** SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**RAMAPURAM CAMPUS, CHENNAI-600 089**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION**

**18ECO107T -Fiber Optics and Optoelectronics**

**QUESTION BANK – UNIT -1**

**Part – A (Each Question Carries 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

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

3. 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

4. In single mode fibers, which is the most beneficial index profile?

a) Step index

b) **Graded index**

c) Step and graded index

d) Coaxial cable

5. The fibers mostly not used nowadays for optical fiber communication system are \_\_\_\_\_\_\_\_\_\_\_

a) **Single mode fibers**

b) Multimode step fibers

c) Coaxial cables

d) Multimode graded index fibers

6. Optical fibers are used in

a) CAT scans

b) X-ray photos

c) Ultrasound scans

**d)** **Endoscopy**

7. In optical fiber communications, the signal source is \_\_\_\_\_\_\_\_ waves.

**a)** **Light**

b) Infrared

c) Radio

d) Very low-frequency

8. Which one of the following is not a guided medium of transmission?

a) Fiber–Optic cable

b) Coaxial cable

c) Twisted-pair cable

**d)** **The atmosphere**

9. Fiber optic system has three basic components, in the order. They are:

a) light guide, light source, light detector

**b)** **light source, light guide, light detector**

c) light detector, light source, light guide

d) light guide, light detector, light source

10. In optical fiber, the outer layer is \_\_\_\_\_\_\_\_\_ and inner layer is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

a) core, cladding

**b)** **cladding, core**

c) transmit, reflect

d) reflect, transmit

11.The fundamental elements of any communication system includes

* · Transmitter
* · Transmission channel
* · Receiver
* · **All the above**

12. …………couples message onto a Transmission channel,in the form of signal which matches transfer properties of the…………….

* · **Transmitter, channel**
* · Receiver, channel
* · Transmitter, receiver
* · Receiver,transmitter

13.Optical power is attenuated through ………….. and …………..absorption by air molecules in an atmospheric channel.

* · Reflection,Refraction
* · Diffraction,Scattering
* · Dispersion,diffraction
* · **Scattering ,absorption**

14.Motivation behind every communication system is to …………

* · Improve transmission fidelity
* · Increase data rate
* · Increase transmission distance between relay stations
* · **All the above**

15.Data are usually transferred over the communication channel by superimposing the information signal onto a sinusoidally varying ……………… known as………

* · **EM wave,carrier**
* · Magnetic wave,carrier
* · Electric wave,Carrier
* · Signal,carrier

16.The optical spectrum ranges from about ………………..(ultraviolet) to about ………………

(far infrared), and visible spectrum is in ………….band.

* · **50nm,100µm,400 to 700 nm**
* · 50nm,150µm,400 to 700 nm
* · 50nm,120µm,400 to 700 nm
* · 50nm,130µm,400 to 700 nm

17.Due to Coherent laser source, optical frequencies are on order …………. Exceeds microwave system information capacity by factor………….

* · 1x1014Hz,105
* · 2x1014Hz,105
* · 3x1014Hz,105
* · **5x1014Hz,105**

18.The advantages of optical fibers includes

* · Low transmission loss
* · Wide bandwidth
* · Immunity to interference
* · **All the above**

**19.** Optical fiber cables can be installed either …………,……….,………or ……….directly in the ground.

* · Aerial
* · Ducts
* · Undersea/buried
* · **All the above**

20.Very low loss optical waveguide in the 1100 nm to 1600 nm region is possible by reducing ………… ions and ………….ion impurities in fiber material.

* · **Hydroxyl ,metallic**
* · Hydrogen,metallic
* · Oxide,metallic
* · Phosphorus,metallic

21.An optical source is …………. Device, which means that linear variation in drive……….results in a corresponding linear change in optical ………

* · Square law,voltage,output power
* · exponential law,voltage,output power
* · **Square law,current ,output power**
* · Exponential law,voltage,output power

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

* · Scattering
* · Absorption
* · Dispersion
* · **All of the above**

23……………&……………..are the two principal photodetectors used in a fiber optic link.

* · Pn diode ,zener diode
* · Pn diode, photodiode
* · **Pin diode,avalanche photodiode**
* · Pin diode, photodiode

24. InGaAs alloy is the prime material candidate in ……………..region.

* · **1100-1600 nm**
* · 1200-1600 nm
* · 1300-1600 nm
* · 1000-1600 nm

25.Design of receiver is more complex than transmitter as it has to ……………. And ………… degraded signal received by photodetector.

