MATH206A Probability Fall 2021

Course schedule: Mon/Wed 2:00pm-3:20pm
Course location: Skye 284

Instructor: Heyrim Cho, Office: MRB 3114 Email: heyrim.cho@ucr.edu
Office hours: Wed 3:20-4:20am or by appointment

Course description:
This course will provide a mathematical foundation to probability theory, and cover various topics that could be useful to those who want to apply probability in their work. The course will start with an introduction to probability spaces, random variables, and related concepts using measure theoretic approach. Major results in probability theory, such as law of large numbers and central limit theorem, will be derived rigorously. Brief introduction to concepts including Markov chains, Martingales, Brownian Motion will be discussed as time permits.

Note that this course 206A is the first part of a three-term sequence in Applied Mathematics (206B Numerical Analysis, and 206C Methods of Applied Mathematics).

Tentative topics:
Probabilities as Measures
Distribution functions and Random Variables
Expectation and Integration of Random Variables
Independence of Events and Independent Random Variables
The Borel-Cantelli Lemmas and the Kolmogorov 0-1 Law
Laws of Large Numbers (Weak and Strong)
Central Limit Theorem
Conditional expectation and Martingales*
Markov Properties and Markov chains*
Brownian Motion*

*If time permits

Recommended resources (a textbook is not required in this course)**:**
Probability Theory and Examples, by Durrett (https://services.math.duke.edu/~rtd/PTE/PTE5_011119.pdf)
Probability and Measure, by Billingsley (https://www.colorado.edu/amath/sites/default/files/attached-files/billingsley.pdf)
Dr. Kevin Costello's lecture note (will be provided in our course webpage)

Course webpage: canvas (elearn.ucr.edu, course announcements will be made on canvas)

Homework: There will be bi-weekly homework assigned on Wednesdays, and due on the following Wednesdays. Submit homework (scanned pdf or photocopy of handwritten solutions, or typed solutions) via Gradescope.

Exams: There will be one takehome midterm and one final exam.
Takehome Midterm: October 27 (Wed) 3:20pm - October 30 (Sat) 6 pm
Final exam: December 7 (Tues), 7:00pm-10:00pm

Grading policy: homework (40%), takehome midterm (25%), final exam (35%).

Policies on late homework and missed exams: In fairness to all students, homework / takehome midterm submitted after the deadline will not be graded. The makeup policy will be given in accordance with UCR policies. Makeup exam will not be given unless a student can present substantial evidence that an absence was caused by extreme personal or medical emergencies or compelling circumstances beyond the student's control. If the absence is foreseeable, such as religious observation, notice must be given in advance. Written verification (from physician, lawyer, judge, parole officer, etc.) or documentation must be presented at the time of the makeup. Students who do not provide adequate documentation for their absence will not receive a score.

Academic Integrity: All work that you submit must be your own. You are welcomed to discuss the material with each other in a general way, but you may not consult anyone else's written work, drafts, etc. Any marked similarity in form or notation between submissions with different authors will be regarded as evidence of academic dishonesty so protect your work. You must cite any reference you use and clearly mark any quotation or close paraphrase that you include. Such citation will not lower your grade, although extensive quotation might.

Accessibility and Disability Service: Students who require certain examination conditions must register with the office of the Student Disability Resource Center (SDRC):

https://sdrc.ucr.edu/ sdrc@ucr.edu (951) 827-3861

UC Riverside is committed to providing equal access to learning opportunities to students with documented disabilities. To ensure access to this class, and your program, please contact the SDRC to engage in a confidential conversation about the process for requesting accommodations in the classroom. Please provide the documentation and discuss it with me in person within the first week of classes.

Campus Resource:

If you are in need of economic, food, or housing support, you can help at basic needs.ucr.edu. You may be eligible for money to buy groceries via basicneeds.ucr.edu/calfresh. If you are in need of immediate assistance, see the Student Affairs Case Manager at casemanagers.ucr.edu. If you are experiencing mental health issues or need counseling contact CAPS https://counseling.ucr.edu/ (951) UCR-TALK.

Math 206B: Introduction to Numerical Analysis

UC Riverside Winter 2019

Instructor: Weitao Chen, **Office**: Skye 247, **Email**: weitaoc@ucr.edu
Lectures: MWF 10:10-11:00, **Room**: Skye 268, **Office Hour**: MWF 9-10

Textbook: *Numerical Analysis* by R. L. Burden and J. D. Faires

Course Description: This course is an introduction to the numerical analysis. Topics that will be covered are numerical solution of nonlinear equations, numerical linear algebra, interpolation and polynomial approximation, numerical differentiation and integration, IVP and BVP problems for ODE, approximation theory.

Grading Criteria:
• Weekly homework assignments, Written homework and computing projects. Written homework problems, which will be assigned each week, are from the textbook. Computing projects will be assigned for each main topic in which the numerical methods discussed in class are studied in the context of a specific problem from scientific research. The computing projects will involve a combination of numerical simulation and mathematical analysis, 30%
• Midterm examination, given during lecture, closed book written exam with about 4 problems, 30%
• Final examination, given during the final exam time, closed book written exam with about 6 problems, 40%

Main Topics: This outline covers 9 weeks of standard 50-minute lectures. The remaining time may be spent on examinations, reviews, and/or extra time on difficult topics.

