K22P 3324

Reg. No. : .....

Name : .....

IV Semester M.Sc. Degree (CBSS – Reg./Supple./Imp.) Examination, April 2022
(2018 Admission Onwards)
PHYSICS
PHY 4C14 : Optics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer both questions (either **a** or **b**) :

1. a) Describe the Laser rate equations for three level laser and four level laser systems.

OR

b) With an energy level diagram, explain the principle and working of a Ruby laser.

2. a) i) Explain the harmonic generation. How is second harmonic achieved ?
ii) With the help of a diagram, describe the sum frequency and difference frequency generation.

OR

b) i) Give an account of bending losses in optical fibres.
ii) Explain the power launching in optical fibres. **(2×12=24)**

SECTION – B

Answer **any four** (**1** mark for part **a**, **3** marks for part **b**, **5** marks for part **c**)

3. a) What is meant by spatial coherence ?
b) What is meant by pumping ? Name five different methods.
c) A laser beam of wavelength 740 nm has coherence time 4×10^{-5} s. Deduce the order of magnitude of its coherence length and spectral half width.

P.T.O.

4. a) What is meant by spectral hole burning ?
   b) Briefly explain the principle and operation of a optical resonator.
   c) At what temperatures are the rates of spontaneous and stimulated emission equal ? Assume, $\lambda = 5000\text{Å}$.

5. a) What is meant by Faraday effect ?
   b) Explain type I and type II phase matching.
   c) Sketch and explain electro-optic amplitude modulator using KDP crystals.

6. a) What is fiber birefringence ?
   b) Give an account of index ellipsoid of KDP crystals.
   c) Optical fibre amplifier as next generation lasers. Explain.

7. a) What are spatial solitons ?
   b) Briefly explain stimulated Raman scattering.
   c) A multimode step-index fiber has a relative refractive index difference of 2% and a core refractive index of 1.5. The number of modes propagating at a wavelength of 1.3 μm is 1000. Calculate the diameter of the fiber core.

8. a) What is meant by optical susceptibility tensor ?
   b) Briefly explain the third harmonic generation.
   c) What is meant by dispersion in optical fibres ? Distinguish between intramodal and intermodal dispersion. **(4×9=36)**