

- N.B. :** (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** from remaining **six**.
(3) **All** questions carry **equal** marks.

1. (a) Explain with a neat sketch the two categories of front-end amplifiers used in optical fiber communication systems. 5
- (b) State the spectral band designations used in optical fiber communications. 5
- (c) Discuss in brief single mode step index fiber and multimode step index fiber. 5
- (d) Name the key parameters for describing the signal transmission in single mode fiber and multimode fibre. 5

2. (a) Define the terms numerical aperture, critical angle, propagating modes and microbands in the context of an optical fiber. 10
- (b) Calculate the required Δ if a fiber with a $8 \mu\text{m}$ core and a $125 \mu\text{m}$ cladding is to be single mode at 1300 nm . Assume that the core index is 1.46 . 5
- (c) A $45^\circ - 45^\circ - 90^\circ$ prism is immersed in alcohol ($n = 1.45$). What is the minimum refractive index the prism must have if a ray incident normally on one of the short faces is to be totally reflected at the long face of an prism? 5

3. (a) What do you understand by degenerating modes in step index fiber? 5
- (b) With a neat sketch explain fiber optic cable. 5
- (c) Name five connectors used in optical fibre communications 5
- (d) What does the coupling efficiency equation? $\eta = (p_f / p_s) = (NA)^2$ signify where p_f is the power coupled to the source p_s source power. 5

4. (a) What do you understand by double heterostructure? State its limitations. 5
- (b) State the difference between LED and LASER. 5
- (c) A light source generating an optical power output equal to $1 \mu\text{W}$ is coupled into an optical fiber with a cross sectional area larger than the active area of the light source. 5
Determine the power coupled into the fiber. θ° equal to 15° .
- (d) Draw the current optical power output curve for Fabry - Perot Laser and explain to relationships. 5

5. (a) List all the parameters that contribute to photo current gain of APD. 5
- (b) Derive an expression for the responsibility "R" of the photo detector. 5
- (c) Briefly discuss the possible sources of noise in optical fiber receiver. Describe in detail what is meant by quantum noise. Consider this phenomenon with regard to 10
 - (i) Digital signalling
 - (ii) Analog transmission.

6. (a) In a point-to-point communication link it is given that launched power is -10 dBm , receiver sensitivity is -40 dBm and the length of the link is 10 km . If the total losses in the link add upto 27 dB . Find the safety margin. If the fiber bandwidth is 1000 MHz . km what is the maximum permissible data rate. If the risk time due to the source and the detector is negligible. 10
- (b) Draw and explain the test-set up for measuring the chromatic dispersion. 10

7. Write short notes on any **two** :—

- (a) Linearly polarized modes
 - (b) Numerical aperture in GIF
 - (c) Scattering losses in optical fiber
 - (d) Distributed feed back laser.
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