

**SRM Institute of Science & Technology**

**Faculty of Engineering & Technology**

Ramapuram Campus

**UNIT-2-Questions**

1. What is dispersion in optical fiber communication?  
a) Compression of light pulses  
b) **Broadening of transmitted light pulses along the channel**  
c) Overlapping of light pulses on compression  
d) Absorption of light pulses

Answer b

2. To avoid overlapping of light pulses down on an optical fiber link, the digital bit rate must be

a) **Less than the reciprocal of broadened pulse duration**  
b) More than the reciprocal of broadened pulse duration  
c) Same as that of than the reciprocal of broadened pulse duration  
d) Negligible

Answer a

3. 3dB optical bandwidth is always \_\_\_\_\_\_\_\_\_\_\_ the 3dB electrical bandwidth.  
a) Smaller than  
**b) Larger than**c) Negligible than  
d) Equal to

Answer b

4.What is pulse dispersion per unit length if for a graded index fiber, 0.1μs pulse broadening is seen over a distance of 13 km?  
a) 6.12ns/km  
**b) 7.69ns/km**c) 10.29ns/km  
d) 8.23ns/km

Answer b

5.In waveguide dispersion, refractive index is independent of   
a) Bit rate  
b) Index difference  
c) Velocity of medium  
**d) Wavelength**

**Answer d**

6. Which kind of dispersion phenomenon gives rise to pulse spreading in single mode fibers.

a) Intramodal

b) Intermodal  
c) Material  
**d) Group Velocity**

**Answer d**

7. With respect to single mode and graded index fibers, which parameter specifies the propagation of polarization modes with different phase velocities & the difference between their effective refractive indices?

a. Mode field diameter  
b. **Birefringence**  
c. Fiber beat length  
d. Spot Size

Answer b

8. The ratio of optical output power to electrical input power is called as ----------------------

a)**power conversion efficiency**

b)Conversion efficiency

c)Extraction efficiency

d)Radiation efficiency

d)Power efficiency

Ans a

9. Practical pulse broadening value for graded index fiber lies in the range of \_\_\_\_\_\_\_\_\_\_  
a) 0.9 to 1.2 ns/km  
**b) 0.2 to 1 ns/km**  
c) 0.23 to 5 ns/km  
d) 0.45 to 8 ns/km

Answer b

10. Disturbance along the fiber such as vibrations, discontinuities, connectors, splices, source/detectors coupling result in \_\_\_\_\_\_\_\_\_\_  
a) Modal noise  
b) Inter-symbol interference  
c) Infrared interference  
**d) Pulse broadening**

Answer d

11. The modal noise can be reduced by \_\_\_\_\_\_\_\_\_\_  
a) Decreasing width of signal longitudinal mode  
b) Increasing coherence time  
c) Decreasing number of longitudinal modes  
**d) Using fiber with large numerical aperture**

Answer d

12. The macroscopic bending losses show an exponential increase due to \_\_\_\_\_\_\_\_ in radius of curvature.

a) Increase  
**b) Decrease**  
c) Stability  
d) no change

Answer b

13.The variant of non-zero-dispersion-shifted fiber is called as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Dispersion flattened fiber
2. Zero-dispersion fiber
3. Positive-dispersion fiber
4. **Negative-dispersion fiber**

**Answer d**

14.Write the equations for finding attenuation in optical fiber

a) αρ = zln[p(0)/p(z)]

b) αρ =1/z[p(0)/p(z)]

**c) αρ =1/zln[p(0)/p(z)]**

d) αρ =1/zln[p(z)/p(0)]

Answer c

15. Identify the causes of Ray-Leigh scattering

a) **Fluctuation in refractive index and density and compositional variations**

b) Pulse broadening and reflection

c) Distortion and oscillation

d) phase and group velocity delay

Answer a

16. Select the wavelength of the optical spectrum that produces maximum attenuation

a) 850nm

b) 900nm

c)1300nm

**d)1400nm**

**Answer d**

17.Give the expression for group velocity(ω-angular frequency, β-propagation constant)

**a.υg=dω/dβ**

b. υg=dβ/dω

c. υg=dω\*dβ

d.υg=dω+dβ

Answer a

18. Practical pulse broadening value for graded index fiber lies in the range of \_\_\_\_\_\_\_\_\_\_  
 a) 0.9 to 1.2 ns/km  
 **b) 0.2 to 1 ns/km**  
 c) 0.23 to 5 ns/km  
 d) 0.45 to 8 ns/km

**Answer b**

19.Disturbance along the fiber such as vibrations, discontinuities, connectors, splices, source/detectors coupling result in \_\_\_\_\_\_\_\_\_\_  
 a) Modal noise  
 b) Inter-symbol interference  
 c) Infrared interference  
 **d) Pulse broadening**

**Answer d**

20. With respect to single mode and graded index fibers, which parameter specifies the propagation of polarization modes with different phase velocities & the difference between their effective refractive indices?

**a.** Mode field diameter  
**b. Birefringence**  
**c.** Fiber beat length  
**d.** Spot Size

**Answer b**

21.Which type of scattering occurs due to interaction of light in a medium with time dependent optical density variations thereby resulting into the change of energy (frequency) & path?

**a. Stimulated Brilliouin Scattering (SBS)  
b.** Stimulated Raman Scattering (SRS)  
**c.** Mie Scattering  
**d.** Rayleigh Scattering

**Answer a**

22. A multimode step index fiber has source of RMS spectral width of 60nm and dispersion parameter for fiber is 150psnm-1km-1. Estimate rms pulse broadening due to material dispersion.

