| LSC Use Only No: LSC Action-Date: | UWUCC USE Only No. 04-131 | UWUCC Action-Date: Appr 10/26/04 | Senate Action Date: Appr 12/7/04 |
|---|---|---|---|

## Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

| Contact Person<br>Dr. V. Wijekumar / Dr. Roberta Eddy | Email Address<br>vjwije@iup.edu |
|---|---|
| Proposing Department/Unit<br>SDR/Science for Disaster Response | Phone<br>724-357-4588/4482 |

**Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.**

**1. Course Proposals (check all that apply)**

__X__ New Course _____Course Prefix Change _____Course Deletion

_____Course Revision _____Course Number and/or Title Change _____Catalog Description Change

| *Current* Course prefix, number and full title | SDR 231: Hazards of Ionizing Radiation<br>*Proposed* course prefix, number and full title, if changing |
|---|---|

**2. Additional Course Designations: check if appropriate**

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_______ Other: (e.g., Women's Studies, Pan-African)

**3. Program Proposals**

_____New Degree Program ______Catalog Description Change _____Program Revision

_____New Minor Program ______Program Title Change _____Other

______New Track

| *Current* program name | *Proposed* program name, if changing |
|---|---|

**4. Approvals**

| | | Date |
|---|---|---|
| Department Curriculum Committee Chair(s) | Kenneth E Hershman | 4/3/04 |
| Department Chair(s) | Kenneth E Hershman | 4/3/04 |
| College Curriculum Committee Chair | [signature] | 08/10/04 |
| College Dean | John D. Eck | 8/19/04 |
| Director of Liberal Studies * | | |
| Director of Honors College * | | |
| Provost * | | |
| **Additional signatures as appropriate:** (include title) | | |
| UWUCC Co-Chairs | Gail S Sechrist | 10-26-04 |

* where applicable

# SYLLABUS OF RECORD

## I. Catalog Description

SDR 231 Hazards of Ionizing Radiation

2 class hours
2 lab hours
3 credit hours
(2c-2l-3cr)

Prerequisites: SDR 131 and permission of instructor and local, state or federal agency/organization authorization.

Level 2 nuclear physics designed to provide the intermediate level first responders with the knowledge, skills, and abilities necessary to assess the radiation hazards at an incident site that involves the radiological or nuclear weapons of mass destruction. The lecture presentation topics include internal and external radiation hazards, the units and quantities used to measure the radiation effects on human including radiation dose calculations, the effects of radiation on various parts of the body, the Nuclear Regulatory Commission dose standards and the methods used to protect individuals from the harmful effects of radiation and contamination. A practical exercise is used to emphasize the techniques necessary to estimate the dose received from various radiation sources by measuring the radiation exposure with survey meters and detectors.

## II. Course Objectives

Students successfully completing this course will be able to

1. Identify the need for radiation dosimetry.
2. Determine the level of danger from internal and external radiation sources.
3. Explain the predominant effects that radiation has on humans.
4. Explain the rules and regulations regarding radiation protection.
5. Estimate the dose received from various sources by measuring the radiation exposure with survey meters and detectors.

## III. Course Outline

Lecture (28 total hours)

A. Introduction (3 hours)

1. Radiation Incidents at various sites

B. Radiation Dosimetry (10 hours)

1. Types of Radiation
2. Ionizing and Non-Ionizing Electromagnetic Radiation
3. Ionizing Radiation from Particles
4. Alpha decay
5. Beta decay
6. Gamma decay
7. Half-life and Activity
8. Interaction Of Radiation with Matter
9. Exponential Absorption of Gamma Rays
10. Measurement of Radiation Interaction with Matter
    a. Radiation Exposure
    b. Absorbed Dose
    c. Dose-Equivalent
11. Internal Radiation Exposure Dose Calculations
12. External Radiation Exposure Dose Calculations
13. Levels and Symptoms of Radiation Injury
14. Common Terms of Reference for Gross Effects of Radiation Injury

C. Radiation Effects (10 hours)

1. Physical Effects of Radiation
2. Chemical Effects of Radiation
3. Biological Effects of Radiation
4. The Effect of Radiation on the Organs and Tissues of the Body
5. High Dose Effects of Radiation
6. Low Dose Effects of Radiation

7. Linear No-Threshold Risk Model
8. Case Studies
    a. Cancer risks among atomic-bomb survivors
    b. Medical cases

Exam 1 (1 hour)

D. Radiation Protection (4 hours)

1. Dose Standards (NRC)
2. Protection Against External Radiation Sources
3. Protection Against Internal Exposure (Internal Exposure Control)

Exam 2 (During Final Exam Week or end of course depending on mode of delivery) (1 hour)

<u>Laboratory (Practical Exercise) (28 total hours)</u>

E. Dose Measurements and Calculations – lab (26 hours)

1. Radiation Safety (2 hours)
2. Dose Measurements with survey meters at various sites (12 hours)
3. Dose Calculations with detectors at various sites (12 hours)

F. Capstone Event (2 hours)

**IV. Evaluation Methods**

Evaluation methods and percent weights of overall grade are the following:

**Written Exam (50 points)**

Two comprehensive problem-solving examinations are given at the end of each section. Scenario-based questions are also included, where student must demonstrate the ability to estimate the dose received from various radiation sources either by measuring the radiation exposure with survey meters and detectors or by direct calculations, and to discuss potential effects on humans.

