UN 0805
Operational Health Physics
2021 - Winter

Instructors:

Josip Zic (McMaster University
Phone: (647) 261-2500
e-mail: zicjj@mcmaster.ca

Schedule:

Lectures:	April 11, 18, 24, 25
	May 9, 16, 30
	June 6
Assignments:	#1 – April 24
	#2 – May 29
	#3 – June 5
Final Exam:	June 13

Study materials:

Course notes

Additional reading: International Commission on Radiation Protection (ICRP) 103, 115, 119
Canadian Nuclear Safety Commission (CNSC):
Radiation Protection Regulations
Nuclear Substances & Radiation Devices

Prerequisites:

- Undergraduate Degree in Science or Engineering

Grading: (Grading scale: 0-100%)

3x Assignments:	60%
Final exam:	40%

Assignments: Assignments/Projects constitute an essential part of student preparation and will consist of homework problems, assigned study and projects.
Some assignments may not contribute directly to the final mark. However, students are expected to perform the assigned work and be prepared to present their solutions in class.

Learning objectives

Introduce students to the fundamentals of occupational and environmental health physics encountered in the nuclear power, medical and research fields. Concepts include principles and regulatory framework for radiation safety; key dosimetric quantities, units and models; doses from internal and external exposures to ionizing radiation; elements of a radiation safety program; and environmental exposure pathways.

Learning outcomes

Upon completion of this course, students will be able to:

1. Explain and apply key dosimetric quantities, units and models.
2. Understand the basic framework of Radiation Protection, as defined by the International Commission on Radiation Protection (ICRP)
3. Understand Canadian Nuclear Safety Commission (CNSC) Nuclear Safety Act and Regulations, as they pertain to Radiation Protection at a Class I Nuclear Facility.
4. Explain and describe the application of the key elements of radiation safety programs for various nuclear facilities and settings.
5. Perform basic assessments and analysis required of Health Physicists in a variety of settings, such as:
    a. Dose estimation for radiological exposure scenarios involving exposure to airborne contamination, surface contamination and / or external radiation hazards,
    b. Shielding needs assessments, and
    c. Hazard assessments of protocols involving radioactive materials.
6. Understand how to plan radiological work, implement ALARA tools to minimize dose and estimate collective dose.
7. Explain how radiological source term changes throughout the life of a nuclear facility and its impact on dosimetry, instrumentation, material release, environmental releases and decommissioning.
8. Understand the basic principles of clearing material from radiological areas.
9. Determine doses resulting from routine and accidental releases of radioactive material to the environment.
10. Establish derived emission limits for nuclear facilities and assessing potential public doses from accidents.

Academic misconduct

Academic misconduct includes, but is not limited to:

> Cheating on examinations, assignments, reports, or other work used to evaluate student performance. Cheating includes copying from another student's work or allowing one's own work to be copied, submitting another person's work as one's own, fabrication of data, consultation with an unauthorized person during an examination, or use of unauthorized aids.

Course Outline

1. Introduction (2 hours)

PART 1

2. Radiation Protection Programs (13 hours)
    2.1. Review of Harmful Effects of Radiation
    2.2. ICRP Framework of Radiation Protection
    2.3. Canadian Radiation Protection Related Acts and Regulations
    2.4. Radiation Safety Considerations at CANDU Nuclear Facilities
    2.5. Clearance of Material from Radiological Areas

3. Concepts, Quantities and Units (7.5 hours)
    3.1. External and Internal Dosimetry Programs
    3.2. Dose from Internal Exposures and Dosimetric Models
    3.3. Annual Limits on Intake and Derived Air Concentrations

PART 2

4. Operational Health Physics (15 hours)
   - 4.1. Radioactive Source Term
   - 4.2. Contamination Control
   - 4.3. Shielding
   - 4.4. Planning Radioactive Work
   - 4.5. Implementation of ALARA Tools
   - 4.6. Estimation of Project Collective Doses
   - 4.7. Events that Shaped Radiation Protection Programs

5. Emergency Response (7.5 hours)
   - 5.1. Doses from Accidental Releases at Nuclear Facilities
   - 5.2. Derived Release Limits
   - 5.3. Emergency Preparedness

PART 3

6. Public and Environmental Exposure (7.5 hours)
   - 6.1. Effluent and Environmental Monitoring
   - 6.2. Radiation Instrumentation
   - 6.3. Public Exposure Scenarios