MATH 251 Multivariable Calculus
Spring Semester 2016

Catalog Data: MATH 251 Multivariable Calculus (4-0) Credit 4. Three dimensional analytic geometry and vectors; partial derivatives; multiple integrals; vector calculus. Prerequisites: Grade of C or better in MATH 156.

Objectives: This third semester calculus course is designed mainly for the students majoring in mathematics, engineering and the sciences. The main objective of this course is to continue the study of calculus, covering mainly three dimensional analytic geometry, differentiation and integration of functions of several variables, and vector calculus. An additional objective is the students development of a deeper insight and sophistication in mathematics.

Outcomes: The Student will be able to:
1. Use equations to describe curves and surfaces in the space. In addition they will be able to find the arc length and curvature of a curve.
2. Perform operations on vectors and use vector functions to describe and analyze the motion of an object in the space.
3. Find domains, limits, and partial derivatives of multivariable functions and apply derivative analysis to geometric problems, approximation problems, and optimization problems.
4. Evaluate double and triple integrals and use them to find the volume, center of mass, moments of inertia and surface area.
5. Evaluate line integrals and surface integrals, understand and use the major theorems in vector calculus (the Fundamental Theorem of Line Integral, Green's Theorem, Stokes' Theorem, and the Divergence theorem).

Instructor: Susan Barton, Ph.D., Professor of Mathematics
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Office/phone: Engineering Lab Building 101H / 304-442-3297
Office Hours: MWF: 8:30-9 and 10 -11; TR 9:30 – 11; R 12-1; MW (MathLab) 2 - 3
Class Meetings: MTWF 12:00 – 12:50 Elab 205
Method: This is a lecture based course meeting 4 times a week. Although a course calendar etc. may be found at community.wvu.edu/~smb031
Resource: Publisher's website at http://stewartcalculus.com/media/10_home.php

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Textbook: James Stewart, *Calculus,* Seventh Edition, Brooks/Cole Publishing Company, 2011. 978-0-538-49781-7

Chapters Covered:
Chapter 12, all sections
Chapter 13, all sections
Chapter 14, all sections
Chapter 15, all sections
Chapter 16, all sections

Topics:

1. Three Dimensional Analytic Geometry and Vectors (16 days):
   a) Three Dimensional Coordinate Systems
   b) Vectors
   c) Dot Product
   d) Cross Product
   e) Equations of Lines and Planes
   f) Quadric Surfaces
   g) Cylindrical and Spherical Coordinates
   h) Vector Functions and Space Curves
   i) Derivatives and Integrals of Vector Functions
   j) Arc Length and Curvature
   k) Motion in Space: Velocity and Acceleration
2. Partial Derivatives (14 days)
   a) Functions of several Variables
   b) Limits and Continuity
   c) Partial Derivatives
   d) Tangent Planes and Differentials
   e) The Chain Rule
   f) Directional Derivatives and the Gradient Vector
   g) Maximum and Minimum Values
   h) Lagrange Multipliers
3. Multiple Integrals (15 days)
   a) Double Integrals Over Rectangles
   b) Iterated Integrals
   c) Double Integrals Over General Regions
   d) Double Integrals in Polar Coordinates
   e) Applications of Double Integrals
   f) Surface Area
   g) Triple Integrals
   h) Triple Integrals in Cylindrical and Spherical Coordinates
   i) Change of Variables in Multiple Integrals
4. Vector Calculus (16 days)
   a) Vector Fields
   b) Line Integrals
   c) The Fundamentals Theorem of Line Integrals
   d) Greens Theorem
   e) Curl and Divergence
   f) Parametric Surfaces and Their Areas
   g) Surface Integrals
   h) Stokes' Theorem
   i) The Divergence Theorem

Grading and Assessment:
   Quizzes/Homework: There will be 5 quizzes and 6 homework assignments for 25 points apiece. I will drop the lowest 3 grades. This thus counts for 200 points (about 23.5%) of your course grade.

Attendance: One point will be assigned for every day that you are in the room when attendance is taken AND you do not use your cell phone or other distracting device in class. This is a participation point and may be taken away at the instructor's discretion. The result will be scaled (if necessary) to 50 points (about 6%) of your course grade.

Exams: Four in class hourly tests, each worth 100 points (about 12%) of your course grade.

Final Exam: A comprehensive final exam worth 200 points (about 23.5%) of the course grade will be given.

