Unit III

5. (a) Discuss the free electron theory of metals and explain how it fails to distinguish between metals, insulators and semiconductors. **6**

(b) State Bloch's theorem. Explain the key physical implications of the Kronig-Penney model regarding the formation of energy bands in solids. **6**

6. (a) Differentiate between intrinsic and extrinsic semiconductors. Define Fermi energy and discuss its significance. **6**

(b) Explain the working principle, structure, and current-voltage (I-V) characteristics of a solar cell. **6**

Unit IV

7. (a) State the basic postulates of Einstein's Special Theory of Relativity. Derive the Lorentz transformation equations. **6**

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B.El.Ed. (Third Year) EXAMINATION, 2026

(Regular & Reappear)

PHYSICS-II

Time : 3 Hours] [*Maximum Marks : 60*

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Explain the Photoelectric Effect. Derive Einstein's photoelectric equation and discuss how it establishes the particle nature of light. **6**

   (b) State Heisenberg's Uncertainty Principle. Use it to prove that an electron cannot exist inside the atomic nucleus. **6**

2. (a) What is de Broglie's hypothesis ? Derive an expression for the wavelength of a matter wave associated with an electron accelerated through a potential difference **6**

   (b) Describe the Franck-Hertz experiment and explain how it confirms the existence of discrete energy levels in atoms. **6**

Unit II

3. (a) Derive the time-independent Schrödinger wave equation for a particle in one dimension. **6**

   (b) Apply the Schrödinger equation to a particle trapped inside a one-dimensional infinitely deep potential well (particle in a box) to find its normalized wave functions. **6**

4. (a) Discuss the quantum mechanical phenomenon of transmission through a potential barrier (quantum tunneling) qualitatively. **6**

   (b) Explain Pauli's Spin Exclusion Principle and outline the qualitative quantum mechanical description of a hydrogen-like atom. **6**

(b) Explain the concept of time dilation. Show that a moving clock runs slower than a stationary clock. **6**

8. (a) State and explain Hubble's Law regarding the expansion of the universe. What is its cosmological significance ? **6**

(b) Write a comprehensive descriptive note on Cosmic Microwave Background Radiation (CMBR) and its role in modern cosmology. **6**

Unit V

9. (a) Define nuclear binding energy. Draw and analyze the curve of binding energy per nucleon against mass number (A). **6**

(b) Discuss the mechanism of radioactive decay. Derive the relation between half-life and the decay constant. **6**

10. (a) Distinguish between controlled and uncontrolled nuclear chain reactions. Explain how nuclear fission is utilized in a nuclear reactor. **6**

(b) Explain the carbon dating method for determining the age of organic materials. Name the four fundamental interactions found in nature. **6**

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