

EP 4NE3  
Advanced Nuclear Engineering  
Winter 2016/17  
Course Outline

CALENDAR/COURSE DESCRIPTION

The commercial generation of electricity through nuclear reactions is presented at an advanced level. This includes electricity from nuclear fission as well as from nuclear fusion. Various types of reactors will be discussed. The conversion of the nuclear energy to electricity or to other carriers of energy will be studied. During the course, the students will be expected to read chapters from books and journal articles. They will also execute a project of design or analysis of a nuclear reactor system, with existing or self-made computer programs.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Engineering Physics 3D03 or approval of the instructor  
Antirequisite(s): List

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Adriaan Buijs  
JHE A325  
[buijsa@mcmaster.ca](mailto:buijsa@mcmaster.ca)  
ext. 24925

Office Hours:  
By appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Simon Younan  
JHE A401  
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Office Hours:  
By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

<http://avenue.mcmaster.ca/>

COURSE OBJECTIVES

To foster an understanding of the multidisciplinary aspects of modern nuclear engineering and to develop skills for analyzing nuclear power reactor designs. By the end of this course, students should be able to:

- Understand the design features of major nuclear reactor types, including fission and fusion reactors

- Understand the main physical processes underlying nuclear reactors
- Formulate and solve the basic equations associated with the physical processes in a nuclear reactor.
- Utilize the concepts, equations and software simulation tools to evaluate aspects of the performance of a nuclear reactor and associated components
- Evaluate factors governing key processes in nuclear fuel cycles

#### MATERIALS AND FEES

##### Required Texts:

There is no required textbook for this course. Students are encouraged to use reference textbooks and other reference material such as journal papers and conference proceedings.

##### Calculator:

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

##### Other Materials:

Some applicable reference textbooks are:

1. K. Kok (Ed.), Nuclear Engineering Handbook, CRC Press, 2009 (Recommended)
2. Lamarsh and Baratta, Introduction to Nuclear Engineering, Prentice Hall, 2001
3. A.A. Harms, et al., Principles of Fusion Energy, World Scientific, 2000
4. Glasstone and Sesonke, Nuclear Reactor Engineering, 4th Edition, Chapman & Hall, 1994
5. El Wakil, Nuclear Energy Conversion, American Nuclear Society, 1982
6. Tong and Weisman, Thermal Analysis of Pressurized Water Reactors, American Nuclear Society, 1979
7. Lahey and Moody, The Thermal-Hydraulics of a Boiling Water Nuclear Reactor, American Nuclear Society, 1977
8. Todreas and Kazimi, Nuclear Systems, Vol. 1, Hemisphere Publishing, 1990

#### COURSE OVERVIEW

Date/Week	Topic	Readings
Week 1	Review of fundamental fission and fusion reactions	
Week 2	Fission reactor core designs	
Week 3	Fission reactor core designs	
Week 4	Fusion reactor core designs	
Week 5	Fusion reactor core designs	
Week 6	Balance of plant	
Week 7	Spent fuel management	
Week 8	Alternative fission reactor design	
Week 9	Alternative fusion reactor design and LENR	
Week 10	Presentation of Design Project	
Week 11	Presentation of Design Project	
Week 12	Review of material for exam	

**ASSESSMENT**

Component	Weight
Assignments	30%
Quizzes	10%
Design project	30%
Final Exam	30%
Total	100%

**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
N/A	

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](mailto: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/A214). 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 Avenue to Learn (ATL) and e-mail. 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.

#### 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>.