**UNIT-2 MCQ**

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

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

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

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

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

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

a) Intramodal

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

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

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

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

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**

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**

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

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

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

a)Dispersion flattened fiber

b)Zero-dispersion fiber

c)Positive-dispersion fiber

**d)Negative-dispersion fiber**

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)]

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

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

a) 850nm

b) 900nm

c)1300nm

**d)1400nm**

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

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

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**

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

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

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.

a)12.5ns km-1

b)9.6ns km-1

**c)9.0ns km-1**

d)10.2ns km-1

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

a)Attenuation constant

**b)Propagation constant**

c)Boltzmann’s constant

d)Free-space

24. Dispersion-shifted single mode fibers are created by

a)Increasing fiber core diameter and decreasing fractional index difference

b)Decreasing fiber core diameter and decreasing fractional indexdifference

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

d) Increasing fiber core diameter and increasing fractional index difference

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

a)intramodal dispersion

**b)intermodal dispersion**

c)modal delay

d)internal dispersion

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

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

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

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

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

**Unit-3 MCQ**

1. A device which converts electrical energy in the form of a current into optical energy is called as \_\_\_\_\_\_\_\_\_\_\_

**a) Optical source**

b) Optical coupler

c) Optical isolator

d) Circulator

2.How many types of sources of optical light are available?

a) One

b) Two

**c) Three**

d) Four

3. The frequency of the absorbed or emitted radiation is related to difference in energy E between the higher energy state E2 and the lower energy state E1. State what h stands for in the given equation?

E = E2 - E1 = hf

a) Gravitation constant

**b) Planck’s constant**

c) Permittivity

d) Attenuation constant

4. The radiation emission process (emission of a proton at frequency) can occur in \_\_\_\_\_\_\_\_\_\_ ways.

a) Two

**b) Three**

c) Four

d) One

5. Which process gives the laser its special properties as an optical source?

a) Dispersion

b) Stimulated absorption

c) Spontaneous emission

**d) Stimulated emission**

6. An incandescent lamp is operating at a temperature of 1000K at an operating frequency of 5.2×1014 Hz. Calculate the ratio of stimulated emission rate to spontaneous emission rate.

a) 3×10-13

**b) 1.47×10-11**

c) 2×10-12

d) 1.5×10-13

7. The lower energy level contains more atoms than upper level under the conditions of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a) Isothermal packaging

b) Population inversion

**c) Thermal equilibrium**

d) Pumping

8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the laser occurs when photon colliding with an excited atom causes the stimulated emission of a second photon.

**a) Light amplification**

b) Attenuation

c) Dispersion

d) Population inversion

9.A semiconductor laser crystal of length 5 cm, refractive index 1.8 is used as an optical source. Determine the frequency separation of the modes.

a) 2.8 GHz

b) 1.2 GHz

**c) 1.6 GHz**

d) 2 GHz

10. An injection laser has active cavity losses of 25 cm-1 and the reflectivity of each laser facet is 30%. Determine the laser gain coefficient for the cavity it has a length of 500μm.

a) 46 cm-1

b) 51 cm-1

c) 50 cm-1

**d) 49.07 cm-1**

11. A perfect semiconductor crystal containing no impurities or lattice defects is called as \_\_\_\_\_\_\_\_\_\_

**a) Intrinsic semiconductor**

b) Extrinsic semiconductor

c) Excitation

d) Valence electron

12. What is done to create an extrinsic semiconductor?

a) Refractive index is decreased

**b) Doping the material with impurities**

c) Increase the band-gap of the material

d) Stimulated emission

13. The majority of the carriers in a p-type semiconductor are \_\_\_\_\_\_\_\_\_\_

**a) Holes**

b) Electrons

c) Photons

d) Neutrons

14. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is used when the optical emission results from the application of electric field.

a) Radiation

b) Efficiency

**c) Electro-luminescence**

d) Magnetron oscillator

15. Which impurity is added to gallium phosphide to make it an efficient light emitter?

a) Silicon

b) Hydrogen

**c) Nitrogen**

d) Phosphorus

16. Population inversion is obtained at a p-n junction by \_\_\_\_\_\_\_\_\_\_

a) Heavy doping of p-type material

b) Heavy doping of n-type material

c) Light doping of p-type material

**d) Heavy doping of both p-type and n-type material**

17. How many types of hetero-junctions are available?

**a) Two**

b) One

c) Three

d) Four

18. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_ system is best developed and is used for fabricating both lasers and LEDs for the shorter wavelength region.

a) InP

b) GaSb

c) GaAs/GaSb

**d) GaAs/Alga AS DH**

19. Stimulated emission by recombination of injected carriers is encouraged in \_\_\_\_\_\_\_\_\_\_

**a) Semiconductor injection laser**

b) Gas laser

c) Chemist laser

d) Dye laser

20. In semiconductor injection laser, narrow line bandwidth is of the order?

**a) 1 nm or less**

b) 4 nm

c) 5 nm

d) 3 nm

21. The total efficiency of an injection laser with GaAs active region is 12%. The applied voltage is 3.6 V and band gap energy for GaAs is 2.34 eV. Determine external power efficiency.

**a) 7.8 %**

b) 10 %

c) 12 %

d) 6 %

Explanation: The total external power efficiency is defined as

η = ηT(Eq/V)\*100= 0.12 (2.34/3.6) \*100= 7.8 %.

