LASER

129 LASER is a short form of
a) Light amplification by spontaneous emission of radiation
b) Light amplification by stimulated emission of radiation
c) Light absorption by stimulated emission of radiation
d) Light absorption by spontaneous emission of radiation

130 Laser beam is made of
a) Highly coherent electrons
b) Highly coherent photons
c) Highly coherent phonons
d) None of them

131 The life time of electron in meta stable state is of the order of
a) 10^{-9} S.
b) 10^{-3} S.
c) 10^{-8} S.
d) 10^{-7} S.

132 The energy state of an atom is said to be metastable when its
a) Life time is of the order of 0.01 sec
b) Life time is of the order of 0.001 sec
c) Life time is of the order of 0.1 sec
d) Life time is of the order of 1 sec

133 In the population inversion
a) The number of electrons in higher energy state is more than the ground state
b) The number of electrons in lower energy state is more than higher energy state
c) The number of electrons in higher and lower energy state are same
d) None of them

134 The characteristics of laser beam are
a) Highly directional
b) Highly intense
c) Highly monochromatic
d) All of them

135 The energy of photon is equal to
a) hv
b) (3/2)hv
c) hv/2
d) None of them

136 Which event is likely to take place when a photon of energy equal to the difference in energy between two levels is incident in a system?
a) Absorption
b) Emission
c) Absorption and emission
d) None of the above

137 The condition for population inversion is
a) $N2/N1=e^{(E2-E1)/kT}$
b) $N2/N1=e^{-(E1-E2)/kT}$
c) $N1/N2=e^{-(E1-E2)/kT}$
d) $N2/N1= e^{-(E2-E1)/kT}$

138 Which one of the following laser has highest efficiency?
a) Ruby
b) Semiconductor
c) He-Ne
d) Carbon dioxide

139 The method of population inversion in the He-Ne laser is
a) Molecular collision
b) Direction conversion
c) Optical pumping
d) Electron impact

140 The first laser was invented in May, 1960 by
a) TH Maiman
b) Maxwell
c) Einstein
d) C. V. Raman

141 When atom is expose to radiation having a stream of photons each with energy hv, then the following processes can take place
a) Absorption
b) Spontaneous emission
c) Stimulated
d) All of them

emission

142 An atom or molecule in the ground state of energy E_1 can absorb a photon of energy hv and go the higher energy state E_2, then the process is known as
a) Stimulated radiation b) Stimulated absorption
c) Stimulated emission d) Spontaneous absorption

143 In spontaneous emission the atoms or molecules in the higher energy state E_2 eventually return to the ground state E_1 by emitting their excess energy spontaneously. The rate of spontaneous emission is
a) Directly proportional to population of the energy level E_2. b) Directly proportional to population of the energy level E_1.
c) Inversely proportional to population of the energy level E_2. d) None of the above

144 In stimulated emission, a photon having energy E equal to the difference in energy between two levels E_2 and E_1, stimulate an atom in the higher state to make a transition to the
a) Lower energy state with a creation of second photon. b) Metastable state with creation of second photon.
c) Higher energy state with a creation of two photons. d) None of the above

145 The rate of spontaneous emission depends upon the number of atoms in the
a) Ground state b) Excited state
c) Metastable state d) None of the above

146 The rate of stimulated emission depends both on
a) The energy of external photon and on the number of atoms in the excited state. b) The energy of external photon and the number of atoms in the ground state.
c) The energy of external photon and on the number of atoms in the metastable state d) None of the above

147 The spontaneous emission produces
a) Coherent light b) Incoherent light
c) White light d) None of the above

148 The material in which population inversion can take place is called
a) Active medium b) Passive medium
c) Gaseous medium d) Vapour medium

149 In case of population inversion, the number atoms is
a) more in higher energy state than in the lower energy state b) more in higher energy state than in meta-stable state
c) more in lower energy state than in the higher energy state d) None of them

150 The state of population inversion is also known as
a) Positive temperature state b) Negative temperature state

c) Equilibrium state d) None of the above

151 The process of raising the atoms from a lower energy state to higher, to create population inversion is called
a) Exothermal reaction b) Endothermic reaction
c) Pumping d) None of the above

