



# Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Final Semester Examination, Spring 2025

Course Code: PHY102, Course Title: Physics II

Level:1 Term:2 Batch:67

Time: 2:00 Hrs.

Marks: 40

Answer ALL the Questions

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

1.	a)	Which atomic model introduced quantized energy levels?	1	CO1
	b)	Because of which force do neutrons and protons not separate?	1	
	c)	List the types of particles emitted during alpha, beta, and gamma radioactive decay.	2	
	d)	State the postulates of the special theory of relativity.	2	
	e)	Define isotope, isotone, and isobar with examples.	2	
	f)	Label the key components of the Compton Effect using a diagram.	2	
2.	a)	Interpret Einstein's photoelectric equation.	3	CO2
	b)	Explain the key observations and limitations of Rutherford's atomic model.	4	
	c)	How does Einstein's theory relate mass to energy?	4	
	d)	Show that the half-life of a radioactive element is inversely proportional to the decay constant of that element. What will be the mean lifetime of a radioactive substance if its half-life is 67 days?	4	
3.	a)	Find the frequency and wavelength of the photon emitted by the hydrogen atom when it comes from $-15$ eV energy state to $-34$ eV state.	3	CO3
	b)	A man aged 40, left in a spacecraft moving with velocity $0.95c$ for a trip to space, leaving behind his 15-year-old son on Earth. According to his own time, he returned to Earth after spending 25 years in space. After returning, what are the ages of both?	3	
	c)	Find the binding energy and binding energy per nucleon of the ${}^{238}_{92}\text{U}$ nucleus in both MeV and joule units, given that the atomic mass of hydrogen is $1.007825$ u, the mass of a neutron is $1.008665$ u, and the atomic mass of ${}^{238}_{92}\text{U}$ is $238.05078$ u.	3	
	d)	The decay constants of two radioactive elements A and B are $0.181\text{ d}^{-1}$ and $0.257\text{ d}^{-1}$ , respectively. (a) Find the half-life of element B. (b) Will the required time to decay 75% of both elements be the same?	3	
	e)	When an X-ray with a wavelength of $0.2400\text{ nm}$ is incident on an electron, it is scattered at an angle of $60^\circ$ . Find the wavelength of the scattered X-ray.	3	