



COURSE OUTLINE

1. **Course:** PHYS 435, Mathematical Methods in Physics - Fall 2020

Lecture 01: MWF 12:00 - 12:50 - Online

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:

Students are expected to come to campus for some of three of the labs. The in-person labs are listed in section 13.

Online Delivery Details:

This course is being offered online in real-time via scheduled meeting times, you are required to be online at the same time.

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.

Students are expected to come to campus for some of three of the labs, and that the course is not totally online.

Course Site:

D2L: PHYS 435 L01-(Fall 2020)-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 (8)	32%	
Midterm tests (2)	30%	Out-of-Class exams, October 21, and November 25, 2020 - Synchronous
Final Examination	38%	Scheduled by the registrar - Synchronous

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 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:

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, then the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the 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	Wednesday, October 21, 2020 at 6:00 pm	2 Hours
Midterm 2	online	Wednesday, November 25, 2020 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](#)).
- SU Wellness Center:** For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- 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 (svsa@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/policies/files/policies/sexual-violence-policy.pdf>)
- 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. **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.

- f. **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.

- 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 8 assignments in total. Problem sets will usually be assigned on Friday and be due the following Friday, or at a date/time 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.

Electronically Approved - Aug 17 2020 13:58

Department Approval

Electronically Approved - Aug 26 2020 17:15

Associate Dean's Approval