152 In case of optical pumping, an external optical source like Xenon' flash lamp is employed to produce
a) lower population in the metastable state of laser medium b) Low population in the higher energy level of laser medium
c) Higher population in the lower energy level of laser medium d) High population in the higher energy level of laser medium

153 Optical pumping is suitable for any medium which is
a) Transparent to light b) Not transparent to light
c) Metallic d) None of the above

154 Electrical pumping is used for some medium which can conduct electricity
a) affecting the laser activity b) without affecting the laser activity
c) without affecting excited energy state d) None of the above

155 In a semiconductor laser, electrical energy is directly converted to
a) Light energy b) Sound energy
c) Heat energy d) Nuclear energy

156 An optical resonator plays a major role in
a) Stimulating more and more atoms from excited state to ground state b) Generation of intense laser output
c) Generation of unidirectional beam of photons d) All of them

157 Ruby laser is a solid state laser, the active medium is
a) Crystalline substance b) Non crystalline substance
c) Gaseous substance d) None of the above

158 In case of ruby laser , optical resonator cavity is formed by the silvered ends of
a) Tourmaline crystal b) The Calcium crystal
c) Ruby crystal d) Quartz crystal

159 Ruby laser works in the
a) Non pulse mode due to the high pump energy b) Pulsed mode due to the high pump energy
c) Pulsed mode due to the low pump energy d) None of the above

160 The He-Ne laser is a kind of neutral atom gas laser in which the wavelength of laser is
a) $6328A^0$ b) $6943A^0$
c) $10600A^0$ d) None of the above

161 Ruby is crystalline substance of Aluminium oxide doped with
a) Approximately 0.005% by weight of Chromium oxide. b) Approximately 0.5% by weight of Chromium oxide.
c) Approximately 0.05% by weight of d) Approximately 5% by weight of

Chromium oxide. Chromium oxide

162 In case of Ruby laser, the resultant pink colour is due to presence of Cr^{+3} ions in the appropriate concentration which
a) Replace Al atoms in the crystal lattice
b) Replace Oxide atoms in the crystal lattice
c) Replace Na atoms in the crystal lattice
d) None of the above

163 The main advantage of gas lasers is that
a) They can operate in the pulse mode
b) They cannot be operated continuously
c) They can operate continuously
d) None of the above

164 In molecular gas lasers, the laser oscillations are achieved by the transition between
a) The vibrational and translational levels of the molecules
b) The vibrational and rotational levels of the molecules
c) The longitudinal vibrational and translational levels of the molecules
d) None of the above

165 In case of semiconductor lasers the laser transition is possible only in
a) Indirect band gap semiconductors
b) Direct band gap semiconductors
c) Both direct as well as indirect band gap semiconductors
d) None of the above

166 Advantages of semiconductor diode laser are
a) Efficiency is more than 10%
b) They can have a continuous wave output or pulsed output.
c) Highly economical, and further the arrangement is compact
d) All of them

167 The applications of laser in communication are
a) The laser beams are used to transmit thousands of TV programs and simultaneous telephone conversation at a time
b) The communication between the planets has been made possible using laser beams
c) The laser light waves are not absorbed by water and hence it can be successfully employed to establish under water communication between submarines
d) All of them

168 Laser light is produced due to
a) interference phenomenon
b) spontaneous emission of light
c) stimulated emission of radiation.
d) diffraction phenomenon

