COMPLEX SYSTEMS (CSYS)

Courses

CSYS 266. QR: Chaos, Fractals & Dynamical Syst. 3 Credits.
Discrete and continuous dynamical systems, Julia sets, the Mandelbrot set, period doubling, renormalization, Henon map, phase plane analysis, and Lorenz equations. Prerequisite: MATH 122 or MATH 124. CS 020 or CS 021 recommended. Cross-listed with: MATH 266.

CSYS 287. QR: Data Science I. 3 Credits.
Data harvesting, cleaning, and summarizing. Working with non-traditional, non-numeric data (social network, natural language textual data, etc.). Scientific visualization using static and interactive "infographics". A practical focus on real datasets, and developing good habits for rigorous and reproducible computational science. Project-based. Prerequisites: CS 020 or CS 021; STAT 141 or STAT 143 or STAT 211; CS 110 and MATH 122/124 recommended. Cross-listed with: CS 287, STAT 287.

CSYS 300. Principles of Complex Systems. 3 Credits.
Introduction to fundamental concepts of complex systems. Topics include: emergence, scaling phenomena and mechanisms, multi-scale systems, failure, robustness, collective social phenomena, complex networks. Students from all disciplines welcomed. Prerequisite: MATH 301/CSYS 301, calculus, and statistics required. Cross-listed with: MATH 300.

CSYS 302. Modeling Complex Systems. 3 Credits.
Integrative breadth-first introduction to computational methods for modeling complex systems; numerical methods, cellular automata, agent-based computing, game theory, genetic algorithms, artificial neural networks, and complex networks. Semester team-based project. Prerequisite: Graduate standing. Prerequisite: Computer programming in any language; calculus. Linear algebra recommended. Cross-listed with: CS 302.

CSYS 303. Complex Networks. 3 Credits.
Detailed exploration of distribution, transportation, small-world, scale-free, social, biological, organizational networks; generative mechanisms; measurement and statistics of network properties; network dynamics; contagion processes. Students from all disciplines welcomed. Prerequisite: MATH 301/CSYS 301, calculus, and statistics required. Cross-listed with: MATH 303.

CSYS 352. Evolutionary Computation. 3 Credits.

CSYS 354. Deep Learning. 3 Credits.

CSYS 369. Applied Geostatistics. 3 Credits.
Introduction to the theory of regionalized variables, geostatistics (kriging techniques): special topics in multivariate analysis; Applications to real data subject to spatial variation are emphasized. Prerequisite: STAT 223; CS 020 or CS 021; or Instructor permission. Cross-listed with: CE 369, STAT 369.

CSYS 387. Data Science II. 3 Credits.
Advanced data analysis, collection, and filtering; statistical modeling, monte carlo statistical methods, and in particular Bayesian data analysis, including necessary probabilistic background material; a practical focus on real datasets and developing good habits for rigorous and reproducible computational science. Prerequisite: STAT 287 or CS 287 or CSYS 287 or Instructor permission. Cross-listed with: CS 387, STAT 387.

CSYS 390. Internship. 1-18 Credits.
On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

CSYS 391. Master's Thesis Research. 1-9 Credits.
Masters thesis research under the supervision of a graduate faculty member. Prerequisite: Instructor permission.

CSYS 392. Master's Project. 1-6 Credits.
Masters Project under the supervision of a graduate faculty member. Prerequisite: Instructor permission.

CSYS 393. Independent Study. 1-18 Credits.
A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

CSYS 394. Independent Graduate Research. 1-18 Credits.
Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

CSYS 395. Advanced Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.

CSYS 491. Doctoral Dissertation Research. 1-18 Credits.

CSYS 494. Independent Graduate Research. 1-18 Credits.
Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

CSYS 496. Advanced Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.