Sanjay Ghodawat University, Kolhapur

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2020-21
EXM/P/09/00

SY M Sc | **School of Science** | **Department of Physics**

PHS601 | **Nuclear and Particle Physics** | **Semester: III**

Monday, 14.12.2020

Examination: ESE | **Max Marks: 50**

Instructions for Students: 1) Use of non-programmable calculator is allowed
2) All questions are compulsory
3) Figures to the right indicate full marks.

Q.1	**Answer the following questions (Any Two)**	**Marks**	**BL**	**CO**
a)	Derive an expression for the semi-empirical binding energy formula.	08	L5	CO1
b)	A simple quantum mechanical model of the Deuteron is based on a spherically symmetric potential well V=0 and V=-Vo. Find the ground state potential of Deuteron using Schrodinger wave equation.	08	L3	CO1
c)	Explain the conservation laws in a nuclear reaction.	08	L1	CO2
Q.2	**Answer the following questions (Any Two)**	**Marks**	**BL**	**CO**
a)	Explain in detail theory of formation of compound nucleus along with its energy levels of a nucleon.	08	L3	CO2
b)	Explain the theory of β-decay. Give the detailed description of continuous nature of β- ray spectrum.	08	L4	CO3
c)	i) Illustrate theory of α-decay using quantum mechanical treatment. ii) Give the decay scheme of ^{60}Co nuclei and ^{137}Cs nuclei.	08	L2	CO3
Q.3	**Answer the following questions (Any Two)**	**Marks**	**BL**	**CO**
a)	Write a note on the following quantum numbers, explain in terms of classification and example. i) Lepton Number [L] ii) Baryon number [B]	09	L3	CO4

Identify the missing particle of the following.

1. $k^- + p \rightarrow k^+ + ??$
2. $\pi^+ + p \rightarrow k^0 + ??$

b) Write a note on Strangeness quantum number [S]. 09 L4 CO4

Find the strangeness of the following using Gellman and Nishijiman formula.

1. $\begin{pmatrix} k^+ \\ k^0 \end{pmatrix}$ 2. $\begin{pmatrix} k^- \\ k^0 \end{pmatrix}$ 3. (Λ^0)

4. $\begin{pmatrix} \varepsilon^+ \\ \varepsilon^0 \\ \varepsilon^- \end{pmatrix}$ 5. $\begin{pmatrix} \Xi^0 \\ \Xi^- \end{pmatrix}$ 6. $\left(\Omega^-\right)$

c) Discuss the single particle shell model, its validity and limitations. 09 L2 CO1