Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013**

**Subject code: 1710405 Date: 07-01-2014**

**Subject Name: Fiber Optic Communication**

**Time: 10.30 am – 01.00 pm Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | |
|---|---|---|---|
| **Q.1** | **(a)** | What is numerical aperture of an optical fiber? Deduce an expression for the same. | **07** |
| | **(b)** | Distinguish: (i) Step-index and Graded index fibers.<br>(ii) Single mode fiber and Multi mode fiber | **07** |
| **Q.2** | **(a)** | Light travelling in air strikes a glass plate at an angle $\Theta_1 = 33°$, where $\Theta_1$ is measured between the incoming ray and the glass surface. Upon striking the glass, part of the beam is reflected and part is refracted. If the refracted and reflected beams makes an angle of 90° with each other, what is the refractive index of the glass? What is the critical angle for this glass? | **07** |
| | **(b)** | A step index multimode fiber with a numerical aperture of 0.20 supports approximately 1000 modes at an 850 nm wavelength.<br>(i) What is the diameter of this core?<br>(ii) How many modes does the fiber support at 1320 nm?<br>(iii) How many modes does the fiber support at 1550 nm? | **07** |
| | | **OR** | |
| | **(b)** | Explain the phenomenon of total internal reflection using Snell's law with figures and calculations. | **07** |
| **Q.3** | **(a)** | Compare the Ray theory and the Mode theory for optical fiber communication. | **07** |
| | **(b)** | Define signal attenuation and how is it mathematically expressed.<br>Explain the following: 1. Scattering Losses. 2. Bending losses. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Discuss absorption losses in optical fibers, comparing and contrasting the Intrinsic and extrinsic absorption mechanisms. | **07** |
| | **(b)** | Draw and explain the graph of attenuation as a function of wavelength, plot the three transmission windows. | **07** |
| **Q.4** | **(a)** | Explain the basic concept of laser and with energy state diagram describe the absorption and emission of radiation in laser. | **07** |
| | **(b)** | With neat diagram explain the P-I-N photo diode. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain the principle ,characteristics and operation of avalanche photodiode. | **07** |
| | **(b)** | Compare LEDs and LASERs. | **07** |
| **Q.5** | **(a)** | With neat diagram explain the optical time domain reflectometry (OTDR) or the Back scatter measurement method in optical fiber. Also give an illustration of a Possible Back scatter plot from a fiber under test. | **07** |
| | **(b)** | Explain the principle of operation of:<br>(i) EDFA (ii) Wavelength division multiplexing. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | List all the advantages of optical fiber communication | **07** |
| | **(b)** | Draw and explain major elements of an optical fiber transmission link. | **07** |

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