Jordan University of Science and Technology

Faculty of Engineering

Nuclear Engineering Department

NE340 Nuclear Reactors Theory

First Semester 2018-2019

Course Catalog
3 Credit Hours. Review on neutron interactions, center of mass system, differential cross-section, compound nucleus formation model, optical model, theory of total neutron cross-section, Doppler broadening, neutron current and flux, neutron transport theory, one-speed neutron diffusion theory, neutron moderation in hydrogenous and non-hydrogenous medium, slowing down density , conditions for criticality of nuclear reactors, Four and six-factor formula, neutrons economy, infinite reactor, reflector saving, and boundary conditions.

Text Book	
Title	Nuclear Reactor Analysis
Author(s)	J.J. Duderstadt and L.J. Hamilton
Edition	1st Edition
Short Name	Ref #1
Other Information	John Wiley & Sons, 1976

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #2	Introduction to Nuclear Reactor Theory	John R. Lamarsh	1st Edition	Addison-Wesley, 1966

Instructor	
Name	**Dr. Khaled AL-Shboul**
Office Location	E2 L-2
Office Hours	Sun : 12:00 - 13:00 Mon : 13:00 - 16:00 Tue : 12:00 - 13:00 Wed : 13:30 - 14:30
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Class Schedule & Room
Section 1: Lecture Time: Mon, Wed : 11:30 - 13:00 Room: E2113

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
2002060	NE206 Introduction To Nuclear Engineering	Prerequisite / Pass

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	An Introduction to Nuclear Power Generation	**Ch 01** From **Ref #1**
Weeks 2, 3	The Nuclear Physics of Fission Chain Reactions	**Ch 02** From **Ref #1**
Weeks 4, 5, 6	Neutron moderation with and without absorption	**Ch 08** From **Ref #1**, **Ch 06 & Ch 07** From **Ref #2**
Weeks 6, 7, 8	Fission Chain Reactions and Nuclear Reactors	**Ch 03** From **Ref #1**
Weeks 9, 10, 11	Neutron Transport	**Ch 04** From **Ref #1**
Weeks 12, 13, 14, 15	The One-Speed Diffusion Theory Model	**Ch 05** From **Ref #1**

Mapping of Course Outcomes to Program Student Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
To demonstrate a fundamental understanding of the center of the mass system and differential scattering crosssections. [11]	15%	First Exam
To understand the four and six factors formulas used to determine the reactor multiplication factor. [11]	15%	First Exam
To demonstrate a solid understanding of fundamental transport concepts such as neutron density, neutron scalar flux, neutron current density. [11]	20%	Second Exam
To understand how to calculate neutron interaction probabilities density. [11]	10%	Second Exam
To be able to derive the neutron transport equation and the neutron diffusion equation. [11]	15%	Final Exam
To understand how to solve the one group diffusion equations for certain core geometries. [11, 12]	25%	Final Exam

Relationship to Program Student Outcomes (Out of 100%)						
1	2	3	4	5	6	7
87.50	12.50					

Evaluation	
Assessment Tool	**Weight**
First Exam	30%
Second Exam	30%
Final Exam	40%

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