



NOVEMBER/DECEMBER 2018

MPH24C — NONLINEAR OPTICS

Time : Three hours

Maximum : 75 marks

SECTION A — ( $5 \times 6 = 30$  marks)

Answer ALL questions.

1. (a) With a suitable energy level diagram, explain the working of organic dye laser.

Or

- (b) Explain the construction and working of ruby laser with neat diagram.

2. (a) Give outline on polarization response of materials to light.

Or

- (b) Define and explain the following:

- (i) four wave mixing, and
- (ii) self-focusing.

3. (a) What do you mean by  
(i) oscillator and  
(ii) amplifier? Mention their uses.

Or

- (b) Explain stimulated Raman scattering.  
4. (a) Give brief account on borate based NLO materials.

Or

- (b) List out basic requirements for making thiourea complex based NLO materials.  
5. (a) What do you mean by fiber modes? Explain the modes formation in optical fibers.

Or

- (b) Explain the wave propagation in step and graded index fibers.

SECTION B — ( $3 \times 15 = 45$  marks)

Answer any THREE questions.

6. With a neat sketch, explain the construction, working and applications of the following semiconductor lasers: (9 + 6)  
(a) GaAs laser, and  
(b) p-n junction laser.

7. Discuss the following in detail: (7 + 4 + 4)

- (a) second harmonic generation,  
(b) bistability, and  
(c) parametric amplification.

8. (a) Describe the intensity dependent refractive index optical Kerr effect. (7 + 8)

- (b) With theory, elaborate two photon process.

9. Discuss the following characteristic studies for nonlinear optical materials: (8 + 7)

- (a) X-ray diffraction, and  
(b) FT-IT studies.

10. Describe the following topics based on fiber optics: (6 + 4 + 5)

- (a) dispersion,  
(b) fiber bandwidth and  
(c) fiber losses.