1. Numerical solution of Nonlinear Equations.
Chapter 2: Bisection method, Newton's method, fixed-point iteration, steepest descent techniques, Muller's method – 1 week
2. Numerical Linear Algebra.
Chapter 6, 7: Matrix factorization, determination, eigenvalues and eigenvectors, power method. QR algorithm, SVD. —1 week
Chapter 7: Jacobi and Gauss-Seidel iterative methods, conjugate gradient method. – 1 week
3. Interpolation and extrapolation.
Chapter 3: Lagrange polynomials, Hermite interpolation, cubic spline interpolation. – 1 week
4. Numerical differentiation and integration, IVP and BVP.
Chapter 4: Numerical differencing, quadrature rules for numerical integration — 1 week
Chapter 5: Euler's method, Runge-Kutta method for IVP — 1 week
Chapter 11: linear and nonlinear shooting method for BVP – 1 week
5. Approximation theory.
Chapter 8: Least squares method — 1 week
Chapter 8: orthogonal polynomials, Chebyshev polynomials, FFT. – 1 week

Method of Applied Mathematics

Math 206C, Spring 2021

Lectures: MW 12:30pm-01:50pm, via Zoom
Instructor: Jia Gou
Email: jgou@ucr.edu
Office hours: Wednesday 2:00pm-4:00pm, or by appointment.

Course description: This course gives an introduction of basic methods in applied mathematics, including variational methods with examples from mechanics, discrete and continuous dynamic systems, and bifurcation analysis.

Recommended sources (a textbook is not required in this course)**:**

1. I.M. Gelfand and S.V. Fomin, 2000, Calculus of variations, Dover publications, INC.
2. Strogatz, S.H., 2015. Nonlinear dynamics and chaos with applications to physics, biology, chemistry, and engineering, CRC press.
3. Frederick Y.M. Wan, 2017, Introduction to the calculus of variations and its applications, CRC press
4. Yuri A. Kuznetsov, 2004, Elements of applied bifurcation theory, Springer

Tentative list of topics:

Variational methods: functionals, Fundamental lemma of the calculus of variations, Euler-Lagrange equations, invariance of Euler's equation, the general variation of a functional, Hamilton-Jacobi equation, Hamilton equation, eikonals and wavefronts (Week 1-3)

Discrete systems: maps, orbits, fixed points, periodic points, logistic equations, stability of fixed points, invariant sets, Lyapunov exponent (Week 4-6)

Continuous systems: One-dimensional and two-dimensional systems, bifurcations, normal form, basin of attraction, homoclinic and heteroclinic orbits (Week 7-10)

Course webpage: Canvas. (elearn.ucr.edu, course information will be on Canvas.)

Exams: There will be one take home midterm and one final exam.

Midterm: from 6pm on Wednesday Apr 28th to 6pm on Saturday May 1st
Final: 8:00am - 11:00am, Friday, June 11 (as announced by campus schedule)

Homework assignments: There will be 4 bi-weekly homework assignments, including written and coding problems. The assignments will be announced through Gradescope and Canvas

roughly every two weeks on Monday. Matlab is recommended for the coding problems. You may also use other programming languages that you are familiar with. Assignment solutions will be uploaded to Canvas after the due day of the assignments.

Grading policy: 4 homework assignments (15% each), 1 Midterm (20%), 1 Final Exam (20%).

Grading Complaints: If you believe that a problem on a homework or an exam has been graded incorrectly, or that your score was not correctly recorded, you must bring this to the attention of the professor before the date of the final exam and within 7 calendar days of the publishment of the graded assignment and the graded midterms.

Policies on late homework and missed exams: **No** late homework will be accepted, and there will be **no** make-up homework. The makeup exam will be given in accordance with UCR policies. Makeup will not be given unless a student can present substantial evidence that an absence was caused by extreme personal or medical emergencies or compelling circumstances beyond the student's control. If the absence is foreseeable, such as religious observation, notice must be given in advance. Written verification (from physician, lawyer, judge, parole officer, etc.) or documentation must be presented at the time of the makeup. Students who do not provide adequate documentation for their absence will not receive a score.

Academic Integrity: The university places very high importance on honesty in academic work by students. Discussions on homework problems among fellow classmates, teaching assistants or the instructor are welcomed. However, solutions to homework problems will have to be completed **individually**. For questions involving programming, programs code shall be original. As aforementioned, discussions among classmates, teaching assistants or the instructor are welcomed, but **NO** direct copying of the programming code from any source, e.g. from the internet or from a fellow classmate, shall be allowed. Dishonesty will not be tolerated in this course. Please read the student guide for more information:

https://studentdocs.ucr.edu/conduct/uc-riverside_scaip_academic-integrity-student-guide.pdf