

	School of Nuclear Engineering Purdue University West Lafayette, IN 47907		NUCL 30500 Fall 2020										
INSTRUCTORS	<table border="0" style="width: 100%;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%;">Office</td> <td style="width: 33%;">Phone</td> </tr> <tr> <td>Robert Bean</td> <td>EE B080</td> <td>49-63573</td> </tr> <tr> <td>Junghyun Bae</td> <td>EE B075</td> <td>N/A</td> </tr> </table> <p>Email is the best way to reach either the instructor or the TA. When sending an email about the class, please make your subject line, “NUCL 30500 – <???>” where <???</p>			Office	Phone	Robert Bean	EE B080	49-63573	Junghyun Bae	EE B075	N/A	Email bean@purdue.edu bae43@purdue.edu	
	Office	Phone											
Robert Bean	EE B080	49-63573											
Junghyun Bae	EE B075	N/A											
OFFICE HOURS	Virtual Office Hours will be announced on Brightspace, and any changes to them will be announced on Brightspace and emailed out to the class. Office hours will mostly be held via WebEx so that we can share files and screens as needed to assist you.												
PREREQUISITE	NUCL 20500												
COURSE DESCRIPTION	Credit Hours: 2.00. Continuation of NUCL 20500. Experiments with scintillation detectors, multichannel analyzers, neutron detectors, the subcritical pile, and the reactor will be performed. Measurements will be made to demonstrate neutron activation analysis techniques, neutron slowing down, neutron flux distributions, and the effects of control rods on neutron fluxes.												
COURSE GOALS	<ol style="list-style-type: none"> 1. Introduce radiation spectrometers and some of their applications. 2. Study the properties of neutrons and their interactions with matter. 3. Explore some of the fundamental concepts in reactor physics. 4. Introduce students to the operation and control of nuclear reactors. 												
TEXTBOOKS	REQUIRED: <ol style="list-style-type: none"> 1. Knoll, <u>Radiation Detection & Measurement</u>, Fourth Edition, Wiley, 2010 2. Lockheed Martin, <i>Chart of the Nuclides</i>. OPTIONAL: <ol style="list-style-type: none"> 3. Tsoufanidis, <u>Measurement and Detection of Radiation</u>, Second Edition, Taylor & Francis, 1995 (On Reserve in Potter) 4. Taylor, <u>An Introduction to Error Analysis</u>, Second Edition, University Science Books, 1997 5. Glasstone and Sesonske, <u>Nuclear Reactor Engineering</u>, 1st and 4th Editions 												
COURSE HANDOUTS	Course materials can be obtained on Brightspace. You are responsible for any and all course material posted on the website.												
OTHER COURSE MATERIALS	The following items will be useful for you for this class <ol style="list-style-type: none"> 1. A USB flash drive/memory stick 												
ASSIGNMENTS	The course assignments will consist of: <ol style="list-style-type: none"> 1. Homework or Quizzes 2. Laboratory Experiments and Reports 3. Neutron Demo Lab Paper (graded as a lab report) 4. Final Exam <p>Rubrics for the laboratory reports will be provided in advance to help you understand how they will be graded.</p>												
EXPECTED COURSE GRADING and WEIGHTING FACTORS	A: A-[90-93), A[93-97), A+[97-100) B: B-[80-83), B[83-87), B+[87-90) C: C-[70-73), C[73-77), C+[77-80) D: D-[60-63), D[63-67), D+[67-70) F: <60.		<table border="0" style="width: 100%;"> <tr> <td>HW and Quizzes</td> <td style="text-align: right;">35%</td> </tr> <tr> <td>Final Examination</td> <td style="text-align: right;">15%</td> </tr> <tr> <td>Experiments</td> <td style="text-align: right;">50%</td> </tr> </table>		HW and Quizzes	35%	Final Examination	15%	Experiments	50%			
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	Any disputes over grades must be addressed in writing to the instructor within one week of return. Late assignments will be docked 20% per day . For lab reports, due when your lab section begins, the first “penalty” day is the day they are due if not submitted on time.	All laboratory reports must be turned in to pass the course.
PURDUE and COURSE POLICIES IN CASE OF AN EMERGENCY	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. Changes in this course will be posted to the class Brightspace page and, if possible, sent out by email to all students. It is recommended that students regularly visit the Purdue Emergency Preparedness website at http://www.purdue.edu/emergency_preparedness/	
<p>Purdue honors pledge: “As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.” https://www.purdue.edu/provost/teachinglearning/honor-pledge.html</p> <p>Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.</p>		
PLAGIARISM	Plagiarism is defined in “Academic Integrity: A Guide for Students” (http://www.purdue.edu/studentsuccess/orientation/bgr/classroom/05-Wednesday%20Morning-Academic%20Integrity.pptm) as follows: “Plagiarism is a special kind of academic dishonesty in which one person steals another person's ideas or words and falsely presents them as the plagiarist's own product. This is most likely to occur in the following ways: <ul style="list-style-type: none"> • using the exact language of someone else without the use of quotation marks and without giving proper credit to the author • presenting the sequence of ideas or arranging the material of someone else even though such is expressed in one's own words, without giving appropriate acknowledgment • submitting a document written by someone else but representing it as one's own” Any document that includes plagiarized materials will receive a grade of zero.	
UNIVERSITY POLICY FOR DISHONESTY	Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, <u>University Regulations</u>] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]	
UNIVERSITY POLICY ON VIOLENT BEHAVIOR	Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore,	

