

MA 261: Multivariate Calculus
MTWR 12:30 – 1:20 p.m., CLO 140
Fall 2009, Purdue University Calumet

Instructor: Nicolae Tarfulea

Office: 370 CLO.

Office Hours: MTWR 1:30 pm – 3:00 pm (or by appointment).

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Overview: MA 261 is a four credit course in multivariate calculus for students majoring in mathematics, engineering, chemistry, and physics. Topics include solid analytic geometry, partial differentiation, multiple integrals, and vector fields.

Prerequisites: MA 164 or equivalent preparation with a grade of C or higher.

Textbook: *Calculus, Early Transcendentals*, by Varberg, Purcell and Rigdon, Pearson Prentice Hall, 2007.

General Course Objectives: Upon completion of this course, the student should:

- understand multivariate and vector-valued functions, derivatives, and integrals from graphical, algebraic, and numerical viewpoints.
- understand applications of double, triple, line, and surface integrals
- have enhanced problem-solving skills and reasoning abilities (See objective #4 below.)
- understand the use of appropriate mathematical notation
- be able to communicate coherently concerning multivariate and vector-valued calculus concepts (See objective # 6 below.)

Assessable Course Objectives: Upon completion of the course, the student should:

1. have facility with finding equations of lines and planes in \mathbb{R}^3 .
2. have facility with calculating and interpreting partial derivatives, directional derivatives, and gradients.
3. have facility in calculating double and triple integrals in rectangular, polar, cylindrical, and spherical coordinates along with converting them from one coordinate system to another.
4. have facility with applications of the definite integral including area, volume, and center of mass.
5. be able to parameterize curves and compute line integrals.
6. be able to write a more mature mathematical justification.

Homework: Homework problems will be taken from the Exercise Set following each section of the textbook. Doing daily assignments is essential to being successful in this course. Class time will be devoted

to questions concerning difficulties with homework problems. Keep in mind that sufficient time spent on these assignments (1-2 hours daily) is excellent preparation for quizzes and exams.

Quizzes: The quizzes will be based on the homework assignments. There will be a 25 minute quiz when indicated on the lecture schedule below. The quiz questions will cover the same material as the homework that is due the very same day.

Exams: There will be three midterm exams plus a comprehensive final exam. All exams are to be taken in pencil. If the campus closes due to whatever reason on the day of a scheduled exam, the exam will be given during the next class meeting.

Grades: Your course grade is based on your performance on:

- **Exams:** we will have three **midterm exams** of which the two highest grades together will equally count (20% each) for **40%** of the student's course grade. **Final Exam:** the final exam will count for **30%** of your course grade.
- **Class work:** the remaining **30%** of the grade will be based on **quizzes & homework**.

The course grade will be assigned on a scale of:

- 94% -- 100% **A**
- 89% -- 93% **A-**
- 85% -- 88% **B+**
- 80% -- 84% **B**
- 75% -- 79% **B-**
- 70% -- 74% **C+**
- 65% -- 69% **C**
- 60% -- 64% **C-**
- 57% -- 59% **D+**
- 53% -- 56% **D**
- 50% -- 52% **D-**
- below 49% **F**

Absence from Exams: You must take (at least) two midterm exams. Except in extremely exceptional situations, a student who misses the final exam fails the course. **No make-up exams (or quizzes) will be given.**

Attendance: Daily attendance in MA 261 is expected. If you must be absent for an extended period of time for reasons such as extended illness, please call me to obtain assignments. Excessive absences by any student will result in an administrative withdrawal of that student from the course.

Materials: Textbook, notebook for notes and assignments, pencils, and graphing calculator. MA 261 requires a graphing calculator and a TI brand of graphing calculator (e.g., TI 83, TI 86, TI 89, etc.) is highly recommended. Any student on financial aid may seek reimbursement for the cost of the calculator. If necessary, I will provide a letter stating this purchase is a course requirement.

Students with Disabilities: If you are a student with a documented disability who will require academic/classroom accommodations in this course, please register with the Coordinator of Services for Students with Disabilities in the Student Support Services Office located in the Student Union and Library Building (SUL), Room 341, phone numbers: 219-989-2455, 219-989-2454(voice/TTY) or 219-989-2920.

Extra Help: See me in my office and work with other students.

Academic Honesty: The following is an **Honor Code** and an **Honor Pledge** to which all Purdue University Calumet Students must adhere: “I understand that academic dishonesty will not be tolerated at Purdue University Calumet. I am here to learn. Through learning, I will strive to become a better person and a more valuable contributor to society. I understand that dishonesty in the classroom, through cheating, plagiarism or other dishonest acts defeats this purpose and disgraces the mission and quality of a Purdue University Calumet education. Therefore, I make the following pledge: ‘In accordance with the honor code, I will not engage in dishonesty in my academic activities, and I will not tolerate such dishonesty by other students.’”

