

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 source 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 $1.24\text{ }\mu\text{m}$. 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 300 K , 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)