SRM Institute of Science & Technology

Faculty of Engineering & Technology

Ramapuram Campus

Department of Electronics & Communication Engineering

Sub Code/Name:18ECO107T/Fiber Optics and Optoelectronics

Year/Sem/Branch: III/VI/CSE & IT

UNIT 1

PART A (1 Mark)

1. Multimode step-index fiber has _____
a) Large core diameter & large numerical aperture
b) Large core diameter and small numerical aperture
c) Small core diameter and large numerical aperture
d) Small core diameter & small numerical aperture
Answer a

2. Multimode step-index fiber has a large core diameter of range is _____
a) 100 to 300 μm
b) 100 to 300 nm
c) 200 to 500 μm
d) 200 to 500 nm
Answer a

3. Multimode step-index fibers have a bandwidth of _____
a) 2 to 30 MHz km
b) 6 to 50 MHz km
c) 10 to 40 MHz km
d) 8 to 40 MHz km
Ans b

4. Multimode-graded index fibers are manufactured from materials with _____
a) Lower purity
b) Higher purity than multimode step index fibers.
c) No impurity
d) Impurity as the same as multimode step index fibers.
Ans b

5. The performance characteristics of multimode graded index fibers are _____
a) Better than multimode step index fibers
b) Same as multimode step index fibers
c) Lesser than multimode step index fibers
d) Negligible
Ans a

6. The fiber mostly not used nowadays for optical fiber communication systems are _____
a) Single-mode fiber
b) Multimode step fiber

c) Coaxial cables
d) Multimode-graded index fiber
Ans a

7. Single-mode fibers allow single-mode propagation; the cladding diameter must be at least _____
a) Twice the core diameter
b) Thrice the core diameter
c) Five times the core diameter
d) Ten times the core diameter
Ans d

8. When optical fibers are to be installed in a working environment, the most important parameter to be considered is?
a) Transmission property of the fiber
b) Mechanical property of the fiber
c) Core cladding ratio of the fiber
d) Numerical aperture of the fiber
Ans b

9. Optical fibers for communication use are mostly fabricated from _____
a) Plastic
b) Silica or multicomponent glass
c) Ceramics
d) Copper
Ans b

10. Optical fibers are used in _____
a) CAT scans
b) X-ray photos
c) Ultrasound scans
d) Endoscopy
Answer d

11. In optical fiber communications, the signal source is _____ waves.
a) Light
b) Infrared
c) Radio
d) Very low-frequency
Ans a

12. Which one of the following is not a guided medium of transmission?
a) Fiber–Optic cable
b) Coaxial cable
c) Twisted-pair cable
d) Free space
Answer d

13. In optical fiber, the outer layer is _____ and inner layer is _____ .
a) core, cladding
b) cladding, core
c) transmit, reflect
d) reflect, transmit
Ans b

14. The fundamental elements of any communication system includes
a) Transmitter
b) Transmission channel

c) Receiver

d) All the above

15. Data are usually transferred over the communication channel by superimposing the information signal onto a sinusoidally varying _____known as_____

a) EM wave,carrier

b)   Magnetic wave,carrier

c) Electric wave,Carrier

d) Signal,carrier

16. Optical signals launched into the fiber, become progressively attenuated and distorted with increasing distance because of ……….................. mechanisms in the waveguide.

a) Scattering

b)   Absorption

c) Dispersion

d) All of the above

17._____& _____are the two principal photodetectors used in a fiber optic link.

a) PN diode ,zener diode

b) PNdiode, varactor diode

c) PIN diode,avalanche photodiode

d) Tunnel Diode and Shottky diode

18. The typical value of n for a diamond is _____

a) 1.5258

b)   1.00

c) 1.33

d) 2.42

19. The expression for the refractive index is given by

a) $N = v/c$

b) $N = c/v$

c) $N = cv$

d) $N = 1/cv$

Ans b

20. Numerical aperture is expressed as the_____

a) $NA = \sin \theta a$

b) $NA = \cos \theta a$

c) $NA = \tan \theta a$

d) $NA = \sec \theta a$

Ans a

21. For total internal reflection to occur, which condition must be satisfied?

a) $n1 = n2$

b) $n1 > n2$

c) $n1 < n2$

d) $n1 \times n2 = 1$

Ans b

22. Find the refractive index of a medium having a velocity of 1.5×10^8.

a) 0.5

b) 5

c) 0.2

d) 2

Ans d

23. The refractive index of water is_____
a) 1
b) 2.66
c) 5
d) 1.33
Ans d
24. The numerical aperture of a coaxial cable with core and cladding indices given by 2.33 and 1.4 respectively is
a) 3.73
b) 0.83
c) 3.46
d) 1.86
Ans d
25. Find the acceptance angle of a material which has a numerical aperture of 0.707 in air.
a) 30
b) 60
c) 45
d) 90
Ans c
26. The numerical aperture of a material with acceptance angle of 60 degree in water will be
a) 1.15
b) 2.15
c) 5.21
d) 1.52
Ans a
27. Snell's law is given by_____
a) $n_1 \sin \theta_1 = n_2 \sin \theta_2$
b) $n_2 \sin \theta_1 = n_1 \sin \theta_2$
c) $\sin \theta_1 = \sin \theta_2$
d) $n_1 \cos \theta_1 = n_2 \cos \theta_2$
Ans a
28. Calculate the ratio of sine of incident angle to the sine of reflected angle when the refractive indices of medium 1 and 2 are given as 2.33 and 1.66 respectively.
a) 0.71
b) 1.4
c) 2
d) 3.99
Ans a
29. Find the ratio of the refractive index of medium 1 to that of medium 2, when the incident and reflected angles are given by 300 and 450 respectively.
a) 0.5
b) 1
c) 2
d) 4
Ans c
30. The critical angle is defined as the angle of incidence at which the total internal reflection starts to occur. State True/False.
a) True
b) False
Ans a

