

ME201 ADVANCED CALCULUS

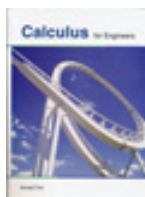
Winter 2017

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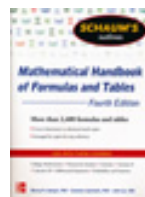
Web Page: <http://www.mhtlab.uwaterloo.ca/courses/me201/index.html>

bookmark this page: you will be expected to use this page regularly for things such as: important dates, course notes, assignments, etc.

Textbooks:



Calculus for Engineers
D.W. Trim
Prentice-Hall, 4th ed., 2008
(same as first year)



Mathematical Handbook of Formulas and Tables, Fourth Edition
M.R. Spiegel, S. Lipschutz, and J. Liu
Schaum's Outline Series, 2013

Supplementary Books: 1) *Advanced Calculus* by R. Wrede and M.R. Spiegel, Schaum's Outline Series
2) *Ebook Schaum's Outline of Advanced Calculus, Third Edition*

Outline: Chapter 11 - Vectors and Three Dimensional Analytic Geometry
Chapter 12 - Differential Calculus of Multivariable Functions
Chapter 13 - Multiple Integrals
Chapter 14 - Vector Calculus
Numerical Methods - least squares curve fits, numerical integration

Assignments: Problems will be assigned weekly, but it is a policy of Mechanical and Mechatronics Engineering that weekly assignments in all courses are not marked. Students are expected to develop the independence and initiative to study on their own. Solutions are available for all assigned problems on the ME201 web page at (<http://www.mhtlab.uwaterloo.ca/courses/me201/assign.html>). It is important that you keep up with the material by doing the problems - **REGULARLY, ON YOUR OWN, BEFORE LOOKING AT THE SOLUTIONS.** To do well in exams, you must develop problem solving skills week by week throughout the term. These skills cannot be developed by cramming lecture notes at the last minute or looking at solution sets for a few hours before exam time. There is simply too much material to learn in this way. Lectures will also mean more to you if you are keeping up as new material is presented.

Projects: Two projects will be assigned during the term. Each student is expected to work on these projects and report their findings on an **individual basis**. Excel can be used for all necessary calculations and plotting.

Tutorials: T.A.'s will work through selected problems and answer questions about lecture material and assignments. They will also provide individual help.

Assessment: Projects 15%
Midterm 35%
Final 50%

For the midterm and the final exams you are permitted to bring your *Mathematical Handbook of Formulas and Tables* plus a crib sheet consisting of one $8\frac{1}{2} \times 11$ sheet of paper; one side only. The preparation of a well structured crib sheet will help in the preparation for exams as you assign priority to what is and is not important.

Projects

Two projects will be assigned during the term that apply concepts learned in class. You are expected to present your analysis and results in clear, concise reports, typed or neatly handwritten. The reports should explain the techniques used, summarize the analysis, describe any problems encountered and present the results. You are expected to provide sufficient detail that clearly demonstrates your understanding of the problems.

- The projects must be completed individually.
- Anyone suspected of copying or cheating will be assigned a grade of zero.
- All projects must be handed in immediately following the lecture period on the Due Date.
- No extensions will be granted.
- Failure to hand the project in on time will result in a grade of zero for that project.

Title		Assigned Date	Due Date	Value
Project #1:	Numerical Integration & Least Squares Analysis	February 6	March 3	7.5%
Project #2:	Volume Integration	March 10	March 24	7.5%

***ME201* Course Schedule**

Week	Days	Topics	Text Sections
1	Jan. 3 - 6	Vectors, Points, Curves & Lines in 3D	11.1, 11.2, 11.3, 11.4
2	Jan. 9 - 13	Vectors and Planes in 3D, Calculation of Distance, Differentiation & Integration of Vectors	11.5, 11.7 11.6 11.9, 11.10
3	Jan. 16 - 20	Tangent Vectors and Arc Length, Curvature and Centripetal Acceleration	11.11 11.12, 11.13
4	Jan. 23 - 27	Introduction Multivariable Functions, Partial Derivatives, Chain Rule and Gradient	12.1, 12.2 12.3, 12.5 12.6, 12.4
5	Jan. 30 - Feb. 3	Directional Derivative, Tangent Lines, Tangent Planes, and Extrema of Functions	12.8 12.9 12.10, 12.11
6	Feb. 6 - 10	Constrained Max/Min Problems, Lagrange Multipliers, Least Squares and Numerical Integration	12.12 12.13 8.7
7	Feb. 13 - 17	Midterm week - no lectures	
8	Feb. 20 - 24	Study Week - no lectures	
9	Feb. 27 - Mar. 3	Double Integrals, Areas & Volumes from Double Integrals	13.1, 13.2, 13.7 13.3, 13.6
10	Mar. 6 - 10	Triple Integrals, Cylindrical & Spherical Coordinates, Moments of Area, Mass & Volume	13.8, 13.9 13.11, 13.12 13.5, 13.10
11	Mar. 13 - 17	Vector Fields, Gradient, Divergence, Curl Operations and Line Integrals	14.1 14.2 14.3
12	Mar. 20 - 24	Independence of Path, Conservative Force Fields & Surface Integrals	14.4 14.5, 14.7, 14.8
13	Mar. 27 - 31	Divergence Theorem and Green's Theorem	14.9 14.6
14	Apr. 3	Stoke's Theorem	14.10

ME201 Recommended Problems

Assignment	Week	Section	Problems
1	Jan. 6	11.3	<i>Assignment #1</i>
		11.4	Vectors, Vector Operations and
		11.5	Vector Representations
2	Jan. 13	11.6	<i>Assignment #2</i>
		11.7	Applications of Vectors and Vector
		11.9	Calculus
		11.11	
3	Jan. 20	11.10	<i>Assignment #3</i>
		11.12	Curvature, Acceleration & Partial
		11.13	Derivatives
		12.1	
		12.3	
4	Jan. 27	12.4	<i>Assignment #4</i>
		12.5	Chain Rule, Gradients, Directional
		12.6	Derivatives, Tangent Lines &
		12.8	Tangent Planes
		12.9	
5	Feb. 3	12.10	<i>Assignment #5</i>
		12.11	Minima & Maxima of Multivariable Functions
6	Feb. 10	12.12	<i>Assignment #6</i>
		12.13	Lagrange Multipliers, Least Squares
		8.7	& Numerical Integration
7	Mar. 3	13.1	<i>Assignment #7</i>
		13.2	Romberg Integration, Double Integration
		13.3	and Surface Area
		13.6	
		13.7	
8	Mar. 10	13.8	<i>Assignment #8</i>
		13.9	Triple Integrals, Volumes,
		13.10	Centroids & Moments
		13.11	
		13.12	
9	Mar. 17	14.1	<i>Assignment #9</i> Vector Fields
10	Mar. 24	14.2	<i>Assignment #10</i>
		14.3	Line Integrals, Conservative Force
		14.4	Fields, Scalar Potential Functions &
		14.5	Green's Theorem
		14.6	
11	Mar. 29	14.7	<i>Assignment #11</i>
		14.8	Surface Integrals, Divergence
		14.9	and Stoke's Theorem
		14.10	