COURSE SYLLABUS

Radiological Instrumentation

RW 224-01

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

   a. Course Title: Radiological Instrumentation
   b. Course Number: RW 224-01
   c. Semester/year: Spring/2004
   d. Credit Hours: 4 Hours
   e. Instructor: Olav Amundsen
   f. Office Phone: 505 392 5335 ext 265
   g. Office Hours: by appointment
   h. Prerequisite: RW-224

2. Course Description

   In this course students will be introduced to instrumentation. There are many
different types of equipment for monitoring and sampling radiation. This course
introduces the radiation survey instrumentation used at most facilities.
Contamination monitoring instrumentation, air sampling equipment and counting
room equipment is emphasized, with hands on training with the equipment
required for work in a radioactive area. Three lecture hours per week.

3. Course Rationale/Transferability

   This course is an undergraduate level course designed to advance the student in
Radiological Instrumentation. The curriculum follows the Department of Energy
Handbook 1122-99's content. 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

   Department of Energy Handbook 1122-99, Radiological Control Technician, Study
Guide (Modules 2.15 through 2.19). Can be printed at the following website:

   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></th>
<th>Percentage of Overall Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Examinations</td>
<td>40 %</td>
</tr>
<tr>
<td>Homework / Pop Quizzes</td>
<td>50 %</td>
</tr>
<tr>
<td>Final Exam</td>
<td>10 %</td>
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</tbody>
</table>

Upon completion of the aforementioned 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 further enhance the skills of the student in Instruments used to monitor radioactivity in the Nuclear Industry. The class will focus on the use of equipment. The student will have to document proficiency in identifying equipment and show that he can use the equipment. The course is divided into four modules. These modules focus on (1) radiation survey instrumentation, (2) contamination monitoring instrumentation, (3) air sampling equipment and (4) counting room equipment.

7. **Specific Course Objectives/Competencies**
Course Title: Radiological Instrumentation
Module Title: Radiation Survey Instrumentation
Module Number: 2.16

Objectives:

2.16.01 List the factors which affect an RCT’s selection of a portable radiation survey instrument, and identify appropriate instruments for external radiation surveys.

2.16.02 Identify the following features and specifications for ion chamber instruments used at your facility:
   a. Detector type
   b. Instrument operating range
   c. Detector shielding
   d. Detector window
   e. Types of radiation detected/measured
   f. Operator-adjustable controls
   g. Markings for detector effective center
   h. Specific limitations/characteristics.

2.16.03 Identify the following features and specifications for high range instruments used at your facility:
   a. Detector type
   b. Instrument operating range
   c. Detector shielding
   d. Detector window
   e. Types of radiation detected/measured
   f. Operator-adjustable controls
   g. Markings for detector effective center
   h. Specific limitations/characteristics.

2.16.04 Identify the following features and specifications for neutron detection and measurement instruments used at your facility:
   a. Detector type
   b. Instrument operating range
   c. Types of radiation detected/measured
   d. Energy response
   e. Operator-adjustable controls
   f. Specific limitations/characteristics.

References:

1. Radiation Detection and Measurement, Glenn F. Knoll
2. Basic Radiation Protection Technology, Daniel A. Gollnick
3. Operational Health Physics, Harold J. Moe
4. ANSI N323A
5. (Various Manufacturers Technical Manuals)
Instructional Aids:

1. Overheads
2. Overhead projector and screen
5. Chalkboard/markerboard
6. Lessons learned

Course Title: Radiological Instrumentation
Module Title: Contamination Monitoring Instrumentation
Module Number: 2.17
Objectives:

2.17.01 List the factors which affects an RCT's selection of a portable contamination monitoring instrument.

2.17.02 Describe the following features and specifications for commonly used count rate meter probes used at your site for beta/gamma and/or alpha surveys:
   a. Detector type
   b. Detector shielding and window
   c. Types of radiation detected/measured
   d. Energy response for measured radiation
   e. Specific limitations/characteristics

2.17.03 Describe the following features and specifications for commonly used count rate instruments used at your site:
   a. Types of detectors available for use
   b. Operator-adjustable controls
   c. Specific limitations/characteristics

2.17.04 Describe the following features and specifications for commonly used personnel contamination monitors at your site:
   a. Detector type
   b. Detector shielding and window
   c. Types of radiation detected/measured
   d. Energy response for measured radiation
   e. Operator-adjustable controls
   f. Specific limitations/characteristics

2.17.05 Describe the following features and specifications for commonly used contamination monitors used at your site (Tool, bag, laundry monitors).
   a. Detector type
   b. Detector shielding and window
   c. Types of radiation detected/measured
   d. Energy response for measured radiation
   e. Specific limitations/characteristics

References:

1. Radiation Detection and Measurement, Glenn F. Knoll
2. Basic Radiation Protection Technology, Daniel A. Gollnick
3. Operational Health Physics, Harold J. Moe
4. ANSI N323A
5. (Various Manufacturers Technical Manuals)

Instructional Aids:

7. Overheads
8. Overhead projector/screen
9. Chalkboard/whiteboard
10. Lessons learned
Objectives:

2.18.01 Identify the factors that affect the operator's selection of a portable air sampler.

2.18.02 Identify the physical and operating characteristics and the limitation(s) of the Staplex and Radeco portable air samplers.

2.18.03 Identify the physical and operating characteristics and the limitation(s) of Motor air pumps.

2.18.04 List the steps for a preoperational checkout of a portable air sampler.

2.18.05 Identify the physical and operational characteristics and the limitation(s) of beta-gamma constant air monitors (CAM's).

2.18.06 Identify the physical and operating characteristics and the limitation(s) of alpha constant air monitors (CAM's).

References:

1. Basic Radiation Protection Technology, Daniel A. Gollnick
2. Operational Health Physics, Harold J. Moe
3. ANSI N323A
4. (Various Manufacturers Technical Manuals)

Instructional Aids:

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

2.19.01 Describe the following features and specifications for commonly used laboratory counter or scalers:
   a. Detector type
   b. Detector shielding
   c. Detector window
   d. Types of radiation detected and measured
   e. Operator-adjustable controls
   f. Source check
   g. Procedure for sample counting

2.19.02 Describe the following features and specifications for low-background automatic counting systems:
   a. Detector type
   b. Detector shielding
   c. Detector window
   d. Types of radiation detected and measured
   e. Operator-adjustable controls
   f. Source check
   g. Procedures for sample counting

2.19.03 Describe the following features and specifications for commonly used gamma/alpha spectroscopy systems used at your facility:
   a. Detector type
   b. Detector shielding
   c. Detector window
   d. Types of radiation measured
   e. Procedures

References:
1. Radiation Detection and Measurement, Glenn F. Knoll
2. Basic Radiation Protection Technology, Daniel A. Gollnick
3. Operational Health Physics, Harold J. Moe
4. ANSI N323A
5. (Various Manufacturers Technical Manuals)

Instructional Aids:
1. Overheads
2. Overhead projector and screen
3. Chalkboard/markerboard
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 required to attend lectures and will have to take all exams and deliver all homework.