

Exam. Code : 103204

Subject Code: 1388

B.A./B.Sc. 4th Semester

PHYSICS

(Atomic Spectra & Lasers)

Paper—B

Time Allowed—3 Hours]

[Maximum Marks—35

Note :— Section A is compulsory. Attempt **ONE** question each from Sections B, C, D and E. All questions carry equal marks.

SECTION—A

Note :—Attempt all the **SEVEN** parts.

- I. (a) Calculate the value of total angular momentum (J) for $L = 2$.
- (b) State correspondence principle, how does it help us ?
- (c) Which energy levels are involved in D lines of sodium ?
- (d) Find shortest wavelength emitted in the Principal series of hydrogen atom ?
- (e) Explain the role of metastable state in He-Ne laser.
- (f) How semiconductor lasers differ from gas lasers ?
- (g) Why laser beams are highly directional ? $1 \times 7 = 7$

SECTION—B

- II. What is meant by fine structure of hydrogen spectrum ?
Depict energy states by suitable energy level diagram,
how spin orbit interactions effect the energy levels of
hydrogen ? 7
- III. Enlist limitations of Bohr Theory. Explain how Sommerfeld's
ideas of relativistic correction helped to explain fine structure
of hydrogen. 7

SECTION—C

- IV. (a) How anomalous Zeeman effect differs from normal
Zeeman effect ? Describe the effect of magnetic
field on frequency of yellow lines of sodium. 4
- (b) Calculate the Zeeman shift observed in the Normal
Zeeman effect when a spectral line of wavelength
 5000 \AA is subjected to the magnetic field of
 0.4 Wb/m^2 . 3
- V. Explain symmetrical and anti symmetrical wave
functions. What is the behaviour of particles under these
wave functions ? 7

SECTION—D

- VI. (a) Show that population inversion can not take place
by optical pumping in two energy level system. 4

(b) A laser beam having an aperture of 1.2 cm sends out a beam of power 50 mw, calculate :

- (i) The angular spread of the beam
- (ii) Intensity of the image, given focal length of the lens $f = 8$ cm and $\lambda = 6238 \text{ \AA}$. 3

VII. Derive Schalulow Townes condition for larger oscillations.

7

SECTION—E

VIII. Why ND : YAG lasers are more efficient than Ruby lasers ?

Describe the principle and working of Nd : YAG. 7

IX. Write a short note on :

- (a) Resonant cavity
- (b) Q-switching
- (c) Holography. 7