169 Which laser was invented first?
a) Semiconductor
b) Ruby laser

laser

c) He-Ne laser d) CO_2 laser

170 Which of the following is a gas laser?

a) He-Ne laser b) Ruby laser

c) Semiconductor laser d) Nd-YAG laser

171 Which of the following conditions is very essential for the production of laser light?

a) Stimulated absorption b) Stimulated emission process

c) Population inversion process d) All of them

172 Which of the following is not a pumping process?

a) Optical pumping b) Electrical pumping

c) Chemical pumping d) Thermal pumping

173 Pulsed laser light is produced from a

a) Ruby laser b) CO_2 laser

c) Semiconductor laser d) He-Ne laser

174 Which of the following is not a laser property?

a) Coherence b) Divergence

c) Extreme brightness d) Highly directional

175 Laser system does not include

a) Active medium b) Pumping mechanism

c) Optical activity d) Optical resonator

176 Which source of light is brightest?

a) Sunlight b) Laser light

c) Arc light d) Sodium light

192 The stimulated emission of radiation means ……..

a) before completion of life time, stimulation of an atom from higher state to lower energy state
b) after completion of life time, stimulation of an atom from higher state to lower energy state
c) before completion of life time, stimulation of an atom from lower state to higher energy state
d) none of the above

193 The condition needed for laser action is……..

a) stimulated absorption
b) spontaneous emission
c) stimulated emission
d) population inversion.

194 The population inversion is to……

a) Depopulate lower energy state
b) Depopulate higher energy state
c) Depopulate metastable state
d) none of the above

195 In the optical pumping ……

a) Photons are used to excite the atoms in the medium
b) electrical energy is used to excite the atoms in the medium
c) magnetic energy is used to excite the atoms in the medium
d) All of these

196 The different types of lasers are ……

a) solid state lasers
b) gas lasers
c) semiconductor lasers
d) all of them

197 The advantages of using laser drilling in industries is/are ……

a) it generates very low heat in the material during drilling
b) it is possible to drill at different angles
c) its accuracy and consistency are very high
d) all of them

198 The advantages of gas cutting laser is/are

a) very fast and accurate
b) very simple and cost effective
c) it is used to cut materials of any thickness with high precision
d) all of them

199 The condition of total internal reflection is that ……

a) the angle of incidence exceeds the critical angle
b) the angle of incidence is less than critical angle
c) the angle of incidence is equal to critical angle
d) none of the above

200 The critical angle is defined as ……..

a) the refraction at which the total internal reflection occurs
b) the reflection at which the total internal reflection occurs
c) the angle of incidence at which total internal reflection occurs
d) none of the above

201 The main principle of optical fiber is ……

a) total internal reflection
b) total internal refraction
c) total internal dispersion
d) none of the above

202 The application of laser beam in computer peripherals is/are …….

a) optical disks
b) optical wave guide
c) CD ROM disk
d) all of them

203 The method of producing 3D image of an object due to the …… is known as holography.

a) interference of non coherent light waves on a photographic plate
b) interference of coherent light waves on a photographic plate
c) only reflection of coherent light waves
d) none of the above

204 In holography

a) Only phase of a wave reflected from the object is recorded on the film
b) Only amplitude of a wave reflected from the object is recorded on the film
c) Amplitude as well as phase of a wave reflected from the object is recorded on the film
d) Neither amplitude nor phase of a wave reflected from the object is recorded on the film

205 When hologram is reconstructed we get the 3D image of the object because

a) Only phase of a wave reflected from the object is recorded on the hologram
b) Only amplitude of a wave reflected from the object is recorded on the hologram
c) Amplitude as well as phase of a wave reflected from the object is recorded on the hologram
d) Neither amplitude nor phase of a wave reflected from the object is recorded on the hologram

206 The basic principle of holography is that ……

a) to create the interference pattern of object wave and reference wave
b) to create the interference pattern of object wave only
c) to create the interference pattern of reference wave only
d) none of the above

207 Holography was invented by …….

a) C.K.N.Patel in 1948
b) Leith and Upatnicks in 1962
c) Dennis Gabour in 1948
d) Ali-Jawan

208 The applications of holography are ……

a) Holographic storage (mainly used in ROM devices)
b) Three dimensional display of an object
c) Used to determine Young's modulus of metallic rods.
d) all of them

1) What does the acronym LASER stand for?
   a) Light Absorption by Stimulated Emission of Radiation
   b) Light Amplification by Stimulated Emission of Radiation
   c) Light Alteration by Stimulated Emission of Radiation

