Washington State University

MAJOR CURRICULAR CHANGE FORM -- NEW/RESTORE COURSE

☐ Please attach rationale for your request, a complete syllabus, and explain how this impacts other units in Pullman and other campuses (if applicable).
☐ Obtain all required signatures with dates.
☐ Provide original stapled packet of signed form/rationale statement/syllabus PLUS 10 stapled copies of complete packet to the Registrar's Office, campus mail code 1035.
☐ Submit one electronic copy of complete packet to wsu_curriculum@wsu.edu.

Requested Future Effective Date: Fall 2015 (term/year) Course Typically Offered: New Course

DEADLINES: For fall term effective date: October 1st; for spring or summer term effective date: March 1st. See instructions.
NOTE: Items received after deadlines may be put to the back of the line or forwarded to the following year. Please submit on time.

☐ New Course  ☐ Temporary Course  ☐ Restore Course

ENVR_SCI 510 543 Environmental and Internal Dosimetry

Required preparation: ENVR_SCI 406 or permission of instructor

Credit hrs: lecture hrs per week: lab or studio hrs per week: prerequisite:

Description for catalog: Critical analysis of environmental and individual radiation doses, including use of dose estimation models based on international standards. Required preparation: ENVR_SCI 406.

Additional Attributes: Check all that apply.
☐ Crosslisting (between WSU departments)* ☐ Conjoint listing (400/500):
☐ Variable credit:
☐ Repeat credit (cum. max. hrs):
Special Grading: ☐ S, F; ☐ A, S, F (PEACT only); ☐ S, M, F (VET MED only); ☐ H, S, F (PHARMACY, PHARDSCI only)
☐ Cooperative with UI ☐ Other (please list request):

The following items require prior submission to other committees/depts. (SEE INSTRUCTIONS.)
☐ Request to meet Writing in the Major [M] requirement (Must have All-University Writing Committee Approval.)
☐ Request to meet UCORE in __________ (Must have UCORE Committee Approval) See instructions.
☐ Special Course Fee __________ (Must submit request to University Receivables.)

Contact: James R. Pratt Phone number: (509) 372-7212 Campus mail code: WSU-TC
Email: Jrpratt@wsu.edu Instructor, if different: Paul Stansbury & Daniel Strom

Chair/date  Dean/date  All-University Writing Comm Date

Chair (if crosslisted/interdisciplinary)*  Dean (if crosslisted/interdisciplinary)*  UCORE Committee Approval Date

Catalog Subcommittee Approval Date  GSC or AAC Approval Date  Faculty Senate Approval Date

*If the proposed change impacts or involves collaboration with other units, use the additional signature lines provided for each impacted unit and college.
ENVR SCI 523

Environmental and Internal Dosimetry

3 Credits (2 lecture, 1 lab)
M, W 16.15 – 17.05 (lectures)
Lab TBD

This course is one of the electives in a new graduate certificate program in radiation protection.

Instructor information. TBD

Office hours. By appointment.

Course information. Critical analysis of environmental and individual radiation doses, including use of dose estimation models based on international standards.

Students should regularly check the course web site in Angel at http://lms.wsu.edu for course announcements, assignments, handouts, and other relevant course information.

Required textbook.

Other course material will come from other textbooks, journal articles, and online technical guidance documents, and users manuals for the software used in lab exercises, including IMBA, RESRAD, Hotspot, and GENII. Much course materials will be posted on the course Angel site.

Prerequisites. None

Required Preparation (for the catalog listing) ENVR_SCI 406 or permission of the instructor.

Course objectives.

The objectives are for the student
• to be able to use the more common software programs for calculating radiation dose to people from radionuclides taken into the body and from radionuclides present or released into the environment, and
• to understand the scientific bases for the models that are embodied in such dose-calculation software.
• Specifically, the student will
  o learn the analytical techniques necessary to construct the models embodied in the software.
  o solve simple internal and environmental dosimetry problems by reasoning the mathematical models and equations necessary.
  o study the basic recommendations of such bodies as the International Commission on Radiation Protection and will be introduced to the considerable databases of radiological data, which are published in hardcopy and online.
  o locate and understand the considerable databases of radiological data, which are necessary to make the radiation dose calculations performed by the software.
communicate the results of typical radiation doses e calculations to workers or members of the general public who were exposed to radionuclides in the workplace or the environment.

**Laboratory.** The student will perform radiation dose calculations by hand and by using the appropriate software, installed on his or her personal computer or on a personal computer in WSU’s computer facilities. After completing a laboratory exercise, the student will submit a report summarizing the input data and the results of his or her analyses. The submitted reports will be evaluated by the instructor (or his or her representative). If the results are less than satisfactory, the student will be required to repeat the calculation exercise until satisfactory results are obtained.

The student will learn the analytical techniques necessary to construct the models embodied in the software.

The student will solve simple internal and environmental dosimetry problems by reasoning the mathematical models and equations necessary.

