Math 1320-09 Engineering Calculus II

SPRING 2019

Instructor: Qing Xia, Office: JWB 107, Email: xia@math.utah.edu
Teaching Assistant: Dapeng Mu, Office JWB 107, Email: mu@math.utah.edu
Lecture Time and Location: MTWF, 08:35am–09:25am, WEB L110 (MTWH)
Lab Time and Location: Thursday, 07:30am–08:20am (LCB 222) or 08:35am–09:25am (LCB 323)
Office hours: TBA by the instructor and TA

Dates

- Class begins, Monday, January 7, 2019
- Two Midterms, Fridays: Feb. 8, Mar. 29, 2019, WEB L110
- Final: Wednesday, May 1, 2019, 8:00 – 10:00 am, WEB L110
- Last day of class: Tuesday, April 23, 2019
- Martin Luther King Jr. Day: Monday, January 21, 2019
- Presidents’ Day: Monday, February 18, 2019
- Spring Break: Sun-Sun, March 10-17, 2019

Textbook


Homework

- Homework is assigned each lecture and collected weekly. The assignments will be due on Fridays at the beginning of class.
- Late homework is not accepted.
- Homework solutions that are not stapled will not be accepted.
- Homework with spiral bound notebook fringe will not be accepted.
- Solving and writing out solutions to homework problems is where most of your learning will take place. Take pride in your work.

Quizzes

15-20 minutes Quiz will be on each Friday at the end of class (if there is no midterms that day).
Grading Policy

The grades will be calculated as follows: Lab 15%, Lab Attendance 5%, Homework 15%, Quizzes 10%, 2 Midterms 30%, Final Exam 25%.

The grade scale will be: A (93-100), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C+ (77-79), C (73-76), C- (70-72), D+ (67-69), D (63-66), D- (60-62), E (0-59).

There will be no extra credits, partial credits, rounding up, late homework or makeup exams.

Prerequisite

Math 1320 students are required to earn a ‘C’ or better in 1310 to enroll, or they can alternatively be entered by earning a ‘C’ or better in Math 1210 and by being concurrently enrolled in the MATH 1320 “boot camp” that covers the material in 1310 that is missing from the traditional 1210 sequence. Practically speaking, you are better prepared for this course if you have a solid understanding of differentiation, integration, trigonometry, and if your grades in the prerequisite courses were above the ‘C’ level.

Course Description

The course covers essential Calculus for Engineering applications. The course is structured into four lecture hours per week, and one lab hour per week (Thu). Topics covered include integral expressions for moments and work; modeling with first order differential equations; infinite series and sequences; power series and Taylor series; vectors, dot and cross products, and the geometry of space; the calculus of vector functions and particle motion in space; differential calculus for functions of several variables, including partial and directional derivatives, and multi-variable optimization (Chapters 6–11).

Learning Objectives

The goal of Math 1320 is to further master the basic tools for the study of functions, termed the calculus, and become skilled in its use for solving problems in science and engineering. Math 1310 is a prerequisite for Math 1320, and it is expected that Math 1310 content is sufficiently mastered to be able to move forward in 1320. These basic tools and problem solving skills are described below.

- Students will be able to utilize methods of integration to compute volumes of objects with circular-shaped aspects, and compute lengths of curves. These applications introduce a higher-level concept of integration, involving the summation of small volume segments $dV$ or small length segments $ds$, which are computed by performing an appropriate parametrization to a real-number-line integral.

- Students will be skilled in using integration to compute problems important in physics and engineering. Students will know how to compute of an average value of a function using the mean value theorem for integrals, the center of mass for objects, and the computation of work as a force integrated over a distance. Students will also be able to utilize physical laws to formulate differential equations that solve for the motion of masses by forces of gravitation, friction, electrostatics, to name a few. Students will also become familiar with the phenomenon of exponential growth and decay in science and engineering contexts.

- Students will become skilled in computations and applications of infinite sequences and sums. Students will become familiar with the properties of infinite sums to either converge to a finite value or diverge to an infinite value, and will learn about methods to determine convergence. Students will be able to represent functions as series and approximate functions using Taylor’s theorem.
Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- and 3-dimensional coordinate systems, vectors and vector operations including the dot and cross product, and equations of lines, planes, and other surfaces. Students will also learn how to represent motion of objects in 3D using vector functions, how to represent velocity and acceleration using vector projections into tangential and centripetal coordinates of acceleration, and how to characterize curves in space by computing arc length and curvature. For functions of 3D surfaces, students will be able to characterize aspects of surfaces and volumes using partial derivatives and the gradient vector. Partial derivatives will also be used to describe approximating tangent planes to points on surfaces, and how to compute derivatives of multi-dimensional function compositions can be performed using a multi-dimensional version of the chain rule.

