

AQ - 968

- (q) Write down four limitations of using nano sized aperture in near field microscopy. 4

5. (a) Describe the working principle of optical tweezers with the help of labelled ray diagrams. 10
- (b) What is Raman - optical tweezers ? 2
- (c) What is the advantage of Raman - optical tweezers compared to normal Raman spectroscopy ? 4

OR

- (p) Write the principle of laser cooling. 4
- (q) How Doppler Effect and magnetic field influences the laser cooling process ? 6
- (r) How Atom laser differs from ordinary source of atomic beam ? 4
- (s) What factors limit the minimum temperature achievable from laser cooling ? 2

Third Semester M. Sc. (Part - II) (CBCS) Physics
Examination

3 PHY - 4 (iv)

PHOTONICS - I

Fundamentals of Photonics

P. Pages : 4

Time : Three Hours]

[Max. Marks : 80

[Credit : 04

Note : All questions are compulsory and carry equal marks.

1. (a) Obtain the generalized solution of wave equation. 6
- (b) An electric field of electromagnetic wave is 4×10^9 V/m in vacuum. Calculate intensity and peak of B-field envelope. 4
- (c) Show that electromagnetic waves are transverse waves. 6

OR

- (p) Explain the working of overhead projector with the help of optical ray diagram. 6

- (q) Draw labelled ray diagram of double concave and double convex lens showing focal point.

6

- (r) Differentiate phase velocity and group velocity.

4

2. (a) Derive Kramer's Kronig relations. 8

- (b) The polarization response function must obey causality i.e. the effect cannot precede the cause. Explain this mathematically. 4

- (c) What is angular momentum of a Photon ?

4

OR

- (p) Write and explain the medium equation for linear, isotropic, homogeneous and non-dispersive medium. What will be medium equation for following situations ? Explain each of the following case :—

(i) nonlinear medium.

(ii) anisotropic medium.

(iii) inhomogeneous medium.

(iv) dispersive medium. 8

- (q) Show that both linear and circularly polarized lights are special cases of elliptically polarized light. 8

3. (a) Find the Fraunhofer diffraction pattern from a rectangle aperture with dimensions $a \times l$.

8

- (b) Find the Fourier transform of sign and step function. 8

OR

- (p) What is spatial filter ? Draw and explain the working of simplest spatial filter. 8

- (q) What is Holography ? 2

- (r) How does Holographic camera differ from conventional camera ? 4

- (s) Write any four applications of Holography. 2

4. (a) Derive the expression for existence of evanescent waves using Fresnel equations. 8

- (b) What are the limitations of far field optical microscopy ? How near field optics remove these limitations ? 4+4

OR

- (p) What is near field scanning microscopy (NSOM) or scanning near field microscopy (SNOM) ? What are different modes of near field microscopy ? Explain working of each modes. 12