Syllabus for MATH 241 - 01, Multivariable Calculus

College of the Holy Cross, Fall 2021

Instructor: Dr. Neranga Fernando

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Office hours: Tuesdays 1pm – 2.30pm (in-person/Zoom), Thursdays 9.30am – 11.00am (in-person/Zoom), anytime I am in my office on Wednesdays (in-person), or by appointment (in-person).

Meeting times and location: MWRF 12:00 - 12:50 pm, Swords 321 (MWF) & Stein 304 (R)

Course Objectives: At the end of this course, students should be able to:
- Extend the techniques of calculus to functions of several variables;
- Visualize 3-dimensional graphs;
- Evaluate limits, extreme values of functions, derivatives and integrals of functions of several variables.
- Apply vector calculus theorems to line and surface integrals.

Textbook: *Multivariable Calculus: Concepts and Contexts*, Fourth ed. (Enhanced) by James Stewart. It is absolutely NOT required that you purchase a printed textbook. You may purchase a code to access WebAssign along with the eBook from the College Bookstore.

eBook   : ISBN-13: 9781337678490
WebAssign: ISBN-13: 9781337775304

Web materials: All class announcements, materials and grades will be posted on Canvas.

Quizzes:

There will be six 15-minute in-class quizzes during the semester. The lowest quiz grade will be dropped.

Here are the dates you will be taking a quiz:
Quiz 1 (September 10), Quiz 2 (September 24), Quiz 3(October 1), Quiz 4 (October 22), Quiz 5 (November 5), Quiz 6 (December 8)

It is strongly advised that you do all of assigned homework since the quizzes will closely resemble the homework problems.

Homework:

Homework will consist of two parts: A written portion and WebAssign.

    1. **Written homework** is due at the beginning of class. If you do not hand them in at the beginning of class, they will be counted as a zero. Even if your work is partially complete, please submit your work. Because partially complete is better than a zero. No written homework grade will be dropped.

Here are the due dates of written homework:

Homework 1 (September 17), Homework 2 (October 20), Homework 3 (October 29), Homework 4 (November 12), Homework 5 (December 3)

You should only submit homework problems with an asterisk, but It is strongly advised that you do all of assigned homework since the quizzes will closely resemble the homework problems. No help from any Internet sources other than those offered by WebAssign is allowed. Plagiarism will not be tolerated and will be treated as a violation of the Departmental Policy on Academic Integrity.

By doing mathematics you learn mathematics. You learn math best when you approach the subject as something you enjoy. Learn to explain mathematics to your classmates. Mathematics can be fun and rewarding when there are people around you who enjoy figuring out problems as much as you do. Take advantage of this opportunity and organize study groups. I will not consider working on homework problems with your classmates as a violation of the academic honesty policy in the department. However, you must prepare and submit your own solutions.

Please follow these guidelines when you submit homework assignments:

- Put your name, the date, and the homework assignment number at the top of the first page.
- Staple multi-page assignments. No paperclips or folded corners.
- Write neatly and show all your work.
- On the last page of your assignment, please write the name(s) of your classmate(s) with whom you work on homework problems (with an asterisk).

2. **WebAssign** is a system used to complete the online component of homework. In order to access WebAssign, you will need a Class Key. The Class Key for MATH 241-01 is **holycross 2180 9746**. If you did not purchase an access code along with a eBook from the College Bookstore, then you will eventually need to purchase one directly from WebAssign. No WebAssign homework grade will be dropped.

Mid-term exams:

There will be two mid-term exams during the semester. The mid-term exams are 90-minute exams; they will be held from 6pm to 7.30pm on Wednesday, October 6 and Wednesday, November 17 at Swords 330. We will typically review for each midterm during class on the same day. No mid-term exam grade will be dropped.

Final exam: There will be a cumulative final exam in this course. Location and time of the final exam are to be determined. **Check for final exam schedule conflicts as soon as possible**.

Snow days: If classes are cancelled due to snow, or for other official reasons, any scheduled quiz or test will occur during next class meeting.

Grading: The course grade will be determined as follows:
Final exam: 25%
Mid-term exams: 40% (20% each)
Quizzes: 15%
Homework: Written 10%, WebAssign 10%

 An incomplete grade is given at the discretion of the instructor.

