B.A./B.Sc.(General)-4th Semester

Physics

Paper-B: Optics and Lazer-II

Time allowed: 3 Hours   Max. Marks: 44

NOTE: *Attempt <u>five</u> questions in all, including Question No. VII (Unit-III) which is compulsory and selecting two questions each from Unit I-II. Use of non-programmable calculator is allowed*

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UNIT – I

I.   (a)   Derive relation between Transition probabilities of spontaneous and stimulated emission. Also explain why high frequency lasers are difficult to build and operate.

(b)   Find the coherence length for white light, the wave-length of white light ranges from 400nm to 700nm.   (6½+2½)

II.   (a)   Derive threshold condition for sustained oscillations in the resonance cavity. Explain why it is easier to obtain laser action at the infra-red wavelengths as compared to ultraviolet wavelength.

(b)   Find the intensity of a laser beam of 10mW power, having a diameter of 1.3mm. Assume the intensity to be uniform across the beam.   (6½+2½)

III.   (a)   Explain homogenous and non-homogenous broadening. Derive an expression for Doppler broadening.

(b)   The sodium yellow light of wavelength 5893 $\overset{0}{A}$ is a doublet of 6 $\overset{0}{A}$ width. Find non-monochromaticity.   (6½+2½)

UNIT-II

IV.   (a)   Explain the working of CO_2 laser in detail by drawing necessary energy diagram. What is the role of nitrogen and Hilium in CO_2 laser?

(b)   A step index fibre is being used for a transmission system. The core has a refractive index of 1.5 and the cladding has a refractive index of 1.48. Find the fraction of optical power from a diffused source that the fibre will propagate.   (6½+2½)

V.   (a)   Explain the construction and working of Ruby laser by drawing necessary diagrams. Also explain what is spiking?

(b)   What is holography? Explain the method of recording a hologram.

(6½+2½)

P.T.O.

VI. (a) Explain different types of fibres by drawing necessary figures. Which fibre has the highest band width?

(b) Explain the intermodal and intramodal dispersion in detail. Also explain how they can be reduced? (4½+4½)

UNIT-III

VII. Attempt any eight parts: -

(a) The light from gas lasers is much more monochromatic in comparison to solid state lasers. Explain.

(b) What is Q-Switching?

(c) Explain spatial coherence.

(d) What is Luminescence?

(e) Why there cannot be a perfectly monochromatic source?

(f) What are liaky modes?

(g) What are bending losses in optical fibre?

(h) What is cut-off wavelength for an optical fibre?

(i) What is the cause of scattering loses in optical fibre and how they can be minimized?

(j) How ultraviolet absorption can be reduced in optical fibre? (8×1)

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