EP 2QM3
Introduction to Quantum Mechanics
Fall/Winter 2016/17
Course Outline

CALENDAR/COURSE DESCRIPTION

Wave-particle duality, uncertainty principle, Hydrogen atom, Schrödinger Equation for ID systems, barriers and tunnelling, probability, properties of insulators, semiconductors and metals. Examples from experiments.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in an Engineering Physics or Materials Engineering program
Antirequisite(s): Physics 2C03

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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Office Hours:
By appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn
http://avenue.mcmaster.ca/

COURSE OBJECTIVES

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

- Demonstrate knowledge of the principles of non-relativistic quantum mechanics.
- Solve basic problems covering a wide range of physical phenomena and engineering applications.
- Describe the essential features of a number of high-technology applications and devices that are closely connected with quantum physics.

MATERIALS AND FEES

Required Texts:

Modern Physics for Scientists and Engineers, by Stephen Thornton & Andrew Rex, Published by Thomson/Brooks/Cole, 4th edition, 2013.

Recommended Resources:

"Quantum Mechanics: The Theoretical Minimum", Leonard Susskind and Art Friedman (Perseus Books 2014) and http://theoreticalminimum.com/courses

"The Feynman Lectures on Physics, New Millennium Edition", Richard Feynman and Robert Leighton (Basic Books 2011) and http://www.feynmanlectures.caltech.edu/

Calculator:

Only the McMaster Standard Calculator will be permitted in tests and examinations.

Other Materials:

Modern Physics, by Randy Harris, published by Pearson/Addison Wesley, 2nd edition, 2008.

Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles, by Robert Eisberg & Robert Resnick.
Introduction to Quantum Mechanics, by David J. Griffiths.

COURSE OVERVIEW

Particular emphasis is placed on Chapters 5, 6, 7 and 9 in our text book. More guidance on our specific coverage will be provided during the semester.

ASSESSMENT

Component	Weight #1	Weight #2	Weight #3
Assignments	25%	25%	25%
Mid-term Test(s)	40%	20%	0%
Final Exam	35%	55%	75%
Total	100%	100%	100%

Note 1: You will be given the best evaluation scheme, provided that the stipulation of Note 2 is satisfied.
Note 2: In order to be offered the best score (Weight #1 versus Weight #2 versus Weight #3), it is necessary that one writes the tests and scores at least 25% on each of them to be able to benefit from the options. Please be careful not to "cut things too close" in preparing for the tests.

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.

Successful students will be expected to be able to:

- Utilize the Schrödinger equation to solve problems involving simple potential wells and barriers, with extension to a variety of device applications in a design-related context. [Indicator 1.3]
- Summarize the main outcomes of the solution of the Schrödinger equation for the hydrogen atom and be able to explain the implications for the atom's energy levels based on quantum numbers, and qualitatively, the characteristics of the hydrogen atom's wave functions. [Indicator 1.2]
- At an introductory and qualitative level, analyze selected physical phenomena within the framework of classical (Maxwell-Boltzmann) or quantum statistics (Bose-Einstein or Fermi-Dirac statistics), as applicable. [Indicators 1.2, 1.3]
- Apply quantum mechanical fundamentals in generating qualitative and semi-quantitative evaluations of a broad range of simple physical problems, which are framed in an open-ended context. [indicator 4.3]
- Summarize the basics of the interaction between radiation and matter, including light absorption and emission by atoms, molecules, and solids, and be capable of explaining the key aspects based on quantum mechanical principles. [Indicator 1.2]
- Explain the concepts of angular momentum and spin in quantum mechanics. [Indicator 1.2, 1.3]
- Conceptually connect a range of advanced technologies (e.g., MRI, lasers, diodes and transistors, spintronic devices, STM, SQUIDs, and flash memory) to the relevant quantum mechanical principles. [Indicator 1.3]

For more information on Accreditation, please see the relevant document in the Miscellaneous folder in our ATL site.

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/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 wok 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 e-mail and 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.