

Roll No.

E-982**M. Sc. (Fourth Semester) (Main/ATKT)****EXAMINATION, May-June, 2021**

PHYSICS

Paper Second

(Laser Physics and Applications)*Time : Three Hours]**[Maximum Marks : 80***Note :** Attempt all Sections as directed.**Section—A**

1 each

(Objective/Multiple Choice Questions)**Note :** Attempt all questions.

Choose the correct answer :

- Which among the following characteristics of laser light specifies the precise movement of all individual light waves together through time and space ?
 - Monochromatic
 - Directional
 - Coherent
 - Brightness

- Which scientist first came up with the idea of stimulated emission ?
 - Alexander Graham Bell
 - Isaac Newton
 - Arthur Schalow
 - Albert Einstein
- Which among the following is a key process adopted for the laser beam formation as it undergoes the light amplification ?
 - Spontaneous Emission
 - Stimulated Emission
 - Both (a) and (b)
 - None of the above
- What property of laser light is used to measure strain in roadways ?
 - Intensity
 - Power
 - Coherence
 - None of the above
- The Eximer laser produces light with what wavelength ?
 - Visible
 - Ultraviolet
 - Infrared
 - None of the above

P. T. O.

6. The National Ignition Facility will use what type of laser for fusion power experimentation ?
- (a) Neodymium-glass
 - (b) Argon gas
 - (c) Rhodamine Dye
 - (d) None of the above
7. Chemical lasers use _____ to produce their beams.
- (a) Excessive amounts of electrical power
 - (b) Small amounts of electrical power
 - (c) No electrical power
 - (d) None of the above
8. What type of laser could cause skin cancer if not used properly ?
- (a) Red semiconductor laser
 - (b) Blue semiconductor
 - (c) YAG laser
 - (d) Eximer laser
9. What is/are the consequence(s) of Self-Phase Modulation in non-linear optics ?
- (a) Modification in pulse spectrum
 - (b) Limited transmission rate
 - (c) Dispersion effect
 - (d) All of the above

P. T. O.

10. How many categories of non-linear effects are seen in optical fibers ?
- (a) One
 - (b) Three
 - (c) Two
 - (d) Four
11. Which of the following is not related to Kerr effects ?
- (a) Self-phase modulation
 - (b) Cross-phase modulation
 - (c) Four-wave mixing
 - (d) Stimulated Raman scattering
12. Non-linear effects which are defined by the intensity-dependent refractive index of the fiber is called as _____.
- (a) Scattering effects
 - (b) Kerr effects
 - (c) Raman effects
 - (d) Tomlinson effects
13. Raman effect is scattering of _____.
- (a) Atoms
 - (b) Molecules
 - (c) Protons
 - (d) Photons
14. The elastic scattering of photons is called as _____.
- (a) Atmospheric Scattering
 - (b) Rayleigh scattering
 - (c) Conserved scattering
 - (d) Raman scattering

15. Which of the following cannot be conserved during Raman scattering ?
- Total Energy
 - Momentum
 - Kinetic Energy
 - Electronic Energy
16. In Raman spectroscopy, the radiation lies in the _____.
- Microwave Region
 - UV Region
 - X-ray Region
 - Visible Region
17. Laser energy is used to break up kidney or gallstones in process called :
- Trabeculoplasty
 - Viscocalostomy
 - Lithotripsy
 - None of the above
18. Why are lasers used in “Laser Printers” ?
- They can be focused down to very small spot sizes for high resolution.
 - They are cheap.
 - They are impossible to damage.
 - None of the above

P. T. O.

19. Why are lasers used in fiber optic communication systems ?
- The government has mandated it.
 - They can be pulsed with high-speed data.
 - They are very inexpensive.
 - None of the above
20. Which laser is considered “eye safe” ?
- Laser bar-code scanners
 - The eximer laser
 - Communication lasers
 - None of the above

Section—B

2 each

(Very Short Answer Type Questions)**Note :** Attempt all questions.

- What do you mean by stimulated emission ?
- Define quality factor and write down its expression.
- Define quantum yield with expression.
- What is principle of Ruby LASER ?
- What is principle of NdYAG LASER ?
- Define Q switching.
- Write down the phase matching condition.
- Define multi-quantum photoelectric effect.

Section—C

3 each

(Short Answer Type Questions)**Note :** Attempt all questions.

- What do you mean by population inversion ? How is it achieved in LASER ?

[7]

E-982

2. Explain the principle of Gas Laser and also give its applications.
3. Describe mode locking in LASER.
4. Explain parametric generation of light.
5. What is stimulated Raman effect ?
6. How can LASER be used in isotope separation ?
7. Explain the phenomena of dispersion in optical fiber.
8. Explain the application of LASER in Communication system.

Section—D

5 each

(Long Answer Type Questions)

Note : Attempt all questions.

1. Explain construction, principle and mechanism of any *one* LASER from the following :
 - (a) Carbon Dioxide LASER
 - (b) Semiconductor LASER
2. What is LASER pumping ? Find out expression for output power from LASER.

Or

Explain Natural Broadening mechanism in detail.

3. Illustrate Raman scattering phenomena with suitable energy level diagrams.

Or

Explain Photo Acoustic Raman Spectroscopy in detail.

P. T. O.

[8]

E-982

4. What is refractive index profile of optical fiber ? Explain the types of optical fiber based on refractive index profile.

Or

Describe non-linear interaction of light with matter and explain phenomena of second harmonic generation.

E-982