

# C.U.SHAH UNIVERSITY

## Summer Examination-2019

**Subject Name : Particle and Nuclear Physics**

**Subject Code :4SC06PNP1**

**Branch: B.Sc. (Physics)**

**Semester :6**

**Date: 30/04/2019**

**Time: 10:30 To 01:30**

**Marks : 70**

**Instructions:**

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

<b>Q-1</b>	<b>Attempt the following questions:</b>	<b>(14)</b>
	a) State the Gellmann-Nishijima Scheme.	01
	b) Which particles are said to be strange?	01
	c) State the CPT theorem.	01
	d) Define the range of Alpha particles.	01
	e) Write the Geiger-Nuttall law.	01
	f) Which particle was found to carry away part of the energy in a Beta decay process?	01
	g) Differentiate: Nuclear fusion versus Nuclear fission.	01
	h) Define the process of Pair Production.	01
	i) Which detector is used to detect light radiations?	01
	j) What is the Dead time of a detector/ counter?	01
	k) Give the principle on which Linear accelerators work.	01
	l) Define Parity.	01
	m) Why is it necessary to connect the pn junction in reverse bias while using it as a semiconductor detector?	01
	n) Name any two quarks.	01

**Attempt any four questions from Q-2 to Q-8**

<b>Q-2</b>	<b>Attempt all questions</b>	<b>(14)</b>
	(A) Check whether the given nuclear reaction is possible or not based on the conservation of Charge, Lepton number, Baryon number, Isospin, $I_3$ , Hypercharge and Strangeness. [The strangeness of $\Lambda^0$ is -1 and that of $K^0$ is 1.]	<b>08</b>
	$p + p \rightarrow \Lambda^0 + K^0 + p + \pi^+$	
	(B) Find the Charge, Baryon number, Isospin, $I_3$ , Strangeness and Hypercharge of $\Sigma^+$ having quark content $uss$ .	<b>06</b>
<b>Q-3</b>	<b>Attempt all questions</b>	<b>(14)</b>
	(A) Explain briefly the $\alpha$ -spectrum.	<b>05</b>
	Which properties of the nucleus was revealed in the $\alpha$ -decay spectrum?	



	(B) Derive the expression for Q value of an $\alpha$ -decay process.	04
	(C) Explain briefly the Gamow's theory of $\alpha$ -decay.	05
<b>Q-4</b>	<b>Attempt all questions</b>	<b>(14)</b>
	(A) Enumerate the problems encountered in a $\beta$ -decay process. How was it overcome?	07
	(B) Explain briefly $\gamma$ -decay and internal conversion process.	05
	(C) What values does Lepton and Baryon number have?	02
<b>Q-5</b>	<b>Attempt all questions</b>	<b>(14)</b>
	(A) Briefly explain Direct reactions along with its two types.	03
	(B) Explain in detail the Photoelectric effect.	07
	(C) Determine the Charge, Baryon number, $I_3$ and Strangeness of proton (uud).	04
<b>Q-6</b>	<b>Attempt all questions</b>	<b>(14)</b>
	(A) Explaining the kinematics, derive the expression for Q value of nuclear reactions.	07
	(B) Explain in detail Van De Graaff Accelerator	07
<b>Q-7</b>	<b>Attempt all questions</b>	<b>(14)</b>
	(A) Explain in detail the principle, construction and working of a GM Counter.	09
	(B) Derive the expression for Q value of $\beta^-$ decay.	05
<b>Q-8</b>	<b>Attempt all questions</b>	<b>(14)</b>
	(A) Write a note on Scintillation detectors.	07
	(B) Explain the principle, construction and working of a Cyclotron.	07

