Jordan University of Science and Technology

Faculty of Engineering

Nuclear Engineering Department

NE472 Modelling & Simulation Of Nuclear Reactors

Second Semester 2018-2019

Course Catalog
3 Credit Hours. Modeling of nuclear reactor neutronics and nuclear reactor thermal hydraulics. Simulation for the different physics of nuclear reactors by numerically solving initial value problems, boundary value problems and partial differential equations. Analysis of radiation transport problems by Monte Carlo method, use of MCNP code to determine several parameters of a nuclear reactor.

Text Book	
Title	Class Notes
Author(s)	Instructor
Edition	2nd Edition
Short Name	Ref #1
Other Information	These are comprehensive notes put together by the instructor based on a collective of other references.

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #2	Nuclear Reactor Analysis	James J. Duderstadt, Louis J. Hamilton	1st Edition	
Ref #3	Finite Difference Methods for Ordinary and Partial Differential Equations	Randall J. LeVeque	1st Edition	
Ref #4	Finite Volume Methods for Hyperbolic Problems	Randall J. LeVeque	1st Edition	
Ref #5	Monte Carlo Principles and Neutron Transport Problems	Jerome Spanier, Ely M. Gelbard	3rd Edition	

Instructor	
Name	**Dr. RABIE ABU SALEEM**

Office Location	N1 L-2
Office Hours	Sun : 10:00 - 13:00 Mon : 09:00 - 10:00 Mon : 11:30 - 13:00 Wed : 09:00 - 10:00 Thu : 08:00 - 09:00
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Class Schedule & Room
Section 1: Lecture Time: Mon, Wed : 10:00 - 11:30 Room: E2113

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
2004410	NE441 Nuclear Reactors Analysis	Prerequisite / Study

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	Basics of Modeling and Models of Nuclear Reactors.	
Weeks 2, 3	Basics of Numerical Discretization and Numerical Solutions of Initial Value Problems.	
Weeks 4, 5	Numerical Solutions of Boundary Value Problems.	
Weeks 6, 7, 8, 9, 10	Numerical Solution of Partial Differential Equations.	
Weeks 11, 12	Introduction to Monte-Carlo methods.	
Weeks 13, 14, 15, 16	Introduction to MCNP5.	

Mapping of Course Outcomes to Program Student Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Ability to derive mathematical models for different physical phenomena and to demonstrate a good understanding of the different mathematical models used in a nuclear reactor. [11]	9%	First, Second, Final Exam
Ability to derive numerical approximations for derivatives, determine their order of accuracy and use them to write programming codes that solve initial and boundary value problems. [11]	24%	First, Second, Projects, Final Exam

Ability to write codes of different numerical schemes to solve Hyperbolic, Parabolic and Elliptic partial differential equations. And ability to perform different analysis methods on those numerical schemes like the modified equation analysis and the Von-Neumann stability analysis. [31, 12]	36%	Second, Projects, Final Exam
Ability to demonstrate a good understanding of the basic concepts of Monte Carlo methods and perform simple Monte Carlo calculations. [11]	13%	Final Exam
Ability to create input scripts for MCNP5 and analyze output files to calculate the flux distribution, and K?eff parameters. [11, 12]	18%	Final Exam

Relationship to Program Student Outcomes (Out of 100%)						
1	2	3	4	5	6	7
82	18					

Evaluation	
Assessment Tool	**Weight**
First	20%
Second	20%
Projects	20%
Final Exam	40%

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