* · Modulate,amplify
* · **Amplify,reshape**
* · Filter,transmit
* · Convert, retransmit

26.A linearly polarized waves travelling in direction k can be represented in general form as

* · A(x,t)=eiA0
* · A(x,t)=A0exp[j(wt-k.x)]
* · A(x,t)=eiexp[j(wt-k.x)]
* · **A(x,t)=eiA0exp[j(wt-k.x)]**

27. The relationship between energy E and the frequency v of a photon is given by

* · **E=hv**
* · E=h/v
* · E=v/h
* · E=hv-1

28.The typical value (n) for diamond is

* · 1.5258
* · 1.00
* · 1.33
* · **2.42**

29. The critical angle can be represented as

* · Ɵc=arccos(n2)
* · **Ɵc=arccos(n2/n1)**
* · Ɵc=arccos(n1/n2)
* · Ɵc=arccos(n1)

30. The light ray in air is parallel to the glass surface at ………..

* · **Critical angle**
* · Greater than critical angle
* · Less than critical angle
* · At 60degree

31. Graded Index fiber is used to

1. Reduce absorption and resulting power loss
2. **Reduce dispersion and increase data rate**
3. Secure communication
4. Increase Numerical aperture

32. Which type of optical fiber is used to eliminate modal dispersion during optical communication?

1. **Single mode step Index**
2. Multimode step index
3. Multimode graded Index
4. Does not depend on type of fiber

33. Numerical aperture in optical fiber is used to describe

1. Light spreading ability
2. **Light gathering ability**
3. Light output from external shield
4. Light leakage ability

34. 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**

**35.** Which is the most beneficial index profile in single mode fibers

1. Step Index
2. Co-axial cable
3. **Graded Index**
4. Step and graded Index

36. When a beam of light travels from one medium to another medium \_\_\_\_\_\_\_\_ will not change.

1. Speed
2. Direction
3. **Frequency**
4. Wavelength

37. With respect to single mode and graded index fiber which parameter specifies the propagation of polarization modes with different phase velocities and difference between their effective refractive indices.

1. Mode field diameter
2. Birefringence
3. **Fiber beat length**
4. Spot size

38. A typically structured glass multimode step index fiber shows as variation of attenuation in range of \_\_\_\_\_\_\_\_\_\_\_

a) 1.2 to 90 dB km-1 at wavelength 0.69μm

b) 3.2 to 30 dB km-1 at wavelength 0.59μm

c) **2.6 to 50 dB km-1 at wavelength 0.85μm**

d) 1.6 to 60 dB km-1 at wavelength 0.90μm

39. Multimode graded index fibers have overall buffer jackets same as multimode step index fibers but have core diameters \_\_\_\_\_\_\_\_\_\_\_

a) Larger than multimode step index fibers

b) **Smaller than multimode step index fibers**

c) Same as that of multimode step index fibers

d) Smaller than single mode step index fibers

40. What is needed to predict the performance characteristics of single mode fibers?

a) The intermodal delay effect

b) **Geometric distribution of light in a propagating mode**

c) Fractional power flow in the cladding of fiber

d) Normalized frequency

41.Fiber optic system has three basic components, in the order. They are:

1. light guide, light source, light detector
2. **light source, light guide, light detector**
3. light detector, light source, light guide
4. llight guide, light detector, light source

42.Which mechanism is used in Laser Technology for generation of light?

a)Dispersion

b)Absorption

**c)Stimulated Emission**

d)Spontaneous Emission

43. Optical splice provides a connection between

a)transmitter to fiber

b)receiver to fiber

**c)fiber to fiber**

d)fiber to repeater

44. Optical fibers are highly immune to EMI. Which one of the following four statements justifies it?

a)**They transmit signals in as light rather than electric current.**

b)They are readily shielded by outer conductors in cable.

c)They are too small for magnetic fields to introduce current in them.

d)Magnetic fields cannot penetrate the glass of the fiber.