1. 12.5ns km-1
2. 9.6ns km-1
3. **9.0ns km-1**
4. 10.2ns km-1

**Answer c**

23.Γg = dβ / C\*dk. What is β in the given equation?

1. Attenuation constant
2. **Propagation constant**
3. Boltzmann’s constant
4. Free-space

**Answer b**

24. Dispersion-shifted single mode fibers are created by

1. Increasing fiber core diameter and decreasing fractional index difference
2. Decreasing fiber core diameter and decreasing fractional index

Difference

c).**Decreasing fiber core diameter and increasing fractional index difference**

d) Increasing fiber core diameter and increasing fractional index difference

**Answer c**

25. Chromatic dispersion is also called as\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. intramodal dispersion
2. **intermodal dispersion**
3. modal delay
4. internal dispersion

**Answer b**

26. The effects of intrinsic absorption can be minimized by \_\_\_\_\_\_\_\_\_\_\_  
**a) Ionization**  
b) Radiation  
c) Suitable choice of core and cladding components  
d) Melting

**Answer a**

27. Intermodal dispersion occurring in a large amount in multimode step index fiber results in \_\_\_\_\_\_\_\_\_\_\_\_  
a) Propagation of the fiber  
b) Propagating through the fiber  
**c) Pulse broadening at output**  
d) Attenuation of waves

**Answer c**

28. What is the unit of measurement of the optical attenuation per unit length?  
a) dB-km  
**b) dB/km**  
c) km/dB  
d) V

**Answer b**

29. Absorption losses due to atomic defects mainly include \_\_\_\_\_\_\_\_\_\_\_  
a) **Radiation**b) Missing molecules, oxygen defects in glass  
c) Impurities in fiber material  
d) Interaction with other components of core

**Answer a**

30. In the single mode fibers, the dominant dispersion mechanism is \_\_\_\_\_\_\_\_\_\_\_\_  
a) Intermodal dispersion  
b) Frequency distribution  
c) Material dispersion  
**d) Intra-modal dispersion**

**Answer d**

**PART-B (4 marks)**

1. What are the losses (or) signal attenuation mechanism in a fiber?
2. What are the types of linear scattering losses?

3.A 30 km long optical fiber has an attenuation of 0.8 dB/ km. If 7 dBm of optical

power is launched into fiber, determine the output power in dBm.

4.What are the types of linear scattering losses?

5. Consider a 1-km long multimode step-index fiber in which n1 = 1.480 and Δ = 0.01, so

that n2 = 1.465. What is the modal delay per length in this fiber.

6.What is meant by intrinsic absorption in optical fiber?

7.Mention the way to reduce macro bending losses

8.What are the types of nonlinear scattering losses?

9. What are the two reasons for chromatic dispersion

10. What are the factors that cause Rayleigh scattering in optical fibers?

11. What is meant by dispersion in optical fiber?

12.What is meant by intermodal dispersion?

13. Define – Group Velocity Dispersion(GVD)

14.What is meant by chromatic dispersion?

15.What is Modal Noise?

16. A single mode fiber operating at 1330𝑚𝑚 has a modal birefringence of 1.5 × 10−5 .

Measure the fiber beat length.

17. Mention the parameters used in the design optimization of single mode fiber

18. Analyze the Optimum Refractive-Index Profile of a Graded-Index Fiber.

19. Compare intra and inter modal dispersion.

20. What is propagation constant and write its expression.

21. For silica the fictive temperature Tf is 1400 K, the isothermal compressibility bT is 6.8 ¥ 10-12 cm2 /dyn = 6.8 ¥ 10-11 m2 /N, and the photoelastic coeffi cient is 0.286. Estimate the scattering loss at a 1.30-mm wavelength where n = 1.450.

PART-C

1. What is the mean optical power launched into an 8km length fiber is 20MW, the mean optical power at the fiber output is 3µW. Determine i)Overall signal attenuation in dB/km and

ii)The overall signal attenuation for a 10km optical link using the same fiber with splices at 1km intervals, each giving an attenuation of 1dB.

2. Explain with suitable diagrams the different mechanisms that contribute to attenuation in optical fibers.

3. .Discuss in detail the intermodal dispersion with relevant expressions and diagrams

4. A 6km optical link consists of multimode step index fiber with a core refractive index of

1.5 and a relative refractive index of 1%. Estimate the delay difference between the slowest and fastest modes at the fiber output and the rms pulse broadening due to intermodal dispersion on the link. Also derive the expression involved in it.

5. Explain the scattering and bending losses that occur in an optical fiber with relevant diagrams and expressions.

6. Discuss material and waveguide dispersion mechanisms with necessary mathematical expressions

9. Compute the total intermodal, intramodal and total dispersion for a fiber having fiber length 1km, line width 50nm, intermodal and intramodal dispersions5ns/km and 80 pcs/km

10. What do you mean by pulse broadening? Explain its effect on information carrying capacity

of a fiber.

11. Discuss the Chromatic dispersion mechanism with necessary mathematical expressions.

12. Describe the inter-modal and intra-modal dispersion with necessary expressions.

13.An LED operating at 850 nm has a spectral width of 45 nm, what is the pulse spreading in ns/km due to material dispersion? What is the pulse spreading when a laser diode having1 2nm spectral width is used? The material dispersion is 90ps/nm.km.

14. With neat sketches, comment on Macro bending and Micro bending Losses.

15.Derive expressions for material dispersion and waveguide dispersion and explain them.

16.Discuss the attenuation encountered in optical fiber communication due to Bending, Scattering and Absorption.