



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 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
 - ii. The Numerical Aperture of the fiber
 - iii. The acceptance angle in air for the fiberCO1

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 $1.5 \times 10^{-19} J$ are incident upon it. Calculate (i) photodiode operating wavelength, (ii) the incident optical power required to obtain a photocurrent of $2.5 \mu A$ 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 biconical tapper) coupler has $70 \mu W$ optical power launched into port one. The measured output powers at ports two, three and four are $0.004, 26$ and $27.5 \mu W$ respectively. Determine: what are the coupling ratio, excess loss, insertion loss between the input and output ports. CO5,6