Engineering Physics (PH1001-1)
MCQ Questions

UNIT-III: Lasers & Optical Fibers

1. Important characteristic of laser beam is
   (a) Interference
   (b) Diffraction
   (c) Dispersion
   (d) Coherence

   Ans: (d)

2. Emission of a photon by an excited atom due to interaction with a passing photon nearby is called
   (a) Spontaneous emission
   (b) Induced absorption
   (c) Stimulated emission
   (d) Thermionic emission

   Ans: (c)

3. Metastable states are
   (a) Ground state energy states.
   (b) Excited state energy levels in which electrons stay for very short interval of time.
   (c) Excited state energy levels in which electron can stay for unusually long time.
   (d) Nuclear energy states.

   Ans: (c)

4. The required condition to achieve laser action in a system is
   (a) State of population inversion
   (b) Excitation source
   (c) A resonant cavity
   (d) All the three

   Ans: (d)

5. What is the need to achieve population inversion?
   a) To excite most of the atoms
   b) To bring most of the atoms to ground state
   c) To achieve stable condition
   d) To reduce the time of production of laser

   Ans: (a)

6. In a laser, the mirrors are there on either side of the device
   (a) In order to filter the heat & leave out only the light.
   (b) To protect the eyes of the observer.
   (c) To save energy of the excitation source.
   (d) So that same photons continue to cause further batches of stimulated transitions.

   Ans: (d)

7. Nd:YAG laser is a
   (a) Two level laser
   (b) Three level laser
   (c) Four level laser
   (d) Five level laser

   Ans: (c)

8. In He-Ne laser, the ratio of He to Ne gas molecules is of the order
   (a) 1:10
   (b) 1:1
   (c) 10:1
   (d) 100:1
   Ans: (c)

9. The pumping sourse in Nd:YAG laser is
   (a) Chemical
   (b) Optical
   (c) Electrical
   (d) Mechanical

   Ans: (b)

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

    Ans: (b)

11. Laser action is found in _____ semiconductor.
    a) direct band gap
    b) indirect band gap
    c) germanium
    d) silicon

    Ans: (a)

12. The light from a laser source is monochromatic because all the photons
    a) are in phase
    b) have same energy
    c) have same amplitude
    d) are in the same direction

   Ans: (b)

13. Which one of the following statements best describes stimulated emission in a laser?

   (a) Electrons collide with atoms in a metastable state and cause photons to be emitted.

   (b) Atoms in a metastable state de-excite and cause electrons to be emitted.

   (c) Photons interact with atoms in a metastable state and cause photons to be   emitted.

   (a) Photons interact with atoms in a metastable state and cause electrons to be emitted.

   Ans: (c)

14. Which of the following is an example of optical pumping?
    a) Nd:YAG
    b) Helium-Neon laser
    c) Semiconductor laser
    d) Dye laser
   Ans: (a)

15. Why is laser light monochromatic?
    a) The excited electrons are in a metastable state.
    b) The system is in a state of population inversion.
    c) The emitted photon and incident photon are of the same phase.
    d) Photons of the same energy as that of the incident photons are emitted when the electrons transit down from a higher energy level.
   Ans: (d)

16. Which of the following statements concerning a laser system is incorrect?
    a) Spontaneous emission occurs in the laser system.
    b) The intensity of the laser beam can be varied by changing the reflective coefficient of the partially reflecting mirror.
    c) The laser system does not require an external energy source.
    d) The laser medium consists of a metastable state.
   Ans: (c)

17. The active medium in Nd:YAG laser is
        (a) Neodymium
        (b) YAG crystal
        (c) Yttrium
        (d) Aluminium
   Ans: (a)

18. The number of atoms in the excited state becomes much greater than the number of atoms in the ground state. This is known as
 (a) normal population
 (b) population inversion
 (c) stimulated emission
 (d) spontaneous emission

 Ans: (b)

19. Laser light is intense because
  (a) it has very less number of Photons that in phase

  (b) it has very less number of Photons that are not in phase

  (c) it has very large number of Photons that are in phase

  (d) it has very large number of Photons that are not in phase

 Ans: (c)

