GIET UNIVERSITY, GUNUPUR – 765022

RN19MSC008

Roll No: | | | | | | |

Total Number of Pages : 2 AR-18 M. Sc

M. Sc 3rd SEMESTER REGULAR EXAMINATIONS, NOV/DEC 2019-20

Subject code: CBCT-PHY-306

Subject: FIBER OPTICS & OPTOELECTRONICS

Time: 3 Hours Max Marks: 80

The figures in the right hand margin indicate marks.

SECTION A

Q.1 Answer **any four** of the following: [4 X 4 = 16]

a) The core and the cladding of a silica optical fiber have refractive indices of $\mu_1 = 1.5$ and $\mu_2 = 1.4$ respectively. (i) Calculate the critical angle of reflection for the core-cladding boundary and (ii) calculate acceptance angle of the fiber.
b) Give the expression for the normalized frequency parameter V.
c) Briefly describe linear scattering loss in optical fibers.
d) State the criteria for designing a connector. Mention their categories.
e) Write a note on Edge emitting LEDs.
f) Define the quantum efficiency and responsivity of a p-n diode. How are the two related to each other?

OR

2. Answer **all** questions from the following [2 x 8 = 16]

a) Draw the variation in refractive index along the radial direction of an optical fiber.
b) Write the classification of fibers on the basis of type of the material, modes and refractive index profile.
c) What is attenuation? Mention the basic attenuation mechanisms in a fiber.
d) Write a note on bending losses in fiber.
e) Distinguish between a splice and a connector.
f) What are couplers? Define coupling length.
g) Define modulation response of an LED and give its expression.
h) Mention the limitations of Semiconductor Optical Amplifier.

SECTION-B

Answer **all** Questions: [16 x 4 = 64]

3a. Distinguish between step index and graded index fibers. Derive expressions for the power flow through the core and cladding of a step index fiber.

OR

b. (i) With appropriate diagrams explain the double crucible method of fiber fabrication. Mention the limitations of this method.

(ii) Discuss the structure of Fiber Bragg Grating. State Bragg's condition and mention the advantages of this type of grating. (8+8 marks)

4a. What is intramodal dispersion? Define dispersion parameter. Obtain the expression for waveguide dispersion.

OR

b. Discuss the design of single mode fibers with an emphasis on dispersion shifted fibers and dispersion flattened fibers.

5a. Explain with the help of neat diagrams, (i) fusion splices (ii) Mechanical splices and (iii) Multiple splices.

OR

b. Discuss the extrinsic loss parameter of fiber to fiber misalignment loss mechanism, associated with fiber to fiber connections. Explain the three types of misalignment and draw the graphs for their measured losses.

6a. Write an essay on noise considerations. Obtain the general expression of the signal to noise ratio of an optical receiver. Mention the approximation of the expression when p-n and p-i-n photodiodes are used in the receiver.

OR

b. Distinguish between the amplification processes in a rare earth doped fiber amplifier and a fiber Raman amplifier.