

## GEOGRAPHIC INFORMATION SCIENCE

### THE FACULTY

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### MASTER OF SCIENCE IN GEOGRAPHIC INFORMATION SYSTEMS (GIS)

The Master of Science in Geographic Information Systems (GIS) degree is designed for professionals and recent university graduates seeking to enhance their knowledge of the analysis, management, and communication of geographic information. It combines the development of strong technical skills and in-depth understanding of geographic information science and theory.

### LEARNING OUTCOMES

Upon completion of this program, students will be able to

- understand the spatial aspects of an external client's needs and develop a practical project plan for addressing these needs
- design, compile, and develop a spatial database and a set of analytical tools into a system appropriate to solve a geospatial problem
- demonstrate a mastery of geographic analysis and cartographic skills
- Effectively communicate and present project results in oral, written, and graphic forms.

### ENTRANCE REQUIREMENTS

Minimum requirements for entrance include

- A bachelor's degree or equivalent in any field.
- Two letters of recommendation confirming the applicant's potential for success in the program.
- Competence in speaking and writing English. Students for whom English is a second language must demonstrate competence by submitting a Test of English as a Foreign Language (TOEFL) score above 550 written (210 computer-based. Internet-based minimum of 80 with no section score lower than 18). Alternative internationally recognized tests such as International English Language Testing System (IELTS) overall score at band 6.5 or above may be considered equivalent.
- Analytical and technical aptitude demonstrated through appropriate coursework, professional experience, Graduate Record Examination (GRE) or similar test scores, or letters of recommendation.

### PROGRAM STRUCTURE

The one-year program consists of 10 months of coursework and the undertaking of a Major Individual Project (MIP). Each of the six terms is seven weeks in length and the annual schedule allows for two three-week breaks. Student cohorts begin each year in September and January.

The two-year program consists of up to 12 seven-week terms, with corresponding three-week breaks as in the one-year program.

Each of the first four seven-week terms includes both core courses and a variety of elective courses. Students not only learn the critical theoretical foundations and the cutting-edge technologies, but also explore broader issues related to effective and appropriate application of the technology. A menu of short workshops (GIS 660) is offered throughout the program to provide opportunities for students to

selectively focus their attention on one of the many major themes in GIS, specific application areas, or advanced theory topics.

Each of the first four terms includes one or more intensive multi-day, instructor-led course(s) from the current Esri software training curriculum that supplement the regular theory and technology courses. GIS colloquia are offered during the year. These colloquia give students exposure to cutting-edge research and developments in GIS and an opportunity to hear from some of the most well-known GIS scholars and managers.

All students are required to undertake a Major Individual Project (MIP) that applies GI Technology and/or Science to a problem of their choice. This is the professional equivalent of an academic masters thesis. The Project Course series (GIS 69X) is directed toward building students' skills in project design and implementation.

Opportunities for projects come from University of Redlands Faculty, organizations in the region, or from students' former, current, or future employers. Students begin developing their MIP topics during the beginning of the GIS 69X series and make gradual progress toward completing the MIP by the end of their program, be it one year or two. Before graduating, all students must successfully pass an oral defense of their project work before their Advisory Committee and submit an approved extended written report on the work completed. Students are also required to make an oral presentation and a poster presentation of their MIP before an audience of their peers and colleagues in the discipline of their project.

#### PROGRAM REQUIREMENTS

Master of Science 38 credits

The Master of Science degree requires 38 credits at the graduate level, which are comprised of 10 credits of core courses, 20 credits of elective courses, and 8 credits of Major Individual Project. Elective courses can be taken in the form of regularly offered electives, GIS workshops, topics courses that are offered from time to time by GIS-related faculty, University of Redlands School of Business GIS-focused electives, or by individualized study, the focus of which is determined by GIS faculty.

#### COURSES:

##### CORE COURSES: 10 CREDITS

- GIS 611 Fundamentals of Geographic Information, Research, Techniques & Applications (4)
- GIS 691 Project Concept & Scope (2)
- GIS 692 Project Management (4)

##### ELECTIVES: 20 CREDITS

- GIS 660 GIS WORKSHOPS (1-4)
- GIS 661 TOPICS COURSES(S) (1-2)
- GIS 662 Geographic Database Management Systems (4)
- GIS 663 Data Remote Sensing and Image Analysis (4)
- GIS 669 GIS for the Web (4)
- GIS 665 Geospatial Analysis (4)
- GIS 666 Projections and Coordinate Systems (2)

- GIS 667 Programming for GIS (2)
- GIS 668 Communicating Geographic Information (2)
- GIS 630 GIS Professional Practice (2)
- GIS 671, GIS 672, GIS 673 Individualized Study (1–2)
- GISB 691 Project Concept and Scope (2)

#### PROJECT COURSES: 8 CREDITS

- GIS 695 Project Implementation (2)
- GIS 696 Project Completion (6)

The most current information about the curriculum, entrance requirements, and application procedures is available on the program's website at [www.msgis.redlands.edu](http://www.msgis.redlands.edu) or by contacting the program office at (909) 748-8128 or by e-mail at [msgis@redlands.edu](mailto:msgis@redlands.edu).

