



COURSE OUTLINE

1. **Course:** PHYS 435, Mathematical Methods in Physics - Fall 2019

Lecture 01: MWF 12:00 - 12:50 in PF 128

Instructor	Email	Phone	Office	Hours
Dr Nasser Moazzen-Ahmadi	nmoazzen@ucalgary.ca	403 830-4053	SB 525	W 10:00-11:00

Course Site:

D2L: PHYS 435 L01-(Fall 2019)-Mathematical Methods in Physics

Note: Students must use their U of C account for all course correspondence.

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Physics 343, Mathematics 211; and Mathematics 375 or 376; and Mathematics 367 or 377.

Antirequisite(s):

Credit for Physics 435 and Mathematics 433 will not be allowed.

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %	Date
Assignments	25%	
Midterm tests (2)	20%	in class, October 25, and November 25, 2019, subject to change
In-class D2L quizzes	15%	
Final Examination	40%	To be scheduled by the Registrar

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	95 %	90 %	85 %	80%	75%	70 %	65 %	60%	55%	50 %	45 %

This course has a registrar scheduled final exam.

If the student obtains less than 50% on the combined mid-term and final exams, then the final grade will at most be a D+.

4. **Missed Components Of Term Work:**

In the event that a student misses the midterm or any course work due to illness, supporting documentation, such as a medical note or a statutory declaration will be required (see [Section M.1](#); for more information regarding the use of statutory declaration/medical notes, see [FAQ](#)). Absences must be reported within 48 hrs.

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize themselves with these regulations. See also [Section E.3](#) of the University Calendar.

5. Scheduled Out-of-Class Activities:

There are no scheduled out of class activities for this course.

6. Course Materials:

Required Textbook(s):

K. F. Riley, M. P. Hobson, S. J. Bence, *Mathematical Methods for Physics and Engineering*. Cambridge University Press, Third edition.

7. Examination Policy:

No aids are allowed on tests or examinations.

Students should also read the Calendar, [Section G](#), on Examinations.

8. Approved Mandatory And Optional Course Supplemental Fees:

There are no mandatory or optional course supplemental fees for this course.

9. Writing Across The Curriculum Statement:

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also [Section E.2](#) of the University Calendar.

10. Human Studies Statement:

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

11. Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **10 business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections [I.1](#) and [I.2](#) of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all

community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208).

- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#).

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics & Astronomy, Dr. David Feder by email phas.ahugrd@ucalgary.ca or phone 403-220-8127. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See [Section E.4](#) of the University Calendar.
- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](tel:403-220-5333) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: sciencerep@su.ucalgary.ca. [Student Ombudsman](#), Email: ombuds@ucalgary.ca.
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- l. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

(a) Assignments

There will be 6-8 assignments in total. Problem sets will usually be assigned on Friday and be due the following Friday in class, or at a date/time/location specified on the assignment. Late homework will be penalized 20% per calendar day.

(b) Course Learning Incomes

Trigonometry, geometry, algebra, basic calculus, complex numbers, series and limits, partial differentiation, vector algebra, matrices, vector calculus, line, surface and volume integrals

(c) Syllabus

12. Fourier series

- 12.1 The Dirichlet conditions
- 12.2 The Fourier coefficients
- 12.3 Symmetry considerations
- 12.3 Symmetry considerations
- 12.4 Discontinuous functions
- 12.5 Non-periodic functions
- 12.6 Integration and differentiation
- 12.7 Complex Fourier series
- 12.8 Parseval's theorem

13. Integral transforms

- 13.1 Fourier transforms
- 13.2 Laplace transforms

24 Complex variables

- 24.1 Functions of a complex variable
- 24.2 The Cauchy-Riemann relations
- 24.3 Power series in a complex variable
- 24.4 Some elementary functions
- 24.5 Multivalued functions and branch cuts
- 24.6 Singularities and zeros of complex functions
- 24.7 Conformal transformations
- 24.8 Complex integrals&
- 24.9 Cauchy's theorem
- 24.10 Cauchy's integral formula
- 24.11 Taylor and Laurent series
- 24.12 Residue theorem
- 24.13 Definite integrals using contour integration

25 Applications of complex variables

- 25.1 Complex potentials
- 25.2 Applications of conformal transformations
- 25.3 Location of zeros
- 25.4 Summation of series
- 25.5 Inverse Laplace transform
- 25.6 Stokes' equation and Airy integrals
- 25.7 WKB methods
- 25.8 Approximations to integrals

18 Special functions

- 18.1 Legendre functions
- 18.2 Associated Legendre functions
- 18.3 Spherical harmonics
- 18.4 Chebyshev functions
- 18.5 Bessel functions
- 18.6 Spherical Bessel functions
- 18.7 Laguerre functions
- 18.8 Associated Laguerre functions
- 18.9 Hermite functions
- 18.10 Hypergeometric functions
- 18.11 Confluent hypergeometric functions
- 18.12 The gamma function and related functions

20 Partial differential equations: general and particular solutions

- 20.1 Important partial differential equations
- 20.2 General form of solution

20.3 General and particular solutions
20.4 The wave equation
20.5 The diffusion equation
20.6 Characteristics and the existence of solutions
20.7 Uniqueness of solutions

21. Partial differential equations: separation of variables and other methods

21.1 Separation of variables: the general method
21.2 Superposition of separated solutions
21.3 Separation of variables in polar coordinates
21.4 Integral transform methods
21.5 Inhomogeneous problems – Green’s functions

28 Group theory (time permitting)

28.1 Groups
28.2 Finite groups
28.3 Non-Abelian groups
28.4 Permutation groups
28.5 Mappings between groups
28.6 Subgroups
28.7 Subdividing a group

29 Representation theory (time permitting)

29.1 Dipole moments of molecules
29.2 Choosing an appropriate formalism
29.3 Equivalent representations
29.4 Reducibility of a representation
29.5 The orthogonality theorem for irreducible representations
29.6 Characters
29.7 Counting irreps using characters
29.8 Construction of a character table
29.9 Group nomenclature
29.10 Product representations
29.11 Physical applications of group theory

Course Outcomes:

- By the end of this course, students will:
- Have learned to express a function in Fourier series and conditions under which such an expansion can be made;
- Be able to apply the transform methods to solve ordinary second order differential equations encountered in the physical sciences;
- Have learned the basic elements of complex analysis and its use to compute certain types of integrals;
- Be able to apply special functions in solving relevant problems in physics and astronomy.

Department Approval:

Electronically Approved

Date: 2019-08-30 11:37