2) What does the acronym MASER stand for?
   a) Microwave Amplification by Stimulated Emission of Radiation
   b) Molecular Absorption by Stimulated Emission of Radiation
   c) The name of Albert Einstein's dog

3) What is one way to describe a Photon?
   a) Solid as a rock
   b) A wave packet
   c) A torpedo

4) What determines the color of light?
   a) its intensity
   b) its wavelength
   c) its source

5) Which scientist first came up with the idea of stimulated emission ?
   a) Alexander Graham Bell
   b) Isaac Newton
   c) Arthur Schalow
   d) Albert Einstein

6) Which laser is considered "eye safe"?
   a) Laser bar-code scanners
   b) The eximer laser
   c) Communications laser

7) Why are lasers used in fiber optic communications systems
   a) The government has mandated it
   b) They can be pulsed with high speed data
   c) They are very inexpensive

8) What type of laser is used in CD and DVD players?
   a) Semiconductor
   b) YAG
   c) Alexandrite

9) Why are lasers used in "Laser Printers"
   a) They can be focused down to very small spot sizes for high resolution
   b) They are cheap
   c) They are impossible to damage

10) As wavelength gets longer, the laser light can be focused to…
   a) Larger spot sizes
   b) Smaller spot sizes

11) Which color of light has the shortest wavelength ?
   a) Yellow
   b) Blue
   c) Red
   d) Green

12) What property of laser light is used to measure strain in roadways?
   a) Intensity
   b) Power
   c) Coherence

13) What is the type of laser used most widely in industrial materials processing applications?
   a) Dye Laser
   b) YAG laser
   c) Ruby Laser
   d) Carbon Dioxide Laser

14) Why are lasers used for cutting materials
   a) It never gets dull
   b) It has a small "heat affected zone"
   c) Accuracy
   d) Smoother cuts
   e) Repeatability
   f) All of the above

15) The Eximer laser produces light with what wavelength?
   a) Visible
   b) Ultraviolet
   c) Infrared

16) Laser energy is used to break up kidney or gallstones in process called?
   a) Trbecularplasty
   b) Lithotripsy
   c) Viscocanalostomy

17) The National Ignition Facility will use what type of laser for fusion power experimentation?
   a) Neodymium-glass
   b) Argon gas
   c) Rhodamine Dye

18) Most lasers are electrically inefficient devices.
   a) True
   b) False

19) Chemical lasers use_to produce their beams.
   a) Excessive amounts of electrical power
   b) Small amounts of electrical power
   c) No electrical power

20) What type of laser could cause skin cancer if not used properly?
   a) Red semiconductor laser
   b) Blue semiconductor
   c) Eximer laser
   d) YAG laser

This set of Optical Communications Multiple Choice Questions & Answers (MCQs) focuses on "Optical Fibers".

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
View Answer
Answer: a
Explanation: Multimode step-index fiber has large core diameter and large numerical aperture. These parameters provides efficient coupling to inherent light sources such as LED's.

2. 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
View Answer
Answer: c
Explanation: A multimode step index fibers show an attenuation variation in range of 2.6 to 50dBkm^{-1}. The wide variation in attenuation is due to the large differences both within and between the two overall preparation methods i.e. melting and deposition.

3. 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
View Answer
Answer: a
Explanation: A multimode step index fiber has a core diameter range of 100 to 300μm. This is to facilitate efficient coupling to inherent light sources.

4. 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
View Answer
Answer: b
Explanation: Multimode step index fibers have a bandwidth of 6 to 50 MHz km. These fibers with this bandwidth are best suited for short -haul, limited bandwidth and relatively low-cost application.

5. 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 same as multimode step index fibers.
View Answer
Answer: b
Explanation: Multimode graded index fibers have higher purity than multimode step index fiber. To reduce fiber losses, these fibers have more impurity.

6. 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
View Answer
Answer: a
Explanation: Multimode graded index fibers use a constant grading factor. Performance characteristics of multimode graded index fibers are better than those of multimode step index fibers due to index graded and lower attenuation.

