

Enrollment No: _____

Exam Seat No: _____

C.U.SHAH UNIVERSITY

Winter Examination-2015

Subject Name: Laser and Fiber Optics

Subject Code: 4SC04PHC2

Branch: B.Sc (All)

Semester: 4

Date: 24/11/2015

Time: 2:30pm To 5:30pm

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
 - (2) Instructions written on main answer book are strictly to be obeyed.
 - (3) Draw neat diagrams and figures (if necessary) at right places.
 - (4) Assume suitable data if needed.
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- Q-1 Attempt the following questions: (14)**
- a) What is full form of LASER **01**
 - b) What is Holography? **01**
 - c) Define Metastable state. **01**
 - d) Gives the formula of acceptance angle in optical fiber. **01**
 - e) Define stimulated emission of radiation. **01**
 - f) Define core and cladding in optical fiber cable. **01**
 - g) What is pumping Process in laser? **01**
 - h) Give the definition of induced absorption. **01**
 - i) Gives the types of fiber in the basis of mode of propagation. **01**
 - j) What is the active medium in Carbon dioxide laser? **01**
 - k) Multimode fibers are generally used in _____ **01**
(a) Large distance communication (b) Short distance communication
(c) Very large distance communication (d) none
 - l) What is the numerical aperture of an optical fiber cable with a clad index of 1.378 and a core index of 1.546^e? **01**
 - m) _____ Process is controllable from outside. **01**
(a) Spontaneous emission (b) Stimulated emission
(c) Absorption transition (d) light
 - n) Define critical angle of propagation in fiber optics. **01**

Attempt any four questions from Q-2 to Q-8

- Q-2 Attempt all questions (14)**
- a) What are Einstein's coefficients? Derive the relation between Einstein's coefficients A and B. prove that the ratio of spontaneous emission and stimulated emission is proportional to the cube of frequency. **06**
 - b) What is acceptance angle for optical fiber? Derive an expression for acceptance **06**



	angle of the optical fiber.	
	c) Calculate the Numerical aperture and acceptance angle of an optical fiber from the following data: $n_1 = 1.55$ and $n_2 = 1.50$.	02
Q-3	Attempt all questions	(14)
	a) Explain the method of construction and reconstruction of a Hologram in details.	05
	b) Gives classification of optical fiber according to refractive index.	05
	c) Gives the advantages of optical fiber.	04
Q-4	Attempt all questions	(14)
	a) Explain in details construction, working and application of Nd-YAG laser	06
	b) Describe the construction of fiber optic cable. Give a brief account of the main components of an optical fiber structure and discuss function of each.	05
	c) Gives difference between stimulated emission and spontaneous emission.	03
Q-5	Attempt all questions	(14)
	a) Explain in details CO ₂ Laser giving active medium, active centre, pumping source, construction and working with appropriate figure.	06
	b) What are modes of propagation for optical fiber? Explain single mode optical fiber and multimode optical fiber in details.	05
	c) Derive the formula for numerical aperture of optical fiber.	03
Q-6	Attempt all questions	(14)
	a) Explain in details fiber optics communication system.	05
	b) Discuss application of Laser in details.	06
	c) Gives the classification of optical fiber according to material profile.	03
Q-7	Attempt all questions	(14)
	a) Explain with a neat diagram construction and working of a semiconductor laser.	06
	b) Explain in details three level and four level pumping schemes.	05
	c) Calculate the refractive indices of the core and the cladding material of a fiber from the following data. $NA = 0.22$ and $\Delta = 0.012$ where $\Delta = \text{fractional refractive index}$.	03
Q-8	Attempt all questions	(14)
	a) Explain construction and working of a He-Ne Laser.	05
	b) Discuss the application of optical fiber communication.	06
	c) Explain optical resonator cavity.	03

