Physics 201 (3 credit hours)
Fall 2023 Semester
Multivariable Calculus and Vector Analysis for Physicists

The instructor reserves the right to revise, alter, or amend this Syllabus as necessary. Students will be notified in writing of any such changes. Updated August 15, 2023.

Logistics

Instructor	Dr. Norman Mannella
Office	Nielsen 210/IAMM 313
Phone	(865) 974 – 6123 (both offices)
Email	nmannell@utk.edu
Lecture Time and Location	M-W-F: 1:50 – 2:40, Nielsen 304
Office Hours	After class, or by appointment

General Course Description

The course focuses on fundamental concepts and develops the ability to work with topics such as line, surface, and volume integrals, differential operators such as gradient, divergence and curl, vectors fields and their flow, conservative fields and potentials. These topics serve as part of the mathematical background that is used in upper division courses such as Classical Mechanics, Electromagnetism, Quantum Mechanics, and their applications covered in elective courses.

Course Objectives

The course objectives are:
1) Introduce students to concepts in multivariable calculus and vector analysis
2) Perform calculations such as multivariable integrals, line, surface, and volume integrals, apply the fundamental theorems of vector calculus
3) Guide students to the implementation of the new math concepts towards the solution of physical problems
4) Improve problem solving skills, develop the ability to use different coordinate systems dictated by the symmetry of the problem

Prerequisites

MATH 142 or 148, i.e. Calc II

List of Topics

Vectors and Geometry of Space: Linear Independence, Bases, Dot and Vector Products, Vector functions.
Functions of several variables: Partial differentiation, Multiple variable integration, Taylor expansion, Maxima/Minima – free and with constraints (Lagrange's multipliers).
Orthogonal Coordinate systems, Curvilinear coordinates.
Parametrization of lines, surfaces and volumes.
Line, Surface and Volume integrals.
The fundamental Theorems of vector calculus.
Nabla operator, Div, Grad, Curl operators in Cartesian and Curvilinear coordinates.
Conservative fields and Potentials.

Textbook

Mathematical methods for Physics and Engineering, by Riley, Hobson, Bence. (Cambridge)

Further reading assignments from other sources will be provided to you on Canvas.

Other suggested sources include
  Calculus – Early Transcendentals, by Stewart, Clegg, Watson. (Cengage)
  Mathematics for Physicists and Engineers, by Weltner, John, Weber, Schuster, Grosjean. (Springer)

Announcements, Lecture Notes, Course Material, and Course Updates

Lectures and Canvas (Online@UT) are my primary modes of communication with the class. Announcements, Lecture Notes, additional Course Material, Homework, solutions to Homework, and Course Updates including definite dates for exams etc. will be posted on Canvas. **Please note that it will be your responsibility to be aware of the content of any communication taking place in class**, be it an announcement or anything related to the course material, in case you are not present. **You are required to have an official UT email address** and read announcements on Canvas and your email on a daily basis. Information that cannot be transmitted to you during the lectures or on Canvas, or any personal communication, will be given to you via email.

Contacting the Instructor

I prefer personal contact to e-mail contact, and therefore encourage you to come to office hours, or schedule an appointment. As another alternative, I am going to be in my office most of the time, if you show up chances are that I might see you, unless I am really in the middle of something. Call me in the office to check. **Anyhow, I strongly encourage you to see me.** As a general rule, I do NOT address homework problems by e-mail. On the other hand, if you have a personal emergency, e-mail is fine. **Do NOT send me emails through Canvas. Send me an email to nmannell@utk.edu.** If you send me an email, please **include "PHYS 201" in the email subject.**

Class Format and Course Material

I will use a combination of lectures, problem solving sessions, and engage you in discussions. **Attendance** is therefore **STRONGLY encouraged**.

This course consists of several components: lectures, homework problems, reading assignments, problem solving sessions. **The material you will be expected to learn and will be tested on during the exams will be taught to you as part of all of these course components**.

Reading Assignments and working out the assigned examples/exercises/problems are a compulsory and vital part of the course. I stress the importance of "Reading": This means carefully working your way through all the parts of the assigned document(s), including examples. You must read carefully and assimilate the concepts, work through the derivations of the equations, follows and work out the examples, and then test your knowledge by doing exercises and problems. This is what "reading" means and this is the meaning of the word in this course. **The lectures will NOT necessarily repeat the material in the textbook**, but will be used to discuss the course material in a variety of ways. Some lectures will follow the textbook, some other will discuss topics not covered in the textbook, and/or discuss them in a different manner. It is extremely important to keep up with the work, since the material builds on itself. Each day, preview the topics for the next class; after class, study the topics in detail and work on the suggested examples/exercises/problems. Make sure to check the Canvas webpage the evening before class. Have a copy of the material on your desk when you attend class.

