



K17P 0396

Reg. No. : B5PSPH 1606

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Fourth Semester M.Sc. Degree (Reg./Suppl./Imp.)

Examination, March 2017

(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 with energy level diagram the principle and working of a He-Ne laser. Give its applications.

OR

- b) i) Explain the nonlinearity in the polarization of the medium.
ii) Derive the equation for the generation of second harmonics.

2. a) i) Describe the characteristics of single mode and multimode optical fibres.
ii) Derive the expression for numerical aperture in optical fibres and give its significance.

OR

- b) Derive the Einstein coefficients in the theory of laser. Discuss material dispersion and waveguide dispersion in optical fibres. (2×12=24)

SECTION – B

Answer **any four**. (One mark for Part **a**, 3 marks for Part **b**, 5 marks for Part **c**) :

3. a) What do you mean by spatial coherence ?
b) Explain the rate equation for a three level laser system.
c) What are the different types of line broadening mechanisms in laser ?
4. a) What is electro-optic effect ?
b) Discuss the principles of intensity and phase modulation using electro-optic effect.
c) With the help of diagram, describe the sum frequency and difference frequency generation.

P.T.O.



5. a) Define axial modes in a cavity resonator.
- b) The half width of the gain profile of a He-Ne laser material is 2×10^{-3} nm. If the length of the cavity is 30 cm, how many longitudinal modes can be excited? The emission wavelength of He-Ne laser is 6328 \AA .
- c) Explain the working of solid state ruby laser.
6. a) What are the different losses in optical fibre.
- b) Calculate the numerical aperture if the value of mode parameter is 2.111 for a single mode fibre. Diameter of the core is $4.01 \mu\text{m}$ and the wavelength of laser light is $1.3 \mu\text{m}$.
- c) Discuss signal-degradation in optical fibres?
7. a) What is self-focussing of light?
- b) Distinguish between Type 1 and Type 2 phase matching.
- c) Write a note on Coherent Antistoke's Raman Scattering.
8. a) Give the characteristics of laser beam.
- b) The length of a laser tube is 150 mm and the gain factor of the laser material is $0.0005/\text{cm}$. If one of the cavity mirrors reflect 100% light that is incident on it, what is the required reflectance of the other cavity mirror?
- c) Discuss power launching in optical fibres. **(4x9=36)**