Handbook for

Professional Science Master’s in

Geographic Information Systems

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Certificate in Geographic Information Systems

Department of Geography and Urban Studies, Temple University

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Welcome to the graduate program of the department of Geography and Urban Studies (GUS). This Handbook is designed for current students in the PSM in GIS program. The Handbook will help you plan and undertake your individual program of study and meet the specific requirements of the degree program. Some of the rules are department specific, and this Handbook is your best source for this information. Other rules emanate from the College of Liberal Arts (CLA), where the department is located, or the Graduate School, which is the body that guides all graduate education at Temple University in all its colleges and departments.

PSM in GIS Overview
The Professional Science Master’s in Geographic Information Systems (GIS) at Temple provides students with a) a conceptual understanding of core and advanced GIS concepts, b) advanced training in high-demand GIS skills, and c) professional development to prepare them to be competitive on the GIS job market in Philadelphia and beyond. Students pursue a curriculum that provides advanced training in GIS, as well as professional development opportunities through an internship experience and additional exposure to “real world” scenarios. The program ensures ongoing professional relevance through regular communications with an advisory board of GIS professionals and through interactions with program mentors from local industries and government agencies. The program aims to place students in competitive and relevant GIS-oriented jobs.

The program requirements of the PSM in GIS include core courses in GIS fundamentals, spatial database design, application development, cartographic visualization, advanced spatial analysis, and GIS ethics and practice. The curriculum also includes an array of electives, such as web and mobile applications, remote sensing, and applications-based courses. Additionally, all students will be required to complete either a GIS capstone or internship as a culminating experience.

Professional Science Masters (PSM)
The professional science master’s degree (PSM) is a professional degree program that provides students with advanced training for a job in technology-based companies, governmental agencies, and non-profit organizations. The PSM emerged in response to both industry need and student requests for professional programs to receive advanced training in the sciences and has grown rapidly since 1997. PSM programs are designed to dovetail into present and future professional career opportunities. There are currently over 235 PSM programs in the United States, and the National Professional Science Master’s Association (NPSMA) provides a platform for developing, promoting, and strengthening PSM

1 National Professional Science Master’s Association website: http://www.npsma.org/

2 Professional Science Master’s (PSM) Degree & National Professional Science Master’s Association Overview. This document provides a useful overview of information on the PSM, including program objectives, guidelines, examples, benefits, and statistics: http://www.npsma.org/assets/documents/psm_npsma_overview2011.pdf
programs nationwide. Additional information about the PSM degree program can be found at http://www.npsma.org/.

Curriculum and Program Objectives

Several recent efforts within academia, industry, and government have sought to reveal the competencies and knowledge areas required for GIS employment, as well as standardize GIS educational content and professional preparation for GIS careers. These include efforts by the University Consortium for Geographic Information Science (UCGIS; www.ucgis.org) Geographic Information Science and Technology (GIS&T) Body of Knowledge,3 The U.S. Department of Labor Geospatial Technology Competency Model,4 and the National Geospatial Technology (GeoTech) Center’s Developing a Curriculum (DACUM) geospatial industry job analysis report.5 Also, the GIS Certification Institute (GISCI; www.gisci.org), the leading certifying body for the GIS profession, has developed an exam to complement its current portfolio-based certification.6 This exam is intended to capture the basic competencies required for employment across all GIS industry sectors. Future specialized GIS industry certifications, such as those being developed around geospatial intelligence and GIS management, are likely to extend from this base exam.

We leverage these previous efforts and have used them as a guide in designing a curriculum that instructs students in the primary competencies and knowledge areas required for a career in GIS, and prepares them for the GISCI certification exam.

