COURSE CODE: 261319

COURSE NAME: NUCLEAR REACTOR THEORY

SEMESTER & YEAR: Spring Semester (February-May), I year

INSTRUCTOR: Renato Gatto

HOURS: TBA

LOCATION: TBA

CFU (Credits): 9

TOTAL NO. OF CONTACT HOURS: 9 x 8 = 72

PREREQUISITES: 1st level degree (laurea triennale) in Engineering or Physics

OFFICE HOURS: After class, or by appointment (Palazzo Baleani, call 06 4991-8603 or email to renato.gatto@uniroma1.it)

COURSE AIMS: The objective of the course is to provide a general comprehension of the physical phenomena underlying the slowing-down and diffusion/transport of neutrons in media without and with nuclear fuel, and to illustrate the mathematical tools necessary to carry out criticality calculations.

LEARNING OUTCOMES: The student is expected to be able to perform and interpret analytical calculations relative to the neutronic design of a nuclear reactor, both in static and dynamic conditions.

TEXTBOOK: "The Elements of Nuclear Reactor Theory", by S. Glasstone and M.C. Edlund. Lecture notes provided by the Instructors.

GRADING POLICY:

-ASSESSMENT METHODS: Oral final exam 90% + Numerical Project 10 %

-ATTENDANCE REQUIREMENTS: Students are strongly encouraged to attend.

COURSE DESCRIPTION

1. Introduction to reactor physics

2. Mean free path

3. Fick's law

4. Slowing down of neutrons

   4.1 Elastic scattering

   4.2 Scattering law

   4.3 Mean logarithmic decrement

   4.4 Slowing down power and moderation ratio

   4.5 Lethargy

5. Slowing-down in infinite, non-absorbing media

   5.1 Slowing-down in hydrogen

   5.2 Slowing-down density in hydrogen

   5.3 Slowing-down in media containing media with atomic mass greater than one

   5.4 Slowing-down in a system containing different nuclides

6. Slowing-down in infinite absorbing media

   6.1 Slowing-down with capture in hydrogen moderator

   6.2 Slowing-down in media containing nuclei with atomic mass greater than one

   6.3 Resonance escape probability with well-separated resonances

7. Neutron "age" theory

   7.1 Continuous slowing-down model

   7.2 "Age" equation without captures

8. Transport equation

   8.1 Transport theory

   8.2 Transport kinetic equation

9. Neutron diffusion (basic transport approximation)

   9.1 Transport correction

   9.2 Transport mean free path

   9.3 Diffusion equation

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