UG (CBCS) EVEN SEMESTER EXAMINATION, 2023

EDUCATION (B.Sc. B.Ed.)

PHYSICS (HONOURS)

8th Semester

Course No. : BSPH - 801

(Cosmology and Nuclear Quantum Mechanics, Astrophysics)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

The figures in the margin indicate full marks for the questions

1. (a) Normalize the wave function $\psi = A \exp(-ax^2)$ where A, a are constant.

   (b) For a given wave function $\psi = \frac{A}{r} e^{ikr}$ evaluate the expression for current density J.

   (c) Write short notes on group velocity and phase velocity. 4+4+2=10

Or

2. (a) Explain Ehrenfest theorem.

   (b) How to evaluate the expectation value of a anantum mechanical operator. 8+2=10

3. (a) Derive an expression for the normalized wave function and energy of a particle moving in a potential v(x) where,

$v(x) = 0 \quad -a < x < a$

$= \infty \quad |x| > a$

(b) Derive an expression for the reflection (R) and transmission (T) coefficient of a particle moving in a potential v (x).

$v(x) = 0 \quad x < 0$

$= V_0 \quad x > 0$

Hence show that $R + T = 1$ 4+6=10

Or

4. (a) Explain the phenemenon of quantum tunneling.

(b) Derive an expression for the normalized wave function and energy of a free particle in one dimensional infinite potential wall. 4+6=10

5. (a) Derive an expression for the maximum probility of a linear harmonic oscillator at its ground state.

(b) A linear harmonic oscillator is oscillating under a potential $v(x) = \frac{1}{2} kx^2 + cx$, derive an expression for its ground state energy eigen values. 4+6=10

Or

6. Derive expressions for the following physical parameters for an hydrogen atom at its ground state

(a) $< r >$

(b) $< r^2 >$

(c) $< r^5 >$ 4+3+3=10

7. Write short notes on: 5+5=10

(a) Defuse Nubelae

(b) Emission Nubelae

Or

8. Describe P.P. and CNO chain. 5+5=10

9. (a) Show that 1 U = 931.5 Mev

(b) Write short notes on : 2+4x2=10

(i) Nuclear magnetic moment

(ii) Electrical anadrupole moment.

Or

10. Explain the Big-Bang theory and the study state of universe. 10

★★★