

School of Basic and Applied Sciences

Chemistry
ETE - Jun 2023

Time : 3 Hours

Marks : 100

Sem IV - C1UD401C - Perspectives of Modern Physics and Basic Electronics

Your answer should be specific to the question asked
Draw neat labeled diagrams wherever necessary

1. Can photons and electrons with identical momentum have identical wavelengths? Identify the wavelength difference if the two have the same energy. K2 CO2 (5)
2. The mass of a moving electron is 11 times than its rest mass. Determine the momentum and kinetic energy of the electron. K1 CO1 (5)
3. Draw the circuit diagrams of a n-p-n transistor connection in CE mode. In a common emitter connection, $I_b = 10\mu A$, and transistor amplification factor $\beta = 150$. Calculate the value of collector current (I_C) and current gain (α) K1 CO3 (5)
4. State Einstein's postulates of special theory of relativity. Obtain the equations for the Lorentz transformation. K3 CO2 (10)
5. Find the particle's velocity if its total energy is exactly three times that of its rest mass. K2 CO1 (10)
- 6) Rockets A and B are observed from the earth to be travelling with velocities $0.8c$ and $0.7c$ in the same line in the same direction. Find the velocity of B as seen by an observer on A K3 CO4 (10)

OR

- Briefly describe the ether hypothesis. Explain in depth the Michelson-Morley experiment and mention the results. K3 CO4 (10)
7. A particle possesses kinetic energy k and rest mass m_0 . Demonstrate that its de-Broglie wavelength is given by the formula: $\lambda = \frac{hc}{\sqrt{k(k + 2m_0c^2)}}$ K4 CO3 (10)
 8. Discuss Compton Effect? Explain the physical significance of the Compton shift given by the expression, $\lambda' - \lambda = \frac{h}{m_0c}(1 - \cos\theta)$ where various terms have their usual meaning. K3 CO3 (15)
 - 9) A particle has a velocity $6i + 5j + 4k$ m/s in a coordinate system moving with velocity $0.8c$ along the X- axis relative to a laboratory frame. Find the velocity of the particle in the laboratory frame K4 CO5 (15)

OR

- Examine Einstein's quantum explanation for the photoelectric effect. Find the photo electrons' maximal kinetic energy in eV if their work function is 3.0 eV and their radiation frequency is 2.0×10^{14} Hz.
10. Discuss the voltage divider method of biasing transistors. The stability factor and circuit diagram should be examined. Specify the benefits and drawbacks of the voltage divider method of biasing. Design a self-bias circuit using a Ge transistor with $V_{CC} = 16V$ and $R_C = 1.5K\Omega$ for obtaining of $V_{CE} = 8V$ and $I_C = 4mA$. Assume $S = 12$ & $\beta = 50$ K4 CO3 (15)