Prepared by Dr. PKS

MANIPAL UNIVERSITY

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DEPARTMENT OF SCIENCES, M.Sc. (PHYSICS)
IV SEMESTER - END SEMESTER EXAMINATIONS, JUNE 2017 – Make up

SUBJECT: NUCLEAR PHYSICS III [PHY-708.6]

(REVISED CREDIT SYSTEM)

Time: 3 Hours Date: MAX. MARKS: 50

Note: (i) **Answer Any FIVE full questions. Each sub questions carries FIVE marks.**

1. (a) Explain mirror nuclei method of measurement of nuclear size.

   (b) Explain the importance of electric quadrupole moment of a nucleus with example.

2. (a) Explain spatial distribution of slowing down density according to continuous slowing down model. What is meant by "age" of a neutron in a neutron multiplying system?

   (b) Show that critical energy of deformation for casing fission is linear function of the parameter Z^2/A for light nuclei.

3. (a) What is the Lawson's criterion for nuclear fusion reaction?

   (b) Obtain minimum critical radius for a reactor with square geometry in terms of critical buckling using one group equation.

4. (a) What is "Reflector Savings" with reference to a neutron multiplying system? Explain with an example.

   (b) Determine the infinite multiplication factor of a uniform mixture of uranium-235 and beryllium oxide in the atomic ratio of 1 to 10000. The value of σ_a for beryllium oxide is 0.010 barn. The resonance escape probability and the fast fission factor may be taken to be unity. η for uranium-235 is 2.06.

5. (a) Derive four factor formula for a thermal reactor.

(b) Assuming that the energy released per fission of $^{235}U_{92}$ is 200MeV, calculate the number of fission processes that should occur per second in a nuclear reactor to operate at a power level of 20,000kW. What is the corresponding rate of consumption of $^{235}U_{92}$.

6. (a) How to produce transuranic element Plutonium (Z=94) isotope and mention its properties. Write down the outer electronic configuration for the same element.

   (b) A reactor core contains fuel and moderator [Σ_s= 0.64 cm^{-1}, ζ = 0.17]. The thermal neutron flux is $2x10^{12}$ neutrons/(cm^2)(sec) and Σ_a for thermal neutrons in the fuel is 0.005 cm^{-1}; for each thermal neutrons absorbed, 1.7 fission neutrons are produced. Estimate the epithermal neutron flux per unit lethargy interval.

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