Homework

There will be approximately 8-10 problem sets, for which you will have to write out full solutions. I generally encourage students to work together as far as homework is concerned. The goal is to use homework

as one of the most effective ways of assimilating the material and practice for Exams. When writing solutions keep in mind that there is also a large difference in sketching a solution and writing up a solution that someone can read. Be clear in your writing! Clearly state the issue or problem, outline the tools needed, and proceed providing information when needed.

You will be notified in Canvas when the HW is available. **Homework will always be collected at the beginning of the class session**, with due date specified on the HW itself and communicated in Canvas when the HW is made available. Your homework grade will be based on the scores of these problem sets.

Each problem will be graded on a 0 - 5 scale (0 = no work, 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent), or similarly if worth more points (e.g. 0 = no work, 2 = poor, etc.). Note that answers, even if correct, not supported by work will received 0 points.

I will give feedback on your work. After the date on which the HW is returned to the class, **you will have 1 week to revise your work and resubmit the HW for a regrade**.

Please note the following policies, which are quite strict:

Make-up problem sets will NOT be given. If there are extremely serious circumstances supported by proper documentation, exception to this policy may be considered at my discretion.

Due dates and time for HW are FIRM. I post all assignments at least one week in advance, so please plan ahead. Problem sets turned in at MOST 2 days late will receive 90% of the maximum score. Your work will receive 0 points if turned in later than 2 days.

A point is a point: this means that different HW sets might have different total scores, and your total score will be given by the sum of the points that you will collect.

For each HW set, I will make available for you a **Forum in Canvas** where you can discuss among yourself. Questions regarding the HW problems may be asked in lecture, during office hours, or in the Forum, but **NOT** by email.

Tests, Midterm, and Final Exam

There will be in-class **short Tests** (approx. 15 min.). These Tests will consist in either conceptual questions about the material, or in the solution of a problem. Tests will be given on the same day as the HW is due. Tests will be given at my discretion, but you should be prepared. A missed Test will receive 0 points. The two lowest scores on the Tests will be discarded.

There will be one **Midterm Exam** (1 hour-long), and one **Final Exam** (2 hours-long).

Both exams are comprehensive, i.e. you will be tested on the whole material covered up to that point. Midterm and Final Exam questions will generally be similar in character to example problems in the books, homework, and example problems discussed in lectures. *If needed,* you will receive a handout containing selected mathematical and physics formulas. The handouts will be posted on Canvas before Midterm and Final Exams.

Appeals

You are welcome to discuss the grading of any given assignment and exams. Appeals must be dropped in my mailbox, with a brief explanation of the issue. Any appeal will be given consideration if it is raised **no later than one week** after the date on which the graded work is made available for return to the class. After this "appeal period" of one week, scores will be considered final and will not be altered.

Grading Policy and Grading Scale

The semester Grade will be based on a Weighted Averages of the scores in the Final Exam, Midterm Exam, Tests, and Homework as follows:

Homework: 15%
Tests: 35%
Midterm Exam: 20%
Final Exam: 30%

The scores will be converted to the grading scale as follows:

> 90	A
86 – 89	A –
80 – 85	B +
75 – 79	B
70 – 74	B –
65 – 69	C +
60 – 64	C
55 – 59	C –
50 – 54	D+
45 – 49	D
40 – 44	D-
< 40	F

Cheating and Plagiarism will not be tolerated

Students are expected to perform all work in conformance with the University policies regarding Academic Honesty. In particular, all work submitted by a student is expected to represent his/her own work. Violation of the Academic Honesty policies will result in disciplinary actions according to the University rules.

Cheating will not be tolerated. Everyone must have an equal chance to do well. The penalty for cheating on any aspect of this course will be an "**F**" for the course.

Plagiarism of any kind will not be tolerated. Working together on homework does not count as plagiarism. A line by line copy of another student's homework does. If you use a source (book, articles, internet material etc.), you must quote it. Use of a source without citation is plagiarism.

Cheating and/or plagiarism cases found to be in Violation of the Academic Honesty policies will result in disciplinary actions according to the University rules, without exception.

