National Institute of Technology, Hamirpur (HP)
Name of Examination: B. Tech. End Semester Examination (December -2020)

Branch: Electronics & Communication Engineering   **Semester: 7th**

Title of the Course: Optical Communication Systems   **Course Code: ECD-412**

Time: 120 Minutes   **Maximum Marks: 50**

Note:

1. All the questions are compulsory.
2. The Marks of each question are indicated against the question.

Q1. (a) Discuss, dual nature of light in short.   (**3 Marks**)

   (b) A multimode step index fiber having data: diameter = $20\mu m$, numerical aperture = 0.5 and operating wavelength = $1.1\mu m$. Determine total number of guided mode and number of guided mode if the same is multimode graded index fiber.   (**3 Marks**)

   (c) Write performance parameter of photo detector in short.   (**3 Marks**)

   (d) With Suitable diagram, discuss transverse and longitudional polarization.   (**3 Marks**)

   (e) The input power to an optical fiber is 10mW, while the power measured at the output end is $8\mu m$. if the fiber attenuation is 0.2dB/Km. Calculate the length of the fiber.   (**3 Marks**)

Q2. (a) Using electromagnetic wave theory derive the equation:

$$E(z,t)=E_o e^{-\alpha z}\cos(\omega t-\beta z)\hat{a}_x$$ (**4 Mark**)

   (b) Using suitable diagram make difference between:

   (i) Surface Emitting LED

   (ii) Edge Emitting LED   (**4 Mark**)

   (c) An optical system, input power to optical source = 30mW, forward voltage = 2V, output power = 20mW and fiber numerical aperture = 0.1786. Calculate:

   (a) bias current (b)internal efficiency (c) fiber acceptance angel (d) power coupled into the fiber.   (**4 Mark**)

   (d) Find the emitted wavelength form an optical source having $x = 0.05$ (**4 Mark**)

   (e) Using suitable diagram, explain working principle of Erbium doped fiber amplifier (EDFA).   (**4 Mark**)

Q3. (a) Using frame structure discuss: **(5 Mark)**

        (a) SONET

        (b) SDH

(b) (1) A step index fiber is provided with the following data:

    (i) NA = 0.3

    (ii) core refractive index = 1.2

    (iii) total intermodal dispersion = $3.75 \times 10^{-6} s$

    Determine the fiber kept distance to obtain maximum pulse broadening. **(2.5 Mark)**

    (2) A GaAs LASER has following data:

    (i) refractive index = 3.5

    (ii) Frequency Spacing = 50 GHz

    (iii) Wavelength Spacing = 0.135 nm

    Calculate length and wavelength. **(2.5 Mark)**

(c) Discuss performance of passive linear buses using directional coupler. **(5 Mark)**