The primary goal of the PSM in GIS is to graduate students who are competitive on the GIS job market for an array of GIS-related jobs in industry, government, and non-profit organizations based on their conceptual understanding and practical skills in GIS, professional development, and understanding of the field of GIS. Specific program outcomes include:

- A solid grasp of fundamental GIS concepts, as well as cutting edge and recent trends in GIS

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3 The Geographic Information Science and Technology Body of Knowledge document is available on the following website: http://www.aag.org/galleries/publications-files/GIST_Body_of_Knowledge.pdf

4 The Geospatial Technology Competency Model can be viewed at the following website: http://www.careeronestop.org/competencymodel/pyramid.aspx?GEO=Y

5 The full DACUM geospatial industry job analysis report is available at the following link: DACUM: http://www.geotechcenter.org/Resources/Publications/Inventory-of-Geospatial-Workforce-Competencies-for-GIS-Remote-Sensing

6 Additional information about the GISCI exam is available at the following website: http://www.gisci.org/News/NewsDetail/tabid/171/ArticleId/8/GISCI-Exam-Development-Press-Release.aspx
• Preparation to become a certified geographic information systems professional (GISP)  
• An in-depth understanding of GIS ethics and ethical practices in business  
• Strong communication skills for everyday interactions and professional presentations  
• An understanding of recent trends in the GIS profession (e.g. demand for GIS practitioners)  
• Ability to work independently and in teams  
• Leadership and management skills  

Degree Requirements for the PSM in GIS  
30 Credits total  
The degree program can be completed on a full- or part-time basis. Full-time students can complete the program in one calendar year. Part-time students are expected to complete the program in 3 years. Students must complete 7 required core courses (21 credits) and 3 elective courses (9 credits) to graduate.  

Courses  
Required Core Courses (7 courses, 21 credits)  

**GUS 5061 Cartographic Production** This course presents advanced approaches to design and production of thematic maps.  

**GUS 5062 Fundamentals of GIS** This course prepares students with the knowledge necessary to effectively use GIS software packages, and covers fundamental principles such as spatial data models, database management systems, network modeling and geo-coding, and basic vector and raster operations.  

**GUS 5162 Advanced Statistics for Urban Applications** This course teaches advanced statistical methods to examine urban processes and patterns. The course covers spatial point pattern analysis, multivariate regression, logit and probit regression, spatial econometrics, Geographically Weighted Regression (GWR), and hierarchical linear modeling.  

**GUS 8066 GIS Application Development** This course is designed to introduce tools for application development in Geographic Information Systems, covering basic and advanced GIS programming concepts and tools. At the end of this course, students will be able to demonstrate competency in object

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7 A certification in GIS makes job candidates more competitive on the job market and may provide them with access to additional jobs that require the certification. The website for the GIS Certification Institute follows: [http://www.gisci.org/](http://www.gisci.org/)
oriented programming, as well as the tools we will use to develop this competency (VBA and ArcObjects). Topics covered basics of GIS customization, basics of object oriented programming, Visual Studio programming, Python programming, and Web GIS programming.

GUS 8067 Spatial Database Design The focus of this course is on the design and management of spatial databases. Topics covered include the database design process, spatial storage and access methods, relational and object-relational database models, and spatial query languages. Students will learn fundamental spatial database design concepts as well as their implementation and application within geographic information systems (GIS). Emphasis is placed on developing skills necessary for management of both desktop and enterprise-wide GIS databases.

GUS 8068 GIS Ethics and Professional Practice The focus of this course is on the ethical use and application of spatial data and geographic information systems and technologies. Topics covered include overviews of the geospatial industry and GIS profession, issues of spatial data sharing, the maintenance of privacy, and laws applicable to spatial data and GIS. Students will learn about the primary GIS industry sectors and professional organizations, and the codes of ethics and codes of conduct associated with being a GIS professional. A variety of case studies presenting ethical issues relating to the ethical use and application of spatial data and GIS are presented and discussed throughout the semester as a vehicle for exploring issues of ethics and professional practice.

GUS 9187 GIS Capstone Students engage in a structured internship experience (140 hours during the semester), identified with the guidance of PSM faculty at Temple and a prospective employer. The student will complete a GIS-oriented project during the internship that draws on the GIScience and professional skills developed through the PSM curriculum. Student performance will be evaluated based on three criteria: 1) employer report of student performance during the internship, 2) student presentation of project, and 3) student-submitted report of project. The projects will be presented to PSM faculty and students at the conclusion of the semester and reports will be made available to employers and members of the Advisory Board.