A Special Note on the Use of Artificial Intelligence

Everybody, by now, knows about the availability of Artificial Intelligence (AI) and generative AI assistance platforms such as ChatGPT. If you use AI, it is a source, and as such you must quote it. Personally, I do not mind if you use AI, provided that you learn from it. If you use it just to score some points in the HW, it will be nothing but detrimental to your professional preparation. Further details can be found **here.**

Department of Physics and Astronomy Statement on Civility & Community

The Department of Physics & Astronomy at the University of Tennessee is committed to creating an environment that welcomes all people, regardless of their identities. We value the diversity that enriches our department. We understand the importance of free and open dialogue that includes the free exchange of ideas. We do not tolerate uncivil speech or any form of discourse that infringes on others' rights to express themselves, or has a negative impact on their education, or work environment. We actively promote an environment of collegiality and an atmosphere of mutual respect and civility. We understand that respect includes being considerate of others' feelings, circumstances, and their individuality. We recognize the

necessity of a civil community in realizing the potential of individuals in teaching, learning, research, and service. We believe these values extend beyond the department into our work within physics regionally, nationally, and internationally, as well as work and studies in the university, and the broader community. We encourage all members of the department to intervene and report any incidents involving bigotry, or that violate the university code of conduct. http://www.phys.utk.edu/about/civility-community.html 3

Reporting

Anyone who experiences or observes any such incident is encouraged to report it to the Department Head (Prof. A. Del Maestro) or one of the Associate Heads (Prof. M. Breinig). Students can also speak to any faculty or staff member with whom they feel comfortable. Incidents that involve sexual harassment or stalking will be reported to the office of Title IX under mandatory reporting requirements.
http://www.phys.utk.edu/about/civility-community.html 3

University Civility Statement

"Civility is genuine respect and regard for others: politeness, consideration, tact, good manners, graciousness, cordiality, affability, amiability and courteousness. Civility enhances academic freedom and integrity and is a prerequisite to the free exchange of ideas and knowledge in the learning community. Our community consists of students, faculty, staff, alumni, and campus visitors. Community members affect each other's well-being and have a shared interest in creating and sustaining an environment where all community members and their points of view are valued and respected. Affirming the value of each member of the university community, the campus asks that all its members adhere to the principles of civility and community adopted by the campus" https://civility.utk.edu/

Academic Integrity

Each student is responsible for his/her personal integrity in academic life and for adhering to UT's Honor Statement. The Honor Statement reads: "An essential feature of the University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity."

For students with disabilities

Students needing an accommodation based on the impact of a disability should contact me privately to discuss specific needs. Students are also responsible to contact the Office of Disability Services at 865-974-6087 in Hoskins Library to coordinate reasonable accommodations for students with documented disabilities. https://sds.utk.edu/

The University of Tennessee, Knoxville, is committed to providing an inclusive learning environment for all students. If you anticipate or experience a barrier in this course due to a chronic health condition, a learning, hearing, neurological, mental health, vision, physical, or other kind of disability, or a temporary injury, you are encouraged to contact Student Disability Services (SDS) at 865-974-6087 or sds@utk.edu. An SDS Coordinator will meet with you to develop a plan to ensure you have equitable access to this course. If you are already registered with SDS, please contact your instructor to discuss implementing accommodations included in your course access letter

Wellness

The Student Counseling Center is the university's primary facility for personal counseling, psychotherapy, and psychological outreach and consultation services. The Center for Health Education and Wellness manages 974-HELP, the distressed student protocol, case management, the Sexual Assault Response Team, and the Threat Assessment Task Force. https://counselingcenter.utk.edu/ and https://wellness.utk.edu/

COVID-19 Guidelines

Masking -- According to public health authorities, in areas where there is substantial or high COVID transmission, wearing masks in indoor spaces can help reduce transmission of the virus and keep communities healthy. Any individual can choose to wear a mask anywhere on campus, even when it is not required. The university expects everyone to protect others from the spread of COVID-19 and strongly recommends wearing masks in academic and administrative spaces.

For the most current information on masks, please check the COVID-19 website at utk.edu/coronavirus.

Vaccines -- The university recommends that all members of the campus community be vaccinated for their own protection, to prevent disruption to the semester, and to prevent the spread of COVID-19. Vaccination information and appointment signups are available at tiny.utk.edu/vaccine. The Student Health Center medical staff is available to students to answer questions or discuss concerns about vaccines, and the center provides vaccines free of charge for anyone 18 years or older who would like one.

Sickness or Exposure -- If students think they are sick or have been exposed to COVID-19, they should contact the Student Health Center or their preferred health care provider. Students can also contact the university's COVID-19 support team for guidance by filling out the COVID-19 self-isolation form at covidform.utk.edu.

Students are advised not to attend class in-person if they have tested positive for COVID-19 and are in the isolation period, if they have COVID-19 symptoms and have not been cleared by a medical provider, or if they are an unvaccinated close contact in the quarantine period. The university recommends that students and employees stay home anytime they do not feel well. **If you need to miss class for illness, please email me as soon as possible.**

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