K23P 0208

Reg. No. : .....

Name : .....

**IV Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.)**
**Examination, April 2023**
**(2019 Admission Onwards)**
**PHYSICS**
**PHY 4C14 : Optics**

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **both** the questions (Either **a** or **b**) :

1. a) Describe the principle, energy levels and working of $CO_2$ molecular laser.

OR

b) Describe the electro-optic shutters used in lasers. How does it help to enhance the peak power of the laser ?

2 a) i) Explain the basis of harmonic frequency generation in crystals.

ii) Why second harmonic generation is not shown by isotropic media ?

OR

b) Describe the possible signal degradation in optical fibers. **(2×12=24)**

SECTION – B

Answer **any four** questions (**One** mark for part **a**, **three** marks for part **b**, **five** marks for part **c**).

3. a) Distinguish between spatial and temporal coherence.

b) Write and explain the rate equation for the relation of a two-level atomic system.

c) Obtain the expression for Peak power emitted by a Q-switched laser.

P.T.O.

4. a) What do you mean by light amplification ? Does it violate conservation of energy ?
   b) Describe the self-focusing of intense light beams as a non-linear phenomenon.
   c) Explain any method for single atom detection using dye lasers.

5. a) What is magneto optic effect ?
   b) Obtain the expression for the coherence length for second harmonic generation in a crystal.
   c) Describe the phenomenon parametric generation of light.

6. a) What is meant by optical rectification ?
   b) Describe stimulated Raman scattering.
   c) What are spatial solitons ?

7. a) What is the reason for opting graded index fiber to step index fiber for multimode transmission ?
   b) A 1 mW laser is focussed by a lens to a spot of 6 μm radius. Calculate the intensity and electric field at the spot.
   c) Describe the transmission characteristics of optical fibers.

8. a) What is meant by pulse broadening in optical fibers ?
   b) Explain the intermodal dispersion in optical fibers.
   c) You need to transmit data over an optical link of 100 km with fiber loss of 0.2 dB/km. The link has five splices with 0.05 dB loss per splice and two connectors with loss 0.2 dB per connector. If the receiver sensitivity is 20μW, what is the minimum transmitter power in both mW and dBm ? **(4×9=36)**



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