

C. U. SHAH UNIVERSITY

Winter Examination-2021

Subject Name: Nuclear and Particle Physics

Subject Code: 5SC03NPP1

Branch: M.Sc. (Physics)

Semester: 3

Date: 14/12/2021

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator and 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.
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SECTION – I

- Q-1 Attempt the Following questions (07)**
- a Name the constituents of nucleus. **01**
 - b What can we interpret if $b > R$ from Rutherford's Alpha particle scattering experiment? **01**
 - c Find radius of ^{64}Cu nucleus using neutron diffraction. **01**
 - d Evaluate the disintegration energy of ^{18}O , where K_α is 5.60 MeV. **01**
 - e State the Geiger-Nuttall Law. **01**
 - f Out of five groups of alpha particle, which group takes daughter nuclei to the ground state? **01**
 - g Calculate the radius of ^{56}Fe nucleus using electron diffraction. **01**
- Q-2 Attempt all questions (14)**
- a Discuss how the Rutherford's alpha scattering experiment helps in measurement of nuclear size. **07**
 - b Enumerate on nuclear reactions and its types. **07**
- OR**
- Q-2 Attempt all questions (14)**
- a Explain in detail Pauli's neutrino hypothesis. **07**
 - b Discuss the Alpha decay paradox in detail. **07**
- Q-3 Attempt all questions (14)**
- a Evaluate the Q-value (disintegration energy) for the case of spontaneous alpha decay process. **07**
 - b Explain in detail range of alpha particle. **07**
- OR**
- Q-3**
- Elucidate in detail Fermi's theory of beta decay. **14**



SECTION – II

- Q-4 Attempt the Following questions (07)**
- a. State the CPT theorem. 01
 - b. Define and list the magic numbers in Nuclear Physics. 01
 - c. Name the fundamental forces. 01
 - d. How many quarks are there in Mesons and Baryons? 01
 - e. List the members of lepton family; also write the lepton number for Mesons. 01
 - f. What are the value of Strangeness for Pions and Nucleons? 01
 - g. Define nuclear binding energy. 01
- Q-5 Attempt all questions (14)**
- a Derive the Semi Empirical Mass Formula for nucleus. 10
 - b Write a note on quarks. 04
- OR**
- Q-5 Attempt all questions**
- a Explain the classification of elementary particle based on their integral spin. 07
 - b Enumerate on liquid drop model. 07
- Q-6 Attempt all questions (14)**
- a Give an account on mass parabola for odd nuclei. 06
 - b **Find Spin and parity of following nuclei.** 08
 ^{56}Fe , ^7Li , ^{16}O , ^{40}Ca , ^{13}C , ^{13}N , ^{45}Ti , ^{64}Cu
- OR**
- Q-6**
- Check the nuclear reaction is allowed or not with detail description? 14**
- a) $\Sigma^+ + n \rightarrow \Sigma^- + p$
 - b) $\pi^+ + n \rightarrow K^+ + \Sigma^0$
 - c) $\Lambda^0 \rightarrow \Sigma^+ + \pi^-$
 - d) $\Lambda^0 + n \rightarrow \Sigma^- + p$
 - e) $K^+ \rightarrow \pi^+ + \pi^0 + \pi^0$
 - f) $K^- \rightarrow \pi^- + \pi^0$
 - g) $K^- + p \rightarrow \bar{K}^0 + n$