45. In an optical fiber, the fiber core \_\_\_\_\_\_\_\_\_\_\_\_ the cladding.

**a)is denser than**

b)has the same density as

c)is less dense than

d)is another name for

46. The material used for fabrication of inner core of an optical fiber is

**a)glass or plastic**

b)bimetallic

c)copper

d)liquid

47. Unlike wired media, optical fibers are highly resistant to

a)refraction

b)low-frequency transmission

**c)electromagnetic interference**

d)high-frequency transmission

48. The light is propagated within the fiber core by the phenomenon

**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

49. A step-index fiber has specified parameters for refractive index of fiber core and cladding as 1.50 and 1.46, respectively. Its numerical aperture is

**a)0.344**

b)0.156

c)0.486

d)0.244

50. A step-index fiber has specified parameters for 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°

51 Consider a ray of light propagating from one medium to another medium having different indexes of refraction. If the incidence angle is greater than the specified critical angle, then \_\_\_\_\_\_\_ occurs.

**a)reflection**

b)refraction

c)diffraction

d)scattering

52. 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

53. In \_\_\_\_\_\_\_\_\_\_\_\_ profile optical fibers, the propagation of light rays is almost horizontal provided the low-refractive index fiber core has relatively smaller diameter as compared with those of other types of optical fibers.

a)multimode step-index

b)multimode graded-index

c)multimode single-index

**d)single-mode**

54. Dispersion (i.e., distortion in the transmitted optical pulse) is maximum in \_\_\_\_\_\_\_\_\_ type of optical fibers.

**a)Multimode step-index**

b)Multimode graded-index

c)Multimode single-index

d)Single-mode

55. In \_\_\_\_\_\_\_\_\_\_ type of optical fiber cables, the density of the fiber core varies.

a)multimode step-index

**b)multimode graded-index**

c)multimode single-index

d)single-mode

56. In optical fibers, the index of refraction in the fiber core is always

**a)greater than that of cladding**

b)less than that of cladding

c)equal to that of cladding

d)not at all related with that of cladding

57. For single-mode step index fibers, V-number should be less than

**a)2.4**

b)2.8

c)4.2

d)8

58 Which one of the following types does not exist in optical fibers?

a)single-mode step-index

**b)single-mode graded-index**

c)multimode step-index

d)multimode graded-index

59. 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

60. The rays which do not intersect the core axis are called

a)meridional rays

b)radial rays

c)helical rays

**d)skew rays**

**Part – B (Each Question Carries 2 mark)**

1. Explain in detail about the advantages of optical fiber over conventional copper systems.

2. Enumerate in detail about various elements of an optical fiber transmission link with necessary diagrams.

3. Define Figure of merit.

4. Compare pin and Avalanche photodiode(APD’s)

5. Explain how attenuated and distorted signals recovered in transmission link.

6. Write short notes on polarization and its types with equations.

7. What is refractive index.

8. Using snells law,define the relationship at interface between two different media.

9. What is total internal reflection and write its types.

10. A beam of flashlight traveling in air incident on a surface of a thin glass at an angle of 38 0with the normal. The index of refraction of the glass is 1.56. What is the angle of refraction?

11. A boy is in a pool and shines a flashlight toward the level of it at a 35 0angle to the vertical. At what angle does the flashlight beam leave the pool? (the index of refraction of glass is 1.33).

12. 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.

13. Find the angle of refraction if the angle of incidence is 30 0

13. An unknown glass has an index of refraction of n=1.5*n*=1.5. For a beam of light originated 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).

14. The energy of a photon is E= hf = hc / λ, where Planck’s constant is h = 6.63x 10 -34J.s and the speed of light in vacuum is c = × 3 x 108 m/s. If λ = 1× 10-10 m, what is E(in joule) and E(in eV)?

16. Mention the characteristics of graded index fiber.

17. Classify the fibers based on index of refraction and modes.

18. 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.

19 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 air.

20. 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.

21. Describe the function of core and cladding in optical fiber.

22. What is acceptance angle? Why do we need to know this angle?

23. Draw a block diagram of fiber optic communication system and describe the function of each component

24.Why the R.I. of core and cladding are different? Which one has greater R.I. and why?

26. Why is it necessary to meet the total reflection requirement inside an optical fiber?

27. What is meant by the term critical propagation angle?

28. What are the advantages and disadvantages of fiber optic communications?

29. Define Numerical aperture of the fiber. Why it can’t be made very large?

30. Differentiate between step index and Graded index fiber.

31. Differentiate between single mode and multimode fiber.

32. What is meant by mode and index profile?

33. Mention the advantages of Graded Index fiber.

34. Write the expression for the refractive index in Graded index fiber.

35. What is the need of Cladding?

36.What are the advantages and disadvantages of SM fiber and MM fiber?

37. Define skew rays and meridional rays?