K22U 2810

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree (CBCSS – Supplementary) Examination, November 2022
(2016 – 18 Admissions)
COMPLEMENTARY COURSE IN PHYSICS
3C03 PHY : Optics and Photonics

Max. Marks : 32

Time : 3 Hours

Instruction : *Write answers in* ***English only***.

SECTION – A

Very short answer type. **Each** carries **1** mark. Answer **all 5** questions.

1. Two waves of same wavelength λ will interfere constructively at a point when their path difference is
2. SI unit for Einstein coefficient B is
3. In a diffraction pattern due to a straight edge, the ratio of intensity at the first maximum to the intensity at the geometric shadow is
4. In a double refraction, the phase separation between O-ray and the E-ray needed to get a plane polarized light is
5. A fibre optic cable with a cladding of refractive index n_2 and a core of refractive index n_1 has a critical angle ϕ_c =

SECTION – B

Short answer type. **Each** carries **2** marks. Answer **any 4** questions.

6. State superposition principle. Does intensities of waves obey superposition principle ?
7. Explain what is double refraction of light.
8. Explain Malu's law.
9. How can we arrange a plane transmission grating to obtain a Fraunhoffer diffraction ?
10. How population inversion is achieved in He-Ne laser ?
11. Explain critical angle for a fibre optic cable.

P.T.O.

SECTION – C

Short essay/problem type. **Each** carries **3** marks. Answer **any 3** questions.

12. Light of wavelength 576 nm is incident on an air wedge to form interference pattern. If the fringe width is 0.288 mm and the length of the wedge 4 cm, find the maximum thickness of wedge.

13. A beam of monochromatic light incident on a uniform thin film of refractive index 1.5 at an angle of incident 30° from above. The smallest value of thickness for which the top surface of the film appears bright is $t = 3 \times 10^{-7}$ meters. Find the wavelength λ of the light.

14. An optical fiber has a cladding of refractive index 1.45 and a critical angle of 70°. Find the refractive index of the core and the angle of acceptance.

15. A certain atom displays stimulated emission of light of wavelength 570 nm between levels E_2 and E_1. At equilibrium, find the temperature at which the number of atoms in E_2 be exactly half of that in E_1. Given : $k_B = 1.38 \times 10^{-23} JK^{-1}$, $h = 6.63 \times 10^{-34} Js$.

16. For a plane wavefront, show that all Fresnel zones have equal area.

SECTION – D

Long essay type. **Each** carries **5** marks. Answer **any 2** questions.

17. Describe double refraction and explain how elliptically, circularly and linearly polarized light can be produced.

18. Obtain the necessary conditions for a diffraction pattern on a plane transmission grating. Describe how to determine wavelength of an unknown line in a diffraction spectrum, if wavelength of green line λ_{green} is given.

19. Obtain the condition for interference maxima and minima in a Newton's rings arrangement. Explain how we can determine the wavelength of a monochromatic light using this arrangement.

20. Explain Raman effect and provide the quantum mechanical explanation for it.