Seventh Semester B.Tech. Degree Examination, November 2017
(2013 Scheme)
13.702: OPTICAL COMMUNICATION (T)

Time: 3 Hours
Max. Marks: 100

PART - A

Answer all questions. Each carries 2 marks. (10×2 = 20 Marks)

1. Consider a multimode fiber that has a core refractive index of 1.480 and a core-cladding index difference 2.0 percent ($\Delta = 0.0202$). Find the
   a) numerical aperture
   b) the acceptance angle and
   c) the critical angle.

2. What is bending loss and its types?

3. What are the indoor and outdoor cables available in fiber optics?

4. A particular LED has a 5-ns injected carrier lifetime. When no modulation current in applied to the device, the optical output power is 0.250 mW for a specified dc bias. Assuming parasitic capacitances are negligible, what is the optical output at modulation frequency of 100 MHz?

5. Define Noise equivalent power and detectivity of photodetector.

6. Define error rate and quantum limit in fiber optic communication digital receivers.

7. Define optical SNR and how it could be measured.

8. An OTDR is used to measure the attenuation of a long length of fiber. If the optical power level measured by the OTDR at the 8-km point is 0.5 of the measured value at the 3-km point, what is the fiber attenuation?

9. Specify the WDM standards developed by ITU.

10. What is LiFi technology?

P.T.O.
PART – B

Answer any one question from each Module. Each question carries 20 marks.

Module – I

11. Explain the mode theory of optical fibers. 20
12. a) Discuss in detail about polarization mode dispersion and waveguide dispersion in fibers. 10
   b) Discuss in detail about Photonic Crystal fibers. 10

Module – II

13. a) A double-heterojunction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and nonradiative recombination times of 30 ns and 100 ns, respectively. The drive current is 40 mA. Find
       a) the bulk recombination time 8
       b) the internal quantum efficiency and
       c) the internal power level.
       b) With neat diagram explain the laser diode structure and its radiation patterns. Also explain the modulation of laser diode and laser linewidth. 12
14. a) Explain about the amplified spontaneous emission noise and the effects of laser diode nonlinearity. 10
   b) Draw and explain the avalanche photodiode structures and electric field in depletion and multiplication region. Also explain the Avalanche multiplication noise. 10

Module – III

15. a) With neat block diagram explain how the digital signal transmission takes place in optical systems. Also explain about the various digital receiver performance of fiber optic system. 10
   b) What is Semiconductor Optical Amplifier (SOA) and explain how external pumping takes place in SOA. Derive the expression for amplifier gain and SOA bandwidth. 10
16. a) Explain how the amplification mechanism takes place in EDFA amplifier with neat diagrams. 10
   b) Discuss in detail about the measurement of fault detection, length and refractive index of fiber using optical time domain reflectometer. 10

Module – IV

17. With neat sketches explain the operation of various passive optical couplers used in WDM networks. 20
18. a) Explain about soliton links using optical amplifiers and GH effect. 10
   b) Write short notes on optical network and free space optics. 10