

**FACULTY OF SCIENCE**

**M. Sc. III - Semester (CBCS/Non-CBCS) Examination, December 2014**

**Subject: PHYSICS**  
**Paper - I: Modern Optics (Common)**

**Time : 3 hours**

**Max. Marks : 80**

**Note : Answer all questions from Part - A and Part - B.**  
**Each question carries 4 marks in Part - A and 12 marks in Part - B.**

**PART – A (8 x 4 = 32 Marks)**  
*(Short Answer Type)*

- 1 What is meant by population inversion and explain why it is necessary for lasing action?
- 2 What are the properties of laser beams?
- 3 Describe the working of argon ion gas laser.
- 4 Explain the basic principle of semiconducting laser.
- 5 Distinguish between photography and holography.
- 6 Distinguish between plane holography and volume holography.
- 7 Explain harmonic generation of light.
- 8 What is the thickness function of a lens? Explain its importance in Fourier optics.

**PART – B (4 x 12 = 48 Marks)**  
*(Essay Answer Type)*

- 9 a) Discuss the absorption and emission processes in lasers. What are Einstein's coefficients and derive expressions for their inter relation.  
**OR**  
b) Explain threshold condition for lasing action. Compare and contrast three level laser and four level laser.
- 10 a) Distinguish between atomic gas laser and molecular gas laser. Describe the working of CO<sub>2</sub> molecular gas laser using energy level scheme.  
**OR**  
b) What are solid state lasers? Describe the working of Nd : YAG laser using energy level scheme.
- 11 a) Explain the recording and reconstruction procedure in holography with necessary theory.  
**OR**  
b) What are the limitations of Gabor hologram? Describe how these limitations are eliminated in off-axis hologram.
- 12 a) i) What is optical mixing                      ii) Explain self-focussing of light  
**OR**  
b) Explain the use of thin lens as phase transformation element. Discuss the case where the object is placed behind the lens.

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