

DHANAMANJURI UNIVERSITY

JUNE – 2021

Name of Programme : M.Sc. Electronics
Semester : Fourth
Paper Code : ELE-620
Paper Title : Optical Fiber Communication & Biomedical Instrumentation
Full Marks : 40

The figures in the margin indicate full marks for the questions.

Answer all questions

1. Describe the functions of the core and the cladding in an optical fiber. A graded index multimode fiber has the maximum relative index $\Delta = 1.0\%$. Calculate the cladding refractive index if the core's maximum index is 1.486. How many modes can support a step index optical fiber whose $d = 8.3 \mu\text{m}$, $n_{\text{core}} = 1.4513$ and $n_{\text{clad}} = 1.4468$ $\lambda = 1550 \text{ nm}$. 6+2+2=10

Or

List three causes of attenuation in an optical fiber and explain their mechanism. The core refractive index is 1.4513 and the cladding index is 1.4468.

What is

- i) The critical propagation angle?
 - ii) The acceptance angle?
 - iii) The numerical aperture? 7+3=10
2. What are the two major stages of the fiber fabrication process? Briefly describe each. Calculate the pulse spreading due to modal dispersion and the maximum number of bits per second that can be transmitted over 1 km with a graded index fiber of $\text{NA} = 0.200$ $n_1 = 1.486$. 7+3=10

Or

With a neat diagram calculate the power budget of a fiber link of 10 km length which includes

- a) 4 fusion splicing including transmitter and node connection in the 1st km and a node amplifier is to be installed at 1 km whose sensitivity is -10 dBm.
- b) 4 fusion splicing including 1st node and 2nd node connection in the 2nd km and a node amplifier is to be installed at 2 km from the source whose sensitivity is -10 dBm.
- c) 4 fusion splicing including 2nd node and 3rd node connection in the 3rd km and a node amplifier is to be installed at 3 km from the source whose sensitivity is -10 dBm.
- d) 4 fusion splicing including 3rd node and 4th node connection in the 4th km and a node amplifier is to be installed at 4 km from the source whose sensitivity is -10 dBm.
- e) 10 fusion splicing including 4th node and 5th (last) node connection in the 10th km and a node amplifier is to be installed in the last point i.e. 10 km from the source whose sensitivity is -10 dBm.

Select proper splitters to make the design most efficient and power saving. Splicing loss is 0.01 dB/fusion splicing. Connector loss is 0.1 dB/connector. If a single mode fiber cable with attenuation of 0.2 dB/Km is used and Transmitter power is 6 dB of 1550 nm. How much power is left at the last point. 10

3. Explain the important parts of a generalized medical instrument systems. 10

Or

Discuss

a) Medical device safety and risk management.

b) Effectiveness/performance of medical devices.

c) Phases in the life span of a medical device.

d) The role of each participant/stakeholder. 10

4. What are X-Ray computed Topography and magnetic resonance Imaging, Explain briefly. 10

Or

Describe the Physiological Effects of electricity and important susceptibility parameters. 10
