

NUCL 620 (Advanced Topics in Radiation Damage of Nuclear Materials)

Contact Info:

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A. Justification for the Course:

This course is 3 credit hours-course and targets graduate students particularly those who have taken both NUCL 420 and NUCL 520 courses. This NUCL 620 will build on the knowledge gained in those courses as well as other related courses and how to apply fundamental and basic knowledge in solving current challenging problems in radiation damage to nuclear materials. This will allow and encourage motivated students on conducting high end research projects that of significant impact on advancing and improving materials in harsh environments of nuclear reactors.

B. Course Objectives and Learning Outcomes and Method of Evaluation or Assessment:

The course objective is to enhance the knowledge of students in selected advanced topics in radiation damage of nuclear materials. The course is composed of lectures, research projects, assignment papers, and discussion participation in subjects related to radiation damage in nuclear materials. Each student will be also assigned a specific research topic to do extensive literature review of current state of the art problems, perform independent analysis, propose solutions of this problem, make presentation and comprehensive research paper.

Course Grading: Each student will be evaluated and graded based on his/her research project outcome, class presentations, critique of assigned published papers, course participation in evaluating other projects, answer questions, and final project research paper.

Methods of instruction will be composed of lectures, students review and critique of published related papers, presentations, and class discussions. In some projects, laboratory experiments may be required to enhance the project knowledge outcome. This integrated learning method will help enhance the critical thinking of the students as well as communication skills and ethics in conducting advanced research.

C. Prerequisite(s):

NUCL 420 and NUCL 520 are required (or other related/similar courses). Subject to approval.

D. Course Instructor(s):

Ahmed Hassanein, Paul L. Wattelet Distinguished Professor
Director of Center for Materials Under Extreme Environment (CMUXE)
School of Nuclear Engineering

E. Course Outline:

The course will cover several subjects and research projects related to the following effects in reactor and irradiation conditions that may include some of the following topics:

- (1) Thermal Damage
- (2) Collisional Damage
- (3) Particle and Photon Energy Deposition
- (4) Particle/Photon Transport and Range Calculations
- (5) Neutron Damage
- (6) Defects Production and Evolution
- (7) Physical and Chemical Sputtering Erosion and Effects
- (8) Swelling
- (9) Embrittlement
- (10) Hardening
- (11) Creep (thermal and irradiation induced)
- (12) Computational Methods

F. Reading List (including course text):

The instructor may provide some of his own notes, recommend current and recently published materials related to each student's project, assign research papers to critique, and will identify text books/published quality papers suitable for the selected projects.