#### MASTER OF GEOGRAPHIC INFORMATION SYSTEMS (MGIS)

The Master of Geographic Information Systems (MGIS) degree is designed for professionals and recent university graduates seeking to enhance their knowledge of the analysis, management, and communication of geographic information. It combines the development of strong technical skills and in-depth understanding of geographic information science and theories.

#### LEARNING OUTCOMES

Upon completion of this program, students will be able to

- demonstrate understanding of the principles underlying spatial analysis in all its variations,
- demonstrate mastery of high level skills in spatial analysis and geospatial problem solving,
- communicate and present project process and outcomes effectively,
- demonstrate competency in the use of various geospatial software and applications.

#### ENTRANCE REQUIREMENTS

Minimum requirements for entrance include

- a bachelor's degree or equivalent in any field
- two letters of recommendation confirming the applicant's potential for success in the program
- competence in speaking and writing English. Students for whom English is a second language must demonstrate competence by submitting Test of English as a Foreign Language (TOEFL) scores above 550 written (210 computer-based. Internet-based minimum of 80 with no section score lower than 18). Alternative internationally recognized tests such as International English Language Testing System (IELTS) scores at band 6.5 or above may be considered equivalent
- analytical and technical aptitude demonstrated through appropriate coursework, professional experience, Graduate Record Examination (GRE) or similar test scores, or letters of recommendation

#### PROGRAM STRUCTURE

The program consists of 8 months of coursework and the undertaking of an internship of 360 hours. Each of the four terms is seven weeks in length and the annual schedule allows for one three-week break. Student cohorts begin each year in September and January.

Each of the first four seven-week terms includes both core courses and a variety of elective courses. Students not only learn the critical theoretical foundations and the cutting-edge technologies, but also explore broader issues related to effective and appropriate application of the technology. A menu of short workshops (GIS 660) is offered throughout the program to provide opportunities for students to

selectively focus their attention on one of the many major themes in GIS, specific application areas, or advanced theory topics.

Each of the four terms includes one or more intensive multi-day, instructor-led courses from the current Esri software training curriculum that supplement the regular theory and technology courses. GIS colloquia are offered during the year. These colloquia give students exposure to cutting-edge research and developments in GIS and an opportunity to hear from some of the most well-known GIS scholars and managers.

All students are required to take project courses and a professional GIS internship that applies GI Technology and/or Science within a professional practice (GIS 697). The GIS Internship is directed toward enhancing students' skills in building GIS applications and solving geospatial problems.

## PROGRAM REQUIREMENTS

Master of GIS 38 credits

The Master of GIS degree requires 38 credits at the graduate level which are comprised of 10 credits of core courses, 20 credits of elective courses, and 8 credits of GIS Internship. Elective courses can be taken in the form of regularly offered electives, GIS workshops, topics courses that are offered from time to time by GIS-related faculty, University of Redlands School of Business GIS-focused electives, or by individualized study, the focus of which is determined by GIS faculty.

## COURSES

### CORE COURSES: 10 CREDITS

- GIS 611 Fundamentals of Geographic Information, Research, Techniques & Applications (4)
- GIS 691 Project Concept & Scope (2)
- GIS 692 Project Management (4)

### ELECTIVES: 20 CREDITS

- GIS 660 GIS Workshops (1-4)
- GIS 661 Topics Courses(s) (1-2)
- GIS 662 Geographic Database Management Systems (4)
- GIS 663 Remote Sensing and Image Analysis (4)
- GIS 669 GIS for the Web (2)
- GIS 665 Geospatial Analysis (4)
- GIS 666 Projections and Coordinate Systems (4)
- GIS 667 Programming for GIS (2)
- GIS 668 Communicating Geographic Information (2)
- GIS 630 GIS Professional Practice (2)
- GIS 671, GIS 672, GIS 673 Individualized Study (1-2)
- GISB 691 Project Concept and Scope (2)

### GIS INTERNSHIP: 8 CREDITS

- GIS 697 GIS Internship (3-8)

The most current information about the curriculum, entrance requirements, and application procedures is available on the program's website at [www.msgis.redlands.edu](http://www.msgis.redlands.edu) or by contacting the program office at (909) 748-8128 or by e-mail at: [mgis@redlands.edu](mailto:mgis@redlands.edu).

## COURSE DESCRIPTIONS (GIS)

### 611 Fundamentals of Geographic Information, Research, Techniques & Applications. (4).

Provides students with the foundation of theoretical and applied skills in GIScience and technology. Students work on a progression of tasks and assignments focused on GIS data collection, manipulation, analysis, output, and presentation. The assignments reinforce the GIS theory and technology concepts introduced through lectures and discussion.

Prerequisite: enrollment in MS GIS or MGIS program or by permission of the instructor.

Numeric grade only.

