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Course title and Number: NUEN 629: Numerical Methods in Reactor Analysis

Term: Fall 2014

Meeting times:

Lecture TR 12:45-2pm THOM 009C

Lab W 4:00-5:15pm SCC RM 4.210F

**Course Description and Prerequisites**

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| [NUEN 629 - NUM METH REACTOR ANALY](https://compass-ssb.tamu.edu/pls/PROD/bwckctlg.p_disp_course_detail?cat_term_in=201531&subj_code_in=NUEN&crse_numb_in=629) |
| Numerical Methods in Reactor Analysis. (4-0). Credit 4. Solution of variable dimension multigroup discrete representation problems including Sn, Pn, An, variational and Monte Carlo techniques; techniques in reactor kinetics, fuel cycle and optimization. Prerequisites: NUEN 430; NUEN 606 or equivalent. |

Implied prerequisites are an understanding of numerical methods and an ability to write numerical software in Matlab, Python, Fortran, C++, etc.

**Course Outcomes and Objectives**

At the end of this course you will understand the common methods of reactor analysis using numerical methods.

**Instructor Information**

Name: Ryan G. McClarren, PhD.

Telephone Number: (979) 862-1779

Email address: rgm@tamu.edu

Office Hours: TR 9-10am or by serendipity

Office Location: BIZL W 353

**Textbook and/or Resource Materials**

The class notes and various handouts will serve in place of a textbook. Additional supplementary material can be found in the following book:

Lewis, E. E., & Miller, W. F. (1984). *Computational methods of neutron transport*. Wiley.

**Grading Policies**

The course grade will be computed based on the following weights:

Homework: 30%

Project: 30%

Midterm Exam: 30%

Class Participation: 10%

**Course Topics, Calendar of Activities, Major Assignment Dates**

**Topics**

1. Neutron Transport Equation
   1. Derivation
   2. Types of problems
      1. Time-dependent
      2. Alpha-eigenvalue
      3. K-eigenvalue
   3. Multigroup Approximation
   4. Diffusion limit
2. Diffusion methods
   1. Time discretization
   2. Power iteration
   3. Alpha searches
   4. Finite Differences
   5. Nodal Expansion Methods
   6. Coarse-Mesh finite difference
3. Homogenization
   1. General procedure
   2. Discontinuity Factors

These are the topics we will definitely cover. The following list covers potential topics based on student’s interest. The topic of numerical methods for reactor analysis is broader than we have time to cover.

1. Method of Characteristics
   1. General Properties
   2. 2D-1D method
2. Collision Probability Method
3. Discrete Ordinates (Sn) Transport
   1. Acceleration techniques
4. Spherical Harmonics (Pn) Transport
5. Simplified Pn (SPn) “transport”
6. Second-Order Forms of the Transport Equation
7. Monte Carlo Methods
8. Depletion Calculations
   1. Chebyshev rational approximation method (CRAM)
9. Advanced Kinetics Calculations

**Other Pertinent Course Information**

All other information is impertinent.

**Americans with Disabilities Act (ADA)**

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| The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit <http://disability.tamu.edu> |
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| **Academic Integrity**  *For additional information please visit:* [*http://www.tamu.edu/aggiehonor*](http://www.tamu.edu/aggiehonor) |
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| *“An Aggie does not lie, cheat, or steal, or tolerate those who do.”* |