

EP784
Nuclear Fuel Management
Fall 2023
Course Outline

COURSE DESCRIPTION

This is a course on in-core fuel management in nuclear reactors. It covers all aspects of the use of nuclear fuel in CANDU reactors, with comparison to fuel management in light-water reactors. The course includes full-core calculations in simplified but realistic CANDU models. This requires analysis by computer codes and presentation of project results by computer.

The course material consists of:

- 1) Lecturer's notes
- 2) "The Nuclear Fuel Cycle: Analysis and Management", by Robert G. Cochran & Nicholas Tsoulfanidis, ISBN: 0-89448-451-6
- 3) The Essential CANDU - a textbook about the CANDU nuclear reactor (chapter 21) (<http://www.nuceng.ca/candu/>).

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Benjamin Rouben
NRB B-121
roubenb@mcmaster.ca

Office Hours:
By appointment, or by e-mail or zoom any time

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

COURSE OVERVIEW

Date/Week	Topic	Readings
Week 1-2	Front end of nuclear cycle. Review of nuclear-fuel cross sections. Fluence, burnup. Uranium enrichment, effect on resource utilisation.	
Weeks 3-4	Reactivity curve of fuel. Estimating the fuel exit burnup. CANDU lattice calculations with DRAGON code.	
Weeks 5-6	Flux/power flattening. The CANDU Equilibrium Core and Time-Average Model. The DIFC6G full-core diffusion code.	

Weeks 7-8	Students' individual presentations of their Project 1. Channel ages. Snapshot models based on time-average case.
Weeks 9-10	The CANDU core-follow. Criteria for selecting channels for refuelling.
Week 11	PWR fuel management
Week 12	Students' individual presentations of their Project 2. Short Final Quiz.

ASSESSMENT

Component	Weight
Assignments	20%
Projects	70%
Final Quiz	10%
Total	100%

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g., the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at
<http://www.mcmaster.ca/academicintegrity>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for [Academic Accommodation of Students with Disabilities](#).

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. If you are seeking relief for missed academic work because of an absence lasting less than five days in duration, you must use the [McMaster Student Absence Form](#).
2. Absences lasting more than five days must be reported to the Associate Dean's Office (JHE-A214) and appropriate documentation must be provided. For medical absences, the University reserves the right to require students to obtain medical documentation from the Student Wellness Centre.
3. You should expect to have academic commitments Monday through Saturday but not on Sunday or statutory holidays. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may use the McMaster Student Absence Form or contact the Associate Dean's Office.
4. At the third request for relief of academic missed work, you will be asked to meet with the Assistant or Associate Dean (or delegate). Relief for missed academic work is not guaranteed.
5. You are responsible to contact your instructor(s) promptly to discuss the appropriate relief.
6. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/>.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using course website on Avenue to Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent



to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

X = e-mail, LearnLink, Avenue to Learn, web pages, capa, Moodle, ThinkingCap, etc.

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to

<http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf>.