LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

THIRD SEMESTER – **NOVEMBER 2019**

17/18PPH3ES03 – REACTOR PHYSICS

Date: 06-11-2019 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

PART – A

ANSWER **ALL** QUESTIONS: **(10 × 2 = 20)**

1. Calculate the approximate radius of U^{238} nucleus.
2. Differentiate prompt and delayed neutrons.
3. Calculate the time required for 10 % of a sample of thorium to disintegrate. The half-life of thorium is 1.4×10^{10} years.
4. Write the nuclear reactions for the production of fission fuels U^{233} and Pu^{239}.
5. What are moderators in a nuclear reactor? Give two examples.
6. If a fission process starts with 500 neutrons and the multiplication factor K = 1.1, calculate the number of neutrons in the hundredth generation.
7. Define slowing down density.
8. What is negative reactivity? How is it induced?
9. Write a short note on 'nuclear hazards'.
10. Mention the disadvantages of black control rods in modern reactors.

PART – B

ANSWER ANY **FOUR** QUESTIONS: **(4 × 7.5 = 30)**

11. What is nuclear fission? Explain the mechanism of fission.
12. a) Discuss about the emitted and recoverable energy from various fission fragments in a reactor.
    b) Calculate the energy released by the fission of 10 g of U^{235}. Given that the energy released per fission is 200 MeV.
13. Derive neutron current density vector in a reactor.
14. Explain prompt jump and prompt critical condition.
15. Write a note on reactor shielding and reactor safe guards.
16. How is the optimum reactor shape calculated?

PART – C

ANSWER ANY **FOUR** QUESTION: **(4 × 12.5 = 50)**

17. a) Write radioactive law of disintegration and derive expressions for half-life and mean-life periods.
    b) The disintegration constant of a radioactive element is 0.00231 per day. Calculate its half-life and mean-life.
18. Derive expressions for interaction rates and neutron flux.
19. What are thermal neutrons? Discuss the theory of infinite homogeneous reactor and write the conditions for criticality.
20. Explain elastic collision of neutrons and obtain the expression for energy loss.
21. Derive the steady-state diffusion equation of neutrons in a reactor and explain the boundary conditions.
22. Determine rod worth of one central rod by modified one group theory.

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