The student will study the basic recommendations of such bodies as the International Commission on Radiation Protection and will be introduced to the considerable databases of radiological data, which are published in hardcopy and online.

The student will be introduced to the considerable databases of radiological data, which are necessary to make the radiation dose calculations performed by the software.

The student will be given exercises to communicate the results of typical radiation doses e calculations to workers or members of the general public who were exposed to radionuclides in the workplace or the environment.

**Grading.** Grades will be based on examinations with the point values shown below. No particular grading scale is assumed. Class participation is important to your understanding as well as the learning of other students. The expect final grade ranges are shown.

<table>
<thead>
<tr>
<th>14 lab exercises (15 pts each)</th>
<th>Final grades</th>
<th>A: 360-400 pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm exam (Take home)</td>
<td>40 pts</td>
<td>B: 320-359</td>
</tr>
<tr>
<td>Final exam (Take home)</td>
<td>150 pts</td>
<td>C: 280-319</td>
</tr>
<tr>
<td>Total</td>
<td>400 pts</td>
<td>D: 240-279</td>
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<td></td>
<td></td>
<td>F: &lt;240</td>
</tr>
</tbody>
</table>

**Midterm grades.** In this course, midterm grades provide an indication of your progress and will be given using the full range of letter grades (A-F) based on performance on the midterm exam and on the points earned for lab notebook submissions to date. Students receiving a grade of C, D, or F at midterm should meet with the instructor. Midterm grades are advisory and will not appear on your transcript.

**Attendance policy.** Absences should be avoided. Students should contact an instructor if an absence from class is unavoidable. Students are encouraged to read Section 73 (Absences) of the Washington State University Academic Regulations, which is found in the WSU Tri-Cities Student Handbook. Attendance at laboratory sessions is crucial. If a laboratory session is missed by a student for what the
instructor considers a reasonable excuse, the instructor will attempt to provide the truant student a make-up laboratory session.

**Accommodations for Disabled Students.** Reasonable accommodations are available for students who have a documented disability. If you have a documented disability, even temporary, make an appointment as soon as possible with the Disability Services Coordinator, Cherish Tijerina, 372-7352, ctijerina@tricity.wsu.edu. You will need to provide your instructor with the appropriate classroom accommodation form. The forms should be completed and submitted during the first week of class. Late notification may delay your accommodations. All accommodations for disabilities must be approved through Disability Services. Classroom accommodations forms are available through the Disability Services Office.

**Academic Integrity.** I encourage you to work with classmates on assignments. However, each student must turn in original work. No copying will be accepted. At a minimum, penalties will include failure (0 points) on a given assignment. Students who violate WSU’s Standards of Conduct for Students will receive an F as a final grade in this course, will not have the option to withdraw from the course and will be reported to the Office Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand these definitions. Any academic integrity violation will be reported to the Office of Student Conduct and carries the possibility of additional university sanctions. Further details are available at [http://www.tricity.wsu.edu/studentconduct/academic.html](http://www.tricity.wsu.edu/studentconduct/academic.html).

**Safety.** Should there be a need to evacuate the building (e.g., fire alarm or some other critical event), students should meet the instructor at blue pole emergency maker in the parking lot outside of the West building. In order to receive notification regarding campus emergencies (including campus closures), all faculty, staff, and students register their emergency contact information for the Crisis Communication System (CCS) through Zzusis at [http://zzusis.wsu.edu](http://zzusis.wsu.edu). Click “Update Now!” under “Tri-Cities Emergency Info” to register for notification by text message, e-mail, telephone, or any combination of the three. Providing multiple contact methods will help ensure you receive notifications in a timely manner, and your information will NOT be used for any other purpose. Messages regarding campus emergencies will also be distributed through local media. Please also review the Campus Safety Plan, which contains a listing of emergency contacts, and university policies, procedures, statistics, and information relating to campus safety and the health and welfare of the campus community. The Campus Safety Plan can be found at [http://www.tricity.wsu.edu/safetyplan/](http://www.tricity.wsu.edu/safetyplan/).
### Student Learning Outcomes and Evaluation

<table>
<thead>
<tr>
<th>Student Learning Outcomes At the end of this course, students should be able to:</th>
<th>Course Topics/Dates The following topic(s)/dates(s) will address this outcome:</th>
<th>Evaluation of Outcome: This outcome will be evaluated primarily by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply the analytical techniques necessary to construct the models embodied in the software by solving sample problems.</td>
<td>Labs 3, 4 on dose calculation</td>
<td>Written responses in lab reports.</td>
</tr>
<tr>
<td>Solve simple internal and environmental dosimetry problems by stating the mathematical models and equations necessary</td>
<td>Labs 3, 4, 5 on dose calculation</td>
<td>Written responses for lab 5.</td>
</tr>
<tr>
<td>List the basic recommendations of the International Commission on Radiation Protection and demonstrate finding appropriate information on radiological data, which are published in hardcopy and online</td>
<td>ICRP chapters</td>
<td>Demonstrated effective use of IMBA</td>
</tr>
<tr>
<td>Demonstrate locating the considerable databases of radiological data, which are necessary to make the radiation dose calculations performed by the software</td>
<td>See 3 above</td>
<td>Demonstrated effective use of IMBA</td>
</tr>
<tr>
<td>Give an example written communication about the results of typical sample of radiation dose calculations to workers or members of the general public who were exposed to radionuclides in the workplace or the environment</td>
<td>Conceptual models, exposure scenarios</td>
<td>Demonstrated effective use and reporting from HOTSPOT</td>
</tr>
</tbody>
</table>
### Course organization.