### 630 GIS Professional Practice. (2).

Provides student exposure to advanced research and innovative developments in geographic information science and systems and the opportunity to hear presentations from GIS researchers, analysts, developers, and managers who live in or visit the Redlands region. Participation in both annual Esri User Conference and GIS colloquia is required.

Prerequisite: enrollment in MS GIS or MGIS program or by permission of the instructor.

Credit/no credit only.

### 660 GIS Workshops. (1–4).

Topic-oriented workshops in various GIS applications will be offered for the students to choose “cafeteria style.” Approximately 10 workshops will be offered per calendar year and students are required to attend a minimum of four workshops during the term of their program.

Prerequisite: enrollment in MS GIS or MGIS program or by permission of the instructor.

Credit/no credit only.

### 661 Topics in GIS. (1–2).

Designed to reflect curriculum trends and emerging GIS technology.

May be repeated for degree credit, given different topics, for a maximum of 4 credits.

Prerequisite: enrollment in MS GIS or MGIS Program or by permission of the instructor.

Offered as needed.

### 662 Geographic Database Management Systems (4).

Provides fundamental theoretical knowledge about information systems, in general, and the unique demands for managing spatial data. Introduces information systems theory and best practices, system design and architecture, and data modeling. Practice application of database theory and methods builds understanding of modern GIS technology.

Prerequisite: GIS 611 or by permission of the instructor.

Numeric grade only.

### 663 Remote Sensing and Image Analysis. (4).

This course discusses the principles of remote sensing and image analysis. It introduces image data format, acquisition, and interpretation. Additionally, the course covers the subject of electromagnetic radiation principles, remote sensing sensor characteristics, image data classification, and photogrammetry.

Prerequisite: GIS 111 or by permission of the instructor.

Numeric grade only.

665 Geospatial Analysis. (4).

This course surveys a wide range of analytical methods and techniques commonly applied to geospatial data. Both data-driven (exploratory data analysis) and model-driven (testing hypothesis) approaches are included. Major topics include point pattern analysis, spatial autocorrelation, spatial regression models, network analysis, and field analysis.

Prerequisite: GIS 611 or by permission of the instructor.

Numeric grade only.

666 Projections and Coordinate Systems. (2).

This course explores map projections and coordinate systems. We will study the principles and properties of several of the common map projection families, spherical/geographical coordinate systems, and SPC and UTM planar coordinate systems, all within the ArcGIS and GeoCart software environments.

Offered as needed.

Numeric grade only.

667 Programming for GIS. (2).

Introduction to programming concepts necessary for GIS: writing simple statements, organizing code, handling user interaction, and incorporating decision-making logic in code. Introduction to object-oriented programming concepts: methods, properties, and event-driven programming.

Prerequisite: GIS 611 or by permission of the instructor.

Numeric grade only.

669 GIS for the Web. (2).

Practices the skills needed to create GIS

applications for the Web and other networks. Through hands-on projects, students will create their own Web GIS application; in-depth discussions of issues that affect Web GIS from network and security concerns to design for focused and effective Web applications.

Prerequisite: GIS 611 or by permission of the instructor.

Numeric grade only.

668 Communicating Geographic Information. (2).

Begins with basic theory of cartographic and graphic data as it applies to GIS data. Explores GIS data models to support mapping and various advanced applications of cartographic methods, including multivariate mapping, multi-scale mapping, cartographic visualization including mixed virtual reality, animated and interactive mapping, and Web mapping.

Prerequisite: GIS 611 or by permission of the instructor.

Numeric grade only.

671, 672, 673 Individualized Study. (1–2).

Individualized study courses of 1–2 credits offered for students to design their own course of study in a particular GIS topic.

Prerequisites: enrollment in MS GIS or MGIS Program and approval of the instructor.

Credit/no credit only.

691 Project Concept and Scope. (2).

The objective of this course is to initiate the concept and scope of the student's Major Individual Project (MIP). Students will identify their project client and topic, conduct preliminary research on the topic and write a background paper outlining previous research and studies on their topic.

Prerequisite: enrollment in MS GIS program, or by permission of Program Director.

Numeric grade only.

692 GIS Project Management. (4).

Students will learn project management skills involved in a GIS project, including developing a project plan, conducting systems analysis and design, and executing a GIS project through construction and deployment. The assignments include writing assignments corresponding to each phase of a GIS project.

Prerequisite: GIS 691.

Numeric grade only.

695 Project Implementation. (2).

This is the fifth course in the Project Series designed to assist the student with implementation of the GIS solution for their MIP.

May be repeated for degree credit.

Prerequisite: GIS 694 and enrollment in MS GIS program.

Credit/no credit only.

696 Project Completion. (6).

The final term of the program is spent completing the Major Individual Project (MIP). A defense, public presentation, and extended report are required.

Prerequisite: GIS 695 and enrollment in MS GIS Program.

Numeric grade only.

697 GIS Internship. (3-8).

Internship and academic work under faculty. May be repeated as internship. May span across semesters.

Prerequisite: GIS 691 and enrollment in MGIS program, or by permission of Program Director.

Credit/no credit only.