

QUESTION BANK

Subject- Optical Fibres & Communication

Subject Code: BTEC-602-18

- 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) Define Numerical aperture of the fiber. Why it can't be made very large?
- 6) Differentiate between step index and Graded index fiber.
- 7) Differentiate between single mode and multimode fiber.
- 8) Among Microwaves and light waves which have high bit rate distance product? Why?
- 9) Mention the three advantages of optical fiber as waveguide over conventional metallic waveguide?
- 10) Give the expression of the effective number of modes that are guided by a curved multimode fiber of radius 'a'.
- 11) What are leaky modes in optical fibers?
- 12) What is relation between V number and power flow in cladding?
- 13) What is the fundamental parameter of SM fiber?
- 14) Define skew rays and meridional rays?
- 15) What is meant by linearly polarized modes?
- 16) Define MFD?
- 17) Differentiate between step index and Graded index fiber. How the rays do propagate in graded index fiber?
- 18) What is the difference between acceptance angle, critical angle and numerical aperture?
- 19) 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?
- 20) What is the group velocity and phase velocity?
- 21) An optical signal of wavelength λ propagates in a medium of refractive index n_1 . What is the value of phase velocity and Group velocity?
- 22) Explain the following:
 1. Normalized propagation constant
 2. Mode field Theory
- 23) Discuss the linear scattering losses in optical fibers w.r.t 1. Rayleigh Scattering 2. Mie Scattering
- 24) Explain the various irregularities in the fiber of its causes.
- 25) Explain Modal birefringence and beat length in single mode fibers,
- 26) Explain intrinsic and extrinsic absorption in optical fiber material.
- 27) Explain the dispersion mechanism in optical fibers.
- 28) What is the population Inversion? Explain the mechanism of Population inversion for three level & four level energy state system.
- 29) What is the requirement for optical sources to feed into a fiber? Enlist the advantage & Disadvantages of LASER & LED.
- 30) Differentiate the different geometries of LASER

- 31) Explain the various structure of LED.
- 32) Derive the expression for the threshold value of gain for LASER oscillations.
- 33) Explain the principal of LASER diode. What are the pumping techniques of LASER diode? Give the structure of FP cavity LASER and how it is better than FP LASER.
- 34) What do you understand by the term external quantum efficiency and internal quantum efficiency?
- 35) What do you understand by optical detector? Discuss its various types of optical detector and parameters of photo detectors
- 36) Discuss the impact ionization in avalanche photodiode. Explain the multiplication factor and photo multiplication factors also.
- 37) Explain the working of p-i-n photodiode. Also explain the factors that limit the speed of response of photodiode.
- 38) Mention the criteria for choosing the photo detectors for optical communication. How does a reverse bias p-n diode act as a detector?
- 39) Draw the block diagram of optical fiber communication system. Enlist the advantages of optical communication.
- 40). 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 ?
- 41) A graded index fiber has a core with a parabolic refractive index profile and diameter $40\text{ }\mu\text{m}$. Numerical aperture is 0.2. Estimate the total number of guided modes for a wavelength of $1\text{ }\mu\text{m}$.
- 42) What do you understand by Attenuation? Describe its various types with expressions.
- 43) What do you understand by Inter Symbol Interference (ISI) ?
- 44) A multimode graded index fiber exhibits total pulse broadening of $0.1\text{ }\mu\text{s}$ over a distance of 15 km . Estimate : (i) The maximum possible bandwidth without ISI. (iii) Pulse dispersion per unit length.
- 45) Discuss the vapour-phase oxidation technique in preparation of low-loss optical fiber.
- 46) What do you understand by scattering loss ? Describe its types with expressions.
- 47). Discuss various dispersion mechanisms.
- 48) Write the expression for the refractive index in graded index fibers.
- 49) A given APD has a quantum efficiency of 65% at a wavelength of 900 nm . If $0.5\text{ }\mu\text{W}$ of optical power produces a multiplied photocurrent of $10\text{ }\mu\text{A}$, find the multiplication M.
- 50) Explain briefly about link power budget analysis?
- 51) 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 $0.87\text{ }\mu\text{m}$ at a drive current of 40 mA .
- 52) A p-i-n photodiode on average generate one electron hole pair per three incident photons at a wavelength of $0.8\text{ }\mu\text{m}$. Assuming all the electrons are collected, calculate: (i) The quantum efficiency of the device (ii) The maximum possible bandgap energy.
- 53) Determine the refractive indices of the core and the cladding material of a fiber if numerical aperture is 0.22 and refractive index difference $\Delta=0.012$.
- 54) Find the maximum diameter of a core for a single mode optical fiber operating at $1.55\text{ }\mu\text{m}$ with $n_1=1.55$ and $n_2=1.48$.
- 55) What is internal quantum efficiency, differential quantum efficiency and total efficiency of semiconductor laser?
- 56) Write short notes on following : (a) The optical power meter

(b) OTDR

(c) Wavelength division multiplexing.

57) Attempt any two parts of the following : (i) Multichannel transmission techniques. (ii) WDM

58) With the help of a neat block diagram, explain the principle of working of point to point digital link.

59) List out various advantages of optical fiber communication system over the conventional electrical communication system.

60) With the aid of suitable diagram, briefly discuss the following in the case optical fiber transmission. (i) Fiber bend losses ; (ii) Dispersion shifted fibers.

61) Write a short note on Dispersion Shifted Fiber (DSF).

62) Explain the working of a Heterodyne detection technique suitable for optical fiber communication.

63) Discuss the following terms for optical fiber: (i) Absorption (ii) Scattering losses.

64). Write short note on: a) Optical TDM systems

b) Frequency chirping

65) Discuss the various design issues in the implementation of WDM light wave system.

66) Draw and explain the tunable semiconductor Lasers.

67) What is WDM light wave systems. Explain in detail.

68) Derive the expression for calculating the power budget.

69) Describe the add/drop techniques in WDM optical networks.

70) Compare the quantum efficiency of PIN and APD Photodetectors.

71) Why is stimulated emission used in Laser? Give the fundamental structure of optical confining.

72) What is linear scattering. Briefly explain the Rayleigh scattering and Mie scattering in detail.

73) Discuss the various sources of errors in optical sources.

74) Differentiate between Splices and connectors.

75) Define Receiver sensitivity.

76) What do you mean by wavelength converter. Explain FWM wavelength converter.

77) What is non linear phase modulation.

78) What is meant by following terms:

a) Self pulsation

b) Partition Noise

79) Derive the expression for noise in PIN and avalanche photodiode.

80) Draw and explain the working principle of avalanche photodiode.