



**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.

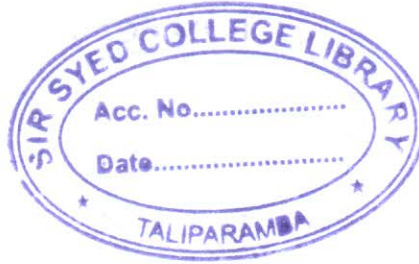
**(2×12=24)**

**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  $4 \times 10^{-5}$  s. Deduce the order of magnitude of its coherence length and spectral half width.

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K22P 3324



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,  $\lambda = 5000\text{\AA}$ .
  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  $1.3\text{ }\mu\text{m}$  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)
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