



TERM END EXAMINATIONS (TEE) – December 2023- January 2024

Programme	: B.Tech.	Semester	: Fall 2023-24
Course Title/ Course Code	: Engineering Physics/ PHY1001	Slot	: E11+E12+E14
Time	: 3 Hrs.	Max. Marks	: 100

Answer ALL the Questions

Q. No.	Question Description	Marks
PART A – (60 Marks)		
1	(a) A roller coaster starts from rest at the top of a hill of height 50 m. It descends and reaches the bottom, moving horizontally at 25 m/s. Calculate the work done by non-conservative forces if the coaster loses 50000 J due to friction and air resistance during its descent.	6
	(b) A passenger of mass 72.2 kg is riding in an elevator while standing on a platform scale. What does the scale read when the elevator cab is i) Descending with constant velocity ii) Ascending with constant acceleration	6
OR		
	(c) A 40 kg shell is flying at a speed of 72 km/hr. It explodes into two pieces, one piece of mass 15 kg stops, Calculate the velocity of the other piece,	6
	(d) The four fundamental forces of nature are at the root of every interaction in the universe. Explain them in the order of their strength	6
2	(a) Calculate the value of de-Broglie wavelength associate with 27°C helium atom.	6
	(b) Derive time dependent Schrodinger equation.	6
OR		
	(c) Explain the concept of wave packet and give mathematical proof of Heisenberg's uncertainty relations.	12
	(a) Explain the classification of nanomaterials based on dimension. Also discuss the different types of carbon nanotubes.	12
OR		
	(b) 'Nanotechnology has the potential to help reduce the human footprint on the environment'. Justify the statement by mentioning some important applications	12
	(a) Using Einstein's theory, show that in the optical region say, at $\lambda = 5000 \text{ \AA}$ and $T = 300 \text{ K}$, the light amplification is not possible	6
	(b) Define the following i) Life Time ii) Population Inversion	6

- iii) Active agent
- OR
- (c) What are Einstein's coefficients? Obtain a relation between them. Also discuss the essential conditions for LASER action

- 5 (a) Define the following
- i) Acceptance Angle
 - ii) Acceptance cone
 - iii) Numerical Aperture
 - iv) Fractional index change

- OR
- (b) Calculate the numerical aperture, acceptance angle, and the critical angle of the fiber from the following data if the fiber is kept in water (RI of water = 1.33)
- n_1 (R.I of core) = 1.50 and n_2 (R.I. of cladding) = 1.45

- (c) Explain the difference between step index and graded index fiber.

PART B – (40 Marks)

The radius of the earth's orbit around the sun is 1.5×10^{11} m. Calculate the angular and linear velocity of the earth. Through how much angle does the earth revolve in 2 days?

A particle confined to move along x axis has the wave function $\psi = ax$ between $x = 0$ and $x = 1$ and $\psi = 0$ elsewhere, Find the probability and the expectation value $\langle x \rangle$ of particle's position. The particle can be found between $x = 0.35$ and $x = 0.45$. Consider 'a' as a constant.

Describe and illustrate with examples the crucial role of surface to volume ratio in altering the properties of nanomaterials from their bulk counterpart in case of spherical nanomaterials.

Explain construction and working of CO₂ LASER.

Explain inter modal dispersion. Derive expression for the delay difference to estimate the maximum pulse broadening in time in step index fibre.

