K19P 0112

Reg. No. : ....

Name : ....

IV Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, April 2019
(2014 Admission Onwards)
PHYSICS
PHY 4C14 : Optics

Time : 3 Hours

Max. Marks : 60

SECTION – A

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

1. a) Describe He-Ne LASER and explain how population is achieved in this type of laser.

   OR

   b) i) Explain the rate equation for a four level laser system.

   ii) Discuss the waveguide dispersion in optical fibres.

2. a) i) With the help of diagram, describe the sum frequency and difference frequency generation.

   ii) Briefly explain Stimulated Raman Gain Spectroscopy.

   OR

   b) i) Discuss power launching in optical fibres.

   ii) Explain parametric generation of light.   (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) Explain spiking in Ruby laser.

   b) Why 4 level laser system is better than 3 level laser system.

   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.

4. a) What is linear electro optic effect ?

   b) Briefly explain phase modulation using electro-optic effect.

   c) Sketch and explain an electro optic amplitude modulator using KDP crystals.

5. a) What is meant by optical mixing ?

   b) Write a short note on spatial solitons.

   c) In a material at 300K two energy have a wavelength separation of 1 μm. Determine :

      i) Effective temperature when the levels are equally populate.

      ii) The effective temperature when the upper level is twice as densely populated as the lower level.

6. a) What is meant by signal degradation in optical fibres ?

   b) What is numerical aperture ? Derive an expression for it.

   c) Calculate the V-number and the number of modes possible in a core of radius 50 μm. If the refractive index of the core is 1.53 and that of the cladding is 1.50, for a light of wavelength 1 μm.

7. a) Give an account of bending losses in optical fibres.

   b) Explain pulse broadening in optical fibres.

   c) Explain the generation of third harmonic generation.

8. a) What are semiconductor lasers ?

   b) Explain coherent Antistoke's Raman scattering.

   c) Explain type I and type II phase matching.   (4×9=36)

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