VIT®
Vellore Institute of Technology

# Final Assessment Test – June 2023

Course: BPHY101L - Engineering Physics
Class NBR(s): 4934 / 4936 / 4938 / 4940 / 4942 / 4944 / 4946 / 4948
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. Derive the velocity of a travelling transverse wave on a string, kept under the tension T and with mass per unit length ρ.

2. a) Explain briefly, why a string which is fixed at both ends, may not generate standing wave all the times. [5]

   b) Find the reflection and transmission coefficients of a travelling wave propagating on a string from higher to lower linear mass densities given as $3.5 \times 10^{-3}$ kg $m^{-1}$ and $2.5 \times 10^{-3}$ kg $m^{-1}$ respectively. [5]

3. Starting with the Maxwell's equations in free space, derive the electromagnetic wave equation and obtain the speed of light.

4. Derive the time independent matter-wave equation, valid for the stationary potential, from the time dependent Schrodinger wave equation.

5. a) Discuss the Davisson-Germer experiment with suitable diagram. [5]

   b) An X-ray photon collides with an electron at rest. After scattering, the photon propagates at 90° with respect to its initial direction. What is the frequency of scattered photon after collision, if its initial frequency is $3 \times 10^{19}$ Hz. [5]

6. Obtain the expression for eigen energy values and eigen function for a particle confined in a one-dimensional infinite potential box.

7. Define quantum confinement. Accordingly classify the nanoparticle with suitable diagrams. Write a short note on blue shift of energy band gap in nanomaterials.

8. Mention three possible radiative transitions in a two-level energy system. In thermal equilibrium, derive the Einstein's coefficients relations for such a system.

9. a) Mention the components of Laser. Explain the role of optical cavity. [5]

   b) Obtain threshold gain for a laser system with 1 m long cavity with mirrors of reflection coefficients of 0.95 and 0.999 and a gain medium with an absorption coefficient of 1.5 $cm^{-1}$. [5]

10. a) Draw the block diagram of Optical Fibre Communication and mention its merits and demerits. [5]

    b) Obtain the expression for critical angle. Using this, derive the expression for acceptance angle and numerical aperture of an optical fibre. [5]