



**Jordan University of Science and Technology**  
**Faculty of Engineering**  
**Nuclear Engineering Department**

NE465 Nuclear Reactor Materials

First Semester 2019-2020

**Course Catalog**

3 Credit Hours. Nuclear reactor materials, fuel element, fission gas swelling, void swelling, materials thermal properties, chemical behavior and radiation damage. Displacements cascades damage and crystal effect, collective effects and damage, sputtering, point defect formation and diffusion, defects reaction theory, hardening, embrittlement, and irradiation creep.

**Text Book**

<b>Title</b>	Fundamental Aspects of Nuclear Reactor Fuel Elements
<b>Author(s)</b>	D.R. Olander.
<b>Edition</b>	2nd Edition
<b>Short Name</b>	Ref #1
<b>Other Information</b>	

**Course References**

Short name	Book name	Author(s)	Edition	Other Information
Ref #2	Fundamentals of Radiation Materials Science	Gary S. Was,	1st Edition	
Ref #3	Ion-Solid Interactions: Fundamentals and Applications	M. Nastasi, J.W. Mayer, and J.K. Hirvonen.	2nd Edition	
Ref #4	Materials Science and Engineering: An Introduction	W.D. Callister,	3rd Edition	

**Instructor**

Name	Dr. GHADEER AL-MALKAWI
Office Location	-

Office Hours	Sun : 09:30 - 10:30 Sun : 12:30 - 13:30 Tue : 09:30 - 10:30 Tue : 12:30 - 13:30 Wed : 13:15 - 14:15 Thu : 09:30 - 10:30 Thu : 12:30 - 13:30
Email	ghmalkawi@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Sun, Tue, Thu : 10:30 - 11:30 Room: E2117

Prerequisites		
Line Number	Course Name	Prerequisite Type
293630	IE363 Engineering Materials	Prerequisite / Study
2003400	NE340 Nuclear Reactors Theory	Prerequisite / Study

Tentative List of Topics Covered		
Weeks	Topic	References
Weeks 1, 2	Mechanical Properties of Metals and Interatomic Bonding.	
Week 3	Aspects of Radiation Effects	
Week 3	General Requirements for the nuclear reactor materials	
Weeks 4, 5	Diffusion in nuclear processes (macroscopic and microscopic view of diffusion)	
Weeks 5, 6	Thermodynamics of Point Defects Formation	
Weeks 7, 8	Kinchin Pease Model for Displacement	
Weeks 8, 9	Sputtering	
Weeks 10, 11	Swelling and Void Formation	
Week 12	Irradiation Creep	
Week 13	Embrittlement	

Mapping of Course Outcomes to Program Student Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
A basic understanding of physical metallurgy and of the relationship between material microstructure and macroscopic behavior, outside of irradiation. [11]	10%	First Exam, Quizzes

An understanding of the mechanisms of radiation-material interaction with different types of radiation types and parameters. [11]	22%	First Exam, Second Exam, Quizzes
Studying the microscopic and macroscopic diffusion of atoms and Freckle pairs and enabling the students to calculate the concentration of the point defects [11]	18%	First Exam, Second Exam, Quizzes
An understanding of the basic mechanisms of materials degradation induced by neutron irradiation and the reactor environment including processes such as swelling, creep, phase transformations and embrittlement. [21, 12]	50%	Second Exam, Quizzes

Relationship to Program Student Outcomes (Out of 100%)						
1	2	3	4	5	6	7
83.33	16.67					

Evaluation	
Assessment Tool	Weight
First Exam	25%
Second Exam	25%
Quizzes	10%
Final Exam	40%

Policy	
Attendance	Since class discussion is a major course ingredient, regular attendance is mandatory. Attendance record will be taken into consideration in any borderline grade decisions.
Exam Policy	There will be no make-up exams except in extreme circumstances at the discretion of the instructor. The instructor has to be informed in advance (by email, phone, personal ...). You will be asked to provide proper documentation.
Disabled Students	Students with any sort of limitation or disability should discuss its consequences with instructor prior to the start of the course.
Emergency Provisions	In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor?s control. Here are ways to get information about changes in this course: - E-learning announcements - Instructor email (ghmalkawi@just.edu.jo)

Date Printed: 2020-01-14