

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEM-V Examination-Nov-2011

Subject code: X51102

Date: 22/11/2011

Subject Name: Optical Communication

Time: 2.30 pm -5.00 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) Answer the following in short:

1. Write advantages of optical fibers over copper wires **02**
2. Mention applications of fiber optics transmission systems **03**
3. Explain different types of optical fibers (based on modes and index)

(b) Answer following in brief

1. Find numerical aperture for step-index fiber having normalized frequency 26.6 at a 1300-nm wavelength. Core radius is 25 μm . **02**
2. What are the requirements for selecting optical fiber materials ? explain fiber materials. **05**

Q.2 (a) Explain following for single mode fiber:

1. Refractive index profile **03**
2. Bending losses **02**
3. Cutoff wavelength **02**

(b) Explain in brief

1. LED structure with cross-section drawing of typical GaAlAs. **04**
2. Three key transition processes involved in laser action **03**

OR

(b) Explain in brief **04**

1. Laser diode rate equation **03**
2. Resonant Frequencies

Q.3 (a) Short note on following:

1. Single mode laser **04**
2. How NA changes as a function of multimode fiber length. **03**

(b) Explain following for Photodetector

1. Noise sources **03**
2. Response time **04**

OR

Q.3 (a) Write short note on following

1. Possible lensing schemes used to improve optical **04**

- source to fiber coupling efficiency.
2. Principal requirements of good optical fiber connectors design **03**
- (b) Short note
1. Temperature effect on avalanche gain **04**
 2. Comparisons of Photodetectors Si, Ge and InGaAs **03**
- Q.4 (a)** Explain following
1. Basic sections of optical receiver with block diagram **03**
 2. Receiver sensitivity **04**
- (b) Answer following
1. Write components and their associated characteristics for point-to-point links. **04**
 2. Calculate photon density for an InGaAsP Semiconductor Optical Amplifier. $w = 5\mu\text{m}$. $d = 0.5\mu\text{m}$. $V_g = 200000000\text{ m/s}$. a $1.0\mu\text{W}$ optical signal at 1550 nm enters the device. **03**
- OR**
- Q.4 (a)** Short note
1. Eye diagrams **04**
 2. Coherent detection **03**
- (b) Short note
1. Rise-time budget **03**
 2. Wideband optical amplifiers **04**
- Q.5 (a)** Explain in brief
1. Operational principles of WDM **04**
 2. Telecommunication and broadband applications of optical fiber systems **03**
- (b) Answer following: **04**
1. A 2×2 biconical tapered fiber coupler has an input power $P_0 = 200\mu\text{W}$. output power at the other three ports are $P_1 = 90\mu\text{W}$, $P_2 = 85\mu\text{W}$, $P_3 = 6.3\text{nW}$. find coupling ratio, excess loss and return loss.
 2. Explain operational principle of OTDR **03**
- OR**
- Q.5 (a)** Short note
1. SONET/SDH **05**
 2. Optical circulators **02**
- (b) Short note
1. Variable optical attenuators **02**
 2. List widely used optical-system test instruments and their functions **05**
