

**CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN,  
NUVEM-GOA  
SEMESTER END EXAMINATION, JUNE 2022**

**Semester: II OF B.Sc.**

**Course Title: Optics & Instrumentation    Course Code: PYG 102  
Total marks: 80    Date: 15/06/22    Duration: 120 minutes    Total No of pages: 03**

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***Instructions:***

- 1) All questions are compulsory, however internal choice is available.*
- 2) Figures to the right indicate maximum marks to the question.*
- 3) Symbols have their usual meanings unless otherwise stated.*
- 4) Draw neat diagram/circuit diagrams wherever necessary.*
- 5) Use of non-programmable calculator is permitted.*

**Q.1    Answer ANY FOUR of the following. (4 × 4 = 16)**

- a) Distinguish between polarized and unpolarized light.
- b) How are X-rays produced? How can the intensity and maximum frequency of X-rays be controlled?
- c) What are nematic and cholesteric liquid crystals?
- d) Discuss the working principle of light emitting diodes.
- e) Define the units of luminous intensity (i) lux and (ii) lumens. Mention their applications.
- f) What is meant by chromatic aberration? Mention two methods of minimising.

**Q.2    Answer ANY FOUR of the following. (4 × 4 = 16)**

- a) What is circular polarization? How are circularly polarized waves produced?
- b) Explain the continuous and characteristic spectra of X-rays.
- c) How are liquid crystal displays constructed?
- d) Define coordination number. Obtain number of atoms per unit cell, coordination number and the second nearest neighbours for a simple cubic crystal.
- e) Derive Bragg's law of X-ray diffraction from a crystalline solid.
- f) What is role of an eyepiece in an optical instrument? Draw the ray diagram of Ramsden eyepiece. Why is it called the positive eyepiece?

**Q.3 Answer the following.**

- A) a) Discuss various mechanisms of attenuation in optical fibres. (3)  
b) What are the essential components of a laser? Explain their functions briefly. (3)

**OR**

- A) c) State Brewster's law and discuss some of its applications. (3)  
d) Discuss the working of Nicol Prism with a neat diagram. (3)  
B) Describe the construction and working of Laurent's half shade polarimeter. (6)

**Q.4 Answer the following.**

- A) a) Discuss the three requirements that have to be met to achieve high percentage of stimulated emissions. (3)  
b) How is a Ruby laser constructed? (3)

**OR**

- A) c) Explain with neat diagrams absorption, spontaneous emission and stimulated emission. (3)  
d) Discuss the pumping scheme that a He-Ne laser employs. (3)  
B) With the help of a labelled diagram, derive an expression for the acceptance angle of an optical fibre. (6)

**Q.5 Answer the following.**

- A) a) With the help of a labelled diagram, discuss working of an electron microscope. (3)  
b) A figure divided into squares each of size  $1.0\text{mm}^2$  is being viewed at a distance of  $9.0\text{cm}$  through a magnifying glass held close to the eye and having a focal length of  $10\text{cm}$ . (3)
- What is the magnification produced by the lens. How much is the area of each square in the virtual image?
  - What is the angular magnification i.e. magnifying power of the lens?
  - Is the magnification produced by the lens equal to its magnifying power?

**OR**

- A) c) Draw a neat labelled ray diagram for a compound microscope. (3)  
d) Write a short note on positive phase contrast. (3)
- B) What is phase contrast microscopy? How does phase contrast work? Draw a (6)  
labelled ray diagram to explain the same.

**Q.6 Answer the following.**

- A) a) Give the ray diagram to show how interference is produced division of amplitude. (3)  
b) What is meant by diffraction? Give two points of differences between Fresnel (3)  
and Frauhoffer diffraction.

**OR**

- A) c) State the Rayleigh's criterion for resolving two close lying images. Use it to get (3)  
the angles of minima for a Frauhoffer diffraction at a single slit  
d) Name two cardinal points of a lens system. What is the advantage of a lens system (3)  
over a single lens with the same focal length?
- B) What is meant by a resolving power of an instrument? Derive the expression for (6)  
resolving power of a telescope with help of a neat diagram.

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