Electives (3 courses, 9 credits)

GUS 5066 Environmental GIS Geographic Information Systems are widely used to investigate environmental processes and to develop solutions to environmental issues. This course will build upon concepts introduced in Fundamentals of GIS to investigate how the techniques, data, and interpretations from GIS analysis are applied across a variety of environmental fields. Topics to be covered include natural hazard vulnerabilities, global climate change, renewable energy potential, environmental health, and conservation. The course structure will consist of lecture, class discussion, and GIS-based lab activities. Students will be expected to read academic and professional literature and to actively participate in and lead class discussions. Students will also be expected to develop a final project on an environmental topic.
**GUS 5065 Urban GIS** Assuming basic familiarity with Geographic Information Systems, this course focuses on applying GIS techniques to the study of such processes as urban sprawl, socioeconomic change, and ecological functioning of urban regions.

**GUS 5069 GIS for Health Data Analysis** Geographic Information Systems (GIS) has emerged as an essential tool for health researchers and practitioners. This course provides an introduction to the most common geographic methods utilized in health research and spatial epidemiology for mapping and analyzing health disparities, disease risk factors, health services and geographic variation in health outcomes and disease. Through lecture and laboratory exercises students will learn how to create and edit spatial data, create disease maps, develop neighborhood-based measures, conduct geographic cluster detection and point pattern analysis, map geographic health disparities, measure access to health services, and critically assess potential study bias introduced from missing geographic data or positional accuracy. Selected case studies will be presented in order to highlight methods and techniques and hands-on experience will be gained through laboratory exercises and real-world applications.

**GUS 8068 Web and Mobile Applications** In this course, students will explore theoretical and practical concepts of Web GIS (Internet GIS). From theoretical perspective they study about advantages and techniques for publishing, visualizing and accessing maps on Internet including architecture of Web GIS/Web mapping systems, markup languages (e.g. HTML, XML, SVG and GML), a scripting language, screen cartography, data sharing and geoportals, spatial web services and OGC standards. From practical perspective they will learn to develop WebGIS/Web mapping applications including static and interactive web mapping systems. They also learn and work with some famous open source software and libraries for developing a Web GIS.

**GUS (Special Topics) Environmental Remote Sensing** This course will teach the basic principles of environmental remote sensing using aerial photography and satellite imagery. Topics covered include the mechanics of aerial photography and satellite remote sensing systems, photointerpretation, image rectification, and image processing and classification. Emphasis will be on urban and environmental applications.

**GUS (Special Topics) Geovisualization** Maps can be powerful devices for communication, but also tools for exploration of relationships among social and physical processes manifesting in space. This course will focus on this dual purpose of maps as tools for visual communication and visual thinking. You will learn traditional principles of cartography such as layout, typography, and color; principles of statistical visualization; how to use maps interactively for exploratory analysis; and how to take what you have discovered and construct maps that argue for your conclusions. We will make Heavy use of free and open source software.

*Students must request permission from the Assistant Director of the PSM in GIS to take additional electives outside the department (e.g. Computer Science, Criminal Justice, Public Health).*
Sample Full-time curriculum

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
<th>Summer I</th>
<th>Summer II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamentals of GIS* (3)</td>
<td>Advanced Statistics for Urban Applications* (3)</td>
<td>Web and mobile applications (3)</td>
<td>GIS Capstone* (3)</td>
</tr>
<tr>
<td>Cartographic Production* (3)</td>
<td>Spatial Database Design* (3)</td>
<td>GIS Ethics and Professional Practice* (3)</td>
<td>Environmental GIS (3)</td>
</tr>
<tr>
<td>GIS Application Development* (3)</td>
<td>Environmental Remote Sensing (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 9 credits</td>
<td>Total: 9 credits</td>
<td>Total: 6 credits</td>
<td>Total 6 credits</td>
</tr>
</tbody>
</table>

**Total credit hours: 30**

*required core courses (21 credits)

The degree program can be completed on a full- or part-time basis. Full-time students can complete the program in one calendar year. Part-time students are expected to complete the program in 3 years.

