



M 25053

Reg. No. : .....

Name : .....

IV Semester M.A./M.Sc./M.Com. Degree (Reg./Sup./Imp.)

Examination, March 2014

PHYSICS

PH 402 : Optics

Time : 3 Hours

Max. Marks : 50

SECTION – A

Contains **four** questions of which answer **any two**, each carry **10** marks.

1. Explain the theory of four level laser system using the rate equations.
2. Explain the phenomenon of second harmonic generation ? Find out the coherence length for the second harmonic radiation.
3. What do you mean by spatial filtering of images ? Explain the concept using the diffraction grating images.
4. Explain the propagation of light in optical fibers. Explain the normal modes of Optical fibers. (2×10=20)

SECTION – B

Contains **eight** questions of which answer **any five** questions each carry **3** marks.

5. Explain spatial coherence.
6. What do you mean by radiation damping ?
7. Explain the concept of Q-switching.
8. Write a note on Fabry Perot resonator.
9. What do you mean by Phase matching ?
10. Write a note on the scattering losses in optical fibers.
11. Explain the working principle of CO<sub>2</sub> laser.
12. Explain the Doppler broadening. (5×3=15)

P.T.O.



## SECTION - C

Contains **five** questions of which answer **any three** questions and **each** question carry **5** marks.

13. Imagine that we chop a continuous laser beam having a wavelength of 623.8 nm into 0.1 ns pulses using some sort of shutter. Compute the resulting line width, band width and coherence length.
14. A step index fiber is made with a core of index 1.52, diameter of 29  $\mu\text{m}$  and a fractional difference index of 0.0007, it is operated at a wavelength of 1.3  $\mu\text{m}$ . Find the fiber V number and the number of modes the fiber will support.
15. Fourier expand the function defined by the following equations  
 $f(t) = -A$  for  $-T/2 < t < 0$   
 $= A$  for  $0 < t < T/2$  and  
 $f(t + T) = f(t)$ .
16. On the surface of the earth the sun subtends an angle of about 32'. Assume sunlight to be falling normally on a double wall arrangement and there is a filter in front of the slit so that the light corresponding to  $\lambda = 5000 \text{ \AA}$  is incident on the slits. What should be the separation between the slits so that fringes of good contrast are observed on the screen.
17. At what temperatures are the rates of spontaneous and stimulated emission equal. Take  $\lambda = 500 \text{ nm}$ . **(3×5=15)**