Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
(Autonomous)
End Semester Examination: MAR / APR 2025
Faculty: Science and Technology

Program: B.Sc. (Gen 03) **Semester: VI** **SET: A**
Program (Specific): General B.Sc. **Course Type: DSC**
Class: T.Y.B.Sc **Max. Marks: 35**
Name of the Course: Nuclear Physics
Course Code: 24-PHY-364 **Time: 2Hr**
Paper: IV

Instructions to the candidate:

1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Draw a well labelled diagram wherever necessary.*

Q1) Define or state the following **5**

a) What is compound Nucleus ?
b) Define radioactivity.
c) Define packing fraction.
d) What is a quark?
e) Define binding energy.

Q2) Answer the following. (Attempt any 4) **4**

a) What is recovery time in G.M counter?

b) If we have function f(x) for which f(x) = -f(x), what is its parity?

c) Which force holds the nucleon together in a nucleus?

d) What is an exoergic and endoergic reaction?

e) What is the roll of effective multiplication factor (k) in chain reaction?

f) What do you mean by critical size of the reactor?

Q3) Answer the following. (Attempt any 4/6) **8**

a) Write a short note on electrical quadrupole moment.

b) State any three conservation laws in nuclear reaction.

c) Explain lepton in short.

d) Describe ideal equilibrium.

e) Write a short note on carbon dating.

f) Obtain the threshold energy for the following reaction

$${}_{83}\mathrm{Bi}^{209} + \mathrm{p} \rightarrow {}_{83}\mathrm{Bi}^{208} + {}_{1}\mathrm{H}^{2}$$

Where mass of $_{83}Bi^{209}$ =208.980394 a.m.u

Mass of proton = 1.007825 a.m.u

Mass of $_{83}Bi^{208}$ =207.979731 a.m.u

Q4) Short answer questions (Attempt any 2/4) **8**

a) Explain the construction and working of cyclotron .

b) Explain with a neat labelled diagram working of scintillation counter.

c) Calculate the energy released during the following fusion reaction

$$2\ {}_1H^1 + 2\ {}_0n^1 \rightarrow\ {}_2He^4$$

Where mass of $_1H^1$ =1.007825 a.m.u

mass of $_0n^1$ = 1.008665 a.m.u

mass of $_2He^4$ = 4.003424 a.m.u

d) Derive the equation $N = No\ e^{-\sigma nx}$ for nuclear cross-section.

Q5) Attempt any two of the following (2/4) **10**

a) Draw a diagram of swimming pool reactor and explain it.

b) Derive an equation for the specific activity.

c) Describe proton – proton cycle.

d) Explain binding energy curve.