**Transferring credits**

If a student has taken a graduate level course in our program or elsewhere, we can accept up to 6 credits towards the PSM. If the courses were taken at Temple, no credits need to be transferred because they will appear on the transcript. If the courses were taken at a different institution, the student will need to complete the Transfer of Graduate Credit form.

https://www.temple.edu/grad/forms/

If a student has completed the undergraduate section of Fundamentals of GIS (GUS 3062), they will not be able to accept that credit towards the PSM and will need to substitute a different course.

The Program Director is required to approve all electives that are not included on the list.

Students in the GIS graduate certificate program (see below) may apply all 12 credits if they apply and are accepted to the program when they are enrolled in their 12th credit.

Students can double-count classes between our MA in GUS and our graduate GIS certificate. If they complete their MA in GUS having taken the 12 credits of the certificate as their electives, they receive the certificate upon graduation.
GIS Certificate

Our certificate is a 12-credit/4 course program to provide students who have completed an undergraduate degree with advanced GIS skills. This certificate program may be of interest to current graduate students at Temple from across the university in fields such as Public Health, Sociology, and Environmental Science. The program will also be of interest to non-matriculated students and professionals seeking to enhance their GIS skills. Students will be required to take one core course (GUS 5062: Fundamentals of GIS) and can choose the remaining three courses from an approved GIS elective. This flexibility will allow students to gain the skills that are most relevant to their course of study and/or professional interests.

Advising

**PSM:** The Assistant Director of the PSM in GIS will advise students throughout their degree and help students determine their class schedule each semester, answer general questions about the program, and help the student define their research focus in the program. The Assistant Director will meet with new students at the end of their first semester in the program to give them a chance to discuss any problems and to ensure that they are making good progress toward completion of the degree.

**Certificate:** Certificate students should contact the Assistant Director of the PSM for advising.
Standards and Assessment

The program abides by the graduate school’s standards for scholarship:

- A student who receives more than two grades below "B-" or more than one grade of "F" is dismissed for failure to maintain satisfactory grades. (02.24.11.02)

- A minimum cumulative GPA of 3.0 is required in order to graduate. (02.24.11.03)

- To remain in Academic Good Standing at Temple University, a non-matriculated or matriculated graduate student must achieve a term GPA of at least 3.0 for each term and maintain a cumulative GPA of at least 3.0 for all work completed at Temple University. The policy on Academic Good Standing operates in conjunction with Graduate School Policy 02.24.11.02 concerning substandard grades. (02.24.11.05)

Incomplete: An instructor may assign an Incomplete ("I") to a student who does not complete all coursework assuming that 51 percent of the course work has been completed, the instructor agrees to issue an incomplete, and the instructor and student sign a contract. The "I" may be changed to a letter grade if the student completes the coursework within one calendar year. The student must file a contract with the faculty member of record stating what outstanding work remains to be completed. The faculty member must sign the contract and retain it in the student’s permanent departmental file. All work must be completed, graded, and the change of grade card filed with the Office of Academic Records within one calendar year of the assignment of the Incomplete. The default grade will become permanent if work is not completed per the contract or within one year of the assignment of the Incomplete grade. A student who receives a Permanent Incomplete and wishes to receive credit for that course is required to re-register, pay tuition, and retake that course to receive a grade.

Leaves of absence: A graduate student may request a leave of absence from the Graduate School if s/he is unable to continue studying for a period of time. However, students should note that the Graduate School rarely grants more than four semesters of leave and only in exceptional circumstances. Also, students should recognize that taking a leave of absence does not affect the time limits for completing degrees. To apply for a leave of absence, the student must first obtain supporting signatures on the official form from his/her Advisor and the department’s Graduate Director (the form is accessible on-line at www.temple.edu/grad/forms/index.htm).

Academic grievance procedure: When graduate students believe their academic work has been judged unfairly and need help to resolve this complaint, they should try first to communicate with the instructor whose judgment they believe to be unfair and/or with the department’s Graduate Director.

