COURSE SYLLABUS

Radiological Control Systems

RW 213-01

Arts & Sciences
New Mexico Junior College
5317 Lovington Highway
Hobbs, New Mexico 88260
1. General Course Information

a. Course Title: Radiological Control Systems
b. Course Number: RW 213-01
c. Semester/year: Fall/2003
d. Credit Hours: 3 Hours
e. Instructor: Olav Amundsen
f. Office Phone: 505 392 5335 ext 265
g. Office Hours: by appointment
h. Prerequisite: None

2. Course Description

In this course, students will be introduced to systems used to control radiological events. Coverage will include the documentation process, communication systems, counting errors and statistics and dosimetry. The understanding of the requirements of documentation and communication systems as defined by the Department of Energy is emphasized, as related to one’s work with radioactive materials. The importance of reporting these data in a correct manner is a core element in the module describing counting errors and statistics. A description of the various ways of calculating exposure limit through dosimetry practices is taught. Three lecture hours per week.

3. Course Rationale/Transferability

This course is an undergraduate level course designed to introduce the student to the documentation process as well as the use of statistics. This will also be the introduction to Dosimetry. This course has no guarantee of transferability to other New Mexico Schools or out-of-state institutions. Students are advised to check with the receiving institutions if they intend to transfer to another institution.

4. Required/Suggested Course Materials


Other material listed with each module under section 7- Specific Course Objectives/Competencies within this document.
5. **Grading Policy**

Each student is evaluated by homework assignment/pop quizzes, written examinations, reports and projects. Final grades will be determined by averaging three graded areas based on the following scale. A grade of 80 % or better is necessary for certification.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Written Examinations</td>
<td>40 % of overall grade</td>
</tr>
<tr>
<td>Homework / Pop Quizzes</td>
<td>50 % of overall grade</td>
</tr>
<tr>
<td>Final Exam</td>
<td>10 % of overall grade</td>
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Upon completion of the afore mentioned averaging grades will be administered as follows:

- A= 90-100
- B= 80- 89
- C= 70- 79
- D= 60- 69
- F= 59- 00

6. **General Course Objectives/Competencies**

This course is an undergraduate level course designed to introduce the student to the document process and the fundamentals of measuring radioactivity. The course is divided into four modules. These modules focus on (1) radiological documentation, (2) communication systems, (3) counting errors and statistics and finally (4) dosimetry. The course will prepare the students for more site academic training. The course covers more advanced numerical mathematics and previous college mathematics is a plus.

7. **Specific Course Objectives/Competencies**
Course Title: Radiological Control Systems
Module Title: Radiological Documentation
Module Number: 2.01

Objectives:

2.01.01 List the types of records/reports that the Radiological Control group is responsible for maintaining at your site.

2.01.02 Describe the types of records and reports used at your site by the Radiological Control Group, to include but should not be limited to:
   a. Radiological Work Permits
   b. Survey Reports
   c. Analysis Reports
   d. Radiological Deficiency Reports
   e. ALARA Documentation
   f. Exposure Reports

2.01.03 Explain the requirements for the records management system, such as QC, auditability/retrievability, management information at your site.

References:

1. 10 CFR Part 835 (1998) "Occupational Radiation Protection"

Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Chalkboard/whiteboard
4. Lessons learned
Objectives:

2.02.01 Explain the importance of good communication.

2.02.02 Identify two methods of communication and be able to determine different types of each.

2.02.03 Describe different types of communication systems.

2.02.04 Describe the FCC and DOE guidelines regarding proper use of communication systems.

2.02.05 Describe general attributes of good communications.

2.02.06 Explain the importance of knowing how to contact key personnel.

2.02.07 Identify the communication systems available at your site and methods available to contact key personnel.

2.02.08 Describe the emergency communication systems available at your site.

Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Chalkboard/whiteboard
4. Recommended - radio, telephone, pager, warning alarms, phonetic alphabet handout
5. Lessons learned
Objectives:

2.03.01. Identify five general types of errors that can occur when analyzing radioactive samples, and describe the effect of each source of error on sample measurements.

