LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2018**

16/17PPH3ES03– REACTOR PHYSICS

Date: 29-10-2018 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

PART – A

Answer all the questions **(10×2=20)**

1. Calculate the binding energy and binding energy per nucleon of $_{17}Cl^{35}$ nucleus from the following data. Mass of $_{17}Cl^{35}$ nucleus = 34.9800 amu, mass of 1 proton = 1.007276 amu and mass of 1 neutron = 1.008665 amu.
2. Calculate the fission rate and burnup rate for U^{235}, with given values $\alpha = 0.175$, $P = 2$ MW and $E_R = 168$ MeV.
3. What is multiplication factor?
4. Write the average neutron energy for fission in thermal, intermediate and fast reactors.
5. Define collision density.
6. Calculate the average increase in lethargy per collision, ξ of neutrons when graphite is used as a moderator.
7. What are reentrant and non-reentrant surfaces?
8. How does the control rod motion affect the criticality of a reactor?
9. Differentiate black and grey control rods.
10. What is meant by the term buckling? What is the value of buckling for an infinite uniform reactor?

PART – B

Answer any FOUR questions **(4 × 7.5 =20)**

11. a) Discuss about the emitted and recoverable energy from various fission fragments in a reactor. **(5.5)**

b) Calculate the energy released by the fission of 2 g of $_{92}U^{235}$ in kWh. Given that the energy released per fission is 200 MeV. **(2)**

12. Derive the equation of continuity for neutrons in a reactor.
13. Derive the expression for thermal neutron flux of an infinite homogenous reactor and discuss the condition for criticality.
14. What are prompt and delayed neutrons? Find the reactor period when U^{235} is used as a fuel, assuming no delayed neutrons are emitted in the fission.
15. Write a note about reactor shielding and reactor safe guards.

16. What is diffusion length? Derive the relation between diffusion length and crow-flight distance of neutrons in a reactor.

PART – C

Answer any FOUR questions **(4 × 12.5 =20)**

17. a) State radioactive law of disintegration and derive expressions for half-life and mean-life periods of a radioactive sample. **(10)**

b) 1 g of radium is reduced to 2.1 mg in 5 years by alpha decay. Calculate the half-life period of radium. **(2.5)**

18. Derive expression for interaction rate and flux of neutrons using diffusion theory.
19. Discuss moderation of neutrons in hydrogen and derive expressions for collision density and slowing down density.
20. Explain how the power and reactivity of a reactor affected by various temperature coefficients.
21. Discuss the importance of control rods in a reactor and derive an expression for rod-worth.
22. Write the steady state diffusion equation and solve it for infinite planar source and point source in an infinite medium.

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