7. 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
View Answer
Answer: b
Explanation: Multimode graded index fibers have smaller core diameter than multimode step index fibers. A small core diameter helps the fiber gain greater rigidity to resist bending.

8. Multimode graded index fibers with wavelength of 0.85μm have numerical aperture of 0.29 have core/cladding diameter of _____
a) 62.5 μm/125 μm
b) 100 μm/140 μm
c) 85 μm/125 μm
d) 50 μm/125μm
View Answer
Answer: b
Explanation: Multimode graded index fibers with numerical aperture 0.29 having a core/cladding diameter of 100μm/140μm. They provide high coupling frequency LED's at a wavelength of 0.85 μm and have low cost. They are also used for short distance application.

9. Multimode graded index fibers use incoherent source only.
a) True
b) False
View Answer
Answer: b
Explanation: Multimode graded index fibers are used for short haul and medium to high bandwidth applications. Small haul applications require LEDs and low accuracy lasers. Thus either incoherent or incoherent sources like LED's or injection laser diode are used.

10. 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
View Answer
Answer: b
Explanation: In single mode fibers, graded index profile is more beneficial as compared to step index. This is because graded index profile provides dispersion-modified-single mode fibers.

11. 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
View Answer

Answer: a
Explanation: Single mode fibers are used to produce polarization maintaining fibers which make them expensive. Also the alternative to them are multimode fibers which are complex but accurate. So, single-mode fibers are not generally utilized in optical fiber communication.

12. 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
View Answer
Answer: d
Explanation: The cladding diameter in single mode fiber must be ten times the core diameter. Larger ratios contribute to accurate propagation of light. These dimension ratios must be there so as to avoid losses from the vanishing fields.

13. A fiber which is referred as non-dispersive shifted fiber is?
a) Coaxial cables
b) Standard single mode fibers
c) Standard multimode fibers
d) Non zero dispersion shifted fibers
View Answer
Answer: b
Explanation: A standard single mode fiber having step index profile is known as non-dispersion shifted fiber. As these fibers have a zero dispersion wavelength of 1.31μm and so are preferred for single-wavelength transmission in O-band.

14. Standard single mode fibers (SSMF) are utilized mainly for operation in _____
a) C-band
b) L-band
c) O-band
d) C-band and L-band
View Answer
Answer: c
Explanation: SSMFs are utilized for operation in O-band only. It shows high dispersion in the range of 16 to 20ps/nm/km in C-band and L-band. So SSMFs are used in O-band.

15. Fiber mostly suited in single-wavelength transmission in O-band is?
a) Low-water-peak non dispersion-shifted fibers
b) Standard single mode fibers
c) Low minimized fibers
d) Non-zero-dispersion-shifted fibers
View Answer
Answer: b
Explanation: Standard single mode fibers with a step index profile are called non dispersion shifted fiber and it is particularly used for single wavelength transmission in O-band and as if has a zero-dispersion wavelength at 1.31μm.

1. What is the principle of fibre optical communication?
a) Frequency modulation
b) Population inversion
c) Total internal reflection
d) Doppler Effect
View Answer
Answer: c
Explanation: In optical fibres, the light entering the fibre does not encounter any new surfaces, but repeatedly they hit the same surface. The reason for confining the light beam inside the fibres is the total internal reflection.

2. What is the other name for a maximum external incident angle?
a) Optical angle
b) Total internal reflection angle
c) Refraction angle
d) Wave guide acceptance angle
View Answer
Answer: d
Explanation: Only this rays which pass within the acceptance angle will be totally reflected. Therefore, light incident on the core within the maximum external incident angle can be coupled into the fibre to propagate. This angle is called a wave guide acceptance angle.

3. A single mode fibre has low intermodal dispersion than multimode.
a) True
b) False
View Answer
Answer: a
Explanation: In both single and multimode fibres the refractive indices will be in step by step. Since a single mode has less dispersion than multimode, the single

mode step index fibre also has low intermodal dispersion compared to multimode step index fibre.

