

21U608

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Name: .....

Reg.No: .....

**SIXTH SEMESTER B.Sc DEGREE EXAMINATION, APRIL 2024**

(CBCSS - UG)

(Regular/Supplementary/Improvement)

**CC19U PHY6 B12 / CC20U PHY6 B12 - NUCLEAR PHYSICS AND PARTICLE PHYSICS**

(Physics - Core Course)

(2019 Admission onwards)

Time : 2.00 Hours

Maximum : 60 Marks

Credit : 3

**Part A** (Short answer questions)

Answer *all* questions. Each question carries 2 marks.

1. Distinguish between isotopes and isobars.
2. What is meant by Proton and Neutron Separation Energies?
3. What is an alpha decay?
4. What is reaction cross section in a nuclear reaction?
5. What is the use of cadmium rods in a nuclear reactor?
6. Differentiate between nuclear fission and fusion reactions.
7. What is neutron activation analysis?
8. What is a semiconductor detector?
9. Give the names of three accelerators still in use.
10. How will you distinguish between weak force and strong force?
11. In particle interaction and decays the beam particle and target particle are protons. Why?
12. What is quarkonium?

**(Ceiling: 20 Marks)**

**Part B** (Short essay questions - Paragraph)

Answer *all* questions. Each question carries 5 marks.

13. Discuss about the exchange particle in nuclear forces and its rest mass energy.
14. Compute the Q value for the  $^{238}\text{U} \rightarrow ^{206}\text{Pb}$  decay chain, and find the rate of energy production per gram of uranium.

15. Calculate the threshold kinetic energy for the reaction  $p + {}^3\text{H} \rightarrow {}^2\text{H} + {}^2\text{H}$  (a) if protons are incident on  ${}^3\text{H}$  at rest; (b) if  ${}^3\text{H}$  (tritons) are incident on protons at rest.
16. Explain the principle and working of a ionization chamber.
17. Explain the principle and working of proportional counter.
18. Explain the working of van de graaff generator with neat diagram.
19. A cyclotron is connected to the oscillator of frequency 15MHz, what should be the operating magnetic field for accelerating protons? The radius of dees is 60cm. Calculate the maximum kinetic energy of proton in eV, the mass of the proton =  $1.67 \times 10^{-27}$ kg.

**(Ceiling: 30 Marks)**

**Part C (Essay questions)**

Answer any *one* question. The question carries 10 marks.

20. Explain liquid drop model of nucleus and obtain binding energy of a nucleus of atomic number Z and mass number A based on the model.
21. Give an account of various conservation laws in particle reactions of elementary particles.

**(1 × 10 = 10 Marks)**

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