Engineering Physics
ENGPHYS 3D04
Principles of Nuclear Engineering
Fall 2025

McMaster University
ENGINEERING

Instructor Information

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Office Hours:
TBD
Course Instructor

Matt Moran
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Office Hours:
By appointment
Lab Instructor

TA Information

Name: TA names and contact information will be posted to A2L when they are determined.

Class Times

Lectures will be held on the following days (except reading week and stat. holidays):

- Mondays @ 9:30 – 10:20 h

- Tuesdays @ 10:30 – 11:20 h
- Thursdays @ 9:30 – 10:20 h

Tutorial schedule:

The tutorials run every week on Monday at 11:30 – 12:20 h except week #1 and reading week.

Class Format

In Person

The course will be organized as follows:

- Three lectures per week (in-person attendance only)
- One tutorial per week
- Four labs per term

The course will be partitioned into three modules whereby the scope of each module will be communicated in-class and A2L. Each module will have its own set of lectures, tutorials, and exam. Therefore, the last exam will only cover the content of the module, not the entire course. Homework problems will be posted to A2L, which are optional.

Course assessments are as follows:

1. **Quizzes** will be given during tutorial periods in-person and are intended to help students stay on top of course material. All quizzes will be open book; electronics are not permitted except for a university approved calculator. Students that regularly attend lectures and attempt homework problems should find quizzes straightforward. Quizzes should be viewed as a way to stay on top of course material as a form of practice. Note the assessment section, which describes two options for students: option A includes quizzes, while option B does not.
2. **Lab reports** will be written individually based on the labs that they performed in co-ordination with the Lab Supervisor. Students are expected to review the lab manual (available on A2L) prior to every lab and are encouraged to ask questions. The written report should follow the Report Writing Guidelines

document for 3D04 and will be evaluated using the lab report evaluation form (both provided on A2L). Students will receive feedback on their reports, which should be applied in subsequent reports. The labs are intended to apply the theory learned in-class.

3. There will be three **exams** of equal weight whereby the scope of each exam is specific to each module. The motivation for this format is twofold: to reduce scope to give students focus and to make the final exam period less intense. The exams will be based on content discussed in-class, material referenced in the textbook, and the quizzes. Labs will be out of scope from the exams. The scope will be clearly communicated in-class. Exams will be open book (e.g., printed lecture slides, textbook, notes). Students are expected to have a physical textbook with them in exams to reference figures and tables. The standard McMaster calculator will be permitted but no other electronics (e.g., laptops, smart phones, smart watch, etc.).

To maximize your success in this course, you should:

1. Attend lectures and tutorials, review lecture slides, and read textbook chapters assigned in class.
2. Frequently review A2L for course information.
3. Read the lab manual prior to every lab and ask questions if anything is unclear.
4. Work with your peers to ensure you understand course content.
5. Aim to understand concepts, only memorize knowledge.
6. Ask questions during lectures, tutorials, and office hours if anything is unclear. We're happy to help!

Course Dates: 09/02/2025 - 12/04/2025
Units: 4.00
Course Delivery Mode: In Person
Course Description: Introduction to fission energy systems. Energetics of nuclear reactions, interactions of radiation with matter, radioactivity, design and operating principles of fission reactors. Students perform labs involving the McMaster Nuclear Reactor to gain an understanding of the nuclear physics processes underlying its operation and its applications. Three lectures, one tutorial, one lab (three hours) four times

per term; first term Prerequisite(s): Registration in Level II or above of an Engineering program or credit in at least one of the following: BIOPHYS 1S03, LIFESCI 1D03, MEDPHYS 1E03, PHYSICS 1AA3, 1CC3, 1E03, ISCI 1A24 A/B Antirequisite(s): ENGPHYS 3D03

Important Links

- Mosaic
- Avenue to Learn
- Student Accessibility Services - Accommodations
- McMaster University Library
- eReserves

Course Learning Outcomes

- Conceptualise and explain the fundamental physical phenomena related to nuclear physics, including fission, radioactive decay, and related mechanisms.
- Calculate neutron transport equations, including flux, reactor kinetics, and reactivity.
- Describe at a high level nuclear reactor designs, including major components, heat transport systems, and matters related to reactor safety.
- Calculate values relevant to radiation protection and shielding.

Graduate Attributes

The Canadian Engineering Accreditation Board (CEAB) is a division of Engineers Canada and is responsible for accrediting undergraduate engineering programs across Canada. Accreditation by the CEAB ensures that the engineering programs meet a national standard of quality and cover essential educational requirements. Graduate Attributes are a set of qualities and skills that the CEAB expects engineering graduates to possess. These attributes are a benchmark for the learning outcomes of accredited engineering

programs. This section lists the Graduate Attribute Indicators associated with the Learning Outcomes in this course.