31. For a critical angle of 60 degree and the refractive index of the first medium is 1.732, the refractive index of the second medium is
a) 1
b) 1.5
c) 2
d) 1.66
Ans b

32. The opto-electronic device used for the detection of the optical signal is _____
a) IR sensors
b) Photodiodes
c) Zener diodes
d) Transistors
Ans b

33. It is a device that distributes light from a main fiber into one or more branch fibers.
a) Optical fiber coupler
b) Optical fiber splice
c) Optical fiber connector
d) Optical isolator
Ans a

34. Optical fiber couplers are also called as _____
a) Isolators
b) Circulators
c) Directional couplers
d) Attenuators
Ans c

35. Graded Index fiber is used to _____
a) Reduce absorption and resulting power loss
b) Reduce dispersion and increase data rate
c) Secure communication
d) Increase Numerical aperture
Ans b

36. Numerical aperture in optical fiber is used to describe_____
 a) Light spreading ability
b) Light gathering ability
c) Light output from external shield
d) Light leakage ability

37. Which type of optical fiber is used to eliminate modal dispersion during optical communication? a) Single mode step Index
b) Multimode step index
c) Multimode graded Index
d) Does not depend on type of fiber
Ans a

38. Which is the most beneficial index profile in single mode fibers
 a) Step Index
 b) Co-axial cable
 c) Graded Index
d) Step and graded Index
Ans a

39. Fiber optic system has three basic components, in order. They are_____
 a) light guide, light source, light detector

b) light source, light guide, light detector
c) light detector, light source, the light guide
d) light guide, light detector, light source
Ans a
40.The rays which do not intersect the core axis are called_____
 a) meridional rays
 b)radial rays
 c) helical rays
 d) skew rays
Ans d
41. The rays which pass through the core axis are called_____
a) meridional rays
b) radial rays
c) helical rays
d) skew rays
Ans a
42. The essential condition for total internal reflection to take place within the optical fiber is
when the incidence angle exceeds the specified value of _____
a) critical angle
b) refraction angle
c) reflection angle
d) acceptance angle
Ans a
43. When the incidence angle is _____ the specified critical angle, the light rays bend
along the intersection line of two different mediums of propagation.
a) more than
b) less than
c) equal to
d) not related with
Ans c
44. A step-index fiber has specified parameters for the refractive index of fiber core and
cladding as 1.50 and 1.33, respectively. Its acceptance angle will be approximately
a)25°
b)20°
c)15°
d)10
Ans c
45. The light is propagated within the fiber core by the phenomenon of_____
a) total internal reflection at core-cladding intersection
b) refraction at core-cladding intersection
c) total internal reflection at the outer surface of the cladding
d) change in the velocity of light within the fiber core
Ans a
46. The material used for fabrication of inner core of an optical fiber is_____
a) glass or plastic
b) bimetallic
c) copper
d) liquid
Ans a

47. Optical fibers are highly immune to EMI. Which one of the following four statements justifies it?
a) They transmit signals as light rather than electric current.
b) They are readily shielded by outer conductors in the cable.
c) They are too small for magnetic fields to introduce current in them.
d) Magnetic fields cannot penetrate the glass of the fiber
Ans a

PART B (4 marks)

1. Explain in detail the advantages of optical fiber over conventional copper systems.
2. Explain how attenuated and distorted signals recovered in the transmission link.
3. What is refractive index? Write the expression for the same.
4. Using Snells law, define the relationship at the interface between two different media.
5. When a ray of light moves from medium 1 to medium 2 with different refractive indices, Explain the condition for total reflection.
6. A beam of flashlight traveling in air incident on a surface of a thin glass at an angle of 38^0 with the normal. The index of refraction of the glass is 1.56. What is the angle of refraction?
7. A boy is in a pool and shines a flashlight toward the level of it at a 35^0 angle to the vertical. At what angle does the flashlight beam leave the pool?
8. A slab of glass has an index of refraction of 1.5 and is submerged in water with n=1.33. A beam of monochrome light is incident on the slab and is refracted. Find the angle of refraction if the angle of incidence is 30^0
9. An unknown glass has an index of refraction of n=1.5n=1.5. For a beam of light originating in the glass, at what angles the light 100% reflected back into the glass. (The index of refraction of air is n air=1.00).
10. A step-index silica fiber with a core radius much longer than the operating wavelength of light has a core refractive index of 1.50 and a cladding refractive index of 1.48. Estimate the Numerical aperture of the fiber
11. A step-index silica fiber with a core radius much longer than the operating wavelength of light has a core refractive index of 1.50 and a cladding refractive index of 1.48. Estimate the acceptance angle in the air
12. A step-index silica fiber with a core radius much longer than the operating wavelength of light has a core refractive index of 1.50 and a cladding refractive index of 1.48. Estimate the acceptance angle in water having a refractive index of 1.33.
13. Mention the advantages and disadvantages of fiber optic communications.
14. Differentiate between step index and Graded index fiber.
15. Differentiate between single-mode and multimode fiber
16. Define skew rays and meridional rays.
17. Refractive index of the core is higher than the cladding. Justify the statement.

PART C (10 marks)

1. With the aid of neat diagrams, discuss various components of optical fiber transmission.
2. Categorize the fibers based on the index of refraction and modes
3. Derive the expression for Acceptance angle and Numerical Aperture
4. Describe in detail the methods adopted for the installation of fiber cables. Mention the precautions to be taken during the installation.
5. Discuss in detail about the types of rays in ray optics