U423

Name:..... Reg. No.....

BSc DEGREE END SEMESTER EXAMINATION MARCH 2016

SEMESTER **4: PHYSICS (COMPLEMENTARY FOR CHEMISTRY)**

COURSE: **U4CPPHY8 - PHYSICAL OPTICS, LASER PHYSICS AND SUPERCONDUCTIVITY**

Time: Three Hours Max. Marks: 60

PART A

(Very short answer questions. Answer **all.**
Each question carries 1 mark)

1. What do you mean by the term coherence length?
2. What is the path difference between two waves for constructive interference?
3. What do you mean by the grating constant of a plane transmission grating?
4. Will it be possible to polarize a sound wave? Why?
5. What is Brewster's law?
6. What are the main components of a laser device?
7. Draw the energy levels and the resulting transitions used in a ruby laser system.
8. Mention any two applications of superconductivity.

(1 × 8 = 8)

PART B

(Brief answer questions. Answer **any six** questions.
Each question carries 2 marks)

9. Explain why superposition of incoherent waves cannot produce interference pattern.
10. For interference in thin films in the reflected system, write down the condition for Constructive and destructive interference.
11. Compare Fresnel and Fraunhofer types of diffractions.
12. Distinguish between uniaxial and biaxial crystals. Give example for each.
13. What are polaroids? Mention two applications.
14. Using suitable figures, discuss the processes of spontaneous and stimulated emissions.
15. Discuss any four properties of laser beams.
16. Write short note on high temperature superconductivity.

(2 × 6 = 12)

PART C

(Problems/Derivations. Answer **any four** questions.
Each question carries 4 marks)

17. Light of wavelength 6000 Aº from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen placed 100 cm away is 1 cm, determine the slit separation.

18. Calculate the minimum number of lines on a grating that will just resolve the sodium lines 5890 Aº and 5896 Aº in the first order spectrum.

19. Prove that when unpolarized light is passed through a polarizer, the intensity of the transmitted light is half that of the incident light.

20. Calculate the thickness of doubly refracting glass plate capable of producing a path difference of $\lambda/4$ between ordinary and extraordinary waves. Given, the wavelength of light λ =5890 Aº, refractive index of ordinary ray = 1.54 and the refractive index of extra ordinary ray =1.53.

21. Determine the ratio of populations of the two states in a laser that can produce stimulated emission of wavelength of 6328 Aº at 27 ºC.

22. A superconducting material has a critical temperature of 4 K at zero magnetic field and a critical field of 0.01 T at 0 K. Determine the critical field at 2K.

(4 × 4 = 16)

PART D

(Long answer questions. Answer **any two** questions.
Each question carries 12 marks)

23. With the help of a neat diagram discuss a method by which Newton's rings are formed. Write down the condition for bright and dark rings. Obtain a relation for the radius of the Newton's rings formed by reflected light.

24. Discuss in detail Fresnel diffraction at a straight edge.

25. Explain what is meant by quarter wave and half wave plates. With the help of neat diagrams, discuss the method of production and detection of elliptically polarized light.

26. Using a suitable diagram, explain Meissner effect in superconductors. Show that superconductors exhibit perfect diamagnetism. Distinguish between type I and type-II superconductors.

(12 × 2 = 24)

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