

Optical Fiber Communication (BTEC-702)

Question Bank

- 1) Describe the function of core and cladding in optical fiber.
- 2) What is acceptance angle? Why do we need to know this angle?
- 3) Draw a block diagram of fiber optic communication system and describe the function of each component
- 4) Why the R.I. of core and cladding are different? Which one has greater R.I. and why?
- 5) Why is it necessary to meet the total reflection requirement inside an optical fiber?
- 6) What is meant by the term critical propagation angle?
- 7) What are the advantages and disadvantages of fiber optic communications?
- 8) Define Numerical aperture of the fiber. Why it can't be made very large?
- 9) Derive the relationship between n_1 , n_2 & θ_c .
- 10) Differentiate between step index and Graded index fiber.
- 11) Differentiate between single mode and multimode fiber.
- 12) Among Microwaves and light waves which have high bit rate distance product? Why?
- 13) Mention the three advantages of optical fiber as waveguide over conventional metallic waveguide?
- 14) What is meant by mode and index profile?
- 15) Mention the advantages of Graded Index fiber.
- 16) Write the expression for the refractive index in Graded index fiber.
- 17) State Snell's Law.
- 18) Define TIR?
- 19) What is the need of Cladding?
- 20) What are leaky modes in optical fibers?
- 21) Define External reflection of light rays?
- 22) Define V number?
- 23) What is relation between V number and power flow in cladding?
- 24) What is the fundamental parameter of SM fiber?
- 25) Give the relation between rays and modes?
- 26) What are the advantages and disadvantages of SM fiber and MM fiber?
- 27) Define skew rays and meridional rays?
- 28) Define cutoff conditions?
- 29) What is meant by Degenerate modes?
- 30) What is meant by linearly polarized modes?
- 31) Define MFD?
- 32) A point source of light is 12cm below the surface of a large body of water ($n=1.33$).
What is the radius of the largest circle on the water surface through which the lights can emerge?
- 33) Draw a block diagram of fiber optic communication system and describe the function of each component
- 34) What is the structure of optical fiber? Give the advantage of optical fiber over metallic cables.
- 35) Differentiate between step index and Graded index fiber. How the rays do propagates in graded index fiber?
- 36) What is the difference between acceptance angle, critical angle and numerical aperture? A

step index fiber has a core and cladding refractive index of 1.50 and 1.46 resp. what is the value of NA and acceptance angle of the fiber?

37. Differentiate between Meridional Rays and Skew Rays. Explain the nature of light.

38. Explain the following:

- a) Normalized propagation constant
- b) Mode field Theory

39. Explain what is meant by critical bending radius for an optical fiber.

40. Discuss the linear scattering losses in optical fibers with respect to

- a) Rayleigh Scattering
- b) Mie Scattering

41. What do you mean by mode coupling? Explain the various irregularities in the fiber of its causes.

42. Explain Modal birefringence and beat length in single mode fibers,

43. Explain intrinsic and extrinsic absorption in optical fiber material.

44. Write a note on polarization maintain fiber.

45. Explain the dispersion mechanism in optical fibers.

46. What is the population Inversion? Explain the mechanism of Population inversion for three level & four level energy state system.

47. What is the requirement for optical sources to feed into a fiber? Enlist the advantage & Disadvantages of LASER & LED.

48. Explain the necessity of carrier confinement in semiconductor laser.

49. Differentiate the different geometries of LASER

50. Explain the various structure of LED.

51. Derive the expression for the threshold value of gain for LASER oscillations.

52. Difference in LED and Laser.

53. Explain the characteristics of LED.

54. Explain the principal of LASER diode. What are the pumping techniques of LASER diode?

55. What do you understand by the term external quantum efficiency and internal quantum efficiency?

56. What do you understand by optical detector? Discuss its various types of optical detector and parameters of photo detectors

57. Discuss the impact ionization in avalanche photodiode. Explain the multiplication factor and photo multiplication factors also.

58. Explain the various measures of efficiency in PIN photodiode & briefly explain the working principle of Schottky barrier photodiodes.

59. Explain the working of p-i-n photodiode. Also explain the factors that limit the speed of response of photodiode.

60. Mention the criteria for choosing the photo detectors for optical communication. How does a reverse bias p-n diode act as a detector?

61. What do you mean by acceptance angle of an optical fiber, show how it is related to refractive index of the fiber core, cladding and medium where fiber is placed ?

62.. Explain the following :

- (i) Normalized Propagation constant.
- (ii) Mode field diameter.

63. What do you understand by Attenuation? Describe its various types with expressions.

64. Differentiate between meridional and skew rays. An optical fiber in air has NA 0.4 ; compare the acceptance angle for skew rays which changes direction by 100° at each

reflection. Discuss the vapour-phase oxidation technique in preparation of low-loss optical fiber.

65. What do you understand by scattering loss? Describe its types with expressions.

66. Discuss various dispersion mechanisms.

67. The radiative and non radiative recombination lifetimes of the minority carriers in the active region of double heterostructure LED are 50 ns and 100 ns respectively. Determine the total carrier recombination life time and the power internally generated within the device when the peak emission wavelength is $0.87 \mu\text{m}$ at a drive current of 40 mA.

68. Explain the working principle of LED. How the quantum efficiency of a LED is defined? List out various parameters which are needed to be optimized for getting maximum output power from the LED.

69. Derive an expression for the coupling efficiency of a surface emitting LED into a step index fiber, assuming the device to have a Lambertian output. Also write the difference between Edge and Surface emitting LED.

70. A p-i-n photodiode on average generate one electron hole pair per three incident photons at a wavelength of $0.8 \mu\text{m}$. Assuming all the electrons are collected, calculate:

- a) The quantum efficiency of the device
- b) The maximum possible bandgap energy.

71. Explain the principle, construction and working of APD.

72. Write Short Notes on:

- (a) Population Inversion
- (b) Optical Detection Principle

73. Explain what is meant by : (a) Modal birefringence (b) The beat length in single mode fibers.

74. Explain the detection process in p-n photodiode. Compare this device with the p-i-n photodiode.