	<p>Violent Behavior is prohibited in or on any University Facility or while participating in any university activity. See http://www.purdue.edu/policies/facilities-safety/iva3.html.</p>
<p>MENTAL HEALTH STATEMENT</p>	<p>If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.</p> <p>If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.</p> <p>If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.</p> <p>If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.</p>
<p>UNIVERSITY POLICY ON ATTENDANCE</p>	<p>Students are expected to be present for every meeting of the classes in which they are enrolled. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor as far in advance as possible. For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor (or TAs) as soon as possible by email, or by contacting the main office that offers the course. When the student is unable to directly contact the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, the student or the student's representative should contact the Office of the Dean of Students.</p>
<p>GRIEF ABSENCE POLICY FOR STUDENTS</p>	<p>Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments in the event of the death of a member of the student's family.</p> <p>See the University's website for additional information: http://www.purdue.edu/studentregulations/regulations_procedures/classes.html</p>
<p>STUDENTS WITH DISABILITIES</p>	<p>Purdue University is committed to maintaining an inclusive community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, Purdue University seeks to develop and nurture its diversity. The University believes that diversity among its many members strengthens the</p>

	<p>institution, stimulates creativity, promotes the exchange of ideas and enriches campus life.</p> <p>Purdue University views, evaluates and treats all persons in any university-related activity or circumstance in which they may be involved solely as individuals on the basis of their own personal abilities, qualifications and other relevant characteristics.</p> <p>Purdue University does not condone and will not tolerate Discrimination against any individual on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, disability, status as a veteran, marital status, parental status, sexual orientation, gender identity or gender expression. Purdue University promulgates policies and programs to ensure that all persons have equal access to its employment opportunities and educational programs, services and activities. The principal objective of this policy is to provide fair and consistent treatment for all students and employees of the University. Purdue is committed to increasing the recruitment, selection and promotion of faculty and staff at the University who are racial or ethnic minorities, women, persons with disabilities and veterans. The University also is committed to policies and programs that increase the diversity of the student body.</p>
ACCESSIBILITY	<p>Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.</p>
NON-DISCRIMINATION	<p>Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.</p> <p>Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.</p> <p>You may find Purdue's nondiscrimination statement: http://www.purdue.edu/purdue/ea_eou_statement.html</p>
ACADEMIC GUIDANCE IN THE EVENT A STUDENT IS QUARANTINED OR ISOLATED	<p>If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer</p>

	<p>suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email. I will work with you to make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.</p> <p>Recorded Lectures and Assignment information will be available on Brightspace for students who are unable to attend class in person.</p>
<p>ATTENDANCE POLICY DURING COVID-19</p>	<p>Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in the final grades, but the student still needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747.</p>
<p>CLASSROOM GUIDANCE REGARDING PROTECT PURDUE</p>	<p>The Protect Purdue Plan, which includes the Protect Purdue Pledge, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask in classrooms and campus building, at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.</p> <p>Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.</p> <p>Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not</p>

	<p>wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights.</p> <p>Overarching SOP for Classrooms, Instructional Laboratories, and Experiential Courses</p>
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EMERGENCY PREPAREDNESS SYLLABUS ATTACHMENT

EMERGENCY NOTIFICATION PROCEDURES are based on a simple concept – if you hear a fire alarm inside, proceed outside. If you hear a siren outside, proceed inside.

- **Indoor Fire Alarms** mean to stop class or research and immediately evacuate the building.
- Proceed to your Emergency Assembly Area away from building doors. **Remain outside** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.
- **All Hazards Outdoor Emergency Warning Sirens** mean to immediately seek shelter (Shelter in Place) in a safe location within the closest building.
 - “Shelter in place” means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, a civil disturbance including a shooting or release of hazardous materials in the outside air. Once safely inside, find out more details about the emergency*. **Remain in place** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.

