AS – 207

IV Semester B.Sc. Examination, April/May 2012
(Semester Scheme)
PHYSICS – IV
Acoustics, Optics and Lasers

Time : 3 Hours Max. Marks : 60

Instruction : *Answer* ***any five*** *questions from Part* ***A, four*** *questions from Part* ***B, five*** *questions from Part* ***C.***

PART – A

Answer **any five** of the following questions. **Each** question carries **six** marks. **(5×6=30)**

1. Derive an expression for a stationary wave formed due to the super position of two identical simple harmonic waves travelling in opposite directions along the same line. Explain the formation of nodes and anti nodes. **6**

2. a) Mention the different methods of sound recording and reproduction.

   b) Explain with a diagram the construction and working of a carbon microphone. **(2+4)**

3. a) Describe briefly two methods of producing coherent beams.

   b) Derive an expression for the refractive index of a thin transparent plate introduced in the path of any one of the interfering beams coming from two coherent sources. **(2+4)**

4. What are Newton's rings ? Describe an experiment to determine the radius of curvature of a plano convex lens by setting up Newton's rings. **6**

5. a) State and explain with a figure, the Rayleigh criterion for resolution.

   b) Derive an expression for the resolving power of a plane diffraction grating. **(2+4)**

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6. Discuss Fraunhofer diffraction at a single slit and obtain expressions for directions of recording maxima and minima. **6**

7. a) What are retarding plates ?

   b) Explain how retarding plates can be used for the production and detection of circularly, elliptically and plane polarized light. **(1+5)**

8. a) What is a laser ?

   b) Derive the relations between the Einstein co-efficients of stimulated emission, spontaneous emission and absorption. **(1+5)**

PART – B

Answer **any four** of the following : **(4×5=20)**

9. A brass rod of length 4 m is clamped at its centre. It is made to vibrate longitudinally. Find the Young's modulus of brass if the frequency of the note produced is 450 Hz and the density of brass is 8200 Kg/m^3.

10. Calculate the distance through which the mirror of Michelson interferometer has to be displaced between two consecutive positions of maximum distinctness of fringes for D_1 and D_2 lines of sodium of wavelengths 5896 Å and 5890 Å respectively.

11. In a biprism experiment interference bands are produced in the focal plane of an eye-piece 1 m from the slit. The separation between the images for conjugate positions of a convex lens are 3.17 mm and 1.75 mm. If the width of the fringes is 0.025 cm, find the wavelength of light used.

12. A point source of light of wavelength 589.6 nm is placed at a distance of 1 m from a zone plate. The image of the source is formed at a distance of 2 m on the other side of the zone plate. What is the power of the equivalent lens which can replace the zone plate ? Also find the radius of the second zone of the zone plate.

13. Find the grating constant of a grating whose width is 3 cm and which just resolves the sodium lines of wavelength 589 nm and 589.6 nm in the second order.

14. Determine the concentration of a solution of length 0.2 m which produces a rotation of 30°. The specific rotation of the solution is 0.0697 rad m^2/Kg.

PART – C

15. Answer **any five** of the following : **(5×2=10)**

a) Diffraction is more easily observed in the case of sound waves than in the case of light. Explain.

b) Results of Focault's experiment to determine the velocity of light contradicts the corpuscular theory of light. Explain.

c) Is it possible to produce interference from two independent sources emitting light of same wavelength ? Explain.

d) A thin film of oil on the surface of water appears coloured. Explain.

e) Two gratings A and B have the same width but A has greater number of lines. Which of them have larger 1) dispersive power 2) resolving power ?

f) Circularly polarized light and unpolarized light behave identically when viewed through a rotating nicol prism. Yet they can be distinguished. Explain.

g) Will atoms in a metastable state drop to the ground state spontaneously ? Explain.

h) If a hologram is cut into several pieces, can each piece give the same image as the whole hologram. Explain.