2.03.02. State two applications of counting statistics in sample analysis.

2.03.03. Define the following terms:
   a. mode
   b. median
   c. mean

2.03.04. Given a series of data, determine the mode, median, or mean.

2.03.05. Define the following terms:
   a. variance
   b. standard deviation

2.03.06. Given the formula and a set of data, calculate the standard deviation.

2.03.07. State the purpose of a Chi-squared test.

2.03.08. State the criteria for acceptable Chi-squared values at your site.

2.03.09. State the purpose of creating quality control (QC) charts.

2.03.10. State the requirements for maintenance and review of QC charts at your site.

2.03.11. State the purpose of calculating warning and control limits.

2.03.12. State the purpose of determining efficiencies and correction factors.

2.03.13. Given counting data and source assay information, calculate efficiencies and correction factors.

2.03.14. State the meaning of counting data reported as $x \pm y$.

2.03.15. Given counting results and appropriate formulas, report results to desired confidence level.

2.03.16. State the purpose of determining background.

2.03.17. State the method and requirements for determining background for counting systems at your site.

2.03.18. State the purpose of performing sample planchet maintenance.

2.03.19. State the method and requirements for performing planchet maintenance for counting systems at your site.

2.03.20. Explain methods to improve the statistical validity of sample measurements.
2.03.21. Define "detection limit," and explain the purpose of using detection limits in the analysis of radioactive samples.

2.03.22. Given the formula and necessary information, calculate detection limit values for counting systems at your site.

2.03.23. State the purpose and method of determining crosstalk.

2.03.24. State the criteria for acceptable values of crosstalk for counting systems at your site.

2.03.25. State the purpose of performing a voltage plateau.

2.03.26. State the method of performing a voltage plateau on counting systems at your site.

References:


Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Chalkboard/whiteboard
4. Lessons learned

Course Title: Radiological Control Systems
Module Title: Dosimetry
Module Number: 2.04

Objectives:

2.04.01 Identify the DOE external exposure limits for general employees.

2.04.02 Identify the DOE limits established for the embryo/fetus of a declared pregnant female
general employee.

2.04.03 Identify the administrative exposure control guidelines at your site, including those for the:
   a. General Employee
   b. Member of the Public/Minor
   c. Incidents and emergencies
   d. Embryo/Fetus

2.04.04 Identify the requirements for a female general employee who has notified her employer in writing that she is pregnant.

2.04.05 Determine the theory of operation of a thermoluminescent dosimeter (TLD).

2.04.06 Determine how a TLD reader measures the radiation dose from a TLD.

2.04.07 What are the advantages and disadvantages of a TLD compared to a film badge.

2.04.08 Identify the types of beta-gamma TLDs used at your site.

2.04.09 Identify the types of neutron TLDs used at your site.

2.04.10 Determine the requirements for use of TLDs used at your site.

2.04.11 Determine the principle of operation, and the types used, for the personnel neutron dosimeters used at your site.

2.04.12 Determine the principle of operation of self-reading dosimetry (SRD) used at your site.

2.04.13 Determine the principle of operation, and guidelines for use, for the alarming dosimeters used at your site.

2.04.14 List the types of bioassay monitoring methods at your site.

2.04.15 List different uses of area monitoring dosimeters.

References:

Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Chalkboard/whiteboard
4. Lessons learned

8. General/Miscellaneous

See attached General Information Sheet / Institutional Page

9. Critical Incident and Evacuation Plan with Evacuation Route Map

See attached; New Mexico Junior College Emergency/Critical Incident Information sheet and campus map.

10. Course Outline

a. Class Dates
To be arranged

b. Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Chalkboard/whiteboard
4. Computer Lab

c. Examinations

In addition to the final exam, a minimum of one exam for each module will be administered during the semester. The test date and specific course material covered by the exam will be announced during class by the instructor at the start of each module. Examinations must be taken at the scheduled time. If a student is aware that she/he will not be able to take the exam at the scheduled time, then prior to the exam date he/she must reschedule a special examination with the professor. Any other absences from examination will be retaken only if the professor decides it was a valid excuse, otherwise, a grade of “0” will be recorded.

d. Late Papers, Homework or Projects

Five points per day will be deducted from the grade for late work. Possible field trips associated with class projects will be announced and scheduled as early as practical.

e. Tardiness
Students are expected to be seated at the time each lecture is scheduled to begin.

f. **Withdrawal**

You may officially withdraw from this class on or before the end of the class with a grade of “W”. Last date of withdrawal will be posted by instructor at the beginning of the class.

g. **Audits**

No student may “audit” the class after having signed up for credit. In other words, you may not change from credit status to audit status once the course has commenced.

h. **Attendance**

Students are not required to attend lectures, but will have to take all exams and deliver all homework.