LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRDSEMESTER – APRIL 2018

16PPH3ES03/PH 3955 - REACTOR PHYSICS

Date: 05-05-2018 Dept. No. Max. : 100 Marks
Time: 09:00-12:00

PART A

Answer **ALL** Questions (10×2=20)

1. Define breeding gain, write the relation connecting breeding gain and breeding ratio.
2. Find the fuel consumption rate for U235 with given values, thermal value α=0.135, ER = 200 MeV and power = 2 MW.
3. Sketch the distribution of mass of fission fragments for the different fission chains of U^{235}.
4. A radioactive sample has its half -life equal to 54 days. Find its disintegration constant and average life?
5. Differentiate prompt and delayed neutrons.
6. What are fission product poissons?
7. If the fission process starts with 1100 neutrons and the multiplication factor K=1.05, Calculate the number of neutron in the hundredth generation?
8. Determine buckling of an Infinite cylinder reactor with radius 0.95c.m.
9. Write a short note on "Nuclear Hazards".
10. If the Q value for fission of $_{83}Bi^{209}$ is approximately 200 MeV. Estimate the critical energy for the fission of the nucleus.

PART B

Answer any **FOUR** Questions (4×7.5=30)

11. A hypothetical point source of one speed neutrons emits 110 neutrons/sec, in to the surrounding infinite graphite block. Determine the neutron flux at a distances of 0.32 m from the source. {For graphite assume 1/L=1.81 m-1 ,D=9.2 mm.}
12. Derive Fick's law of diffusion and explain validity of Fick's law in neutron diffusion.
13. Nickel 59 has an absorption cross section of 4.2 and a scattering cross section of 14.5. Compute the moderator ratio for Nickel .How many collisions would be required to thermalize a 1 MeV neutron.
14. Discuss in detail, reactor power as a function of time after a step insertion of reactivity for various temperature co-efficient with neat plot.
15. Explain the various types of nuclear reactors.
16. Calculate the power output of a nuclear reactor which consumes 8 Kg of U^{235} per day. Given that the average energy released per U^{235} fission is 208 MeV.

PART C

Answer any **FOUR** Questions (4×12.5=50)

17. Explain neutron life cycle in a reactor for infinite assembly.
18. Calculate the thermal flux in the rectangular parallelepiped sigma-pile reactor and determine power of the reactor.
19. Determine rod worth of central rod by modified one group theory.
20. Define "Lethargy". Show that to a good approximation the average increase in lethargy in any moderator is 2/A+2/3.
21. State and explain reciprocity theorem.
22. A bare reactor consists of long rods of uranium metals 22.4mm in diameter, arranged in a square lattice with a pitch of 0.134m suspended in a cylindrical vessel containing heavy water as moderator. (H/D=1.4). From the properties of the materials, Bm^2 is known to be 8.76 m^{-2}. Estimate the mass of the natural uranium that will make the reactor just critical. Take density of Uranium=$19x10^3$ Kg/m^3.

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