Calculators: Calculators are NOT permitted on quizzes, mid-term exams and the final exam.

Additional resources:

Brendan Fay is the grader for this course. Brendan's office hours are from 6.30pm to 7.30pm on Tuesdays and Thursdays at Swords 328. You may contact Brendan at jbfay23@g.holycross.edu

There is a tutoring program through Academic Services and Learning Resources (ASLR). Multivariable Calculus is one of the subjects for which students can obtain tutoring. You may discuss homework problems with tutors from ASLR, and I would not consider it as a violation of the academic honesty policy in the department. However, you must prepare and submit your own solutions.

For more information see: https://www.holycross.edu/support-and-resources/academic-services-and-learning-resources

Issues with the course/instructor:

If you have issues with this course and/or instructor which you are not comfortable discussing with your instructor, you should contact the Chair of the Department of Mathematics and Computer Science, Professor Gareth Roberts, at groberts@holycross.edu.

Academic Honesty: Collaboration on quizzes, mid-term exams and final exam is NOT allowed.

A necessary prerequisite to the attainment of the goals of the College is maintaining complete honesty in all academic work. Students are expected to present their own work in exams and in any material submitted for credit. Students may not assist others in presenting work that is not their own. Offenders are subject to disciplinary action. A violation of the Department Policy on Academic Integrity will result in a 0 for that quiz or exam, and a letter describing the occurrence of academic dishonesty will be sent to the Chair of the Department of Mathematics and Computer Science and your Class Dean.

For more on Academic Integrity see: https://www.holycross.edu/academics/programs/mathematics-and-computer-science/node/211581/academic-integrity

COVID-19:

- We are in the middle of a pandemic. Please wear a mask during class time, quizzes, mid-term exams, final exam and office hours.

- If you have any symptoms of illness, please do not attend the class. If you test positive for COVID-19, please do not attend the class even if you do not have symptoms, and please let me know immediately. You may attend office hours via Zoom so I can go over the topics covered in class.

- If I test positive for COVID-19, I will teach and hold office hours via Zoom until I am allowed to be back on campus.

- If classes are switched to remote learning due to COVID-19, I will teach and hold office hours via Zoom until restrictions are lifted.

- If I switch to teaching and holding office hours via Zoom due to an aforementioned situation, I will post all the Zoom links and passwords on Canvas.

- In order to facilitate contact tracing (if needed), I kindly ask that you sit in the same seat for the entire semester.

It is very important to follow the College's guidelines on COVID-19. For College's guidelines on COVID-19 see:

https://www.holycross.edu/2019-novel-coronavirus-covid-19-information/student-resources

Diversity and Inclusion: It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. Any suggestions you have pertaining to diversity and inclusion are encouraged and appreciated.

Important:

1. Any student with special needs is encouraged to meet with me during the first week of classes to discuss accommodations. The student must bring a current Memorandum of Accommodations from the Office of Accessibility Services.

The following is the **link to the Office of Accessibility Services**:

https://www.holycross.edu/health-wellness-and-access/office-accessibility-services

2. Please note that, consistent with applicable federal and state law, this course may be video/audio recorded as an accommodation only with permission from the Office of Accessibility Services. Students are not permitted to record the contents of this class under any other circumstances.

3. If you are an athlete and have conflicts with an important class activity (homework, quiz, mid-term, or final), please let me know in advance.

4. For College's Excused Absence Policy see:

https://catalog.holycross.edu/requirements-policies/academic-policies/#coursepoliciestext

5. All electronic devices (mobile phones, laptops etc.) must be turned off during class time, quizzes, mid-term exams and final exam.

Syllabus: Syllabus is subject to change. It is your responsibility to be aware of any changes I may make to the syllabus as I announce them in class. Students are responsible for all information given when they are absent.

Some Additional Notes:

1. I will hold an additional 3-hour final exam review session the day before (or two days before) the final exam. We will discuss and find a time that works for all of us. I will let you know the location before you go home for Thanksgiving.

