



K16P 0207

Reg. No. :

Name :

**Fourth Semester M.Sc. Degree (Regular/Supplementary/Improvement)
Examination, March 2016
PHYSICS (2014 Admn.)
PHY 4C14 : Optics**

Time : 3 Hours

Max. Marks : 60

SECTION – A

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

1. a) With the help of a diagram explain the working of a carbondioxide laser.

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) Explain the structure and theory of propagation of light in an optical fibre.

ii) Write a short note on the signal degradation in fibres.

OR

b) Discuss the different types of signal distortions in an optical fibre.

(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 temporal coherence ?

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

c) At what temperatures are the rates of spontaneous and stimulated emission equal. Take $\lambda = 500 \text{ nm}$.

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4. a) What is Kerr effect ?
b) Write a note on optical rectification.
c) Distinguish between Type 1 and Type 2 phase matching.
5. a) Define numerical aperture.
b) Calculate the temporal broadening of an impulse after propagating through 1 km in a graded index fibre if refractive index of core is 1.4746 and that of cladding is 1.46.
c) Explain the characteristics of optical fibre amplifier.
6. a) Define quality factor of a laser.
b) Write down any three applications of He-Ne laser.
c) Derive the Einstein's coefficients and explain its significance.
7. a) What is Pockels effect ?
b) Write a note on stimulated Raman Scattering.
c) A step index of single mode fibre exhibits material dispersion of $6 \text{ psnm}^{-1}\text{km}^{-1}$ at an operating wavelength of $1.55 \mu\text{m}$. Assume that $n_1 = 1.45$ and $\Delta = 0.5\%$, calculate the diameter of the core needed to take the total dispersion of the fibre zero at this wavelength.
8. a) Define frequency mixing.
b) With the help of energy level diagram explain the working of a Ruby laser.
c) What are the different types of line broadening mechanisms in laser ?

(4x9 = 36)