**GEOG670 Syllabus**

**Open Source GIS**

**Course Details:**

Session: Spring 2024

Format: In-person and remote

Classroom: LEF 1166

Lecture and Lab Times: Mon/Tue 5:30 pm – 8:00 pm

Instructor: Xin Tao (xtao@umd.edu)

Office: LEF 1167

Office hours: By appointment

Teaching assistant: Shuyu Jin (geojsy@umd.edu)

Office: 4600 River Road

Office hours: By appointment

**Course Objectives**:

There are increasing demands for desktop and enterprise GIS applications to display, analyze, and disseminate geospatial data, information, and services. The remarkable growth in the use of open source GIS resources has facilitated developing cost-effective and feature-rich GIS applications using free and open source software for GIS (FOSSGIS). This course is designed to introduce FOSSGIS and teach how to employ and integrate open-source GIS software to analyze vector and raster data and to develop GIS tools and web services. This course covers how to handle vector and raster data from various data sources with QGIS. This course also introduces PostgreSQL as an object-oriented relational database management system (ORDBMS) to store and manage spatial data and GeoServer as a web GIS server to publish and disseminate spatial information through the Internet. Web map API, such as Leaflet, is briefly reviewed to create browser-based map applications and display data from a variety of sources such as OpenStreetMap, Google, etc.

The format of this course will consist of lectures, lab assignments, readings, and a final project. The lectures will be presented online via the Live Classroom on the Zoom. All lectures involve the interaction between students and the instructor in real time. Lectures will be archived into videos that will be made available. Please note that video recordings are intended for occasional or backup use in case students have to miss lectures due to personal, business, or medical reasons. Real time, online participation is strongly recommended. The readings and lab assignments will also be posted in a timely manner.

**Learning Outcomes**

The specific objectives of this course are that students are expected to learn the following:

* Understand and explain the concepts of open source and open standards
* Understand the Open Geospatial Consortium (OGC) standards
* Handle vector and raster data and their projection in QGIS
* Understand how to load data from a variety of sources into a spatial database such as PostgreSQL
* Understand SQL syntax to create spatial databases and perform spatial queries
* Work with GeoServer to load, publish, and share geospatial data on the web
* Understand how to use Web Maps API, such as Leaflet, to create browser-based map applications and display data from a variety of sources

**Prerequisites**

GEOG646 is pre-requisite, or you should have a minimum of programming experience with HTML, CSS, and JavaScript.

**Course Outline:**

Overview of open source GIS ………………………. 1 week

QGIS vector processing…….…………………………. 1 week

QGIS raster processing ………………………………... 1 week

QGIS graphical model …...……………………………… 1 week

Database basics…………………………………................. 3 weeks

Spatial database …………………………………………… 1 week

Web mapping services …………………………………. 1 week

Web app development……………….….…......………… 2 weeks

Google Earth Engine………………………………………. 1 week

**References**

Discover QGIS 3.x: A Workbook for Classroom or Independent, Kurt Menke, Locate Press, 2019

Mastering Geospatial Development with QGIS 3.x: An in-depth guide to becoming proficient in spatial data analysis using QGIS 3.4 and 3.6 with Python, Packt Publishing Ltd., 3rd Edition, 2019

QGIS, https://www.qgis.org/en/site/

PostgreSQL, https://www.postgresql.org/

PostGIS - Spatial and Geographic objects for PostgreSQL, https://postgis.net/

GeoServer, http://geoserver.org/

Leaflet JavaScript Library for Interactive Map, https://leafletjs.com/

W3Schools online web tutorial, http://www.w3schools.com/

**Grading**:

It is strongly encouraged to attend each lecture and actively participate in the online discussion board as well as in class. Students are required to post a reply on the forums posted by the instructor. Lab assignments will be given weekly to help students gain practical experience in developing websites. Students need to complete final projects to solve a geospatial problem using QGIS, PostgreSQL, and GeoServer or other alternatives.

There will be 7 labs and 1 final project. The lab score is worth 63% of the final grade. The final project score will be worth 27% of the final grade. 10% will be based on attendance and participation.

**Grade Policy**:

* Project, online class activities, and labs:

|  |  |  |
| --- | --- | --- |
|  | % of total grade | Due date |
| Project | 27% | 5/17 |
| Online class activities | 10% | In class |
| Labs | 63% | 3/11 (Lab 1), 3/25 (Lab 2), 4/1 (Lab 3), 4/8 (Lab 4), 4/15 (Lab 5), 4/22 (Lab 6), 4/29 (Lab 7) |

Letter Grade Distribution:

The plus/minus grading system will be used to assign student grades. Minor adjustments to this scale might be made based on the performance of the class as a whole.

97-100.0 = A+

94-96.99 = A

90-93.99 = A-

87-89.99 = B+

84-86.99 = B

80-83.99 = B-

77-79.99 = C+

74-76.99 = C

70-73.99 = C-

67-69.99 = D+

64-66.99 = D

60-63.99 = D-

<60 = F

All students must have a UMD TerpConnect (used to be Glue) account to obtain permissions to upload HTML, CSS, and JavaScript files to your account on TerpConnect at http://terpconnect.umd.edu. Details about the webserver will be provided in the class.

**Academic Honesty**: The University of Maryland, College Park, has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student, you are responsible for upholding these standards for this course. You need to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism.

Within our class, students may work together to review class notes and home assignments. However, assignments must be done individually. Each student must turn in his or her own work, from his or her personal computer. Any discussion or problem solution must be his or her alone, without assistance from any other person.

**Accessibility Resources**: Any student with a disability is encouraged to meet with the instructor privately during the first week of class to discuss accommodations. I will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and provide a DSS accommodation form. Please refer to the Online Undergraduate Catalog Policy on Religious Observance.

**Email**: Both the TA and the instructor will always be available by email. The professor may not always reply to emails after 6pm or on weekends. Normally, an email would be replied within 24 hours. Emails sent over weekend may not be replied until next work day. E-mails should be respectful and professional.

**Course schedule**

The weekly coverage is subject to change as it depends on the progress of the class. However, you must keep up with the reading assignments.

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| --- | --- | --- | --- | --- |
| Week | Date | Topics | Readings | Assignments |
| 1 | 2/26  2/27 | Overview of open source GIS  Introduction to QGIS | QGIS |  |
| 2 | 3/4  3/5 | QGIS vector processing  Vector network analysis | QGIS | Lab 1 out |
| 3 | 3/11  3/12 | QGIS raster processing  Terrain analysis | QGIS | Lab 1 due  Lab 2 out |
| 4 | 3/18  3/19 | No class (Spring recess)  No class (Spring recess) |  |  |
| 5 | 3/25  3/26 | QGIS processing framework  QGIS graphical model | QGIS | Lab 2 due  Lab 3 out |
| 6 | 4/1  4/2 | Database basics  PostgreSQL | PostgreSQL | Lab 3 due  Lab 4 out |
| 7 | 4/8  4/9 | PostgreSQL  PostGIS | PostGIS | Lab 4 due  Lab 5 out  Project Proposal out |
| 8 | 4/15  4/16 | Spatial database  Working with raster | PostGIS | Lab 5 due  Lab 6 out |
| 9 | 4/22  4/23 | GeoServer  Exporting to web maps in QGIS | GeoServer | Lab 6 due  Lab 7 out |
| 10 | 4/29  4/30 | Web app development  Leaflet Maps API | Leaflet | Lab 7 due  Proposal due |
| 11 | 5/6  5/7 | Google Earth Engine  Independent study for final project | W3Schools |  |
| 12 | 5/13  5/14 | Final project presentation  Independent study for final project |  | Final Project due |