2. I will post my past mid-term exams, final exams, and their solutions on Canvas. I will not post solutions to homework problems (without an asterisk) listed on the syllabus. I have given 3+ hours of office hours every week. Please bring all your questions regarding anything discussed in class, lectures notes, homework problems (without an asterisk) or anything posted on Canvas to my office hours. It is your responsibility to attend my office hours if you have any questions.

3. I will hand out problem sheets in class. Since we do not have time to work on all the problems on problem sheets in class, I will post their solutions on Canvas. However, I encourage you all to work on the problems and bring questions to my office hours.

<p style="text-align:center; color:red;">Wishing you all a safe, healthy, happy and successful semester.</p>

Week 1 (partial): September 1 – 3

Section 9.1 Three-Dimensional Coordinate Systems   3, 6, 7, 9, 11, 13, 22, 24, 26, 28, 32, 34, 35, 39

Section 9.2 Vectors 2, 4, 5, 6, 7, 11, 13, 15, 17, 21, 22, 24, 25, 32, 33

Week 2: September 6 – 10

Section 9.3 The Dot Product 1, 3, 5, 9, 11, 13, 15, 17, 21, 23, 27, 31, 33, 35, 37

Section 9.4 The Cross Product 1, 2, 5*, 7, 13*, 19, 21*, 23*, 25, 27*, 29, 31

Section 9.5 Equations of Lines and Planes 1*, 2, 4, 5*, 6, 8, 9, 10, 11*, 13, 15, 17*, 21, 23, 25*, 27, 29, 31, 34, 37, 39, 41, 43, 46, 48, 50, 55

Quiz 1 – Sections 9.1, 9.2

Week 3: September 13 – 17

Section 9.6 Functions and Surfaces 2, 4, 5, 7, 8, 9, 11, 13, 14, 15, 17, 18, 21, 23, 25, 32

Section 9.7 Cylindrical and Spherical Coordinates 1, 2, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 22, 23, 25, 27, 29, 31, 33

Section 10.1 Vector Functions and Space Curves 1, 3, 5, 7, 9, 13, 15, 17, 19, 21, 23, 25, 27, 37, 38, 39, 40

Homework 1 – Sections 9.4, 9.5 (10 problems)

Week 4: September 20 – 24

Section 10.2 Derivatives and Integrals of Vector Functions 3, 5, 9, 11, 15, 17, 19, 23, 25, 30, 31, 35, 40, 45, 46, 47, 48, 49

Section 10.3 Arc Length and Curvature 1, 3, 5, 8, 11, 12, 13, 14, 16, 17, 19, 23, 25, 27, 45, 47, 51, 53

Section 10.4 Motion in Space: Velocity and Acceleration 2, 3, 5, 7, 9, 11, 13, 17, 19, 21, 23, 25, 33, 35

Quiz 2 – Sections 9.3, 9.6, 9.7, 10.1

Week 5: September 27 – October 1

Section 11.1 Functions of Several Variables 2, 5, 7, 9, 11, 15, 18, 19, 21, 22, 23, 25, 27, 28, 29, 35 – 40, 41, 42, 43, 44, 45, 46

Section 11.3 Partial Derivatives 3, 4, 5 – 8, 9, 10, 11, 17, 19 – 47 (odd), 52*, 53, 56, 57, 58, 59, 61*, 63, 65*, 67, 69, 71, 78, 80*

Section 11.4 Tangent Planes and Approximations 1*, 3, 5, 11, 13*, 15, 17, 19*, 22, 23 – 33 (odd), 34, 39, 41, 43, 44

Quiz 3 – Sections 10.2, 10.3, 10.4

Week 6: October 4 – 8

Section 11.5 The Chain Rule 1 – 11, (odd), 13*, 17, 21, 23, 27, 29, 33*, 37, 39, 43*, 45

Review, Mid-Term Exam 1: Section 9.1 – Section 11.4

Section 11.6 Directional Derivatives and the Gradient Vector 1, 2, 4, 6, 7 - 23 (odd), 26, 30, 32, 37 - 43, 47, 50 -53, 55, 57

Week 7: October 11 – 15   Fall Break – no classes

Week 8: October 18 – 22

Section 11.7 Maximum and Minimum Values 1, 3, 5, 7, 9, 11, 13*, 15*, 17*, 27*, 29, 31*, 35*, 37, 39, 41, 43, 45