4. How does the refractive index vary in Graded Index fibre?
a) Tangentially
b) Radially
c) Longitudinally
d) Transversely
View Answer
Answer: b
Explanation: The refractive index of the core is maximum along the fibre axis and it gradually decreases. Here the refractive index varies radially from the axis of the fibre. Hence it is called graded index fibre.

5. Which of the following has more distortion?
a) Single step-index fibre
b) Graded index fibre
c) Multimode step-index fibre
d) Glass fibre
View Answer
Answer: c
Explanation: When rays travel through longer distances there will be some difference in reflected angles. Hence high angle rays arrive later than low angle rays. Therefore the signal pulses are broadened thereby results in a distorted output.

6. In which of the following there is no distortion?
a) Graded index fibre
b) Multimode step-index fibre
c) Single step-index fibre
d) Glass fibre
View Answer
Answer: a
Explanation: The light travels with different speeds in different paths because of the variation in their refractive indices. At the outer edge it travels faster than near the centre But almost all the rays reach the exit end at the same time due to the helical path. Thus, there is no dispersion in the pulses and hence the output is not a distorted output.

7. Which of the following loss occurs inside the fibre?
a) Radiative loss

b) Scattering
c) Absorption
d) Attenuation
View Answer
Answer: b
Explanation: Scattering is a wavelength dependent loss. Since the glass used in the fabrication of fibres, the disordered structure of glass will make some vibrations in the refractive index inside the fibre. This causes Rayleigh scattering.

8. What causes microscopic bend?
a) Uniform pressure
b) Non-uniform volume
c) Uniform volume
d) Non-uniform pressure
View Answer
Answer: d
Explanation: Micro-bends losses are caused due to non-uniformities inside the fibre. This micro-bends in fibre appears due to non-uniform pressures created during the cabling of fibre.

9. When more than one mode is propagating, how is it dispersed?
a) Dispersion
b) Inter-modal dispersion
c) Material dispersion
d) Waveguide dispersion
View Answer
Answer: b
Explanation: When more than one mode is propagating through a fibre, then inter modal dispersion will occur. Since many modes are propagating, they will have different wavelengths and will take different time to propagate through the fibre.

10. A fibre optic telephone transmission can handle more than thousands of voice channels.
a) True
b) False
View Answer
Answer: a
Explanation: Optical fibre has larger bandwidth hence it can handle a large number of channels for communication.

11. Which of the following is known as fibre optic back bone?
a) Telecommunication
b) Cable television
c) Delay lines
d) Bus topology
View Answer
Answer: d
Explanation: Each computer on the network is connected to the rest of the computers by the optical wiring scheme called bus topology, which is an application known as fibre optic back bone.

12. Calculate the numerical aperture of an optical fibre whose core and cladding are made of materials of refractive index 1.6 and 1.5 respectively.
a) 0.55677
b) 55.77
c) 0.2458
d) 0.647852
View Answer
Answer: a
Explanation: Numerical aperture = $\sqrt{n12-n22}$
Numerical aperture = 0.55677.

13. A step-index fibre has a numerical aperture of 0.26, a core refractive index of 1.5 and a core diameter of 100micrometer. Calculate the acceptance angle.
a) 1.47°
b) 15.07°
c) 2.18°
d) 24.15°
View Answer
Answer: b
Explanation: sin i = (Numerical aperture)/n
sin i = 15.07°.

Q1: Data signal with minimum error is generated by which among the following

a. Signal processing circuits
b. Photodiode
c. Linear circuitry
d. None of the above

Answer: (c) Linear circuitry

Q2: Which among the following is described by the concept of numerical aperture in an optical fibre?

a. Light collection
b. Light scattering
c. Light dispersion
d. Light polarisation

Answer: (a) Light collection

Q3: An optical fibre consists of a core μ1 surrounded by a cladding of μ< μ1. A beam of light enters from the air at an angle of α with the axis of the fibre. The highest α for which ray can be travelled through fibre is

a. cos−1μ22−μ12−−−−−−−−√
b. sin−1μ12−μ22−−−−−−−−√
c. tan−1μ12−μ22−−−−−−−−√
d. sec−1μ12−μ22−−−−−−−−√

