



End Term (Even) Semester Examination May-June 2025

Roll no.....

Name of the Program and semester: BTech (ECE), Sem VIII

Name of the Course: Optical Fiber Communication

Course Code: TEC 802

Time: 3 hour

Maximum Marks: 100

Note:

- (i) All the questions are compulsory.
- (ii) Answer any two sub questions from a, b and c in each main question.
- (iii) Total marks for each question is 20 (twenty).
- (iv) Each sub-question carries 10 marks.

Q1

(2X10=20 Marks)

- (a) Define the relative refractive index difference for an optical fiber and show how it may be related to the numerical aperture. CO1
- (b) Draw and explain the general block diagram of optical fiber communication. CO1
- (c) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine
 - i. The critical angle at the core-cladding interface CO1
 - ii. The Numerical Aperture of the fiber
 - iii. The acceptance angle in air for the fiber

Q2

(2X10=20 Marks)

- (a) Briefly describe the scattering losses occur in optical fiber. CO2
- (b) The numerical input/output mean optical power ratio in a 1km, length of optical fiber is found to be 2.5. Calculate the received mean optical power when a mean optical power of 1Mw is launched into a 5km fiber length (assuming no joint or connectors). CO2
- (c) The beat length in a single-mode optical fiber is 8 cm when light from an injection laser with a spectral linewidth of 2 nm and a peak wavelength of 1 μ m is launched into it. Determine the modal birefringence and estimate the coherence length in this situation. CO2



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Q3

(2X10=20 Marks)

- (a) What do you understand by an optical modulator? List the various modes of Laser diode. CO3
- (b) What are the requirements of Laser action? Explain spontaneous and stimulated emission. CO3
- (c) A forward biased LED has a voltage drop of 1.5 volts. If the battery voltage is 6 volts, calculate the resistance to be connected in series, if the current through the LED is 15mA. CO3
How much power is dissipated in the resistor?

Q4

(2X10=20 Marks)

- (a) Define avalanche effect. What are the drawbacks of Avalanche photodiode? CO4
- (b) Define photocarriers and photocurrent. What are the advantages of photodiodes? CO4
- (c) A photodiode has a quantum efficiency of 65% when photons of energy $1.5 \times 10^{-19} \text{J}$ are incident upon it. Calculate (i) photodiode operating wavelength, (ii) the incident optical power required to obtain a photocurrent of $2.5 \mu\text{A}$ when the photodiode is operating as described above. CO4

Q5

(2X10=20 Marks)

- (a) Describe and discuss the optical receiver block diagram in detail. CO5,6
- (b) Discuss optical Ethernet. Also discuss coherent and non-coherent detection in detail. CO5,6
- (c) A four-port multimode fiber FBT (fused bioconical taper) coupler has $70 \mu\text{W}$ optical power launched into port one. The measured output powers at ports two, three and four are 0.004, 26 and $27.5 \mu\text{W}$ respectively. Determine: what are the coupling ratio, excess loss, insertion loss between the input and output ports. CO5,6