PHY 1701 – Engineering Physics

Assignment II

Instructions:

- *Deadline for submitting the assignment 2 is on or before 04.04.2021 (Sunday Mid-night).*
- *Assignments should be hand-written in your notebook. The Name and Roll No should be mentioned in every single page.*
- *Questions should be written first, followed by answers.*

1. What are the allotropy form of Carbon and how they differ from each other?
2. How does chiral vector help to identify various categories of CNTs.
3. Write down the unique properties of CNTs
4. Write a brief note on industrial applications of nanotechnology.
5. Differentiate the different types of coherence?
6. Why population inversion is required for lasing action?
7. Four level lasers are better than three level lasers. Why?
8. Prove that the rate of stimulated absorption is the same as the rate of stimulated emission.
9. Derive an expression for threshold gain of a laser.
10. Describe the construction and working of He-Ne laser with necessary diagrams.
11. Nd-YAG
12. CO_2 Laser
13. How do you measure the monochromaticity of a light source? For a light source of frequency is 10^{14} Hz, the bandwidth of gaseous and solid state laser is 500 Hz and 10^9 Hz respectively. Find out which is more monochromatic, a solid state laser or a gaseous laser?
14. Briefly explain why two-level pumping scheme is not possible for laser action. A laser lamp operates by a discharge of 1000 uF capacitor bank charged to 4 kV in order to produce a laser flash of 10 J what is the efficiency of the laser lamp?
15. An atom has two atomic levels separated by 2.26 eV in energy. At what temperature the ratio of population in the upper excited state (Nu) and lower ground state (N1), Nu/N1 is half? K = 1.38 x 10^23).
16. Find the ratio of spontaneous and stimulated emission for a two level dye laser system of frequency 5 x 10 ^14 Hz at 2000K.
17. Nd-YAG laser might have a 20 ns pulse width, energy of 5mL per pulse, and operates at a repetition rate of 25 pulses per second. Find out the average power of this laser. What is the advantage of pulsed laser?
18. Carbon dioxide laser emits light of wavelength 10.6 μm. If the output power is 10 W, calculate the number of photons emitted per minute.
19. Starting from the integral form, derive the differential form of Gauss's theorem for electrostatics and explain its physical significance.
20. Derive the wave equation for electric field in free space using Maxwell's equations.