QP Code: R262G010 | Reg. No | | | | | | | | | | | AY 25

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

M.Sc. (Second Semester - Regular) Examinations, May – 2026

24MPHPC12002– Basic Nuclear & Particle Physics

(Physics)

Time: 3 hrs | Maximum: 60 Marks

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. Plot the nuclear charge distribution curve for O, Ag & Pb.	CO1	K1
b. Discuss few characteristics of nuclear force.	CO2	K1
c. What is spallation reaction?	CO3	K1
d. What is the energy of secondary neutron in nuclear fission reaction?	CO4	K1
e. Why strange particles are called as strange?	CO5	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Describe the Rutherford alpha scattering experiment. Derive the expression for the distance of closest approach of an alpha particle to the nucleus.	8	CO1	K1
b. What type of particles were used in Rutherford scattering? What is meant by impact parameter?	2	CO1	K2
(OR)			
c. What is the SI unit of quadrupole moment?	2	CO1	K1
d. Explain how the electric quadrupole moment provides information about nuclear shape. Distinguish between spherical, prolate, and oblate nuclei.	8	CO1	K2
3.a. Explain Gamow's theory of alpha decay based on quantum tunnelling. Derive the expression for the decay constant and show how it explains radioactive decay.	10	CO2	K2
(OR)			
b. Derive the expression for Schrodinger equation and its solution for ground state of deuteron.	10	CO2	K2
4.a. Classify the properties of alpha, beta and Gamma particles.	5	CO3	K2
b. Differentiate between Zeeman effect and Stark effect.	5	CO3	K2
(OR)			
c. Write the Breit–Wigner formula for scattering cross-section near resonance.	2	CO3	K1
d. Derive the Breit–Wigner dispersion relation for s-wave ($\ell = 0$) scattering.	8	CO3	K2
5.a. Write short notes on (i) Elastic Scattering (ii) Nuclear Disintegration (iii) Radioactive Capture (iv) Heavy ion reaction.	10	CO4	K2
(OR)			
b. Define parity. Derive the expression for the magnetic dipole moment of a nucleus using the shell model.	10	CO4	K2
6.a. Classify elementary particles on the basis of mass, spin, and fundamental interactions. Explain each category with suitable examples and discuss their properties.	10	CO5	K2
(OR)			
b. Provide a proof outline of the CPT theorem and explain its implications in particle physics.	10	CO5	K2

--- End of Paper ---