

**PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)**

**MSc DEGREE EXAMINATION DECEMBER 2024
(First Semester)**

Branch - PHYSICS

NUCLEAR AND PARTICLE PHYSICS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The binding energy of deuteron is a) 2.0 MeV b) 2.7 MeV c) 2.2 MeV d) 2.5 MeV	K1	CO1
	2	The strong nuclear force is independent of which of the following? a) Charge b) Spin c) Mass d) Nuclear range	K2	CO1
2	3	The only positive term in the Bethe – Weizacker semi-empirical mass formula is? a) Surface b) Volume c) Symmetry d) Coulomb	K1	CO2
	4	Which of the following is a magic number? a) 52 b) 21 c) 7 d) 28	K2	CO2
3	5	Which type of radioactive decay has not changed the atomic number? a) alpha b) beta c) gamma d) isotopes	K1	CO3
	6	In a β^+ decay which of the following is released? a) Neutrino b) Anti-neutrino c) Photon d) Electron	K2	CO3
4	7	The nuclear reaction cross section is measured in barns, what is 1 barn equal to? a) 10^{-10} m^2 b) 10^{-23} m^2 c) 10^{-34} m^2 d) 10^{-28} m^2	K1	CO4
	8	Most of the energy released in the fission process is in the process of _____ a) Kinetic energy b) Thermal energy c) Light energy d) Heat energy	K2	CO4
5	9	Which among the following is not a hadron? a) Proton b) Neut c) Pion d) Electron	K1	CO5
	10	Quark composition of the neutron is? a) u u d b) u d d c) u d s d) u s s	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	What is the evidence of shell structure in nuclei? Explain the main assumptions of the nuclear shell model.	K2	CO1
		(OR)		
	11.b.	What is the binding energy of a nucleus? Draw the curve of binding energy per nucleon against mass number of nuclei and discuss the main features of the curve.		
2	12.a.	Write a short note on Binomial and Poisson distribution.	K2	CO2
		(OR)		
	12.b.	Outline Fermi's theory to explain the continuous energy spectrum in beta decay.		
3	13.a.	Discuss the Yukawa theory of Nuclear Forces.	K2	CO3
		(OR)		
	13.b.	What are deuterons?. State and explain properties of the ground state of deuterons.		
4	14.a.	Explain the process of a nuclear reaction, distinguishing between direct reactions and compound nucleus formation.	K3	CO4
		(OR)		
	14.b.	Summarize the physical and chemical effects of radiation on agriculture.		
5	15.a.	Discuss the classification of elementary particles based on their intrinsic properties.	K1	CO5
		(OR)		
	15.b.	Discuss the conservation laws of elementary particles with examples.		

SECTION - C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Outline the basic assumptions of the liquid drop model of the nucleus and describe how this model is used to estimate the semi-empirical mass formula?	K2	CO1
2	17	Explain Gamow's theory of alpha decay and deduce the Geiger-Nuttall law.	K2	CO2
3	18	Show that differential scattering cross section is independent of scattering angle for neutron-proton scattering using partial wave analysis.	K2	CO3
4	19	Define nuclear fission and explain Bohr and Wheeler's theory of nuclear fission.	K4	CO4
5	20	Explain in detail the quark model.	K5	CO5

Z-Z-Z

END