

**4U02A/B Nuclear Lab**  
**Modern and Applied Physics Laboratory**

Fall/Winter 2016/17  
Course Outline

**CALENDAR/COURSE DESCRIPTION**

2 unit(s) Selected advanced experiments in two areas of applied physics, chosen from among these unique topics: Lasers & Optical Communication, Solar Cell Fabrication, Biomedical and Nuclear Labs. Students must take ENGPHYS 4U02 twice, in order to fulfill degree requirements (for a total of four units). Students must select two unique topics from the list above; the same topic cannot be repeated.

Two labs (three hours each); both terms

Students choosing the Nuclear Lab option in 4U02 will complete five Labs. Three of these are required of all students and are worth a total of 24 % of the 4U02 mark. The two remaining are selected from a varying list of optional Labs (note in any one term not all optional Labs may be available) and are worth a total of 26 % of the 4U02 mark.

**A Health Physics Radiation Safety seminar is required** in early September for all students taking the nuclear labs in Term I (or Term II if that were the case).

The Introduction Session of Nuclear Lab option will be conducted on September 14th.

**PRE-REQUISITES AND ANTI-REQUISITES**

Prerequisite(s): For students who have not taken ENG PHSY 3D03, two labs “Introduction to Gamma Detection & Pulse Height Analysis” and “Material Attenuation of Gamma-rays and Neutrons” are prerequisite. Details will be explained in the Introduction Session of Nuclear Lab.

Antirequisite(s): None.

**INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION**

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TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

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

COURSE OBJECTIVES

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

- Demonstrate competence in university level engineering fundamentals.
- Demonstrate an ability to use appropriate knowledge and skills to identify reasonable assumptions (including identification of uncertainties and imprecise information).
- Demonstrate an ability to use appropriate knowledge and skills to identify a range of suitable engineering fundamentals (including mathematical techniques)
- Demonstrate an ability to respond to technical instructions and questions in Lab. experiments and Lab. reports.
- Construct effective written arguments as appropriate to the circumstances
- Critically evaluate and apply knowledge, methods and skills procured through self-directed and self-identified sources.

MATERIALS AND FEES

Required Texts:

None.

Other Materials:

**Reference information:** This is useful for the students to do their analysis -- especially for the pre-requisite lab #1 and the Required lab #1.

**Tables for Neutron Activation Analysis**

**Table 1** – Neutron Activation Properties of Isotopes in Nature

[http://www3.sympatico.ca/bdiacon/Table\\_1\\_Properties\\_of\\_Isotopes.htm](http://www3.sympatico.ca/bdiacon/Table_1_Properties_of_Isotopes.htm)

**Table 2** – Neutron Activation Properties of Isotopes Useful in Neutron Activation Analysis

[http://www3.sympatico.ca/bdiacon/Table\\_2\\_Isotopes\\_Useful\\_for\\_NAA.htm](http://www3.sympatico.ca/bdiacon/Table_2_Isotopes_Useful_for_NAA.htm)

**Table 3** – Gamma Ray Energy Peaks & Intensities Arranged by Increasing Energy

[http://www3.sympatico.ca/bdiacon/Table\\_3\\_Gamma\\_Rays\\_Arranged\\_by\\_Energy.htm](http://www3.sympatico.ca/bdiacon/Table_3_Gamma_Rays_Arranged_by_Energy.htm)

**Table 4** – Gamma Ray Energy Peaks & Intensities Arranged by Increasing Half-Life  
[http://www3.sympatico.ca/bdiacon/Table\\_4\\_Isotopes\\_Arranged\\_by\\_Half-Life.htm](http://www3.sympatico.ca/bdiacon/Table_4_Isotopes_Arranged_by_Half-Life.htm)

**Table 5** – Thorium Decay Series Arranged by Increasing Energy  
[http://www3.sympatico.ca/bdiacon/Table\\_5\\_Thorium\\_Decay\\_Series.htm](http://www3.sympatico.ca/bdiacon/Table_5_Thorium_Decay_Series.htm)

**Table 6** – Uranium Decay Series Arranged by Increasing Energy  
[http://www3.sympatico.ca/bdiacon/Table\\_6\\_Uranium\\_Decay\\_Series.htm](http://www3.sympatico.ca/bdiacon/Table_6_Uranium_Decay_Series.htm)

#### Interesting and Informative Links:

Nuclear Engineering (Bill Garland)

<http://www.nuceng.ca/>

– general nuclear information to help with analysis of most of the labs.

