

## Introduction to Nuclear Engineering

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### Introduction to Nuclear Engineering NE 3301 (3 credit hours lecture)

Prepared by:  
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**Graduate Teaching Assistants:**

**Required Texts:**

**Fundamentals of Nuclear Science and Engineering**, J. Kenneth Shults and Richard E. Faw  
Marcel Dekker, Inc., ISBN: 0-8247-0834-2

**Introduction to Nuclear Engineering, 3<sup>rd</sup> Ed.**, John R. Lamarsh & Anthony J. Baratta  
Prentice Hall, ISBN 0-201-82498-1

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### CATALOG COURSE DESCRIPTION

#### NE 3301. Introduction to Nuclear Engineering (3 credit hours, lecture)

Catalog description: Fundamentals of radiation, radiation decay, binding energy, types of interactions, shielding, and radioisotopes, fission cross section, fission in a reactor, controlling fission chains, basic reactor model, reactor theory, reactor generations I, II, III, IV, review heat transfer terms, reactor coolant, LOCA, reactor accidents, safety, emergency planning zone, nuclear fuel and fuel cycle, waste storage, decontamination and decommissioning, fusion power, regulating nuclear reactors, nuclear power economics and environment;

Prerequisite: Math 3319 (differential equations / linear algebra) or MAE 3360, Phys 1444 (general technical physics II)

### COURSE LEARNING GOALS/OBJECTIVES

The course objectives for NE 3301 Introduction to Nuclear Engineering are the following:

- ◆ To introduce the students to the fundamental principles of nuclear engineering. These topics include atomic and nuclear physics, fission and fusion, isotopes and radioactivity, nuclear reactions, chart of nuclides, radiations; detection and interaction with matter.
- ◆ Introduction to criticality and reactor kinetics, reactor licensing, safety, economic and environment impact.
- ◆ In addition to light water reactors the CANDU, Gas Cooled Reactors, Liquid Metal Fast Breeder and fusion reactors design will be introduced.
- ◆ Discussion of lesson learned from Three Mile Island and Chernobyl accidents.
- ◆ Introducing discussion of Generation II (current) and Generation III, IV (future nuclear) nuclear power plants.
- ◆ Discussion of fuel loading, coolant, loss of coolant, severe accidents, reprocessing, spent fuel management and storage.
- ◆ Use radiation detection instruments, detection limits, and uncertainty analysis on measurements.

### ATTENDANCE AND DROP POLICY

- Attendance at each class is fully expected in order to achieve satisfactory and timely progress.
- Excessive absences will be noted and the student contacted for an explanation.
- The drop policy for this course is in accordance with University and Department rules and regulations. It is the student's responsibility to be familiar with these policies.

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### Specific Procedures:

#### Exams

There will be about ten sets of homework twenty points (20). The course will have five lab experiments and will count twenty points (20). There will be two (2) midterm exams and a final for this course. Each midterm exam will be worth twenty (20) points and will cover the most recent material. The final exam will be comprehensive and will worth twenty points (20).

All exams are closed book and closed notes. The formula sheet will be provided. You must work alone on all exams. Calculators may be used during exams, but all programmable calculators must be cleared of all programs and/or data before entering the examination room. Discussion and/or communication with anyone, except the instructor, during an exam is forbidden. Any student who willingly provides information to another student during a quiz or exam is as guilty as the student that receives the information.

### Course Grading:

HW	20 Points
Lab	20
Exam I	20
Exam II	20
Final	20
Course Total	<u>100 Points</u>

### Grade Basis:

#### Student Course Average Final Letter Grade

90 - 100	<b>A</b>
80 - 90	<b>B</b>
70 - 80	<b>C</b>
60 - 70	<b>D</b>
< 60	<b>F</b>

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### Course Policies:

#### Missed examinations

There will be no makeup of missed examinations. In emergency situations (death in family, etc.), if the instructor has been petitioned in writing, and if the instructor agrees another exam may be given.

#### Academic Dishonesty

Evidence of academic dishonesty will be dealt with severely. Copying homework or examinations will result in administrative dismissal from the course. The grade recorded will be F.

### Tentative Schedule

NE 3301 Sec 001 Fall 2009

Class No.	Date	Day	Lecture, Exams, Etc.*	HW Problems
1			Chap 2 – Fundamentals	
2			<b>Chap 2 – Reactions &amp; Energy</b>	
3			Chap 2 – Reactions & Energy	
4			<b>Chap 3 – <math>\alpha</math>'s, <math>\beta</math>'s, &amp; <math>\gamma</math>'s</b>	
5			<b>Chap 3 – Neutrons</b>	
6			<b>Chap 3 – Activation Analysis</b>	
7			<b>Lab 1 – The Inverse Square Law &amp; Protection by Distance</b>	
8			<b>Midterm 1</b>	
9			<b>Chap 4 – Nuclear Reactors</b>	
10			<b>Chap 4 – Nuclear Reactors</b>	
11			<b>Chap 4 – Nuclear Fuel Cycle</b>	
12			<b>Chap 4 – Nuclear Fuel Cycle</b>	

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13			<b>Lab 2 – Properties of Radiation – Attenuation</b>	
14			<b>Chap 5 – Neutron Diffusion</b>	
15			<b>Chap 5 – Neutron Diffusion</b>	
16			<b>Chap 6 – Criticality Formulas</b>	
17			<b>Chap 6 – Critical Mass &amp; Size</b>	
18			<b>Lab 3 – Radiation Shielding</b>	
19			<b>Midterm 2</b>	
20			<b>Chap 7 – Reactivity</b>	
21			<b>Chap 7 – Reactivity</b>	
22			<b>Lab 4 – The Geiger-Muller Counter and the Statistics of Random Events</b>	
23			<b>Chap 8 – Heat Transfer</b>	
24			<b>Chap 9 – Radiation Protection</b>	
25			<b>Chap 9 – Radiation Protection</b>	
26			<b>Chap 10 – Shielding</b>	
27			<b>Lab 5 – Proportional Counters</b>	
28			<b>Chap 11 – Licensing &amp; Safety</b>	
29			<b>Chap 11 – Chernobyl</b>	
30			<b>Chap 11 – Three Mile Island</b>	
31			<b>Review</b>	
32			<b>Final As Scheduled by the University</b>	

\* Homework will be assigned on Tuesday and will be due to the following Tuesday at the beginning of class. Revised 03/04/2009