**In both cases, you should seek additional clarifying information by all means possible...Purdue Emergency Status page, text message, Twitter, Desktop Alert, Albertus Beacon, digital signs, email alert, TV, radio, etc....review the Purdue Emergency Warning Notification System multi-communication layers at http://www.purdue.edu/ehps/emergency_preparedness/warning-system.html*

EMERGENCY RESPONSE PROCEDURES:

- Review the **Emergency Procedures Guidelines**
https://www.purdue.edu/emergency_preparedness/flipchart/index.html
- Review the **Building Emergency Plan** (available on the Emergency Preparedness website or from the building deputy) for:
 - evacuation routes, exit points, and emergency assembly area
 - when and how to evacuate the building.
 - shelter in place procedures and locations
 - additional building specific procedures and requirements.

EMERGENCY PREPAREDNESS AWARENESS VIDEOS

- **"The Coming Storm"** The Coming Storm is a movie that dramatizes the aftermath of a campus shooting, weaving within the story the best practices and lessons learned from active shooter incidents that have occurred throughout the United States. View FBI Short Movie [[here](#)].
- **"Run. Hide. Fight.®"** [YouTube Video](#) Produced by the City of Houston Mayor’s Office of Public Safety and Homeland Security through a grant provided by a Department of Homeland Security Grant Funded Project of the Regional Catastrophic Planning Initiative, provides critical options for consideration to survive an active shooter event.
- **"Run. Hide. Fight.®"** [Text Version](#).
- Department of Homeland Security Active Shooter web site...resources and tips on how to prepare for this type of horrific incident...[learn more](#)
- **[Ready: Whenever, Wherever](#)**—A public service campaign, from the Indiana Department of Homeland Security, which encourages Hoosiers to practice reasonable awareness and develop a plan for action in the event of an emergency

MORE INFORMATION

Reference the Emergency Preparedness web site for additional information:
https://www.purdue.edu/ehps/emergency_preparedness/



LECTURE (Tuesdays 10:30-11:20 AM; EE 117)				LABORATORY (TWRP 1:30; WF 7:30)
	Week of	Topic	Reading KNOLL (4 th Ed.)	Experiment
1	24 Aug	Intro/Radiation Interactions/Error Propagation	Ch 2 (III), Ch. 3 (I-IV), Ch. 16 (I-VI) Ch. 17 (I-III)	Exp. 1 Oscilloscopes, Amplifiers and Single Channel Analyzers (SCAs)
2	31 Aug	Nuclear Electronics(PHA)/Intro to Spectroscopy	Ch. 4, Ch. 17 (IV), Ch. 18 (I-III)	Exp. 2 Nuclear Single Channel Analyzers and Scintillation Detectors, Introduction to Multi-channel Analyzers (MCAs)
3	07 Sep	Scintillation Detectors	Ch 8, 9	Exp. 3 Nuclear Spectroscopy with Scintillation Detectors I
4	14 Sep	Photon Spectroscopy with Scintillators	Ch 10	Exp. 4 Nuclear Spectroscopy with Scintillation Detectors II
5	21 Sep	Neutron Interactions/Neutron Activation Analysis	Ch. 1 (V), Ch. 2 (IV) Ch. 19 (X)	Exp. 5 Neutron Activation Analysis
6	28 Sep	Neutrons/Approach to Critical/Intro to Neutron Detectors/Exp. Pile	Ch. 14, Ch. 15 (I), G.S.(4 th) 3.150-159	Exp. 6 Exponential Assembly
7	05 Oct	More Neutron Detectors /Reactor topics	G.S. (1 st Ed.):4.96-7	Exp. 7 Neutrons
8	12 Oct	Solid State Detectors	Ch. 11, Ch. 13 (I)	*Exp. 8 Neutron Detectors
9	19 Oct	Solid State Detectors	Ch. 12 I-IV	* Exp. 9 Solid State Detectors (Silicon SB)
10	26 Oct	Inhour Eqn/More Reactor Topics	G.S. (4 th) 5.1-55, 5.155-172, 5.205-210, 5.214-5.221	* Exp. 10 Solid State Detectors (Ge)
11	02 Nov	Reactor Instrumentation		Exp. 11 Initial Reactor Startup
12	09 Nov	Reactor Instrumentation II		Exp. 12 Control Rod Calibration
13	16 Nov	Thermoluminescent Dosimeters (TLD)	Ch. 19 VII	Finishing Reactor Labs
14	23 Nov	TBA		THANKSGIVING VACATION
15	30 Nov	Review (Online Only)		

All reading assignments from Knoll except those marked G.S., which are from Glasstone and Sesonske, 4th ed. Schedule is subject to change.

* These experiments do not have 5 experimental setups and, therefore, will be set up simultaneously. Laboratory groups will rotate through the experiments, so you may not be performing the experiment on the indicated date. You are responsible for doing the reading assignment on the topic (as listed for the lectures) before coming to the laboratory to do the experiment. The details of the rotation will be determined after classes begin. The reactor labs (Exp. 11 & 12) may be scheduled outside of regular class sections. Details of how and when will be determined such that the Protect Purdue COVID restrictions can be followed.