**Laboratory Component (25 points)**

Students write laboratory reports, which include experimental observations, analysis and calculations, and conclusions. Laboratory experiments focus on radiation detection, determination of activities, dose calculation, and evaluation of radiological hazards.

**Capstone Event (25 points)**

The capstone event is a simulation of a real-life incident involving WMD. Students will be evaluated on their ability to assess an "incident site" for possible unknown radioactive hazards, determine the exposure and assess radiation hazards associated with the radiation source, and conduct the proper response call.

Your overall grade will be calculated based on a total point score of 100:

| | |
|---|---|
| 90 - 100 | A |
| 80 - 89 | B |
| 70 - 79 | C |
| 60 - 69 | D |
| < 60 | F |

**V. Attendance Policy**

Attendance in both lecture and laboratory is expected of all students in the class. The policy is governed by university rules and regulations. The students are strongly encouraged to attend all classes.

## VI. Required Textbooks, Supplemental Books and Readings

**Required textbook:**

Wijekumar, V., *Weapons of Mass Destruction-Response Element Advanced Laboratory Integrated Training Indoctrination (WMD-REALITI) on Level 2, Radiological Module (Hazards of Ionizing Radiation).* (Revised October 2003).

**Supplemental Books:**

Cember, H. *Introduction to Health Physics*, 3rd Edition; McGraw-Hill (HP division): New York, 1996.

Firestone, R.B. *Table of Isotopes*, Vols. I and II, 8th ed.; J. Wiley & Sons: New York, 1999.

Krane, K.S. *Introductory Nuclear Physics*; J. Wiley & Sons: New York, 1988.

Shultis, J. K.; Faw, R. E. *Fundamentals Nuclear Science and Engineering*; Marcel Dekker, Inc., 2002.

## VII. Special Resource Requirements

None

## VIII. Bibliography

Due to declining enrollments and investment in the past ten years in nuclear physics and nuclear engineering programs, current textbooks are hard to find with an exception of a few.


1. Cember, H. *Introduction to Health Physics*, 3rd ed.; McGraw-Hill (HP division): New York, 1996.

2. Conway, K. C. *Low Energy Gamma Spectrometer NaI (Tl) Verification of Building Surface Final Survey For Free release For Unrestricted Use Data*, WM'00 Conference, Feb 27-March 2, 2000, Tucson, AZ.

3. Gloyna, E. F.; Ledbetter J. O. *Principles of Radiological Health*; Marcel Dekker, Inc.: New York, 1969.

4. Richardson, H. D. *Industrial Radiography Manual*; U.S. Government Printing Office, Washington, 1968.

5. *Radiation Protection and Emergency Response* (http://www.nrc.gov/).

6. Shultis K. J., and Faw R. E.; *Fundamentals of Nuclear Science and Engineering*; Marcel Dekker Inc.: New York, 2002.

7. Turner, J. E. *Atoms, Radiation, and Radiation Protection*; John Wiley and Sons: NewYork, 1995.

8. U.S. Nuclear Regulatory Commission. *In Situ Gamma Spectrometry and Exposure Rate Measurements*, NUREG-1507, NRC, December 1997.

9. U.S. Nuclear Regulatory Commission. *Measurement Methods for Radiological Surveys in Support of New Decommissioning Criteria*, NUREG-1506, August 1995.

**Online Resources:**

1. http://www.nrc.gov/NRC/radprotect.html
2. http://www.nrc.gov/NRC/EDUCATE/REACTOR/06/06.html
3. http://www.nrc.gov/NRC/NUREGS/BR0217/br0217.html
4. http://www.nrc.gov/NRC/EDUCATE/REACTOR/07/07.html
5. http://ie.lbl.gov/education/glossary/glossaryf.htm

## COURSE ANALYSIS QUESTIONNAIRE

**Section A: Details of the Course**

A1. How does this course fit into the programs of the department? For which students is the course designed? (majors, students in other majors, liberal studies). Explain why this content cannot be incorporated into an existing course.

This course is one of the required courses for students in the BS in natural science with an SDR concentration. It is not intended to be a Liberal Studies course. This course is designed for first responders – the emergency personnel who respond to any suspected incident of a chemical, biological, radiological and or nuclear nature. The content and the intense material coverage are too large to be incorporated in to an existing course such as nuclear physics 472 or radiological health 462.

A2. Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements.