22. Laser modes are generally separated by few \_\_\_\_\_\_\_\_\_\_

a) Tenths of micrometer

**b) Tenths of nanometer**

c) Tenths of Pico-meter

d) Tenths of millimeter

23. The spectral width of emission from the single mode device is \_\_\_\_\_\_\_\_\_\_

**a) Smaller than broadened transition line-width**

b) Larger than broadened transition line-width

c) Equal the broadened transition line-width

d) Cannot be determined

24. Single longitudinal mode operation is obtained by \_\_\_\_\_\_\_\_\_\_

a) Eliminating all transverse mode

b) Eliminating all longitudinal modes

c) Increasing the length of cavity

**d) Reducing the length of cavity**

25. In a DH laser, the sides of cavity are formed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a) Cutting the edges of device

**b) Roughening the edges of device**

c) Softening the edges of device

d) Covering the sides with ceramics

26. Gain guided laser structure are \_\_\_\_\_\_\_\_\_\_

a) Chemical laser

b) Gas laser

**c) DH injection laser**

d) Quantum well laser

27. A correct DH structure will restrict the vertical width of waveguide region is?

a) 0.5μm.

b) 0.69 μm

c) 0.65 μm

**d) Less than 0.4 μm**

28. The absence of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in LEDs limits the internal quantum efficiency.

a) Proper semiconductor

b) Adequate power supply

**c) Optical amplification through stimulated emission**

d) Optical amplification through spontaneous emission

29.The excess density of electrons Δn and holes Δp in an LED is \_\_\_\_\_\_\_\_\_\_\_\_

**a) Equal**

b) Δp more than Δn

c) Δn more than Δp

d) Does not affects the LED

30.The hole concentration in extrinsic materials is \_\_\_\_\_\_\_\_\_ electron concentration.

**a) much greater than**

b) lesser than

c) equal to

d) negligible difference with

31. Determine the total carrier recombination lifetime of a double heterojunction LED where the radioactive and nonradioactive recombination lifetime of minority carriers in active region are 70 ns and 100 ns respectively.

**a) 41.17 ns**

b) 35 ns

c) 40 ns

d) 37.5 ns

32. Determine the internal quantum efficiency generated within a device when it has a radiative recombination lifetime of 80 ns and total carrier recombination lifetime of 40 ns.

a) 20 %

**b) 80 %**

c) 30 %

d) 40 %

33.Compute power internally generated within a double-heterojunction LED if it has internal quantum efficiency of 64.5 % and drive current of 40 mA with a peak emission wavelength of 0.82 μm.

a) 0.09

**b) 0.039**

c) 0.04

d) 0.06

34. The Lambertian intensity distribution \_\_\_\_\_\_\_\_\_\_ the external power efficiency by some percent.

**a) Reduces**

b) Does not affects

c) Increases

d) Have a negligible effect

35.The amount of radiance in planer type of LED structures is \_\_\_\_\_\_\_\_\_\_\_\_

**a) Low**

b) High

c) Zero

d) Negligible

36. In optical fiber communication \_\_\_\_\_\_\_\_\_\_\_\_\_ major types of LED structures are used.

a) 2

b) 4

**c) 6**

d) 3

37. As compared to planar LED structure, Dome LEDs have \_\_\_\_\_\_\_\_\_\_\_\_\_\_ External power efficiency \_\_\_\_\_\_\_\_\_\_\_ effective emission area and \_\_\_\_\_\_\_\_\_\_\_\_\_ radiance.

a) Greater, lesser, reduced

**b) Higher, greater, reduced**

c) Higher, lesser, increased

d) Greater, greater, increased

38.In surface emitter LEDs, more advantage can be obtained by using \_\_\_\_\_\_\_\_\_\_\_\_

a) BH structures

b) QC structures

**c) DH structures**

d) Gain-guided structure

39. Internal absorption in DH surface emitter Burros type LEDs is \_\_\_\_\_\_\_\_\_\_\_\_

a) Cannot be determined

b) Negligible

c) High

**d) Very low**

**40. DH surface emitter generally give \_\_\_\_\_\_\_\_\_\_\_\_**

a) More coupled optical power

b) Less coupled optical power

c) Low current densities

d) Low radiance emission into-fiber

41. In a multimode fiber, much of light coupled in the fiber from an LED is \_\_\_\_\_\_\_\_\_\_\_\_

a) Increased

b) Reduced

**c) Lost**

d) Unaffected

42. The active layer of E-LED is heavily doped with \_\_\_\_\_\_\_\_\_\_\_\_

**a) Zn**

b) Eu

c) Cu

d) Sn

43. The majority of the carriers in a p-type semiconductor are \_\_\_\_\_\_\_\_\_\_

**a) Holes**

b) Electrons

c) Photons

d) Neutrons

44. \_\_\_\_\_\_\_\_\_\_\_\_ confinement is used to increase the carrier concentration recombination at the active region

**a) Carrier**

b) Optical

c)Electrical

d)Signal

45 \_\_\_\_\_\_\_\_\_\_\_ is the ratio of electron-hole pairs generated to the incident photons

a)Power efficiency

**b) Quantum efficiency**

c)Signal efficiency

d)Carrier efficiency