

Seat No. _____

Enrollment No. _____

C. U. SHAH UNIVERSITY

B. Sc. Semester-IV

May-2015 (summer) Examination

Subject Name: Laser & Fiber Optics

Subject Code: 4SC04PHC2

Time: 03 hours

Maximum Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumption wherever necessary.
3. Figures to the right indicate full marks.
4. Draw figure / Diagram wherever necessary.

	Section – I	Marks
Q-1 Answer the following questions in short.		
a) What is LASER?		(01)
b) Define: Metastable state.		(01)
c) Define: Resonant Cavity.		(01)
d) Name the different types of Coherences.		(01)
e) Name the components of the Basic-General LASER system.		(01)
f) Name different types of LASER Systems with Specific Examples.		(02)
Q-2 a) Discuss in detail any one type of Solid State LASER system.		(06)
b) Distinguish: Spontaneous Emission of Radiation versus Stimulated Emission of Radiation.		(05)
c) For <i>In-P</i> LASER diode, the wavelength of light emission is 1.55 μm . Calculate the Band-Gap energy in Electron-Volt unit.		(03)
OR		
Q-2 a) Discuss in detail any one type of Gas LASER system.		(06)
b) Distinguish: LASER beam versus Conventional Light Beam.		(04)
c) Calculate the temperature at which the rate of Spontaneous Emission of radiation and the rate of Stimulated Emission of radiation become equal for the LASER pulse of 0.7 μm wavelength.		(04)
Q-3 a) Define Einstein's co-efficients and derive their relationship. Prove that the ratio of coefficients of spontaneous emission to stimulated emission is proportional to the third power of the frequency of radiation.		(07)
b) Discuss in detail: Applications of Laser in various fields.		(07)
OR		
Q-3 a) Explain the conditions:		(07)
(i) Stimulated Emission to dominate Absorption Transition.		
(ii) Stimulated Emission to dominate Spontaneous Emission.		

- b) What is Holography? Discuss in detail: Construction and reconstruction of a Hologram. (07)

Section – II

Marks

- Q-4 Answer the following questions in short.
- a) What is Snell's law? Write its formula. (01)
- b) What is refractive index of a medium? (01)
- c) What do you know about the refractive indices of Core and Cladding in an optical fiber? (01)
- d) What is attenuation in Optical Fiber communication? (01)
- e) What is Total Internal Reflection? (01)
- f) Write necessary conditions for *total internal reflection* in an optical fiber. (02)
- Q-5 a) Distinguish: Single Mode Optical Fiber versus Multi-Mode Optical Fiber. (06)
- b) Give an account of the main components of an optical fiber cable structure and discuss the function of each in brief. (05)
- c) Obtain the refractive index of cladding if the core refractive index is 1.4 and Fractional-relative refractive index change is 0.03 (03)

OR

- Q-5 a) Calculate critical angle, propagation angle, acceptance angle, numerical aperture, relative or fractional refractive index, V-parameter and number of modes the optical fiber supports, from the following data:
 $\eta_{Core}=1.563$, $\eta_{clad}=1.498$, Core Diameter = 3 μm , Wavelength= 1.32 μm (06)
- b) Distinguish: Step Index Optical Fiber versus Graded Index Optical Fiber. (06)
- c) Obtain numerical aperture of an optical fiber with Acceptance angle (26.80)°. (02)
- Q-6 a) Define and derive formulas for Critical Angle θ_C , Propagation angle θ_{pro} , Acceptance Angle ϕ_{Max} , Numerical Aperture, Fractional Relative Refractive index Δ , V-number and Modes of propagation M_n for fiber optic communication. (07)
- b) Discuss: principle and Working of Optical Fiber communication. (07)

OR

- Q-6 a) Discuss or differentiate the superiority of Fiber Optics Cable over/versus Conventional Coaxial Metallic Cable. (07)
- b) Give a detailed account of the applications of fiber optics in various fields of Science, Industries, Medical and Communication purposes. (07)