20. The emission of photon without being aided by any external agency is called
     (a) light amplification
     (b) induced absorption
     (c) stimulated emission
     (d) spontaneous emission
     Ans: (d)

21. The lifetime of an atom at the ordinary excited state is of the order of
     (a) few millisecond
     (b) few nanosecond
     (c) few microsecond
     (d) unlimited
     Ans: (b)

22. The lifetime of an atom in a metastable state is of the order of
     (a) a few second
     (b) Unlimited
     (c) A nanosecond
     (d) Few millisecond

     Ans: (d)

23. Supply of energy to atoms for excitation is called
     (a) Glowing
     (b) Bombarding
     (c) Incidenting
     (d) Pumping
     Ans: (d)

24. In a semiconductor laser there are no mirrors used because
    (a) the laser light required is of low power
    (b) mere driving a minimum current in the diode is enough for laser action
    (c) p-section acts as one mirror and n-section acts as the other mirror
    (d) a pair of parallel planes cleaved or polished at a particular angle in the crystal reflect the light efficiently

    Ans: (d)

25. A semiconductor laser has a peak emission radiation of wavelength 1.24 μm. What is its band gap value in eV?
    (a) 1.4 eV
    (b) 1.6 eV
    (c) 1 eV
    (d) 1.8 eV

    Ans: (c)

26. A He-Ne laser emits light at a wavelength of 632.8 nm and has an output power of 5 mW. The number of photons emitted in each second by this laser are
    a) 1.79×10^{18} Photons/sec
    b) 1.59×10^{16} Photons/sec
    c) 0.6×10^{16} photons/sec
    d) 1.59×10^{18} photons/sec

    Ans: (b)

27. If the wavelength of light emitted by spontaneous emission is 696 nm at 300K, the ratio of population of two energy levels is
    (a) 1.059×10^{-32}
    (b) 1.059×10^{-33}
    (c) 0.059×10^{-30}
    (d) 1.059×10^{-30}

    Ans: (d)

28. If a pulsed laser emits photons of wavelength 780 nm with 20 mW average power/pulse, the number of photons contained in each pulse if the pulse duration is 10 ns is
    (b) 7.86×10^{8}
    (c) 5.08×10^{8}
    (d) 3.86×10^{8}
    (e) 1.86×10^{8}

    Ans: (a)

29. The wavelength of radiation emitted by a semiconducting laser with band gap energy 2.8eV.
 a) 2.8 Å
 b) 4.3308 Å
 c) 5548.4 Å
 d) 4430.8 Å
 Ans: (d)

30. Numerical aperture of an optical fiber depends on
 (a) Diameter of the fiber
 (b) Acceptance angle
 (c) Critical angle
 (d) Refractive index of core

 Ans: (b)

31. Optical fiber works on the phenomenon of _____
 a) total internal reflection
 b) polarization
 c) diffraction
 d) refraction
 Ans: (a)

32. 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
 Ans: (d)

33. How does the refractive index vary in Graded Index fibre?
 (a) Tangentially
 (b) Radially
 (c) Longitudinally
 (d) Transversely
 Ans: (b)

34. Which of the following has more distortion?
 (a) Single step-index fibre
 (b) Graded index fibre
 (c) Multimode step-index fibre
 (d) Glass fibre
 Ans: (c)

35. What causes microscopic bend?
    (a) Uniform pressure
    (b) Non-uniform volume
    (c) Uniform volume
    (d) Non-uniform pressure
    Ans: (d)

36. The loss in signal power as light travels down a fiber is called
    (a) Dispersion
    (b) Scattering
    (c) Absorption
    (d) Attenuation
 Ans: (d)

37. The inner portion of the optical fiber cable is called
    (a) Cladding
    (b) Coating
    (c) Inner conductor
    (d) Core

   Ans: (d)

38. When more than one mode is propagating, how is it dispersed?
    (a) Dispersion
    (b) Inter-modal dispersion
    (c) Material dispersion
    (d) Waveguide dispersion
  Ans: (b)