Answer: (b) sin−1μ12−μ22−−−−−−−−√

Q4: In an optical fibre communication system, which among the following is not a typical transmitter function?

a. Coding for error protection
b. Decoding of input data
c. Electrical to optical conversion
d. Recoding to match output standard

Answer: (d) Recoding to match output standard

Q5: In a single-mode fibre, how does the fraction of energy travelling through bound mode appear in the cladding?

a. As a crescent wave
b. As a gibbous wave
c. As an evanescent wave
d. All the above

Answer: (c) As an evanescent wave

Q6: Which among the following fibre optic cables have a core of size 480 µm to 980 µm and made up of polymethylmethacrylate?

a. Glass fibre optic cable
b. Plastic fibre optic cable
c. Plastic clad silica fibre optic cable
d. All of the above

Answer: (b) Plastic fibre optic cable

Q7: A ray of light will undergo total internal reflection if it

a. Goes from rarer medium to denser medium
b. Incident at an angle less than the critical angle
c. Strikes the interface normally
d. Incident at an angle greater than the critical angle

Answer: (d) Incident at an angle greater than the critical angle

Q8: Which of the following is not due to total internal reflection of light?

a. Brilliance of diamond
b. Mirage formation
c. Optical fibre working
d. Rainbow formation

Answer: (d) Rainbow formation

Q9: The fibres not used nowadays for optical fibre communication system are

a. Single-mode fibre
b. Multimode fibre
c. Coaxial cable
d. Multimode graded-index fibres

Answer: (a) Single-mode fibre

Q10: In single-mode fibres, the cladding diameter must be at least

a. Five times the core diameter
b. Thrice the core diameter
c. Ten times the core diameter
d. Twice the core diameter

Answer: (c) Ten times the core diameter

1. Fiber optics was invented by .....

- Thomas Mensah
- Thomas Edison
- John Henry Holmes
- None of the above

View Answer

Thomas Mensah

2. Fiber optic cable operate at frequencies near

- 2 GHz
- 20 MHz
- 200 MHz
- 800 THz

View Answer

800 THz

3. Which is the most beneficial index profile in single mode fibers?

- Step index
- Coaxial cable
- Graded index
- Step and graded index

View Answer

Graded index

4. Which of the following statistics are used for calculations of strengths of optical fibers?

- Edwin statistics
- Gamma statistics
- Newton statistics
- Wei-bull statistics

View Answer

Wei-bull statistics

5. The micro-bending losses are depend on .....

- Diameter
- Core material
- Refractive index
- Mode and wavelength

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View Answer

Mode and wavelength

6. Which of the following can induce a considerable amount of attenuation in optical fibers?

- Dispersion
- Micro-bending
- Radiation Exposure

- Diffusion of hydrogen

View Answer

Radiation Exposure

7..... categories exists in case of cable design.

- 2
- 3
- 4
- 5

View Answer

3

8. Which of the following is described by the concept of numerical aperture in an optical fibre?

- Light scattering
- Light collection
- Light dispersion
- Light polarisation

View Answer

Light collection

9. Which of the following is not a typical transmitter function In an optical fibre communication system?

- Decoding of input data

- Decoding of input data
- Electrical to optical conversion
- Recoding to match output standard

View Answer

Recoding to match output standard

10..... are not used nowadays for optical fibre communication system.

- Coaxial cable
- Multimode fibre
- Single-mode fibre
- Multimode graded-index fibres

View Answer

Single-mode fibre

11. Which component provides additional strength and prevents the fiber from any damage?

- Core
- Cladding
- Buffer Coating
- None of the above

View Answer

Buffer Coating

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

- Material
- Intermodal
- Intramodal
- None of the above

View Answer

Intramodal

13. Which kind of optical devices are adopted or applicable for routing signals from one waveguide to another?

- Optical Splitter
- Optical Coupler
- Optical Combiner
- None of the above

View Answer

Optical Coupler

14. Which of the following method determines the dispersion limitation of an optical link?

- Rise time budget
- Link power budget
- Both A & B

View Answer

Rise time budget

15. Which of the following is the width of the range of wavelengths emitted by the light source?

- Bandwidth
- Beamwidth
- Spectral width
- Chromatic Dispersion

View Answer

Spectral width

16. When a beam of light enters one medium from another, ...will not change?

- Speed
- Direction
- Frequency
- Wavelength

View Answer

Frequency

17. The wavelength of light has no role in .....

- Reflection
- Diffraction
- Interference
- Polarization

View Answer

Polarization

18. Which kind of dispersion is caused by the difference in the propagation times of light rays that take different paths down a fiber?