Lab Information

The four (4) labs will be delivered in-person. A schedule will be prepared and posted on A2L at the beginning of the term. The four labs to complete are:

1. Introduction to gamma detection,
2. Radioactive half-life,
3. Neutron attenuation, and
4. Neutron radiography.

Each lab will occur over a single 3-hour session. If the lab facilities become unavailable for any reason, data will be made available by the Laboratory Supervisor, and students will complete the lab reports based on the supplied data. Laboratory manuals and deliverables due dates are on A2L.

Lab Safety

The Faculty of Engineering is committed to McMaster University's Workplace and Environmental Health and Safety Policy which states: "Students are required by University policy to comply with all University health, safety and environmental programs". It is your responsibility to understand McMaster University Workplace and Environmental Health and Safety programs and policies. For information on these programs and policies please refer to McMaster University Health and Safety. The Lab Safety Handbook is available here, as well as on A2L.

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for some of the experiments and the laboratory equipment. A laboratory-specific set of rules can also be added to ensure that students fully understand laboratory safety rules that are in place prior to their first session.

Course Schedule

A weekly breakdown of the course schedule (subject to change).

Week	Topic	Assessment
1	Admin + Intro to nuclear	
2	Atomic and nuclear physics	
3	Interaction of radiation with matter	
4	Nuclear reactor design	
5	Nuclear engineering topics	Exam I
Midterm Break		
6	Guest lecture	
7	Neutron diffusion and moderation	
8	Nuclear reactor theory	
9	Reactor kinetics	Exam II
10	Heat transfer in nuclear reactors	
11	Radiation protection	
12	Radiation shielding	
13	Safety and licensing	Exam III

Required Materials and Texts

Please sign in with your MacID here to view your booklist

Introduction to Nuclear Engineering
Authors: J.R. Lamarsh, A.J. Baratta
Publisher: Pearson
Edition: Both 3rd and 4th editions are acceptable
The campus bookstore sells it for $225 + tax, but a softcover copy is available on Amazon.ca for approximately $120.

Course Evaluation

There are two assessment options for students (A or B), as indicated below. The highest mark will be taken, which will not take effect on A2L until the end of the year.

Assessment break down.

Assessment Item	Option A	Option B
Quizzes	5%	0%
Lab Reports	20%	20%
Exam I	25%	25%
Exam II	25%	25%
Exam III	25%	30%

Course Evaluation Details

Students wanting to have any deliverable re-assessed will have two weeks from the time the deliverable is returned to the class. Please first see the TA for reconsideration before seeing the instructor.

Attendance of each laboratory experiment and passing the cumulate grade of all four labs is required to pass this course.

Undergraduate Grading Scale

The McMaster 12 Point Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62

Grade	Equivalent Grade Point	Equivalent Percentages
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49

Absences, Missed Work, Illness

MSAF'd lab reports will be given an additional five (5) calendar days to submit. The exams are not subject to Self-Reported MSAFs as they are worth 25% each; faculty approved Administrative Reported MSAFs applied to exams will result in a deferred exam. MSAF'd quizzes will result in reweighing the quiz grade to other deliverables (Option A only).

Generative AI: Some Use Permitted

Students may use generative AI in this course in accordance with the guidelines outlined for each assessment, and so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside assessment guidelines or without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the limitations for use for each assessment and to be clear on the expectations for citation and reference and to do so appropriately.

APPROVED ADVISORY STATEMENTS

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. **It is your responsibility to understand what constitutes academic dishonesty.**

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. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

Courses with an On-line Element

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn, LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, 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 a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Online Proctoring

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

Equity, Diversity, and Inclusion

The Faculty of Engineering is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Faculty, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

Academic Advising

For any academic inquires please reach out to the Office of the Associate Dean (Academic) in Engineering located in JHE-Hatch 301.

Details on academic supports and contact information are available from:

https://www.eng.mcmaster.ca/programs/academic-advising

Requests for Relief for Missed Academic Term Work

In the event of an absence for medical or other reasons, students should review and follow the Policy on Requests for Relief for Missed Academic Term Work.

Academic Accommodation for Religious, Indigenous, or Spiritual Observances (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Copyright and Recording

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Extreme Circumstances

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, Avenue to Learn and/or McMaster email.

Turnitin.com

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.