

6241

Roll No.:.....

Name of the Department : Physics and Astrophysics

Name of the Course : B.Sc. Hons.-(Physics)_CBCS-LOCF

Name of the Paper : Applied Optics (SEC)

Unique Paper Code : 32223908

Semester : III (Reappear Paper) 

Duration: 3 hours

Maximum Marks : 50 Marks

Instructions for candidates

1. Write your Roll No. on the top immediately after the receipt of this question paper.
2. Attempt five questions in all.
3. Question No. 1 is compulsory.
4. All questions carry equal marks.

1. Attempt any five of the following:

(2x5=10)

- (a) Write Planck radiation law equation and explain its salient features.
- (b) What is stimulated emission process?
- (c) Differentiate between light emitting diodes and photodetectors.
- (d) What is population inversion?
- (e) Explain why the ordinary incoherent light works well for making ordinary photographs, but a coherent source is necessary for making holograms.
- (f) Discuss the application of optical fibre bundles in medical diagnostics.

2. (a) With the help of a suitable diagram, explain the meaning of absorption, spontaneous emission and stimulated emission of radiation. Derive the relation between transition probabilities of spontaneous and stimulated emission. (7.5)

(b) Calculate the power per unit area delivered by a laser pulse of energy $4 \times 10^{-3} \text{ J}$ and pulse duration 10^{-9} s , when the pulse is focused on a small spot of radius $1.5 \times 10^{-5} \text{ m}$. (2.5)

3. (a) Describe the meaning of acceptance angle of an optical fibre with the help of appropriate diagrams. Derive the relationship between acceptance angle and numerical aperture. (7.5)

(b) A step index fibre has core and cladding refractive indices 1.466 and 1.460 respectively. If the wavelength of light is $0.85 \mu\text{m}$, find the normalized frequency and the number of modes supported by the fibre. The core diameter is $50 \mu\text{m}$. (2.5)

4. (a) How is the transmission type hologram different from the reflection type hologram? Explain with the help of appropriate diagram. (6)

(b) How is the holography used for character recognition? (4)

5. (a) Discuss the construction of a spatial frequency filtering system, and explain how the desired spatial frequencies are filtered out by using this system. (6)

(b) Draw the diagrams of different apertures which work as low pass, high pass and bandpass filters. (4)

6. Write short notes on any of the two.

(2x5=10)

- (a) Various factors that cause attenuation in the wave guide propagation in an optical fibre.
- (b) Absorption losses in optical fibres.

(c) The working of multimode fibres, and meaning of intermodal dispersion.