REV-01
MSP/17/22

2024/06

SET A

M.Sc. PHYSICS
SECOND SEMESTER
LASER & SPECTROSCOPY
MSP – 205

[USE OMR FOR OBJECTIVE PART]

Duration: 1:30 hrs. **Full Marks: 35**

Objective

Time: 15 mins. **Marks: 10**

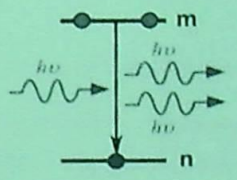
Choose the correct answer from the following: ***1×10=10***

1. The "Full angle beam divergence" is associated with
   a. Directionality b. Monochromaticity
   c. Intensity d. Coherence

2. Which of the following is an example of optical pumping?
   a. Ruby laser b. Helium-Neon laser
   c. Semiconductor laser d. Dye laser

3. What is the wavelength of radiation emitted by a laser made up of a semiconducting material with band gap energy 2.8eV?
   a. 8 Å b. 4.3308 Å
   c. 5548.4 Å d. 4430.8 Å

4. Which Einstein's Coefficient is used in the following process



   a. A_{12} b. A_{21}
   c. B_{12} d. B_{21}

5. If E_e, E_v, E_r represent the electronic, vibrational and rotational energy of a molecule, the which among the following is correct?
   a. $E_e < E_v$ b. $E_v < E_r$
   c. $E_e = E_v$ d. $E_v > E_r$

6. Pure rotational energy spectrum falls in
   a. gamma-rays b. visible rays
   c. micro-waves d. ultra-violet waves

7. The selection rule for rotational transition is
   a. $\Delta J = 1$ b. $\Delta J = 0$
   c. $\Delta J = \pm 1$ d. $\Delta J = \pm 2$

8. The elastic scattering of photons is called as _____ scattering
   a. Atmospheric b. Rayleigh
   c. Conserved d. Raman

9. He-Ne laser is a type of _____
   a. Solid laser b. Liquid laser
   c. Gas laser d. Diode laser

10. In which region of the electromagnetic spectrum, does the semiconductor laser lies?
   a. Visible Region b. UV Region
   c. Microwave Region d. Infrared Region

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Descriptive

Time : 1 hr. 15 mins. **Marks : 25**

[Answer question no.1 & any two (2) from the rest]

1. **a.** What are the special features of LASER which distinguish them from ordinary light? **2+3=5**

   b. What do you understand by Population Inversion in Laser?

2. Employing Einstein's Quantum Theory of Radiation, deduce the ratio of A and B coefficients. **10**

3. Discuss the construction and working of He-Ne Laser. **10**

4. **a.** What is a laser resonator, and how does it contribute to the amplification of light in a laser system? **5+5=10**

   b. Discuss the structures and laser feedback techniques in an open and a confocal resonator.

5. **a.** Discuss the theory of pure rotational spectra of molecule. **5+5=10**

   b. In a CO molecule the wave-number difference between the successive absorption lines in the pure rotational spectrum is 384 m^{-1}. Calculate the moment of inertia of the molecule. Masses of the C^{12} and O^{16} atoms are respectively, 1.99×10^{-26} kg and 2.66×10^{-26} kg.

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