#### COURSE OVERVIEW

Students choosing the Nuclear Lab option will complete **FIVE** labs. Three of these are required of all students and are worth a total of 24% of the mark. The two remaining are selected from a varying list of optional labs and are worth a total of 26% of the mark.

Required labs:

1. Neutron Activation Analysis
2. Spatial Distribution of Reactor Neutron Flux
3. Neutron Radiography

Optional labs:

4. Control Rod Reactivity Worth Measurements
5. Neutron Moderation
6. Approach to Reactor Criticality
7. Xenon Effects on Nuclear Reactor Reactivity

Schedule and others will be decided at Introduction Session on September 14th. This will be notified in Avenue to Learn.

#### ASSESSMENT

**IN ORDER TO PASS THE COURSE, STUDENTS MUST COMPLETE AND PASS THE TWO LAB SECTIONS.**

The marks will be evaluated by the participation in Labs and the reports submitted.

\*Students must attend **all** labs and submit **all** reports to pass.

\*Students are not allowed to participate in labs without attending the safety seminar by Health Physics.

The Report Expectation will be shown to students. Students are required to prepare the reports based on the Report Expectation.

All students must appear on time (late appearance will be penalized by 10% deduction) and attend all five labs. At the end of every lab, the teaching assistants (TAs) will check the experimental record of each student, which must be kept inside a bound laboratory notebook or dedicated lab notebook software.

Each of the experimental reports is due exactly two weeks (Mid-Term Recess week is not included in the two weeks) after the completion of the individual experiment. Reports (preferably in PDF format) are to be posted to the electronic Drop Box in Nuclear Lab of ENG PHYS 4U02 course for the current year on Avenue to Learn.

Every report is due before the time and date indicated. No extensions will be granted and late reports are penalized by 10 % deduction per day. Days include weekends and holidays. Hourly late submission will be rounded to the next half day. For example, a report that is 1 hour late will be considered ½ day late and a 5% deduction will be applied.

All students must participate in the safety lectures/labs/information sessions indicated in each section's information sheet, when the sessions are held.

It is the students' responsibility to check regularly the course web page (Avenue to Learn) for updates and announcements.

Students are required to obtain and maintain McMaster and Avenue to Learn e-mail accounts for timely communications among the instructors, TAs and the students.

You are expected to behave in a way that does not disrupt the learning experience of your peers. Disruptive behavior including making noise, leaving and entering the laboratory, and the use of cellular phones is forbidden and students presenting this type of behaviour will be asked to leave the classroom or laboratory.

Labs are an opportunity for students to obtain practical experience. It is expected that the work in the lab is performed by members of the group or individuals that are assigned to the lab. Students may obtain help from the TAs assigned to the lab, the lab supervisor responsible for the lab, or the instructor. Procuring or accepting help in performing the lab from others will be considered academic dishonesty. This interpretation treats labs similar to tests or exams where the work submitted is expected to be the work of the student.

#### 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
Demonstrated competence in university level engineering fundamentals	1.3
Demonstrate an ability to use appropriate knowledge and skills to identify reasonable assumptions (including identification of uncertainties and imprecise information)	2.1
Demonstrate an ability to use appropriate knowledge and skills to identify a range of suitable engineering fundamentals (including mathematical	2.2

techniques)	
Demonstrates an ability to respond to technical instructions and questions in Lab. experiments and Lab. reports.	7.1
Constructs effective written arguments as appropriate to the circumstances	7.3
Critically evaluates and applies knowledge, methods and skills procured through self-directed and self-identified sources	12.1

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. 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>.