Civility: Purdue University Calumet places a priority on student learning. We value the inherent worth and dignity of every person, thereby fostering a community of mutual respect. We believe that in order to achieve these ideals, all Purdue University Calumet students are expected, while in the role as student or representative of the university, to exhibit and practice civil behaviors, defined as behaviors that:

1. **Respect** faculty, staff, fellow students, guests, and all university property, policies, rules and regulations.
2. **Take responsibility** for one’s choices and actions.
3. **Accept consequences** of one’s inappropriate choices and actions.
4. **Communicate** in a professional and courteous manner in all forms, and at all times, whether verbal, non-verbal or written.

Lecture Schedule

(subject to small changes without prior notice)

Date	Section	Homework
Mon 08/31	11.1 Cartesian Coordinates in 3-D	Section 11.1: 6, 8, 12, 14, 26, 40.
Tue 09/01	11.2 Vectors	Section 11.2: 2, 7, 10, 13, 18, 22.
Wed 09/02	11.2 Vectors	Section 11.2: 2, 7, 10, 13, 18, 22.
Thu 09/03	11.3 The Dot Product	Section 11.3: 4, 6, 11, 16, 58, 61.
Mon 09/07	No Class (Labor Day)	
Tue 09/08	Homework 1 due & Quiz 1 11.3 The Dot Product	Section 11.3: 4, 6, 11, 16, 58, 61.
Wed 09/09	11.4 The Cross Product	Section 11.4: 2, 4, 7, 10, 12, 18, 24.
Thu 09/10	11.5 Vector-valued Functions and Curvilinear Motion	Section 11.5: 4, 6, 10, 14, 22, 36, 42.
Mon 09/14	11.6 Lines and Tangent Lines in 3-D	Section 11.6: 2, 6, 10, 14, 22, 25, 29.
Tue 09/15	11.7 Curvature and Components of Acceleration	Section 11.7: 2, 7, 15, 29, 35, 41, 61.
Wed 09/16	Homework 2 due & Quiz 2 11.7 Curvature and Components of Acceleration	Section 11.7: 2, 7, 15, 29, 35, 41, 61.

Thu 09/17	11.8 Surfaces in Three-Space	Section 11.8: 3, 5, 23, 24, 25.
Mon 09/21	11.9 Cylindrical and Spherical Coordinates	Section 11.9: 2, 3, 4, 5, 17, 21.
Tue 09/22	11.9 Cylindrical and Spherical Coordinates	Section 11.9: 2, 3, 4, 5, 17, 21.
Wed 09/23	Review & Homework 3 due	
Thu 09/24	EXAM	
Mon 09/28	12.1 Functions of Two or More Variables	Section 12.1: 3, 23, 27, 33.
Tue 09/29	12.2 Partial Derivatives	Section 12.2: 4, 9, 14, 17, 25, 29.
Wed 09/30	Homework 4 due & Quiz 3 12.3 Limits and Continuity	Section 12.3: 2, 5, 10, 17, 33.
Thu 10/01	12.4 Differentiability	Section 12.4: 2, 9, 11, 16, 20.
Mon 10/05	12.5 Directional Derivatives and Gradients	Section 12.5: 3, 8, 9, 13, 19.
Tue 10/06	Homework 5 due & Quiz 4 12.5 Directional Derivatives and Gradients	Section 12.5: 3, 8, 9, 13, 19.
Wed 10/07	12.6 The Chain Rule	Section 12.6: 2, 5, 8, 19, 23.
Thu 10/08	12.7 Tangent Planes and Approximations	Section 12.7: 1, 3, 6, 13, 17.
Mon 10/12	12.8 Maxima and Minima	Section 12.8: 2, 6, 8, 12, 19, 30, 31.
Tue 10/13	12.8 Maxima and Minima	Section 12.8: 2, 6, 8, 12, 19, 30, 31.
Wed 10/14	Review & Homework 6 due	
Thu 10/15	EXAM	
Mon 10/19	13.1 Double Integrals over Rectangles	Section 13.1: 3, 5, 10, 17, 21.
Tue 10/20	13.2 Iterated Integrals	Section 13.2: 2, 5, 11, 17, 22, 29, 35.
Wed 10/21	Homework 7 due & Quiz 5 13.3 Double Integrals over Nonrectangular Regions	Section 13.3: 1, 3, 6, 15, 19, 21, 27.
Thu 10/22	13.4 Double Integrals in Polar Coordinates	Section 13.4: 3, 5, 7, 19, 23, 33.
Mon 10/26	13.5 Applications of Double Integrals	Section 13.5: 2, 5, 7.
Tue 10/27	13.5 Applications of Double Integrals	Section 13.5: 2, 5, 7.
Wed 10/28	Homework 8 due & Quiz 6 13.6 Surface Area	Section 13.6: 1, 3, 6, 9, 15.
Thu 10/29	13.7 Triple Integrals in Cartesian Coordinates	Section 13.7: 2, 4, 7, 11, 17, 23, 35.
Mon 11/02	13.8 Triple Integrals in Cylindrical and Spherical Coordinates	Section 13.8: 3, 7, 9, 13, 17.
Tue 11/03	13.8 Triple Integrals in Cylindrical and Spherical Coordinates	Section 13.8: 3, 7, 9, 13, 17.
Wed 11/04	13.9 Change of Variables in Multiple Integrals	Section 13.9: 2, 7, 11, 17, 21.

