

- N.B.** (1) Q. No. 1 is compulsory.
 (2) Attempt any four out of remaining six questions.
 (3) Figures to the right indicate full marks.
 (4) Assume suitable data wherever required.
1. (a) Derive expression for responsivity of a photodetector. 5
 (b) Explain spontaneous emission and stimulated emission. 5
 (c) Explain half power beam width in connection with the optical sources. 5
 (d) Explain propagation modes in Single Mode Fibers. 5
 2. (a) Draw a refractive index profile of a graded index fibre and show with neat diagram transmission of light through this fibre. Explain how GRIN fibre have transmission bit rate much higher than multimode step index fibre. 10
 (b) (i) A graded index fibre has a core diameter of $45 \mu\text{m}$. Core has parabolic refractive index profile. The fibre has NA of 0.22 and operating at wavelength of $1.2 \mu\text{m}$. Estimate total no. of guided modes propagating in the fibre. 10
 (ii) What power is radiated by a LED if its internal quantum efficiency η_{int} is 1.5% and wavelength is 800 nm? Forward current is 45 mA.
 3. (a) Indicate the major advantages of vapour phase deposition in the preparation of glasses for optical fibres. Briefly describe the various vapour phase techniques currently in use. 10
 (b) Explain with neat sketches the fiber splicing techniques. Also enlist the desirable requirements of a good fiber connector and tencing schemes for coupling improvements. 10
 4. (a) What are the different ways to measure the various dispersion effects? Explain Time-Domain Intermodel Dispersion Measurements. 10
 (b) Explain Insertion-Loss Method for measuring attenuation. 10
 5. (a) Explain photodetector and preamplifier noises and relative intensity noise. State the dominant factors that cause signal impairments. 10
 (b) (i) Explain Avalanche Photodiode. 5
 (ii) A given silicon avalanche photodiode has a quantum efficiency of 65% at wavelength of 900 nm. Suppose $0.5 \mu\text{W}$ of optical power produces a multiplied photocurrent of 10 μA . Find multiplication M

$$h = 6.625 \times 10^{-34} \text{ J.S.}$$
 6. (a) Explain and compare pin photodiode with APD with suitable electric field diagrams. 10
 (b) An InGaAs pin photodiode has following parameters at wavelength of 1300 nm, I_D is 4 nA, $\eta = 0.9$, $R_L = 1 \text{ k}\Omega$, surface leakage current is negligible. Incident optical power is 300 nanowatts and receiver bandwidth is 20 MHz.
 Find :-
 (i) Mean square quantum noise current.
 (ii) Mean square dark current.
 (iii) Mean square thermal noise current at 25°C.
 Boltzman constant = $1.38 \times 10^{-23} \text{ J/k.}$
 7. Write short notes on :- 20
 (a) OTDR.
 (b) LASER diode.
 (c) LED.