VIT
Vellore Institute of Technology

# Final Assessment Test – June 2023

Course: BPHY101L - Engineering Physics
Class NBR(s): 4915 / 4917 / 4919 / 4921 / 4923 / 4925 / 4927 / 4929 / 4931 / 4933
Slot: B1+TB1
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. Derive an expression for a transverse wave travelling on a string. Explain how the velocity of the wave changes with tension 'T' and linear density 'μ'.
2. a) What are the different parameters to characterize a wave? Explain with suitable diagram. [5]
   b) A hydrogen atom has a mass of $1.68 \times 10^{-27}$ kg. When attached to a certain massive molecule it oscillates as a classical oscillator with a frequency of $10^{14}$ cycles per second and with an amplitude of $10^{-10}$ m. Calculate the force acting on the hydrogen atom. [5]
3. Write a note on plane electromagnetic waves propagating in free space. Derive electromagnetic wave equation for both electric field and magnetic field vectors.
4. Arrive at Schrodinger's time independent and time dependent wave equation.
5. a) How can you understand the wave nature of matter from Davisson-Germer experiment? [5]
   b) An X-ray with frequency $1.5 \times 10^{19}$ Hz, interacts with an electron inside an atom. After collision with the electron, X-rays with a new frequency of $1.2 \times 10^{19}$ Hz are emitted. How much kinetic energy was imparted to the electron? [5]
6. Derive an expression for the eigen values and eigen functions of an electron trapped in an one dimensional potential box.
7. What is quantum confinement? Explain with suitable diagram. Explain its significance in semiconducting material.
8. Write down the special features of lasers over the conventional light and explain with neat diagram the construction and working of Nd:YAG laser.
9. a) Why two level laser system does not sustain? [5]
   b) A He-Ne laser emits light at a wavelength of 632.8 nm and has an output power of 2.3 mW. Calculate the number of photos emitted per minute. [5]
10. What is attenuation in optical fibre? Discuss the various types of dispersion in fibre optics.
11. a) Discuss the similarities and dissimilarities of single and multimode optical fibres. [5]
    b) In an optical fibre, the core refractive index is 1.4513 and the cladding refractive index is 1.4468. Calculate the following. [5]
       i. Critical angle
       ii. Numerical aperture
       iii. Acceptance angle
12. a) What is the difference between direct and indirect band gap semiconductors? [5]
    b) Explain in detail, with neat diagram, the construction and working principle of PIN photodiode. [5]

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