

Course EP4P03_6P03
Nuclear Power Plant Systems and Operation
Winter 2020
Course Outline

CALENDAR/COURSE DESCRIPTION

- This course is, to a large extent, a self-study course. Students will receive a USB with the full course contents and supporting documentation. Includes audio and interactivity. The USB for this course is not available for general distribution. Further inquiries should be directed to the author, [Dr. George Bereznai](#), whose contribution and generosity is gratefully acknowledged.
- This CANDU Overview course includes: material on the science of the fission chain reaction and nuclear reactors; material on CANDU power-plant systems and their operation; self-study of the text and course material; problem-solving assignments to reinforce the understanding and application of the course material; operation of a CANDU-9 power-plant simulator. The CANDU-9 power-plant simulator was produced by [CTI Simulation International](#) visit their site to see some screen shots). Their contribution is gratefully acknowledged.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in level IV or above of any Engineering program
Antirequisite(s):

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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

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

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Simon Younan
younans@mcmaster.ca

Office Hours:
By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

[On Avenue to Learn.](#)

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Describe and explain the following features of a CANDU Generating unit:
 - the principles of overall unit operation and control
 - the functions, equipment and operation of the main process systems
 - how each major system is controlled
 - how reactor safety and the protection of the public are achieved
2. Conduct normal and abnormal operations on a simulated CANDU-9 Generating unit, including: power manoeuvres, poison override operation, recovery from a reactor trip or a turbine trip, responses to various system malfunctions.
3. Design software to follow the evolution of ^{135}Xe concentration and reactivity, and write a project report

MATERIALS AND FEES

Required Texts:

- “Nuclear Power Plant Systems and Operation”; 3 parts: Reference Text, Lecture Notes and USB (or electronic access), and Learning Resources, by George Bereznai.

Calculator:

Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials:

Instructor’s notes.

COURSE OVERVIEW

This is mostly a self-study course using the course material and the CANDU 9 simulator. The material to be covered each week is as per the list below. There will be 1 or 2 classes per week, to present the instructor’s material and discuss topics and questions.

Date/Week	Topic	Readings
Week 1	Introduction, NPP Safety and Systems	
Week 2	Overall Unit Control	
Week 3	Reactor and Moderator Systems	
Week 4	Reactor Regulating System	
Week 5	Reactor Regulating System	
Week 6	Midterm Examination	
Week 7	Heat Transport Systems	
Week 8	HT Pressure and Inventory Control	
Week 9	Steam, Turbine and Feedwater Systems	
Week 10	Major Unit Transients	
Week 11	Identification and Response to Unit Events	
Week 12	Course Review	

ASSESSMENT

Component	Weight
Weekly Assignments	25%
Midterm Examination	20%
Project	15%
Final Exam	40% (Must Have >50% of Final Mark to Pass Course)
Total	100%
Special Project for Graduate (6P03) Students Only	20%

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only, and will not be directly taken into consideration in determining a student's actual grade in the course.

Outcomes	Indicators
Competence in specialized engineering knowledge	1.4
Demonstrates an ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem.	2.2
Proposes solutions to open-ended problems	4.5
Creates, adapts, modifies and extends tools and techniques as appropriate to solve problems.	5.3
Assesses possible options and design configurations from a sustainability engineering perspective, which emphasizes environmental stewardship, life-cycle analysis, and long-term decision-making principles.	9.3

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

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. The [McMaster Student Absence Form](#) is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/H301). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. 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 submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed here: <http://www.eng.mcmaster.ca/current/documents.html>

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 the course web page. 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>.