City College

5th Semester Internal Examination 2021-22

Physics (Hons)

Paper: DSE B1 (Nuclear and Particle Physics)

Time- 1 hour   **Full Marks-20**

Answer any ten questions. $10{\times}2{=}20$

1. What is the need of activators in the scintillation crystal?

2. How can synchrotron radiation losses be used for useful purposes?

3. A $_{92}U^{232}$ nucleus decays to $_{90}Th^{228}$ with the emission of an α particle. If the kinetic energy of α particle is 5.32MeV, what is the atomic mass of $_{90}Th^{228}$ in u? The atomic masses of $_{92}U^{232}$ is 232.037131 and $_{2}He^{4}$ is 4.002603u.

4. Show that the radius of largest nucleus $_{92}U^{238}$ is only about six times the radius of smallest nucleus $_{1}H^{1}$.

5. Define threshold energy for an endothermic nuclear reaction.

6. On which basis a nuclear fission reaction is called subcritical or supercritical?

7. What is Cerenkov radiation? On which factor does the direction of emitted light depend?

8. What is pair production? Why it can't occur in empty space?

9. Which semiconductor junction detectors are used to detect beta particles and gamma rays?

10. Explain which one should be preferred for studying the details of nucleus, a 30MeV alpha particle or a 30MeV proton.

11. What strength of magnetic field is used in a cyclotron in which protons make $1.9{\times}10^{7}$ revolutions per second?

12. Why a circular accelerator is preferred over a linear accelerator?

13. Identify the type of interaction responsible for the following reactions: $K^{+} \rightarrow \mu^{+} + \nu_{\mu}$

14. Check the reaction is allowed or not: $p + p \rightarrow p + n + K^{+}$

15. Check the decay is possible or forbidden: $\mu^{-} \rightarrow e^{-} + \nu_{\mu} + \bar{\nu_{e}}$