Final Assessment Test- Jan/Feb 2023

VIT
Vellore Institute of Technology

Course: BPHY101L - Engineering Physics

Class NBR(s): 5765/5771/5801/5815/5830/5852/5868/5875/5879 Slot: E1+TE1

Time: Three Hours Max. Marks: 100

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. Describe the normal modes of a standing wave on a stretched string and get the expression for their eigen frequencies. Draw the first four normal modes for these standing waves.

2. a) Use sine and cosine functions and sketch the simple harmonic motion for the particles in a medium where a harmonic wave travels. [5]

   b) The displacement of a particle of a string carrying a traveling wave is given by $y=3$ cm sin $6.38(0.50x-50t)$, where x is in cm and t in sec. Find (a) the amplitude, (b) the wavelength, (c) the frequency and (d) speed of the wave. [5]

3. Summarize Maxwell's equations in integral form. In relation to that, arrive at wave equation in terms of E and B, for an electromagnetic wave traveling in free space.

4. What are the reasons considered by de Broglie to propose his hypothesis? Do electrons have wave nature? Justify your answer with supporting experiment.

5. a) Explain why Compton effect is observed for x-rays and gamma rays. [5]

   b) Show that the spread of velocities caused by Heisenberg Uncertainty principle does not have measurable consequences for a 100 g ball confined to a room of 15 m on a side. Assume the ball is moving at 2 m/s along the x direction. [5]

6. For a particle in a box, apply Schrodinger equation to evaluate the Eigen values, Eigen functions and probability of locating the particle in different energy states with necessary diagrams.

7. Why nanomaterials have become popular now? Why we did not hear about them in the past? Explain 1D, 2D, 3D nanomaterials in detail.

8. Explain the construction, working of carbondioxide laser. Elucidate the transitions occuring with neat diagram.

9. a) Analyse the advantages of four level lasers over two level and three level lasers. [5]

   b) The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 330 K. [5]

10. Enumerate the advantages of fibre optic cable over conventional cables. Explain the different types of losses in signals experienced in fibre optic cable.

11. a) Define numerical aperture, relative refractive index and V-number of an optical fiber. Derive expressions for all the three. [2+1+2]

b) For a step index fibre having core index 1.43 and cladding index 1.4, calculate critical angle, critical propagation angle and numerical aperture. [5]

12. Compare the performance of laser diode and LED as light source for fiber optic applications.