A student must initiate the grievance procedure no later than the semester following the completion of the course from which the grievance has arisen. Formal grievances will be processed only during the Fall and Spring semesters of the academic year. The grievance process occurs in stages:

Stage I: The student prepares a written statement of the grievance, provides supporting documents (like copies of the student's work), and identifies his/her preferred remedy. The student gives copies of
this material to the instructor, the Graduate Director, and the department chair. The instructor should respond in writing within one week of receiving the grievance.

Stage II: If the complaint is not resolved to the student's satisfaction during Stage I, the student may then write a letter of appeal to the department chair, again providing supporting documents. This letter of appeal with documentation is forwarded to the department's Graduate Committee. (Should any of the committee members be involved in the dispute, the department chair will appoint another member to replace that person.) The Graduate Committee may choose to interview any or all parties to the dispute. It may also request one or more faculty members (not involved in the dispute) to evaluate work where the assigned grade is contested. The Graduate Committee drafts a written statement of its findings and sends that statement to the student and the instructor.

Stage III: If the complaint is not resolved to the student's satisfaction during Stage II, the student may forward all of the relevant documents, including his/her letter of appeal, to the Associate Dean for Graduate Affairs in the College of Liberal Arts, who will insure that the complaint is reviewed at the College level and convey the results to the student.

The CLA Graduate Grievance Procedure is online at:
http://www.cla.temple.edu/students/graduate/grievances/.
**Student Services**

**Computer resources:** As soon as a student registers for classes, Temple University Computer Services will assign her or him an AccessNet ID. This can be used to send and receive email, use the BlackBoard learning management system, connect to the Temple library, including its electronic databases, use OWLnet and TUPortal, and make full use of Temple’s computer resources. To learn how to obtain a AccessNet ID, see https://accounts.temple.edu/selfcare/createLogin.jsp or call 215.204.8000 for help. Students are also eligible to enroll in free computer training seminars that cover subjects such as basic word processing, using BlackBoard, constructing websites, and using digital cameras. For information about these computer seminars, see https://computerservices.temple.edu/technology-training.

**Health services:** Once students have paid the Student Health Services Fee, they may use Temple’s Student Health Services to get basic care, both routine and to address accidents or illnesses. This is not a full-service medical facility, and paying the Health Services Fee does not provide you with health insurance, since it does not cover many medical costs like specialists or hospital visits. For information about Health Services, see http://www.temple.edu/studenthealth/. Students are also eligible to obtain free Counseling Services at Temple to address a wide variety of personal, psychological, or emotional issues. To find out about free Counseling Services, see www.temple.edu/counseling.

**Health insurance:** Graduate students who are not otherwise insured can pay to enroll in a Student Health Insurance plan offered by Temple. Students can find out about the cost and extent of this insurance coverage by consulting the University’s Human Resources office at http://www.temple.edu/hr/. Graduate students who serve as Teaching Assistants or Research Assistants under the TUGSA contract have the benefit of being able to enroll in a health insurance plan that is largely subsidized by Temple University. See www.tugs.org for more information.

**Student union:** Graduate students at Temple University may choose to join the Temple University Graduate Student Association (TUGSA), a union that represents their interests and working conditions. To learn more about TUGSA, see www.tugs.org.

**Transportation and parking:** Temple’s Main Campus is served by excellent public transportation provided by the Southeastern Pennsylvania Transportation Authority (SEPTA). SEPTA operates buses as well as the Broad Street subway line that stops at the intersection of Broad Street and Cecil B. Moore Avenue. SEPTA also runs regional commuter trains that bring passengers from all over the region to a station only two blocks from Temple’s Main Campus. (See http://www.septa.org).

Students who drive to campus may gain access to gated parking lots either by purchasing parking passes or paying cash to use Visitor Parking. For information about using university parking lots, see www.temple.edu/parking.

**Housing:** Graduate students have a wide range of affordable housing options. Detailed descriptions and information about cost and availability of on campus housing can be obtained from the Office of University Housing (215-204-7184). Information about off campus housing options can be obtained from the university’s coordinator of off campus housing (215-204-3279), http://housing.temple.edu/.

