liquid.
13. Discuss elementary theory of plane diffraction grating and thereby explain how it produces a spectrum of light incident on it.
14. Define diffraction. Discuss how a plane grating is used to determine the wavelength of light.
15. What is Fresnel diffraction? Explain Fresnel's theory of half period zones.

Q.III Attempt any four of the following (20 Marks)

1. Derive Newton's formula for a lens system.
2. Define linear, axial and angular magnification of a lens system and hence obtain a relationship between them.

3. Explain Rayleigh's criterion for limit of resolution.
4. Compare magnification and resolution.
5. What do you mean by just resolved? Explain modified Rayleigh's criterion.
6. Explain what you mean by double refraction.
7. Explain the construction and working of Nicol prism.
8. Distinguish between positive and negative crystals.
9. What do you mean by positive and negative crystals?
10. Explain the characteristic properties of calcite crystal.
11. What is optical rotation? Explain the laws of rotation of plane of polarization.
12. What is specific rotation? Explain how to calculate it.
13. State and explain the principle of superposition of waves.
14. What is interference? Discuss what you mean by coherence.
15. State the conditions to obtain steady interference bands.
16. What do you mean by constructive and destructive interference?
17. Explain Lloyd's single mirror experiment to measure the wavelength of monochromatic source used.
18. What is diffraction? Explain Fraunhofer diffraction.
19. What is zone plate? How it is constructed?
20. Explain the action of zone plate.
21. Compare zone plate and convex lens.
22. What do you mean by cardinal points? Explain in brief.
23. Write a note on resolving power of optical instruments.
24. What is magnification? Compare it with resolution.
25. What do you mean by magnification? Define the terms lateral, axial and angular magnification.
26. Explain with reason for modified Rayleigh's criterion.
27. Explain polarization by double refraction.
28. Explain in brief positive and negative crystals.

29. Explain the laws of rotation of plane of polarization.

30. Write a note on diffraction grating.
