The Minor Program in Geographic Information Sciences is designed to give students the technical skills needed to acquire, manage and analyze geospatial data. Almost everything we do involves geospatial information such as deciding where to live and travel. Influenced by computer technology, the academic discipline of geographic information science includes such areas as geospatial visualization, remote sensing, big geospatial data handling, mobile GIS, and web mapping among others, and has evolved dramatically in the past few decades. The fields of GIS-computer systems that manage and analyze different forms of digital geospatial data, and remote sensing-the science of obtaining geographic information from aircraft and satellites, have been growing at an extraordinary rate. Digital cartography has revolutionized traditional cartography to vastly improve map making and visualization of geographic information in a multimedia environment. Students in the minor program will receive extensive training in all of these exciting areas and join the next generation of geospatial scientists. These skills are in great demand in fields such as environmental, sustainable development, urban planning, governmental sectors, military intelligence, engineering, modeling, and computer science related fields.

### Strongly Suggested:

**Foundation Courses.** These courses do not count towards the minor but are suggested (choose one)

- **Developing Countries:** GEOG 130 [or other approved courses]
- **Natural Disasters:** GEOG 140 [or other approved courses]
- **Introduction to Methods of Geospatial Intelligence and Analysis:** GEOG 170

### The Curriculum: 15 credit hours

**Technical core courses (6 cr):**

- GEOG 372 (3 cr) **Remote Sensing.** Principles of remote sensing in relation to photographic, thermal infra-red and radar imaging. Methods of obtaining quantitative information from remotely sensed images emphasizing the study of spatial and environmental relationships.
- GEOG 373 (3 cr) **Geographic Information Systems.** Characteristics and organization of Geographic data; creation and use of geospatial databases; metadata; spatial data models for thematic mapping and map analysis; use of geographic information systems in society, government, and business. Practical training with use of advanced software and geographic databases.

**Quantitative course (3 cr):**

- GEOG 306 (3 cr) **Quantitative Methods for Geographic and Environmental Sciences.** Essentials in the quantitative analysis of spatial and other data, with a particular emphasis on statistics and programming. Topics include data display, data description and summary, statistical inference and significance tests, analysis of variance, correlation, regression, and some advanced concepts, such as matrix methods, principal component analysis, and spatial statistics. Students will develop expertise in data analysis using advanced statistical software.*

**Advanced Technical Courses (Choose 2):**

- GEOG 416 (3 cr) **Conceptualizing and Modeling Human-Environmental Interactions.** Develops skills to carry out research that integrates environmental and economic aspects of sustainability by introducing extensively used quantitative tools for analyzing human-environmental interactions in the field of ecological economics. These include, e.g., index number calculations and decomposition analysis, Environmental Kuznets Curve (EKC), environmental input-output analysis and life-cycle analysis, and multi-criteria decisions aid (MCDM).
- GEOG 473 (3 cr) **Geographic Information Systems and Spatial Analysis.** Analytical uses of geographic information systems; data models for building geographic data bases; types of geographic data and spatial problems; practical experience using advanced software for thematic domains such as terrain analysis, land suitability modeling, demographic analysis, and transportation studies.
- GEOG 475 (3 cr) **Computer Cartography.** Advanced skills of computer mapping using more sophisticated software packages. Map projection evaluation and selection, coordinate system conversion, techniques of quantitative thematic mapping, map design and generalization, hypermedia and animated cartography. Emphasis on designing and making cartographically sound sophisticated thematic maps.
- GEOG 476 (3 cr) **Object-Oriented Computer Programming for GIS.** Expands on conceptual and practical aspects of programming for geographic applications. The focus of this course is to provide students more advanced programming in object oriented programming languages (i.e. Python). In addition, students will develop a proficiency in applying these advanced programming principles to manipulating spatial data sources within the Geographic Information Systems (GIS).
- GEOG 498I (3 cr) **Data Structures for Geospatial Computing.** The aim of the course is to familiarize the student with the fundamentals of geospatial representations, such as spatial indexes and network data structures, and with techniques for manipulating geospatial information for geographic information systems, for spatially-based decision systems and location-based services. The main topics will be vector-based map representation and querying techniques, manipulation, and analysis of terrain models, network representations for applications to road networks and social networks, scalable representations for big geospatial data. Students with some programming background will highly benefit from this course.

### Admission to the Program:
There are no special requirements for the Geographic Information Science Minor Program. Geographic science methods are applicable to many diverse fields, such as agriculture, marketing, environmental science, archaeology, homeland security, and more. The Department of Geographical Sciences welcomes students from every area of study.

### Requirements:

- All credits for the minor must be taken in the Department of Geographical Sciences at the University of Maryland, College Park.
- All courses must be completed with a grade of 2.0 or better.
- No more than six credits are to be included in the minor and student's major, supporting courses, and college requirements.
- Must complete 15 credits in Geography

Application form attached, return to Advising Office, Lefrak 2181M.

Email: geog-advice@umd.edu
Phone: 301-405-4073
Department of Geographical Sciences  
University of Maryland, College Park

**MINOR APPLICATION**  
MINOR IN GEOGRAPHIC INFORMATION SCIENCE (GIS)

**NAME OF STUDENT_______________________________________________________**

**UNIVERSITY I.D. NUMBER__________________________________________________**

**MAJOR______________________ SEMESTER DECLARED: ___________**

**TELEPHONE WHERE YOU CAN BE REACHED DURING THE DAY_______________________**

**E-MAIL________________________________**

**EXPECTED DATE OF GRADUATION______________________________**

**REASON WHY DECLARING GIS MINOR (EXPAND ON YOUR SELECTION)?**

**FRIENDS__________     CLASS________      INSTRUCTOR______      WEBSITE ____________**

**JOB POTENTIAL___________   CURRICULUM STRUCTURE________________________**

**OTHER_______________**

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**COURSES COMPLETED TOWARD MINOR (15 credits)**

**Technical Core (6 cr)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
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<tbody>
<tr>
<td>GEOG 372</td>
<td>3</td>
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<tr>
<td>GEOG 373</td>
<td>3</td>
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**Advanced Technical (6 cr)**

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<th>Course Code</th>
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<tbody>
<tr>
<td>GEOG 416, 473, 475, 476, 498I, other ___</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 416, 473, 475, 476, 498I, other ___</td>
<td>3</td>
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</table>

**Quantitative (3 cr)**

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<th>Course Code</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>GEOG 306, other*</td>
<td>3</td>
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</tbody>
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*GEOG306; credit only granted for: BIOM301, BMGT230, CCJS200, ECON321, EDMS451, GEOG306, GVPT422, INST314, JOUR405, PSYC200, or SOCY201

**REMEMBER: STUDENT MUST ACHIEVE A “C-” OR BETTER IN EACH COURSE APPLIED TO THE GIS MINOR.**

**FOR GEOGRAPHY MAJORS: A MAXIMUM OF 6 CREDITS CAN OVERLAP WITH YOUR MAJOR.**

****COURSES COMPLETED IN ONE MINOR MAY NOT BE USED TO SATISFY THE REQUIREMENTS OF ANOTHER MINOR.**

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**SIGNATURE OF STUDENT ___________________ DATE ____________**

**SIGNATURE OF GEOGRAPHICAL SCIENCES ADVISOR ___________________ DATE ____________**

**THIS STUDENT HAS COMPLETED ALL THE REQUIREMENTS FOR A MINOR IN GEOGRAPHIC INFORMATION SCIENCES (GIS).**