- Modal dispersion
- Delay dispersion
- Material dispersion
- Wavelength dispersion

View Answer

Modal dispersion

19. Which is the average insertion loss of fusion splice in fiber optics?

- 0.9 dB
- 0.19 dB
- 0.09 dB
- 0.009 dB

View Answer

0.09 dB

20. Which type of fiber has the highest modal dispersion?

- Graded index mode
- Step-index multimode
- Step-index single mode
- Graded index multimode

View Answer

Step-index multimode

21..... is used as an optical transmitter on the Fiber Optical Communications.

- APD
- LED
- PIN diode
- LSA diode

View Answer

LED

In single step index fiber core refractive index _____

a) increases from center of core
b) decreases from center of core
c) remains constant for core
d) none of above.

7. 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
View Answer
Answer: d
Explanation: The numerical aperture is given by NA = $\sqrt{(n1^2 – n2^2)}$, where n1 and n2 are the refractive indices of core and cladding respectively. On substituting for n1 = 2.33 and n2 = 1.4, we get NA = $\sqrt{(2.33^2-1.4^2)}$ = 1.86.

8. 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
View Answer
Answer: c
Explanation: The numerical aperture is given by NA = n sin θa, where n is the refractive index. It is unity in air. Thus NA = sin θa. To get θ= $\sin^{-1}$(NA), put NA = 0.707, thus θa = $\sin^{-1}$(0.707) = 45 degree.

9. 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
View Answer
Answer: a
Explanation: The numerical aperture is given by NA = n sin θa, where n is the refractive index. It is 1.33 for water medium. Given that the acceptance angle is 60, we get NA = 1.33 sin 60 = 1.15.

10. The core refractive index should be lesser than the cladding refractive index for a coaxial cable. State True/False
a) True
b) False
View Answer
Answer: b
Explanation: The light should pass through the core region only, for effective transmission. When light passes through cladding, losses will occur, as cladding is meant for protection. Thus core refractive index must be greater than the cladding refractive index.

11. The refractive index is 2.33 and the critical angle is 350. Find the numerical aperture.
a) 2
b) 1.9
c) 2.33
d) 12
View Answer
Answer: b
Explanation: The numerical aperture is given by NA = n cos θc, where θc is the

critical angle and n is the refractive index. On substituting for n = 2.33 and θc = 35, we get NA = 2.33 cos 35 = 1.9(no unit).

12. Choose the optical fibre material from the given materials.
a) Glass
b) Plastic
c) Silica
d) Quartz
View Answer
Answer: c
Explanation: Silica is the most dominant optical fibre material. This is because of its hardness, flexibility, melting point. Also it is an easily available material.

2. Numerical aperture is expressed as the
a) NA = sin θa
b) NA = cos θa
c) NA = tan θa
d) NA = sec θa
View Answer
Answer: a
Explanation: The numerical aperture is the measure of how much light the fiber can collect. It is the sine of the acceptance angle, the angle at which the light must be transmitted in order to get maximum reflection. Thus it is given by NA = sin θa.

3. For total internal reflection to occur, which condition must be satisfied?
a) N1 = N2
b) N1 > N2
c) N1 < N2
d) N1 x N2=1
View Answer
Answer: b
Explanation: The refractive of the transmitting medium should be greater than that of the receiving medium. In other words, the light must flow from denser to rarer medium, for total internal reflection to occur.

4) The loss in amplitude is known as .....

a) dispersion

b) material absorption

c) attenuation

d) wave guide