The lecture subjects and the lab activities for the course are given in the table below.

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Subjects</th>
<th>Lab Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction; Review of Absorbed Dose, Dose Equivalent, and Related Topics</td>
<td>WSU Computer Use Policies; Install software on students’ laptops, as desired; Share URLs for on-line software and useful websites</td>
</tr>
<tr>
<td>2</td>
<td>Internally Incorporated Radionuclides: Pathways, Levels, Health Effects, and Medical Treatment</td>
<td>More web resources for Health Physics. Advance use of Excel™</td>
</tr>
<tr>
<td>3</td>
<td>Biokinetic Models for Internal Dosimetry: Internal Dosimetry Made Simple</td>
<td>Dose calculation by hand: ICRP 30 approach</td>
</tr>
<tr>
<td>4</td>
<td>Biokinetic Models for Internal Dosimetry: Internal Dosimetry Made Simple (cont.)</td>
<td>Computer codes for Internal Dosimetry (Freely available codes: DCAL, RadBox, PopTools &amp; Commercially available codes: LUDEP, IMBA Professional Plus)</td>
</tr>
<tr>
<td>5</td>
<td>Biokinetic Models for Internal Dosimetry: Differing Dosimetric Models: ICRP 26/30; ICRP 60/66/68/72; ICRP 103 (et.al.); Differing Biokinetic Parameter “Models”: ICRP 23 v ICRP 89</td>
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<tr>
<td>6</td>
<td>Internal Dosimetry Monitoring Bioassay and Radiobiological Data</td>
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<tr>
<td>7</td>
<td>Quality Assurance/Quality Control and Decision Levels in Internal Dosimetry</td>
<td>Separation Methods/Alpha spectrometry technique / Visit USTUR Laboratory</td>
</tr>
<tr>
<td>8</td>
<td>Radiopharmaceutical Dosimetry: Medical Internal Radiation Dose (MIRD) Concept. Computational Phantoms for Radiation Protection, Imaging and Radiotherapy</td>
<td>Nuclear Medicine Internal Dose Codes: MIRDose and OLINDA/EXM</td>
</tr>
<tr>
<td>9</td>
<td>Conceptual Models of Exposure &amp;; Exposure Scenarios; Atmospheric Transport: the Atmosphere, Stability Concepts, Data, the Gaussian Model; the Affect of Sampling and Data Quality on Environmental Dose Calculations</td>
<td>Install HOTSPOT; evaluate simple Gaussian results for an acute release</td>
</tr>
<tr>
<td>10</td>
<td>Atmospheric Transport (cont.): Deposition Processes, Puff Models, Other Types of Transport Models, their Applicability and Reliability; the Concept of 95th Percentile Meteorology</td>
<td>Apply HOTSPOT for an extended case, including 95th percentile met</td>
</tr>
<tr>
<td>11</td>
<td>Surface Water Transport: Water Movement in Rivers, Lakes, Estuaries, and Oceans; Complex Surface Water Models, Including Sedimentation</td>
<td>Install GENII; develop a complete surface water scenario</td>
</tr>
<tr>
<td>12</td>
<td>Aquatic Food Chains; Fresh v Salt Water: Fish, Mollusks, Crustaceans, Water Plants, Marine Mammals; Terrestrial Food Chains. Deposition/retention, Root Uptake, Translocation in Plants, Seasonality, Animal Products.</td>
<td>Apply GENII to a chronic atmospheric release, combine with a chronic marine case</td>
</tr>
<tr>
<td>13</td>
<td>Groundwater Transport: Types of Models for Vadose and Saturated Zones; Resuspension, &quot;Special Radionuclides&quot; Tritium, Carbon-14, etc.</td>
<td>Install RESRAD. Develop an initial soil contamination scenario</td>
</tr>
<tr>
<td>14</td>
<td>Equilibrium v Dynamic Models; Uncertainty Analysis in Environmental Predictions; Summary of Various RESRAD Codes and Other Env. Codes (CAP-88)</td>
<td>Use RESRAD to simulate groundwater transport to an exposed reference individual</td>
</tr>
<tr>
<td>15</td>
<td>Sources of Radioepidemiological Data, Development of Risk Estimates, and Probability of Causation</td>
<td>Use NIOSH Interactive RadioEpidemiological Program (IREP) to compute PC for various example cases</td>
</tr>
</tbody>
</table>

Take home midterm exam given out Week 8, returned week 9)