



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 'ρ'. [5]
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. [5]
4. Arrive at Schrodinger's time independent and time dependent wave equation. [5]
5. a) How can you understand the wave nature of matter from Davisson-Germer experiment? [5]  
b) An X-ray with frequency  $1.5 \times 10^{18}$  Hz, interacts with an electron inside an atom. After collision with the electron, X-rays with a new frequency of  $1.2 \times 10^{18}$  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. [5]
7. What is quantum confinement? Explain with suitable diagram. Explain its significance in semiconducting material. [5]
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. [5]
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 photons emitted per minute. [5]
10. What is attenuation in optical fibre? Discuss the various types of dispersion in fibre optics. [5]
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]