QP CODE: 22100532

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Reg No : ....

Name : ....

B.Sc DEGREE (CBCS)REGULAR / REAPPEARANCE EXAMINATIONS, APRIL 2022

Third Semester

Core Course - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

A7E4A114

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Can interference occur with sound waves? Explain.
2. In a double slit experiment, what will happen to the interference pattern if the slit seperation is increased?
3. Write the condition for obtaining dark fringes in interference pattern due to transmitted light.
4. What will happen in Newton's rings experiment when air in the interface is replaced with a transparent liquid?
5. State two differences between interference and diffraction.
6. The fifth secondary maximum is not obtained in the diffraction pattern of a double slit. What should have been the ratio of the slit width to slit seperation?
7. Brewster’s law is not applicable for metallic surfaces. Why?
8. Write any two methods for producing plane polarized light.
9. Can we obtain light amplification in the absence of stimulated emission? Explain.
10. What are requirements for population inversion and laser action?
11. Draw the energy level diagram of a three level laser system.
12. What are the basic parts of an optical fiber?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A parallel beam of light of wavelength 589nm is incident on a glass plate having refractive index μ=1.5 such that the angle of refraction in the plate is 60^0. Calculate the smallest thickness of glass plate which will appear dark by reflected light.

14. A wedge shaped air film, having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between the consecutive bright fringes is 0.12×10^{-2} m. Calculate the wavelength of light used.

15. A shift of 100 circular fringes is observed, when the movable mirror of Michelson's interferometer is shifted by 0.0295mm.Calculate the wavelength of light.

16. If a zone plate has to have a principle focal length of 50cm corresponding to wavelength 6×10^{-5}cm, obtain an expression for the radii of different zones. What would be its principal focal length for wavelength= 5×10^{-5} cm?

17. What will be the Brewster angle for a glass slab of refractive index 1.5 immersed in water of refractive index 1.33.

18. a) Is it possible to convert a half wave plate to a quarter wave plate? Explain.
    b) A half waveplate constructed for a wavelength 380 nm . For what wave length does it work as a quarter wave plate?

19. What is the population ratio between two energy levels in thermal equilibrium? A He-Ne laser has an emission wavelength of 639 nm at 300 K. Find the ratio of populations of the two states in this laser.

20. The total number of lasing particles (ions, electrons, holes etc.) in a laser are $2 \cdot 8 \times 10^{19}$. If the Laser emits radiation of wavelength 700nm , then calculate the energy of one emitted photon and total energy available per pulse. Assume the efficiency of Laser as 100%.

21. A step index fiber has a core diameter 29mm, refractive index 1.52 and fractional refractive index of 0.0007. It is operated with a wavelength of 1.3 mm. Find the normalized frequency or V number of the fiber and the number of modes the fiber will support.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. State the principle of superposition of waves. Define interference and derive the conditions for I_{max} and I_{min}. What do you mean by 'visibility of fringes'?

23. With the help of a neat diagram explain the Fresnel diffraction at a straight edge. Show that the separation between successive maxima goes on increasing along the region of the geometric shadow . Also obtain the expression from wavelength of incident light.

24. Obtain the expression for intensity distribution of a monochromatic light in a Fraunhofer diffraction at a single slit. Identify the maxima and minima of the distribution.

25. A step index fiber with core diameter of 30 and μm n_1 =1·530 and n_2 =1·515 show absorption of 0.0002% of incident power at each reflection on the core-clad boundary. Find the attenuation in dB/km for a ray suffering 10^6 reflections in a fiber length of 1km. Assume that there are no other losses.

(2×10=20)