In seeking housing, students will want to consider access to the main campus which is 2 miles north of Center City (i.e., downtown). Classes are normally held in the late afternoon and early evening at the Main Campus. Faculty offices, library resources, and class rooms where most teaching assistants offer
courses, are on the main campus. The main campus is easily accessible by public transportation (bus and train) and has sufficient fee-based parking lots.

**Disability resources and services:** If a student has a disability (either physical or learning), they should strongly consider registering with Disability Services before they request an accommodation in their studies. Typically, the Office of Disability Services will require letters from a health care provider before a student can register. Once registered, students may request that the Office of Disability Services make recommendations to instructors regarding such things as increased time to complete assignments, or exemption from foreign language requirements. Disability Services will keep the student’s record separate from her academic record in the department and the College of Liberal Arts. This record is confidential and will be destroyed five years after the student leaves Temple.

[www.temple.edu/disability/about.htm](http://www.temple.edu/disability/about.htm).

**Sexual harassment and sexual assault:** Sexual harassment and sexual assault subvert the mission and work of Temple University, and can threaten the career, educational experience, and well-being of students, faculty, and staff. Temple University is committed to providing a learning and working environment that emphasizes the dignity and worth of every member of its community, free from discriminatory conduct. Sexual harassment and sexual assault, in any form or context, are inimical to this and will not be tolerated.

University policies on sexual harassment and sexual assault, which include procedures for filing complaints, are available upon request by contacting Sandra A. Foehl, Associate Vice President for Affirmative Action, Mitten Hall Lower Level, 1913 North Broad Street, Philadelphia, PA 19122-6099 or by calling 215-204-6772. More information is also available at [http://policies.temple.edu/PDF/296.pdf](http://policies.temple.edu/PDF/296.pdf).

**Campus safety and security:** It is Temple University’s policy to provide to all students, upon request, a copy of the University’s policies and procedures regarding campus safety and security, as well as crime rates and statistics for the most recent three-year period. In doing so, Temple University complies with two important pieces of legislation: the Pennsylvania College and University Security Information Act, and the federal Right-to-Know and Campus Security Act. To receive a copy of “You and Campus Safety,” write to Temple University Department of Campus Safety Services, 1101 West Montgomery Avenue, Philadelphia, PA 19122, or call 215-204-6262. To access Temple University’s Campus Safety Services go to [http://www.temple.edu/safety/](http://www.temple.edu/safety/). The emergency safety number is 215.204.1234 (1-1234 from campus phones).
Departmental and External Resources

**The Technology Center** is a 75,000 sq. ft. state-of-the-art resource that demonstrates innovative technological and collaborative space support for our students. The facility provides 24 hour computer and Internet access during academic semesters and features access to 600 computers, software products, break out rooms, and a graphics laboratory. The Tech Center also provides access to 3D printing and poster making resources. For a tour of the facility, click here: http://www.temple.edu/cs/techcenter/tcpreview.htm.

**Campus-wide Computer Labs:** All CLA-operated computer labs run a variety of GIS, statistical, and productivity software. Although the technology is constantly changing, our instructors are working with CLA Information Technology to have the software needed to complete your coursework included in the standard disk image used throughout CLA labs. A listing of labs, their locations, and hours of operation are available at the following link: http://www.cla.temple.edu/it/labs/.

**The Spatial Analytics Lab at Temple (SALT):** SALT (Spatial Analytics Lab at Temple) is a university geographic information systems, cartography, and spatial analytics laboratory at Temple University housed and managed by the Department of Geography and Urban Studies. The central activities of the lab are to support multidisciplinary research projects and programs related to health, environment, and information technologies that are funded through external grants. In addition, the lab supports funded research and cartographic production projects implemented by faculty and students in the department. The facility is equipped with GIS and cartography workstations, a teleconference center, and office support for managing projects in a 2500 square foot facility located in Gladfelter Hall on Temple University’s main campus. Information about SALT is available at the following link: http://www.cla.temple.edu/gus/research-overview/salt/.