Homework 2 – Sections 11.3, 11.4, 11.5 (10 problems)

Section 11.8 Lagrange Multipliers (Day 1)   1, 3, 5, 7*, 9*, 11*, 18*, 21, 40, 41

Section 11.8 Lagrange Multipliers (Day 2)   1, 3, 5, 7*, 9*, 11*, 18*, 21, 40, 41

Quiz 4 – Section 11.6

Week 9: October 25 – 29

Section 12.1 Double Integrals over Rectangles   1, 8, 9, 10, 11, 13

Section 12.2 Iterated Integrals   1, 3, 5, 9, 13, 15, 17, 21, 25, 30, 37

Section 12.3 Double Integrals over General Regions   1-9 (odd), 13-31(odd), 36, 41-51(odd), 52, 54, 55, 56, 57, 61, 63, 65

Homework 3 – Sections 11.7, 11.8 (10 problems)

Week 10: November 1 – 5

Section 12.4 Doubles Integrals in Polar Coordinates   1 – 4, 5 – 9, 10, 11, 12, 13, 14, 15*, 16 – 21, 22*, 23, 25, 27, 29*, 31, 33, 35*

Section 12.5 Applications of Double Integrals (Mass and Density) 1*, 2, 3, 4, 5*, 6, 7, 8, 9, 10 (find only mass in problems 3 – 10)

Section 12.7 Triple Integrals   3, 5, 7*, 9, 11*, 13*, 15, 17, 19*, 21, 29, 31, 33, 34, 35, 37

Quiz 5 – Sections 12.1, 12.2, 12.3

Week 11: November 8 – 12

Section 12.8 Triple Integrals in Cylindrical and Spherical Coordinates   1, 3, 5, 6, 7 – 13 (odd), 17 – 25 (odd), 26, 31, 35, 37

Section 12.9 Change of Variables in Multiple Integrals   1 – 11 (odd), 12, 13, 14, 15 – 27 (odd)

Section 13.1 Vector Fields & Section 1, 3, 5, 11 – 18, 21, 23, 25, 29 – 32, 33, 34
13.5 Curl and Divergence   1, 3 – 11 (odd), 12, 13, 15, 17, 19, 21, 22

Homework 4 – Sections 12.4, 12.5, 12.7 (10 problems)

Week 12: November 15 – 19

Section 13.2 Line Integrals 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21*, 33, 39*, 41

Review, Mid-Term Exam 2: Section 11.5 – Section 13.5

Section 13.3 The Fundamental Theorem for Line Integrals (Day 1) 1, 3, 5, 7*, 9, 11, 13, 15*, 17, 19, 21, 23, 25, 28, 29, 31, 32*, 33, 34*

Section 13.3 The Fundamental Theorem for Line Integrals (Day 2) 1, 3, 5, 7*, 9, 11, 13, 15*, 17, 19, 21, 23, 25, 28, 29, 31, 32*, 33, 34*

Week 13 (partial): November 22 – 26

Section 13.4 Green's Theorem   1, 3, 5, 7, 9*, 11*, 12, 13*, 14, 17*, 19

Week 14: November 29 – December 3

Section 10.5 Parametric Surfaces 1, 3, 5, 13 – 18, 19, 21 – 26
Section 12.6 Surface Area   1 – 13 (odd), 14

Section 13.6 Surface Integrals   5 – 31 (odd)

Section 13.8 The Divergence Theorem 1 – 13 (odd), 17, 19, 24

Homework 5 – Sections 13.2, 13.3, 13.4 (10 problems)

Week 15: December 6 – 10

Section 13.7 Stokes' Theorem (day 1)   1 – 9 (odd), 13, 15, 17

Section 13.7 Stokes' Theorem (day 2)   1 – 9 (odd), 13, 15, 17

Quiz 6 – Sections 10.5, 12.6, 13.6

Section 11.2 Limits and Continuity (if time permits) 5, 7, 9, 11, 13, 15, 17, 19, 27, 29, 31, 33, 35, 36, 37

Final Exam Review

The mind is not a vessel to be filled but a fire to be kindled.

— Plutarch