Students will be able to read and understand problem descriptions, then be able to formulate equations modeling the problem usually by applying geometric or physical principles. Solving a problem often requires a series of transformations that include utilizing the methods of calculus. Students will be able to select the appropriate calculus operations to apply to a given problem, execute them accurately, and interpret the results using numerical and graphical computational aids.

Students will gain experience with problem solving in groups, be able to communicate effectively about problem objectives and the use of solving methods with peers, and solve problems in a team fashion. Students will also learn how to and articulate questions effectively with both the instructor and TA, and be able to effectively communicate problem solutions through both written and oral deliveries.

Tentative Week-by-week guide of topics and textbook sections
We will adjust pace though the lectures.

• Week 1: Integration applications
  - 6.4: Arc length
  - 6.5: Average values of a function
  - 6.6: Applications of integration to engineering (work/energy integrals)

• Week 2: Sequences and series.
  - 8.1: Sequences
  - 8.2: Series
  - 8.3: Integral and comparison tests for series

• Week 3: Martin Luther King day on Monday. Integral and comparison tests, other convergence tests, power series
  - 8.4: Other convergence tests
  - 8.5: Power series

• Week 4: representing functions as power series, Taylor polynomials and applications;
  - 8.6: Representing functions as power series
  - 8.7: Taylor and Maclaurin series
  - 8.8: Applications of Taylor polynomials
• Week 5: Review of series; Midterm 1

• Week 6: Vectors, Dot Product
  – 9.1: Three dimensional coordinates
  – 9.2: Vectors
  – 9.3: Dot product

• Week 7: Cross Product, Equations of Lines and Planes, Functions and Surfaces,
  – 9.4: Cross product
  – 9.5: Equations of lines and planes
  – 9.6: Functions and Surfaces (cover lightly)
  – 9.7: Cylindrical and Spherical coordinates (cover lightly)

• Week 8: Vector Functions, Arc Length and Curvature
  – 10.1: Vector functions and space curves
  – 10.2: Derivatives and integrals of vector functions
  – 10.3: Arc length and curvature (cover curvature lightly)
  – 10.4: Velocity, acceleration in space

• Week 9: Multivariate functions;
  – 10.5: Parametric surfaces (cover very lightly)
  – 11.1: Functions of several variables

• Week 10: Spring Break;

• Week 11: Partial Derivatives,
  – 11.2: Limits of multivariate functions (cover lightly)
  – 11.3: Partial derivatives
  – 11.4: Tangent planes and linear approximation
  – 11.5: Chain rule

• Week 12: Directional derivatives and gradient vector, optimization.
  – 11.6: Directional derivatives and gradient vector
  – 11.7: Maximum and minimum values

• Week 13: Lagrange, Multivariate integration.
  – 11.8: Lagrange multipliers
  – 12.1: Double integrals
  – 12.2: Iterated integrals

• Week 14: Polar coordinates and applications
– 12.3: Integration on general regions
– 12.4: Polar coordinates

• Week 15: Polar coordinates and applications
  – 12.5: Probability and center-of-mass
  – Review.

• Week 16: review and final exam

Strategies for success

• Attend class regularly.
• Read or at least scan the relevant text book sections and lecture note outlines before you attend class.
• Ask questions and become involved.
• Plan to do homework daily; try homework on the same day that the material is covered in lecture; do not wait until just before homework and lab reports are due to begin serious work.
• Form study groups with other students.

Other Policies

• Cheating: You’ll receive 0 points if caught cheating in homework or exams; The act of cheating in exams will be reported.
• Behavior in class is required.
• Attendance is encouraged in lectures and mandatory for labs.

ADA Statement

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services (CDS), 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and me to make arrangements for accommodations. All information in this course can be made available in alternative format with prior notification to CDS.

Student Responsibilities

All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. You have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, collusion, fraud, theft, etc. Students should read the Code carefully and know you are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.
http://regulations.utah.edu/academics/6-400.php