This course does not require changes in any other course in the department. A new track (Science of Disaster Response) of the existing program of the BS in Natural Science will include this course among the controlled electives.

A3. Has this course ever been offered at IUP on a trial basis (e.g. as a special topic) If so, explain the details of the offering (semester/year and number of students).

This course was offered as a pilot of an eleven-day WMD-REALITI Chemical, Biological, Radiological and Nuclear Intermediate level course for the National Guard in May 2003. There were 16 students enrolled in this course.

A4. Is this course to be a dual-level course? If so, please note that the graduate approval occurs after the undergraduate.

This course is not a dual level course.

A5. If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures?

This course is not to be taken for variable credit.

A6. Do other higher education institutions currently offer this course? If so, please list examples (institution, course title).

To the best of our knowledge, this course and its intended degree program are unique in the United States. This lack of specific scientific education for emergency first responders at an accredited institution was one of the primary motivating factors for the National Guard Bureau (NGB) to approach IUP to develop this course.

A7. Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation.

The request for the creation of this course came from the Department of Defense.
National Guard Bureau (NGB) Weapons of Mass Destruction-Response Element Advanced Laboratory Integrated Training and Indoctrination (WMD-REALITI) Sustainment Training Program. Funded by Concurrent Technologies Corporation for $92,986, January 3, 2003 to August 30, 2003.

## Section B: Interdisciplinary Implications

B1. Will this course be taught by instructors from more than one department or team taught within the department? If so, explain the teaching plan, its rationale, and how the team will adhere to the syllabus of record.

This course will be taught by one instructor.

B2. What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments that clarify their attitudes toward the proposed change(s).

The intended audience of SDR 231 may require intensive delivery and specific educational objectives that are not met by existing IUP courses.

B3. Will this course be cross-listed with other departments? If so, please summarize the department representatives' discussions concerning the course and indicate how consistency will be maintained across departments.

This course is not cross-listed.

B4. Will seats in this course be made available to students in the School of Continuing Education?

Only if the Continuing Education students have been accepted in the SDR program.

**<u>Section C: Implementation</u>**

C1. Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedule(s) of current faculty. What will be taught less frequently or in fewer sections to make this possible? Please specify how preparation and equated workload will be assigned for this course.

Yes, faculty resources are adequate because of external funding. If no external funding is available, then additional faculty resources will be required. This course will be counted as one preparation and four hours of equated workload. Each contact hour in laboratories in chemistry, biology, and physics is assigned one (1) workload hour, so 2c + 2l = 4 workload hours. The faculty credentials include possession of a Ph.D. in experimental nuclear physics and a minimum of five years teaching experience, balanced with three to five years of professional work experience in the following areas, skill sets, and certificates. The qualified faculty member will have experience in radiation safety, nuclear physics, radiology, and health physics and holds a certificate in Radiation Safety accepted by the Nuclear Regulatory Commission. In addition, the faculty should have at least five years of training at a facility using radioactive materials and radiation-producing machines.

C2. What other resources will be needed to teach this course and how adequate are the current resources? If not adequate, what plans exist for achieving adequacy? Reply in terms of the following:

*Space
*Equipment
*Laboratory Supplies and other Consumable Goods
*Library Materials
*Travel Funds

Space: For academic year 2002/2003, Weyandt Hall will suffice, but future offerings will require a separate facility. The DoD is covering the cost of this facility.

Equipment: Specialized equipment, including scintillation detectors, photo-multiplier tubes, gas-filled detectors, Geiger-Muller counters, ionization chambers, and semiconductor detectors, is provided by the DoD through the WMD-REALITI grant.

Laboratory Supplies: Laboratory supplies are provided by the DoD through the WMD-REALITI grant.

Library: Concurrent Technologies Corporation (CTC), on behalf of the NGB, has packaged materials needed by the students. Additional materials will be available on-line.

Travel Funds: not applicable

C3. Are any of the resources for this course funded by a grant? If so, what provisions have been made to continue support for this course once the grant has expired? (Attach letters of support from Dean, Provost, etc.)

Yes. The DOD/NGB grant is expected to continue for several years.

C4. How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?

We expect this course to be offered every Fall semester depending on student demand and faculty availability.

C5. How many sections of this course do you anticipate offering in any single semester?

One section will be offered at a time.

C6. How many students do you plan to accommodate in a section of this course? What is the justification for this planned number of students?

A maximum of 24 students can be accommodated in this class in which students do a considerable amount of laboratory work which limits the enrollment.

C7. Does any professional society recommend enrollment limits or parameters for a course of this nature? If they do, please quote from the appropriate documents.

No professional society recommends enrollment limits or parameters for this course.

C8. If this course is a distance education course, see the Implementation of Distance Education Agreement and the Undergraduate Distance Education Review Form in Appendix D and respond to the questions listed.

This course is not a distance education course.

**<u>Section D: Miscellaneous</u>**

Include any additional information valuable to those reviewing this new course proposal.

No additional information is necessary.