

## COMPLEX SYSTEMS AND DATA SCIENCE CGS

All students must meet the Requirements for the Certificates of Graduate Study

### OVERVIEW

In complex physical, biological, social and engineered systems, the self-organizing dynamics of interacting entities (be they molecules, cells, genes, bacteria, plants, birds, humans, nanobots, electrical substations, etc.) give rise to emergent system properties (such as consciousness, cancer, global warming, societies, etc.). Fortunately, many essential properties of such systems may be studied, modeled and understood using similar approaches, regardless of the application domain. Learning these cutting-edge complex systems approaches can help students move to the forefront of their field and stand out when competing in a tough job market.

The Certificate in Complex Systems may be earned either in conjunction with or independent of a UVM graduate degree program. In the latter case, credits earned with a grade of B or better may transfer into a graduate degree program following completion of the certificate. All policies regarding transfer credit apply.

### SPECIFIC REQUIREMENTS

#### Requirements for Admission to Graduate Studies for the Degree of Certificate of Graduate Study

A Bachelor's degree and prior coursework in calculus, statistics, and computer programming (in any language, but prior Python is helpful) are the minimum prerequisites. Linear algebra is recommended but not required. Specific electives may have additional prerequisites.

#### Minimum Degree Requirements

The Certificate of Graduate Study in Complex Systems requires a total of 15 credits, distributed as shown below:

| Requirement Description                    |                                 | Credits |
|--|---------------------------------|---------|
| CSYS/MATH 6701                             | Principles of Complex Systems I | 3       |
| CSYS/CS 6020                               | Modeling Complex Systems I      | 3       |
| CSYS 5870                                  | Data Science I - Experience     | 3       |
| or STAT 5870                               | Data Science I - Experience     |         |
| or CS 5870                                 | Data Science I - Experience     |         |
| Complex Systems and Data Science Electives |                                 | 6       |

6 credits of approved Complex Systems and/or Data Science Electives taken at the graduate level. These include all courses at the 5000- or 6000-level with a CSYS prefix, many courses with a CS, Math, or Stat prefix, and miscellaneous relevant domain-specific courses in areas such as engineering, public administration, biology, plant biology, physics, etc. All electives must be approved by the graduate coordinator.