Thu 11/05	Review & Homework 9 due	
Mon 11/09	EXAM	
Tue 11/10	14.1 Vector Fields	Section 14.1: 3, 10, 15, 23.
Wed 11/11	14.2 Line Integrals	Section 14.2: 1, 3, 7, 11, 17, 19, 28.
Thu 11/12	14.2 Line Integrals	Section 14.2: 1, 3, 7, 11, 17, 19, 28.
Mon 11/16	14.3 Independence of Path	Section 14.3: 2, 5, 13, 22, 27.
Tue 11/17	Homework 10 due & Quiz 7 14.3 Independence of Path	Section 14.3: 2, 5, 13, 22, 27.
Wed 11/18	14.4 Green's Theorem in the Plane	Section 14.4: 1, 3, 7, 11, 15.
Thu 11/19	14.4 Green's Theorem in the Plane	Section 14.4: 1, 3, 7, 11, 15.
Mon 11/23	14.5 Surface Integrals	Section 14.5: 2, 5, 8, 9, 13.
Tue 11/24	14.5 Surface Integrals	Section 14.5: 2, 5, 8, 9, 13.
Wed 11/25- Thu 11/26	No Classes (Thanksgiving)	
Mon 11/30	14.6 Gauss's Divergence Theorem	Section 14.6: 1, 3, 5, 9, 19.
Tue 12/01	14.6 Gauss's Divergence Theorem	Section 14.6: 1, 3, 5, 9, 19.
Wed 12/02	14.7 Stokes's Theorem	Section 14.7: 1, 4, 6, 7, 10.
Thu 12/03	14.7 Stokes's Theorem	Section 14.7: 1, 4, 6, 7, 10.
Mon 12/07	Review	
Tue 12/08	Review	
Wed 12/09	Review	
Thu 12/10	Review & Homework 11 due	

EMERGENCY PROCEDURE GUIDES: In the event of...

Fire...

- Know the location of the fire alarms, fire extinguishers and evacuation routes and exits.
- Evacuate when the alarm sounds.
- Help ensure everyone evacuates.
- Assist others during the evacuation.
- Call University Police (2911 if you are using a campus phone or 899.2911) if you or others need assistance or if someone is trapped in an elevator.

Severe Weather...

- Know the location of your Storm Safe Area.
- Listen for announcements via the campus public address system.
- Follow instructions.
- Help ensure everyone is aware and follows instructions.

Medical Emergency...

- Immediately call University Police (989.2911)
- Immediately call 9-911 (if you are using a campus phone or 911 if you are using a cell phone) if an ambulance is needed.

Power Failure...

- If it lasts more than a few seconds...secure your space and go to the first floor.

- Listen for announcements via the campus public address system.
- Follow instructions.
- Help ensure everyone follows instructions.
- REMEMBER...emergency lighting is limited in duration...it is intended to help you evacuate safely...it is not intended to help you keep working.

Elevator Failure...

- If you are trapped, activate the elevator alarm and use the emergency telephone to contact University Police.
- If you hear someone who is trapped in an elevator, reassure them that you will call University Police (989.2911).

Criminal Activity...

- Call University Police (989.2911) immediately if you observe a crime, note a suspicious person or have knowledge of a crime previously committed. The confidential hotline number for reporting suspicion of criminal behavior is 989-2912.

Dangerous Individuals...

- Call University Police (989.2911) immediately if you observe someone demonstrating apparently irrational or harmful behavior.
- Also please take note of the campus resources that are available should you believe that a student may benefit from intervention that could prevent a potential emergency situation:

Dean of Students office: 989-4141

Counseling Center: 989-2366

Hazardous Condition...

- If you see, smell, touch or hear something that is a hazard or has the potential to become a hazard call University Police (989.2911).

Sounds like gunshot...

- Turn off lights to the room.
- Lock or barricade the door.
- Hide where you can't be seen.
- Call the University Police (989.2911)
- Wait for Police to arrive.

WHEN IN DOUBT...CALL UNIVERSITY POLICE AT 989.2911