NOTE: Only excused absences will enable a student to make up exams. This means that you must have an excuse for the day of the missed exam and every subsequent day until you have made it up. In general quizzes and homework may not be made-up

Course Grade: Grades are assigned according to the following scale:

A – 90 - 100%   (765 – 850 points)
B – 80 -   (680 – 764 points)
C – 70 -   (595 – 679 points)
D – 60 -   (510 – 594 points)
F - below 60%

Borderline grades may be improved based on performance and grade distribution of the whole class.

Calculator Usage: Graphing calculators will be forbidden on most exams and quizzes.

Computer Usage: None   **Reference:** None   **Laboratory Projects:** None
ABET Category Content: Mathematics - Credit 4 or 100%

Academic Integrity:
The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University
regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code
http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code. Should
you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me *before* the assignment is due to discuss the matter.

Social Justice Statement:
"West Virginia University Tech is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran's status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Disability Services (293-6700). "

Disclaimer: The professor reserves the right to make any necessary adjustments and/or modifications to this syllabus.

Monday	Tuesday	Wednesday	Friday
11 12.1	12 12.2	13 12.3	15 12.4
18	19 12.5	20 12.5	22 Quiz/12.6
25 12.6	26 13.1	27 13.2	29 13.3
Feb 1 Review	2 Exam I	3 13.4	5 14.1
8 14.2	9 14.2/14.3	10 14.3	12 14.4
15 14.5	16 14.6/Quiz	17 14.6	19 14.7
22 Review	23 Exam II p1	24 14.7	26 14.8
29 14.8	Mar 1 15.1	2 Exam II p2 then 15.2	4 15.3
7 15.3/15.4	8 15.4	9 15.5	11 15.5/Quiz
14 15.6	15 15.7	16 15.7	18 15.8/Quiz
21	22	23	25
28 Review	29 Exam III (thru 15.7)	30 15.8	Apr 1 15.9
4 16.1	5 16.1/16.2	6 16.2	8 16.3
11 16.4	12 16.4/Quiz	13 16.5	15 16.6
18 Review	19 Exam IV	20 16.7	22 16.7
25 16.8	26 16.9	27 16.9	29 Review

Final Exam Wednesday May 4th from 10:00 – 11:50

Suggested problems
From Calculus, 7th edition, by Stewart
eoo means every other odd.

12.1 1 - 7 odd, 9a, 11 - 17 odd, 19b, 21, 23-37 odd
12.2 1 - 7 odd, 11, 15, 19, 21, 25 - 35 odd
12.3 1, 5, 7, 9, 11, 15, 17, 21, 23, 25, 27, 29, 31, 35, 41, 43, 47, 51
12.4 1, 5, 7, 9, 11, 15, 23, 25, 27, 29, 31, 33, 35, 39
12.5 1, 3, 5, 7, 11-21 odd, 25, 29, 31, 35, 39, 41, 45 - 65 odd,
12.6 1 - 27 odd, 29, 31, 35, 41, 43

13.1 1 - 21 odd, 35, 39
13.2 1 - 25 odd, 29 - 39 odd
13.3 1 - 29 odd, 33, 37, 39, 41
13.4 1 - 27 odd, 31-35 odd,

14.1 1, 5, 7, 9, 11-29 odd, 30, 31, 35-45 odd, 53 - 61 odd
14.2 1 - 9 odd, 13-19 odd, 23, 27-37odd
14.3 1, 3, 9, 13-53 odd, 57, 61, 77
14.4 1, 3, 5, 11, 15, 17, 23-33 odd
14.5 1 - 31 odd, 37, 39, 41
14.6 1 - 25 eoo, 27-31 odd, 39, 41, 47, 49, 53
14.7 1 - 7 odd, 9 - 17 eoo, 27 - 33 odd, 37, 45, 49
14.8 1 - 17 eoo, 19, 25, 33

15.1 1a, 3, 5, 9, 11, 13
15.2 1 - 29 eoo
15.3 1 - 17 odd, 19 - 27 eoo, 31, 37-47 odd, 49, 51
15.4 1 - 31 odd, 33
15.5 1 - 11, 15, 17, 21
15.6 1 -
15.7 1 -
15.8 1 -
15.9 1 -
15.10

16.1 1 - 17 odd, 21, 23, 25, 29, 31
16.2 1 - 21 odd, 25, 31, 33, 39, 41?
16.3 1 - 23 odd, 27 - 31 odd
16.4 1, 3, 7-19 odd, 23, 27
16.5 1 - 21 odd, think about 23-29
16.6 1 - 23 odd, 31, 35, 37, 39
16.7 1 - 27 eoo, 39
16.8 1 - 9 odd, 11a, 13-17 odd
16.9 1 - 15 odd, 19