NUCL 4000: Nuclear Lab

Syllabus

NUCL 4000: Nuclear Lab

Fall 2018

Laboratories: Tuesday or Wednesday 2:00 PM – 5:00 PM
Location: MEB 1206
Instructor: Matthew Lund
Office: MEB 1206
Email: matthewl.lund@utah.edu
Office Hours: Wednesday 10:00 AM – 12:00 PM MEB 1206


Additional Materials: Will be provided as needed.

Prerequisites: NUCL3000 Nuclear Principles in Science and Engineering, NUCL3100 Neutron-Based Engineering, or Instructor’s consent

Course Objectives: In this UNEP course, “Nuclear Science and Engineering Using TRIGA”, students will have a unique hands-on opportunity to conduct research at UNEF facilities. Each laboratory will teach students important techniques used in nuclear laboratories and reactors by:
1. Introducing students to radiation detectors and instrumentation used in the University of Utah Nuclear Engineering Facilities (UNEF) by hands-on experience.
2. Introducing students to experimental techniques to measure radiation used in nuclear laboratories.
3. Providing students practical training on radiation protection, dosimetry, detector calibration, and sample analysis.
4. Introducing students to basic reactor principles as applied to the UUTR.
5. Teaching students basic nuclear laboratory and reactor skills, including sample analysis, sample preparation, quality assurance, reactor control measurements, operation of research reactors, etc…..

Course Outcomes: Students should be able to …
1. Demonstrate understanding of different types of radiation detectors, including calibration and measurement techniques.
2. Determine the radioisotopes within a given environmental sample, using different techniques.
3. Determine the elemental composition of samples using Neutron Activation Analysis.
4. Demonstrate understanding of UUTR reactor basics.
5. Determine initial criticality, control rod worth, reactivity, and shutdown margin for the UUTR reactor.
6. Measure the flux profile of the UUTR reactor.

Requirement: Every student must complete the “radiation safety training” with the “Radiological Safety Office” http://www.rso.utah.edu/. Each student must complete the online portion on Canvas at https://utah.instructure.com/courses/571471 and an in person training with RSO office. The next in person training is on September 12th at 1:30-4:30 P.M.

Assessments and Course Evaluation: Grading will be based mostly on the final lab writeups. Each lab will be posted in CANVAS in advance as a module with an introduction, safety, and procedure content pages, a reading
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A quiz to complete, a discussion page, and an assignment to submit the final laboratory writeup. A sample laboratory format is provided in CANVAS along with the grading rubric for each writeup. All laboratory reports are due the week after the completion of the lab.

- Reading Quizzes: 20%
- Radiation Safety Training: 10%
- Final Laboratories Writeups: 70%

Final grades will be based on the following percentages:

- 100.0% to 93.00% = A
- 92.99% to 90.00% = A-
- 89.99% to 87.00% = B+
- 86.99% to 83.00% = B
- 82.99% to 80.00% = B-
- 79.99% to 77.00% = C+
- 76.99% to 73.00% = C
- 72.99% to 70.00% = C-
- 69.99% to 60.00% = D
- 59.99% to 0.00% = F

**Attendance, Drop Policy, and Department Guidelines:**

- Attendance at each class is fully expected in order to achieve satisfactory and timely progress.
- Students can miss the class only once.
- 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.
- Please see the College of Engineering Guidelines at [https://www.coe.utah.edu/students/current/semester-guidelines/](https://www.coe.utah.edu/students/current/semester-guidelines/)

**Academic Misconduct:** Academic misconduct, which includes cheating, plagiarism, or falsifying information, will **not** be tolerated in the class and will result in an automatic E for the course and referral to the University Student Behavior Committee. Each laboratory final write-up should be the unique work of each student and must contain references to any citations. Please contact the instructor with any questions on academic misconduct or see the University of Utah Student Code at [https://regulations.utah.edu/academics/6-400.php](https://regulations.utah.edu/academics/6-400.php).

**University Policies:**

1. **The Americans with Disabilities Act:** The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services.

2. **Addressing Sexual Misconduct:** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran’s status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

3. **Safety Statement:** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-
2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

4. Wellness Statement: Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student’s ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness - www.wellness.utah.edu; 801-581-7776.

5. Veterans Center: If you are a student veteran, we want you to know that the U of Utah has a Veterans Support Center on campus. They are located in Room 161 in the Olpin Union Building. Hours: M-F 8-5pm. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: http://veteranscenter.utah.edu/. Please also let me know if you need any additional support in this class for any reason.

6. Learners of English as an Additional/Second Language: If you are an English language learner, please be aware of several resources on campus that will support you with your language development and writing. These resources include: the Department of Linguistics ESL Program (http://linguistics.utah.edu/esl-program/); the Writing Center (http://writingcenter.utah.edu/); the Writing Program (http://writing-program.utah.edu/); the English Language Institute (http://continue.utah.edu/eli/). Please let me know if there is any additional support you would like to discuss for this class.

Schedule*:

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lab</th>
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<tbody>
<tr>
<td>1</td>
<td>8/20-8/21</td>
<td>Introduction, Dynamic Learning Activity Safety</td>
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<tr>
<td>2</td>
<td>8/27-8/28</td>
<td>Lab 1: Calibration of Gamma Spectroscopy</td>
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<td>3</td>
<td>9/3-9/4</td>
<td>Lab 2: Half-life and Radiation Shielding</td>
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<td>4</td>
<td>9/10-9/11</td>
<td>Lab 3: Passive Gamma Spectroscopy</td>
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<td>5</td>
<td>9/17-9/18</td>
<td>Lab 4: Liquid Scintillation - Tritium and C-14 Measurements</td>
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<td>6</td>
<td>9/24-9/25</td>
<td>Lab 5: Alpha Spectroscopy Week 1</td>
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<td>7</td>
<td>10/1-10/2</td>
<td>Alpha Spectroscopy Week 2</td>
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<td>8</td>
<td>10/8-10/9</td>
<td>Fall Break</td>
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<td>9</td>
<td>10/15-10/16</td>
<td>Lab 6: Approach to Reactor Criticality (1/M)</td>
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<td>10</td>
<td>10/22-10/23</td>
<td>Lab 7: Thermoluminescent Dosimetry</td>
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<td>11</td>
<td>10/29-10/30</td>
<td>Lab 8: Control Rod Worth, Reactivity, Shutdown Margin</td>
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<td>12</td>
<td>11/5-11/6</td>
<td>Lab 9: Fission Track Analysis / Lab 10: Flux Mapping Week 1</td>
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<td>13</td>
<td>11/12-11/13</td>
<td>Fission Track Analysis Week 2</td>
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<td>14</td>
<td>11/19-11/20</td>
<td>Flux Mapping Week 2</td>
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<td>15</td>
<td>11/26-11/27</td>
<td>Thanksgiving Break</td>
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<td>16</td>
<td>12/3-12/4</td>
<td>Lab 11: Neutron Activation Analysis</td>
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* This schedule is an outline for the course and may be amended due to availability of lab space, equipment, and reactor operations.