

2 February 2021

TO: Faculty Senate

FROM: Paul Loikith, Chair, Graduate Council

RE: M.S. in Geographic Information Science

The following proposal has been approved by the Graduate Council and is recommended for approval by the Faculty Senate.

You may read the full text of the program proposal, as well as Faculty Budget Committee comments, at the [Online Curriculum Management System \(OCMS\) Curriculum Dashboard](#).

**PROPOSAL SUMMARY FOR
College of Liberal Arts and Sciences
M.S. in Geographic Information Science**

Effective Term: Fall 2021

Overview of the Program

Geographic information science (GIS) is an emergent geospatial discipline generating substantial attention in consumer markets, industry, and education. The U.S. Department of Labor considers geospatial technology a high growth industry. A National Science Foundation report published in 2011 identifies geospatial technology as a core tool of our society. That needs to become as fundamental to our education system as reading, writing and arithmetic. In response to the increasing demand for GIS education, PSU offers more than 20 regular GIS courses that support graduate and undergraduate programs, including a graduate GIS certificate program and a Geography GIS minor. The Master of Science in GIS program provides a new pathway for those who are seeking a new career or want to enhance their existing career in GIS. The MS in GIS Program enables PSU to meet the increasing demand for GIS education and trains students for successful entry into or advancement in the geospatial workforce. In addition to serving as a stand-alone master's program, the MS in GIS Program is intended to be stackable for students who want to begin their GIS training in the Graduate GIS Certificate Program.

Evidence of Need

The global GIS market is expected to reach \$17.5 billion by 2023, according to Prescient & Strategic Intelligence. The vibrant GIS industry in the Portland metropolitan region offers great GIS career opportunities regionally and nationally. PSU graduate GIS certificate program admits around 30 students annually. We also see the increase in undergraduate GIS minor students. The MS in GIS could attract new post-baccalaureate students and provide an advanced GIS training for existing graduate and undergraduate GIS students.

The GIS certificate students are very likely to continue with the MS in GIS program because of the "stackable" design of the MS in GIS program. In addition, Portland metropolitan regions are the home to many major GIS companies, such as Quantum Spatial Inc and ESRI R & D Center Portland, many mid-size GIS consultant companies, and federal government agencies. More counties and cities in the region also are seeking to enhance their GIS capacities as a result of the coordinated efforts done at the state level by the Oregon Geospatial Enterprise Office and at the tri-county region by Metro. There is a major demand for advanced, graduate-level GIS training

from employees in the regional private and public sectors. Additional demographic information and market research is available in the full proposal.

Course of Study

The student will plan a program of study with an adviser and other members of the supervisory committee during the first term of residence (the first term after admission to the program). The program of study must include a minimum of 45 graduate credits. Of these, a minimum of 32 graduate credits must be in geography, to include 6 credits of GEOG 509 (GIS Practicum), 12 credits of core geography courses, 8 credits in core GIS competency courses, 4 credits in non-GIS, topical courses, at least 8 credits from one of the five specialized geospatial data science focus areas, and 7 elective credits to meet the 45 credits required by the program.

Students in the program must complete a project-based practicum. The practicum requires the presentation of the student's practicum project into a topic approved by the student's graduate committee, which may include a community partner. The practicum represents an original contribution to knowledge in the field of GIScience and normally involves working with a community partner. A final oral presentation of the project and a project report are required for completion of the degree.

The Geography Department follows the University requirement for minimum and continuous enrollment.

The program consists of coursework in the following areas:

Core Geography courses (12 credits)

GEOG 522 Research Design 4cr

GEOG 591 Professionalism in GIS 2cr

GEOG 572 Critical GIS 2cr

GEOG 592 Geographic Information Systems II: Advanced GIS 4cr

Core GIS Competency courses (choose 2 courses - 8 credits)

GEOG 575 Digital Compilation & Database Design 4cr

GEOG 590 GIS Programming 4cr

GEOG 597 Advanced Spatial Quantitative Analysis 4cr

Non-GIS, Topical courses (4 credits)

4 credits of graduate level non-GIS courses (with approval of the committee)

Specialized geospatial data science focus area (at least two courses in one of the areas below)

- Remote sensing & digital image analysis
 - GEOG 580 Remote Sensing and Image Analysis 4cr
 - GEOG 581 Digital Image Analysis I: Introduction 4cr
 - GEOG 582 Digital Image Analysis II: Advanced Remote Sensing 4cr
 - GEOG 577 (new course title and credit) Photogrammetry and LiDAR 2cr
- Cartography & geovisualization
 - GEOG 584 Cartographic Applications of GIS 4cr
 - GEOG 585 Map Design and Production 4cr
- Computer & information sciences
 - CS 520 Object-Oriented Programming 3cr
 - CS 547 Computer Graphics 3cr
 - CS 549 Computational Geometry 3cr

- CS 554 Software Engineering 3cr
- GEOG 575 Digital Compilation & Database Design 4cr
- GEOG 590 GIS Programming 4cr
- GEOG 595 Maps, Models, and GIS 4cr
- Spatial statistics & quantitative methods
 - ESM 566 Environmental Data Analysis 4cr
 - ESM 567 Multivariate Analysis of Environmental Data 4cr
 - GEOG 597 Advanced Spatial Quantitative Analysis 4cr
- System and data science
 - CS 541 Artificial Intelligence 3cr
 - CS 542 Advanced Artificial Intelligence: Combinatorial Games 3cr
 - CS 543 Advanced Artificial Intelligence: Combinatorial Search 3cr
 - CS 545 Machine Learning 3cr
 - SYSC 514 System Dynamics 4cr
 - SYSC 525 Agent Based Simulation 4cr
 - SYSC 527 Discrete System Simulation 4cr
 - SYSC 531 Data Mining with Information Theory 4cr
 - SYSC 535 Modeling & Simulation with R and Python 4cr
 - SYSC 540 Introduction to Network Science 4cr
 - SYSC 552 Game Theory 4cr
 - SYSC 575 AI: Neural Networks I 4cr

GIS Practicum (6 credits)

GEOG 509 Practicum

Electives (7 credits or take the number of credits to reach 45 credits required by the program)

Graduate level GIS courses or seminars (or other courses approved by the committee). The list below includes some courses that could be used as electives.

G 525 Field GIS 4 cr

GEOG 507 SEM: Speaker Series 1cr

GEOG 576 (new course) 3D Terrain Analysis & Visualization 2cr

GEOG 589 Building a GIS Database with GPS 4cr

GEOG 594 GIS for Water Resources 4cr

Other emergent geospatial technology topics offered as seminars or 510 may be approved for the focus area or as electives.

Students might need to complete additional CS courses to meet the prerequisite requirements of the CS courses. Please check with the instructor before registering for the course.

Minimum credits: 45 credits