

17. (a) Distinguish the symmetric and asymmetric slab waveguides in detail.

Or

- (b) What is coupling? Explain the different types of coupling in detail.
18. (a) What is an optical fibre? Explain the propagation of light through optical fibre.

Or

- (b) Classify the optical fibres on the basis of materials, modes of propagation and refractive index.
19. (a) For atomic transitions, derive Einstein relations and hence deduce the expressions for the ratio of spontaneous emission rate to the stimulated emission rate.

Or

- (b) Describe in detail longitudinal and transverse laser modes.
20. (a) What is the fundamental principle of a hologram? How is it produced and how is the image reconstructed from it?

Or

- (b) What are the applications of holography? Explain in detail.

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M.Sc.(CBCS) DEGREE EXAMINATION,
NOVEMBER 2012.

First Semester

Physics

Elective I — OPTOELECTRONICS AND LASERS

(For those who joined in July 2012 onwards)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

1. Mention the wavelength range of the X - rays.
2. What is critical angle?
3. Define waveguide.
4. What is an optic network?
5. How will you classify optical fibres?
6. Define acceptance angle.
7. Can we obtain light amplification in the absence of induced emission?

8. What is metastable state?
9. What is meant by wavefront?
10. What is Fresnel hologram

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Compute the frequency spread and wavelength spread between longitudinal modes for a cavity 0.3 mm long that is filled with aluminum gallium arsenide (AlGaAs). This structure is typical of an AlGaAs laser diode whose mean (center) wavelength is $0.82 \mu\text{m}$ and whose refractive index is 3.6.

Or

- (b) What is polarization? Explain it.

12. (a) Explain about the mode condition in symmetric slab waveguide.

Or

- (b) Compute the numerical aperture and acceptance angle for the symmetrical AlGaAs slab waveguide where $n_1 = 3.6$, $n_2 = n_3 = 3.55$ and $n_0 = 1$.

13. (a) What is numerical aperture? Calculate the numerical aperture of an optical fibre whose core and cladding are made of materials of refractive index 1.6 and 1.5 respectively.

Or

- (b) Discuss the applications of fibre optics.

14. (a) A CO_2 laser source emits light at a wavelength of $9.6 \mu\text{m}$ and has an output power of 10kW. How many photons are emitted in each hour by this laser while operating?

Or

- (b) Discuss with suitable diagram the principle of construction and working of a Ruby laser.

15. (a) What is the difference between holography and photography?

Or

- (b) Explain about the rainbow multiplex.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Explain about the material dispersion and pulse distortion.

Or

- (b) What is reflection? Describe the reflection at a plane boundary in detail.