39. The core of an optical fiber has a
    (a) Lower refracted index than air
    (b) Lower refractive index than the cladding
    (c) Higher refractive index than the cladding
    (d) Similar refractive index with the cladding
 Ans: (c)

40. Having cladding around the core is preferred to coating the core with a reflecting
    material(silvering) because
    (a) Silvering is not economical
    (b) Coating may get affected by abrasions
    (c) Coated material may undergo chemical changes in the field conditions and thus
         become dull
    (d) The total internal reflection at the core-cladding interface is superior to the one by any
         coated material
   Ans: (d)

41. Attenuation means
    (a) Amplification of signal strength
    (b) Division of signal strength
    (c) Loss of signal strength
    (d) Tuning of signal
    Ans: (c)

42. In an optical fiber the signal loss due to scattering is mainly due to
    (a) Rayleigh scattering
    (b) Raman scattering
    (c) Wein's scattering
    (d) All the answers
    Ans: (a)

43. In an optical fiber, Rayleigh scattering occurs when a photon
    (a) Encounters an impurity atom in its path
    (b) Hits the cladding
    (c) Encounters sharp changes in refractive index over distances smaller than its wavelength
    (d) Encounters a microscopic bend
 Ans: (c)

44. Signal distortion occurs due to
    (a) Irregularities in fiber structure
    (b) Variation in refractive index of the core at different points
    (c) Spreading of pulse
    (d) Macroscopic bend

 Ans: (c)

45. The numerical aperture of an optical fiber in air is 0.32. The numerical aperture of an optical fiber in water of R.I. 1.33 is
    (a) 0.43
    (b) 0.24
    (c) 0.64
    (d) 0.96

    Ans: (b)

46. The numerical aperture of a fiber if the angle of acceptance is 15 degrees, is
    (a) 0.17
    (b) 0.26
    (c) 0.50
    (d) 0.75
    Ans: (b)

47. Fractional index change for an optical fiber with core and cladding of refractive indices 1.563 and 1.498 respectively is
   (a) 0.00415
   (b) 0.04159
   (c) 0.04300
   (d) 0.00400
   Ans: (b)

48. The angle of acceptance of an optical fiber with numerical aperture of 0.446 is
   (a) 26.49°
   (b) 7.78°
   (c) 20.5°
   (d) 30.6°
   Ans: (a)

49. An optical signal loses 15% of its power after traversing a fiber length of 400 m. The fiber loss is
   (a) 0.0176
   (b) 1.7645
   (c) 17.645
   (d) 0.1764
   Ans: (b)

50. The attenuation in an optical fiber of length 500 m, when a light signal of power 100 mW emerges out of the fiber with a power of 90 mW is
   (a) 0.0915 dB/km
   (b) 0.00915dB/km
   (c) 9.15 dB/km
   (d) 0.915 dB/km
   Ans: (d)

51. Optical fibers are used in
   (a) CAT scans
   (b) X-ray photos
   (c) Ultrasound scans
   (d) Endoscopy

   Ans: (d)

52. Which fiber is preferred for long distance communication?
   (a) Step index single mode fiber
   (b) Graded index multimode fiber
   (c) Step index multimode fiber
   (d) Graded index fiber

   Ans: (a)

53. In the structure of the fiber optic cable, the refractive index of the core is always _____ the refractive index of the cladding
    (a) Less than
    (b) Equal to
    (c) Greater than
    (d) None of these

    Ans: (c)

54. The numerical aperture (NA) in optical fiber is used to describe
    (a) Light spreading ability
    (b) Light gathering or light-collecting ability
    (c) Light output from an external shield
    (d) Light leakage ability

    Ans: (b)

55. The refractive index of the core is uniform throughout and undergoes an abrupt change at the cladding boundary which is known as_____
    (a) Uniform-index fiber
    (b) Scale-index fiber
    (c) Graded-index fiber
    (d) Step index fiber

    Ans: (d)