



Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, April 2018
First Degree Programme under CBCSS
PHYSICS
Core Course XI
PY 1643 – Classical and Modern Optics
(2013 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. The center of Newton's rings pattern in reflected system is dark. Why ?
2. Explain Rayleigh's criterion for resolution.
3. Define optic axis of a doubly refracting crystal.
4. Explain briefly the phenomenon anomalous dispersion.
5. Write down Hartmann's dispersion formula.
6. Which property of light is used in fiber optical communication ?
7. What are the important properties of hologram ?
8. Distinguish between photography and holography.
9. Gas lasers preferred than solid lasers. Why ?
10. What do you understand by a metastable state ? (10×1=10 Marks)

SECTION – B

Answer **any eight** questions **not** exceeding **a** paragraph. **Each** carries **two** marks.

11. Explain with formula the terms coherence length and coherence time.

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12. What is Fraunhofer diffraction ?
13. What are half period zones ? Why are they called so ?
14. Distinguish between Fresnel and Fraunhofer diffraction.
15. Show that the reflected and refracted rays are perpendicular to each other, when light is incident at polarizing angle.
16. What are negative crystal and positive crystal ? Give examples.
17. Explain the elementary theories of dispersion.
18. Explain pulse dispersion in optical fibers.
19. Distinguish between single mode and multimode fibers.
20. What are advantages of hologram over photograph ?
21. What is pumping ? What are the different types of pumping used in the production of lasers ?
22. Write down the important characteristics of laser. (8×2=16 Marks)

SECTION – C

Answer **any six** questions. **Each** carries **four** marks.

23. A monochromatic light of wavelength 600 nm is incident normally on a soap film of refractive index 1.42. What is the least thickness of the film that will appear bright and dark by reflection ?
24. When a liquid is introduced between the lens and the plate in a Newton's ring arrangement, the diameter of the n^{th} dark ring changes from 3 mm to 2.5 mm. Calculate the refractive index of the liquid.
25. The diameter of the central zone of a zone plate is 0.23 cm. If a point source of light 5890 Å is placed at a distance of 6 m from it, calculate the position of first image.
26. A plane transmission grating of length 6 cm has 14000 lines per cm. If the wavelength used is 5×10^{-7} m, find the resolving power of the grating in the first order and the smallest wavelength difference that can be resolved.



27. When an unpolarised light falls on two crossed Polaroid's no light pass through it. What portion of the original intensity is transmitted if a third Polaroid, with axis at 45° with each of the other two is placed between them ?
28. Calculate the thickness of a half wave plate for sodium light of wavelength 589.3 nm. (Given $\mu_o = 1.54$ and ratio of velocities of ordinary and extra ordinary components is 1.007)
29. The numerical aperture of an optical fiber is 0.2441. If the refractive index of the core is 1.5, calculate the refractive index of the cladding and acceptance angle.
30. Find the number of photons emitted per second from a ruby laser of 1mW power. (Given, wavelength of light = 694 nm)
31. A step index fiber has a normalized frequency of 26.6 at 1300 nm wavelength. The core radius is 25 μm , find the numerical aperture. How many modes propagate at this wavelength ? **(6×4=24 Marks)**

SECTION – D

Answer **any two** questions. **Each** carries **fifteen** marks.

32. Describe with diagram, Michelson's interferometer and explain how it is used to find the wavelength of a monochromatic light.
33. Discuss the working of a zone plate. Derive a formula for its focal length. Compare it with a converging lens.
34. Explain, with theory, the production of circularly, elliptically and plane polarized light.
35. What are optical fibers ? Explain with relevant theory how light wave is propagated through an optical fiber ? Discuss some advantages of optical fiber communication system. **(2×15=30 Marks)**
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