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Daffodil International University

**Faculty of Science & Information Technology**

**Department of Computer Science and Engineering**

**Final Examination, Spring-2026**

**Course Code: PHY102, Course Title: Physics-II**

**Level: 01 Term: 03 Batch: 69**

**Time: 2 Hour** **Marks: 40**

## Answer ALL Questions

*[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]*

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|---|---|---|---|---|
| 1. | *(a)* | State the concept of the De Broglie hypothesis and write its expression. | 1 | CO-1 |
| | *(b)* | State what is meant by an inertial frame of reference and give any example. | 1 | |
| | *(c)* | Define binding energy. Then, sketch and explain the curve of binding energy per nucleon as a function of mass number. | 2 | |
| | *(d)* | What type of reaction occurs in a nuclear reactor? Briefly explain the process. | 2 | |
| | *(e)* | State the limitations of Galilean Transformation. | 2 | |
| | *(f)* | Differentiate between the Photoelectric Effect and the Compton Effect. | 2 | |
| 2. | *(a)* | Summarize the key postulates of the Bohr atomic model. How does it modify the limitations of the Rutherford atomic model? | 4 | CO-2 |
| | *(b)* | Following the radioactive decay process,<br>(i)Derive the radioactive decay law and<br>(ii)Obtain the expression for half-life. | 3 | |
| | *(c)* | Describe the concept of length contraction and derive the relation between proper length and contracted length using the postulates of the Special Theory of Relativity. | 3 | |
| | *(d)* | A high-energy photon collides with a free electron initially at rest. After the interaction, the photon is scattered at an angle with a longer wavelength.<br>a) Explain the phenomenon of Compton Effect.<br>b) Using conservation of energy and momentum, obtain the expression for the wavelength shift of the photon. | 1+4 | |

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|---|---|---|---|---|
| 3. | *(a)* | Find the binding energy and binding energy per nucleon of $^{238}_{92}U$ nucleus in MeV unit. Given: proton mass = 1.007276 u, neutron mass = 1.008665 u, and nuclear mass = 238.05078 u. | 3 | CO-3 |
| | *(b)* | Two elements "X" and "Y" have half-lives of 6 days and 9 days respectively. Evaluate the time required for each to reduce to 10% of its initial amount. | 3 | |
| | *(c)* | A woman aged 28 travels in a spacecraft at a speed of 0.95c, leaving her 6-year old daughter on Earth. She spends 20 years in space.<br>After returning, find the ages of both the mother and the daughter. | 3 | |
| | *(d)* | An electron moves with velocity of v = 0.8c. Using the concept of relativistic mass, calculate:<br>a) The relativistic mass of the electron.<br>b) The percentage increase in its mass compared to its rest mass. | 3 | |
| | *(e)* | Using uncertainty principle, determine the minimum velocity of an electron needs to have to be inside a nucleus. | 3 | |