2009

M.Sc.

3rd SEMESTER EXAMINATION

PHYSICS

PAPER—PH-2103

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Module–PH-2103A

(Marks : 20)

Answer *Q. No. 1* and any *one* from the rest.

1. Answer any *five* bits : 2×5

(a) State the applications of double focusing mass spectrometer in modern physics.

(b) Write down the Weizsacker's semi-empirical mass formula for ${}_{Z}X_{N}^{A}$ and mention the B.E. correction terms.

(c) How can you conclude that α-decay is possible only when $A \geq 150$ of radioactive nuclei.

(d) Diagrammatically present charge-current distribution configuration of the nuclei ${}_{Z}Y_{N}^{A}$.

(e) What is Kuric plot?

(f) Discuss the Selection rules in multiple γ transition based on the conservation of angular momentum.

(g) Draw a Schematic experimental set up for detection of neutrino.

(h) Show the isomeric-transition of ${}_{35}Br^{80}$ (isomaric nuclei) with energy level diagram for emission of γ, β^+ and β^- radiation.

2. What are mass parabola? Express the parabolic mass relationship. Graphically show the transitions of the following even$_A$108 isobaric nuclei with parabolic presentation : 2+2+3+3

$$_{50}Sn^{108} \xrightarrow[\beta^+]{} {}_{49}In^{108} \xrightarrow[\beta^+]{} {}_{48}Cd^{108}$$

$$_{47}Ag^{108} \xrightarrow[\beta^-]{} {}_{48}Cd^{108}$$

$$_{44}Ru^{108} \xrightarrow[\beta^-]{} {}_{45}Rh^{108} \xrightarrow[\beta^-]{} {}_{46}Pd^{108}$$

and $$_{47}Ag^{108} \xrightarrow[\beta^+]{} {}_{46}Pd^{108}$$

3. Graphically discuss nuclear resonance absorption and fluorescence. What is recoilfree gamma ray Spectroscopy ? State the important uses of Mossbauer effect. 6+2+2

Module–PH-2103B

(*Particle Physics*)

(Marks : 20)

Answer *Q. No. 1* and any *one* from the rest.

1. Answer any *five* bits : 2×5

(a) Calculate the coupling constant for Gravitational interaction in natural unit.

(b) $\pi^\circ \longrightarrow \gamma + \gamma$

$K^\circ \longrightarrow \pi^\circ + \pi^\circ$

In the above reactions predict the conservation of Isospin (I) and third component of Isospin (I_3).

(c) Write down GNN formula for quarks. Calculate the charges for S and d quarks by this formula.

(d) Define structure constant in Lie group. Write down the generators in SU(2) group.

(e) Prove that time reversal operator is anti-unitary.

(f) Show that in SU(2)

$2 \otimes 2 = 3 \oplus 1$.

(g) Define G-parity. Where it is conserved ?

(h) What are proper and improper symmetries ?

2. (a) For Baryons prove that
$3 \otimes 3 \otimes 3 = 10 \oplus 8 \oplus 8 \oplus 1$. 5

(b) Isospin symmetry predicts that $m_p = m_n$. Prove it. 3

(c) Explain spontaneous symmetry breaking in particle physics. 2

3. (a) Prove that

$$S + t + u = \sum_i m^2_i$$

where s, t, u are mandels'tam variables. 5

(b) Calculate the threshold K.E. of the proton in the lab. frame to create an anti-proton in a proton-proton collision. 5

———