



COURSE OUTLINE

1. **Course:** PHYS 435, Mathematical Methods in Physics - Fall 2021

Lecture 01: MWF 12:00 - 12:50 in SA 104

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

In Person Delivery Details:

Lectures will take place online for the beginning of the course and will start in-person on October 25.

Re-Entry Protocol for Labs and Classrooms:

To limit the spread of COVID-19 on campus, the University of Calgary has implemented safety measures to ensure the campus is a safe and welcoming space for students, faculty and staff. The most current safety information for campus can be found [here](#). **Online Delivery Details:**

Some aspects of this course are being offered in real-time via scheduled meeting times. For those aspects you are required to be online at the same time.

To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor's permission.

Live lectures will be delivered on-line via zoom. The lectures will be recorded and posted (or their links) soon after the lecture. Lecture notes, assignments, and solutions for assignments and midterms will be posted on D2L.

Course Site:

D2L: PHYS 435 L01-(Fall 2021)-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; 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 (6)	30%	Sept 24, Oct 08, Oct 22, Nov 05, Nov 19, Dec 3 at 11:59 PM Calgary time
Midterm tests (2)	30%	Out-of-Class exams, October 21, and November 25, 2021.
Final Examination (in-person)	40%	Scheduled by the registrar

The midterms are designed to take 1 hr and 20 minutes but students will be given 2 hrs to complete it. All students will start writing at the same time.

The final exam is designed to take 2 hrs to write but students will be given 3 hrs to complete it. All students will start writing at the same time.

Additional time will be granted to SAS students, and other accommodation will be done on a case-by-case basis in case of conflict or student location in different time zones.

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 will have a final exam that will be scheduled by the Registrar. [The Final Examination Schedule](#) will be published by the Registrar's Office approximately one month after the start of the term. The final exam for this course will be designed to be completed within 2 hours but students will be given 3 hours to complete the 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+.

The University of Calgary offers a [flexible grade option](#), Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not eligible, please visit the following website: <https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade>

4. Missed Components Of Term Work:

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, one possible arrangement is that the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course. This option is at the discretion of the coordinator and may not be a viable option based on the design of this course.

5. Scheduled Out-of-Class Activities:

The following out of class activities are scheduled for this course.

Activity	Location	Date and Time	Duration
Midterm 1	online	Thursday, October 21, 2021 at 6:00 pm	2 Hours
Midterm 2	in-person	Thursday, November 25, 2021 at 6:00 pm	2 Hours

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a conflict with the out-of-class-time-activity, please contact your course coordinator/instructor no later than **14 days prior** to the date of the out-of-class activity so that alternative arrangements may be made.

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.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

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.

- Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten 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 submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [I.1](#) and [I.2](#) of the University Calendar
- 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:

- 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 Services:** For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** 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 (syva@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208). The complete University of Calgary policy on sexual violence can be viewed at (<https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Sexual-and-Gender-Based-Violence-Policy.pdf>)
- d. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional [Code of Conduct](#) and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

[Student Handbook on Academic Integrity](#)
Student Academic Misconduct [Policy](#) and [Procedure](#)
[Research Integrity Policy](#)

Additional information is available on the [Student Success Centre Academic Integrity page](#)

e. **Academic Accommodation Policy:**

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf>

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf>.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the [Request for Academic Accommodation Form](#) and sending it to Dr. David Feder by email phas.ahugrd@ucalgary.ca preferably 10 business days before the due date of an assessment or scheduled absence.

- f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP). 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.
- g. **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.
- h. **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.
- i. **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 assignments in total. Problem sets be due approximately 10-14 days after the date of assignment. Late homework will be penalized 30% 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

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.

Electronically Approved - Sep 06 2021 08:50

Department Approval

Electronically Approved - Sep 07 2021 15:55

Associate Dean's Approval