P.G. Semester-IV Examination, 2023

PHYSICS

Course ID : 42455 Course Code : PHYS-405 ME(B)

Course Title : Laser Physics and Non-linear Optics-III

Time : 2 Hours Full Marks : 40

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **five** of the following questions : 2×5=10

   a) Compare between single mode and multimode fibre.

   b) List down the advantages of optical fiber communication.

   c) Write the expression of refractive index and index difference of a graded index fibre.

   d) What do you mean by biorefringence?

   e) Why two photon absorption is often a significant problem in the design of all-optical switching devices?

   f) Why cross laser beams are used in laser cooling?

g) Write down few potential applicans of different lidar systems.

2. Answer any **four** of the following questions : 5×4=20

a) Explain the basic principle of operation of Kerr medium as optical switch State how simultaneous switching operations can be done using Kerr material. 2+3

b) Discuss about the losses in fibre optic cable. 5

c) What do you mean by numerical aperture and acceptance angle of an optical fibre?

An optical fibre has numerical aperture of 0.20 and a cladding refractive index 1.59. Determine,

i) The acceptance angle for the fibre in water which has a refractive index of 1.33.

ii) Critical angle at core cladding interface 2+1.5+1.5

d) Calculate the reflection coefficient of a phase conjugate mirror. 5

e) What is refractive bistability? Show that a refractive bistable system can be used as an optically controlled switch. 1+4

f) Discuss the liquid phase epitaxy and vapour phase epitaxy techniques.

3. Answer any **one** of the following questions : 10×1=10

a) What do you mean by Pockel's effect? Explain how phase modulation and amplitude modulation can be achieved by Pockel's effect. 2+3+5

b) Explain the pulse broadening due to material dispersion and waveguide dispersion in optical fibre. 5+5

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