BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, RAJASTHAN

First Semester 2016-2017
Mid Semester Test

Course no: EEE G591 — Max. Marks :70
Course Title: Optical Communication — Weightage : 35%
Date : 8-10-2016 — Duration : 1.5 Hrs
(Open-Book) — **M.M.: 70**

Q.1: A step index multimode fiber with core index of 1.5 accept 9% of the incident light falling on the end surface of the fiber at 1.5 μm.Find
(i) B.L product available
(ii) B.L product if the same fiber index profile is changed to a graded index with α as 2 but keeping core size, axis index and cladding index all same as of SI case.
(iii) number of possible modes in both the cases (i) and (ii) if a=40 μm. (15)

Q.2: Design a suitable link for a single channel transmission at 1Gbps for a 50km link at 1400nm having a waveguide dispersion as -5.8 ps/km.nm. Discuss the suitable parameters of the fiber and source. Now extend the design to accommodate 4 new channels,each with a spacing of 4 nm and compute the overall data rate which can be now supported by the fiber. (Assume S= 1ps/km.nm^2) (15)

Q.3: In a standard SI fiber a chirp free pulse with T_0 as 10ps at 1.5 μm becomes 20 ps after 400 km. Now if this pulse with some chirping compresses and show a minimum pulse width at 100 km , then find
(i) minimum pulse duration at 100 km.
(ii) pulse duration after 600 km.
(iii) possible data rate through the fiber if a narrow spectral source is used for a 50 km link.
(15)

Q.4(a): Design a transmitter block to implement FSK and PSK working at 1Gbps. Also write down any four important specifications of a source for such high speed transmitters.
(b): Design a block diagram of a shot noise limited receiver block. Comment on the speed issue of such receivers with specific examples. It the used transmitter has the rex as 0.4 and $\sigma_1 = 4\sigma_0$ at the receiver. Assume current at 1 level is 10 σ_1 then compute the Q value and possible BER.
(7+8)

Q.5: In an optical link of 50km, dispersion broadening provides a power penalty of 1dB when the source rms width is 1nm for a fiber fiber having D as 2 ps/km.nm. In the same system at the receiver end the time rms jitter comes out as 0.1 ns then estimate the corresponding power penalty. (10)
