

24U118

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Name : .....

Reg. No : .....

**FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2024**

(FYUGP)

**CC24U PHY1 CJ102 - ELEMENTS OF MODERN PHYSICS**

(B.Sc. Physics - Major Course)

(2024 Admission - Regular)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

**Part A** (Short answer questions)

Answer *all* questions. Each question carries 3 marks.

1. Explain the relativity of time. [Level:2] [CO1]
2. Write down expressions for relativistic momentum and relativistic energy. [Level:1] [CO1]
3. Sustainiate why the result of Michelson-Morley experiment is mentioned as "negative"? [Level:2] [CO1]
4. Write down inverse Lorentz transformation equations. [Level:1] [CO1]
5. Explain the properties of Electromagnetic radiation. [Level:2] [CO2]
6. Give the expression for Compton shift. [Level:1] [CO2]
7. State the aim of Davisson and Germer experiment. [Level:1] [CO3]
8. State the Heisenbergs position momentum Uncertainty principle. [Level:1] [CO3]
9. Define De Broglie waves. Give any two properties. [Level:1] [CO3]
10. Explain the mechanism of Frank-Hertz experiment. [Level:2] [CO4]

**(Ceiling: 24 Marks)**

**Part B** (Paragraph questions/Problem)

Answer *all* questions. Each question carries 6 marks.

11. A rocket is 40 m long on the ground. When it is in flight its length is 38 m to an observer on the ground. Find the speed of the rocket. [Level:3] [CO1]
12. A proton of rest mass  $1.67 \times 10^{-7}$  kg moves with a velocity  $c/\sqrt{2}$ . Fnd its mass, momentum, total energy and kinetic energy. [Level:3] [CO1]
13. Analyze how atoms intract with photons. [Level:4] [CO2]

14. Light of wavelength  $5000\text{\AA}$  falls on a sensitive plate with photoelectric work function  $1.9\text{eV}$ . Find (i) energy of the photon (ii) kinetic energy of photoelectrons emitted and (iii) stopping potential.  $h = 6.62 \times 10^{-34} \text{ Js}$ . [Level:3] [CO2]
15. An electron is in the  $n=5$  state of hydrogen. To which states can the electrons make transitions and what are the energies of emitted radiation. [Level:3] [CO4]
16. Find out the distance of closest approach when alpha particles of kinetic energy  $5\text{MeV}$  are scattered at  $90$  degree by a copper foil( $Z=79$ ) foil? [Level:3] [CO4]
17. Derive the uncertainty relation between frequency and time for a classical wave. [Level:2] [CO3]
18. Show that product of phase velocity and group velocity is equal to the square of velocity of light. [Level:4] [CO3]

**(Ceiling: 36 Marks)**

**Part C (Essay questions)**

Answer any *one* question. The question carries 10 marks.

19. Explain the theory of Compton effect and validate it with necessary expressions. [Level:2] [CO2]
20. Explain Bohr's model of hydrogen atom. [Level:2] [CO4]

**(1 × 10 = 10 Marks)**

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