

Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, March 2022

First Degree Programme under CBCSS

Physics

Complementary Course for chemistry

PY 1331.2 : OPTICS, MAGNETISM AND ELECTRICITY

(2019 & 2020 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **1** mark.

1. Define constructive interference.
2. Write down the relation between the amplitude of reflection coefficient (r) and reflectivity (R).
3. What is the phase difference between the two successive Fresnel's half period zones?
4. What is meant by plane transmission grating?
5. What is the phenomenon behind the colour shows a compact disc in a white light?
6. What is meant by polarization of light?
7. What do you meant by optical axis?
8. What is an optical fibre?

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9. Define the term magnetic susceptibility.
10. What are the advantages of ac over dc?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. **Each** question carries **2** marks.

11. Explain the phenomenon of interference.
12. What are the necessary conditions for producing sustained interference?
13. Why a soap bubble in bright sunlight is beautiful colored?
14. Obtain an expression for bandwidth of interference fringes.
15. What are the assumptions made by Fresnel to explain the diffraction pattern?
16. What are the major difference between interference bands and diffraction bands?
17. Draw the intensity distribution pattern of double slit diffraction pattern.
18. What is Fraunhofer diffraction?
19. Distinguish between grating and prism spectra.
20. Explain the double refraction in calcite crystal.
21. How a quarter wave plate is constructed?
22. State and explain Brewster's law.
23. What do you meant by negative and positive crystals?
24. What is the basic principle of fibre optic communication?
25. Distinguish between step index and graded index fibre.
26. Explain the difference between ferromagnetism and antiferromagnetism.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. A thin film of plastic of refractive index 1.45 for light of wavelength 589nm is inserted normally in the path of one of the interfering beams. The central bright band shifts through 5 fringes. Find the thickness of the film.
28. A parallel beam of sodium light ($\lambda = 589 \times 10^{-9} \text{ m}$) is incident on a thin glass plate ($n=1.5$) such that the angle of refraction into the plate is 60° . Calculate the smallest thickness of the plate which will make it appear dark by reflection.
29. In Young's experiment, the interference pattern is found to have an intensity ratio between the bright and dark fringes as 9. What is the ratio of intensities and the amplitudes of the two interfering waves?
30. A plane wave front of light of wavelength $5 \times 10^{-7} \text{ m}$ falls on an aperture and the diffraction pattern is observed in an eyepiece at a distance of 1 meter from the aperture. Find the radius of the 100th half period element and the area of the half period zones.
31. A straight edge is illuminated by monochromatic light from a narrow slit parallel to the edge and at a distance of 0.2m from it. The distances of the first and second dark bands from the edge of the geometric shadow on a screen at a distance of 0.6m from the straight edge are $1.7 \times 10^{-3} \text{ m}$ and $2.4 \times 10^{-3} \text{ m}$. Calculate the wavelength of light.
32. Find the value of wavelength (λ) when the angle of minimum deviation is 30° for the second order and the number of lines per cm is 5000.
33. Two polarizing sheets have their polarizing directions parallel so that the intensity of the transmitted light is a maximum. Through what angle must either of the sheets be turned if the intensity is drop one half?
34. Calculate the thickness of a quarter wave plate for light of wavelength $5.9 \times 10^{-7} \text{ m}$. Principal refractive indices are $n_o = 1.544$ and $n_e = 1.553$.
35. Calculate the thickness of ice required to act like a half wave plate for a wavelength of 590nm, $n_e = 1.313$ and $n_o = 1.309$.

36. The core and cladding of a silica optical fiber have refractive indices of $n_1=1.5$ and $n_2=1.4$ respectively. Calculate the critical angle of reflection for the core – cladding boundary.
37. An a.c voltage of peak value 220V and frequency 50Hz is applied to a series RC circuit in which $800 \mu F$, and $R=5\Omega$. Find the impedance of the circuit.
38. An LCR circuit with $L=4.0H$, $C=100\mu F$, $R=40\Omega$, is connected to a variable frequency 220V source. Calculate
- (a) Resonance frequency
 - (b) Impedance at resonance and
 - (c) Amplitude of current at resonance.

(6 × 4 = 24 Marks)

SECTION - D

Answer any **two** questions. **Each** question carries **15** marks.

39. Explain the formation of Newton's rings. How can these be used to determine the wavelength of monochromatic light?
40. Discuss in detail Fraunhofer diffraction due to a single slit.
41. Explain the production and analysis of plane and elliptically polarized light.
42. Describe the principle, construction and working of a ruby laser.
43. On the basis of modern electron theory, briefly explain diamagnetism and paramagnetism.
44. With circuit diagram, explain briefly AC voltage applied to an LCR circuit? Describe the resonance condition.

(2 × 15 = 30 Marks)