MODULE DESCRIPTION FORM

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CL961 Geographical Information Systems

Module Registrar: Dr. Yanick Kremer	**Taught To (Course): Cohorts for whom class is compulsory / optional / elective** **Optional to:** MSc in Sustainability & Environmental Studies MSc Environmental Engineering MSc in Hydrogeology MSc Civil Engineering MSc Environmental Entrepreneurship MSc Sustainable Engineering (Faculty degree) MEng 5th Year MRes Geo-Environmental Engineering MRes Integrated Pollution Prevention & Control (IPPC) Satellite Data for Sustainable Development		
Other Lecturers Involved: Guest lecturers	**Credit Weighting: 10**	**Semester: 1**	
Assumed Prerequisites: none	**Compulsory/ optional/ elective class**	**Academic Level:** 5	**Compulsory/ optional/ elective class**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
	20				8	56		16	100

Educational Aim

This module introduces Geographical Information Systems and spatial data analysis. The course covers the key theory with a strong focus is on practical applications. Students will develop skills to apply GIS independently to real world datasets and problems. The student will need to independently develop spatial research questions, find, or collect relevant data and perform a state-of-the-art spatial analysis.

GIS is a digital tool for analysing spatial phenomena. It focusses on spatial data, so data where the location of the data is just as important as the data itself. GIS allows us to organize, visualize and analyse this data in a spatial context, so that we can interpret and understand the underlying processes. GIS can be used in a wide range of fields for example in engineering (site selection, flood risk, transport planning, impact of construction), environmental science (e.g. soil erosion, health and disease, pollutant transport, landscape visual impact assessment, wildlife preservation), business (e.g. asset management, customer relations) to policy making (e.g. urbanization, deforestation, spatial distribution of crime).

Learning Outcomes

On completion of the module the student is expected to be able to

LO1 Be able to identify the key principles of Geographical Information Systems and spatial analysis and evaluate the potential of using GIS in answering spatial questions in a variety of applications and fields.

LO2 Be familiar with how to use a variety of Geographical Information Systems, including ArcGIS and QGIS

LO3 Be able to obtain real-world datasets and visualize, process and analyse these using GIS.

LO4 Critically evaluate the quality of GIS results and discuss how to deal with error and scale issues.

Syllabus

The course will be taught using a combination of online and on-campus lectures, computer lab tutorials, self-study and independent project work. The following topics will be covered in the lectures and tutorials:

- Spatial data analysis and GIS and why it is it important.
- Map projections and coordinate systems
- Spatial data structures: raster vs vector, data types. Attributes, spatial and relational databases.
- GNSS: Basics of GPS and other positioning systems
- The importance of data in GIS. What is special about spatial data? How to obtain spatial data.
- Metadata: importance and best practices.
- Error and data quality of spatial data. Data quality parameters. Types of error, error propagation by GIS analysis. Digitising error and how to combine it with other sources of error.
- Legal aspects of mapping and GIS
- Different methods of spatial data input into a GIS. Data modelling: representing the world in a GIS. Scale and generalisation.
- Landscape visualization. Visualizing GIS data from the ground level to create an image of the landscape. Incorporation of 3D designs (e.g. major engineering works, architecture). Landscape impact assessment.

The class will be delivered via online/blended learning. A typical week will consist of:

- 1 brief introduction lecture on campus (10-20 minutes).
- 3 to 5 mini lecture videos online (10 minutes each)
- Independent reading (1-2 hours)
- Practical in computer lab or online (2.5 hours)
- MyPlace quiz 5-10 minutes

Assessment is based on the MyPlace quizzes and a portfolio of 3 small independent GIS projects. Each project should require about 1-2 days of work.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 Principles of GIS and spatial data
C1 Students are assessed on a GIS portfolio (80% of grade). The students will develop a portfolio of 3 GIS mini projects, each documented by one page visual and page text. Students will need to demonstrate their understanding of GIS and spatial data analysis in the description of the projects.
C2 MyPlace mini-quizzes after each lecture and computer tutorial (20% of grade).

LO2 Being able to use GIS software.
C1 For the development of the GIS portfolio, the students will need to use GIS software of their choice.
C2 Each class involves a practical using GIS software, practical engagement is assessed using MyPlace mini-quizzes.

LO3 Obtaining, processing and analysing spatial data
C1 For the portfolio, students will need to independently obtain real world data, process it for successful incorporation into their GIS, visualize and analyse the date.

LO4 Evaluate the quality of GIS results discussing potential errors.

C1 Each portfolio project will have a one-page description, in which the student will need to discuss motivation, procedure (as a flow chart), results, conclusion, discussion of potential errors, and references.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/staff/policies/academic/http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/)

1. Assessment and feedback promote effective student learning. Learning is assessed by coursework where the student develops a portfolio of 3 small GIS projects. Each project in the portfolio needs to be documented by one visual element (e.g. map, graphs, animation, visualization) and a one-page description. The development of the portfolio will require the students to independently obtain relevant data, process, combine, visualize and analyse this data. Usage of state-of-the-art software (both commercial and open source) is required. Early on the students will submit one portfolio project idea for constructive feedback. One of the portfolio projects will be submitted early and receive early feedback.
2. Assessment and feedback practices promote effective student learning. Each week includes a practical. In addition to lecturer and demonstrator support, online video clips are available demonstrating key steps in the tutorials. MyPlace mini-quizzes are used to assess the tutorials.
3. Assessment criteria for the GIS portfolio are communicated clearly to the students in week 1.
4. Assessment and feedback procedures are reviewed annually.
5. The assessment by portfolio enables the student to choose projects fitting to their field of study and potential future employers, ensuring appropriateness to the student's professional context.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	8 MyPlace Quizzes		5-10 minutes each	20%			Portfolio of 3 projects	80%
L/Outcomes	LO1, LO2, LO4						LO1, LO2, LO3, LO4	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines (*academic weeks*):
Week 5 submit first portfolio project. This is an opportunity to get early feedback on portfolio work. Students can choose to resubmit this first project in week 10.
Week 10 Submit all three portfolio projects.

Resit Assessment Procedures:
---Submission of coursework(s) prior to commencement of the August exam diet.

PLEASE NOTE:
Students must gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference**

*** de Smith, M.J., Goodchild, M.F., Longley, P.A., Geospatial Analysis. A comprehensive guide to principles techniques and software tools. Sixth edition

*** Nathalie Pettorelli, Henrike Schulte to Bühne, Aurélie C. Shapiro & Paul Glover-Kapfer. 2018. WWF Conservation Technology Series 4 Satellite remote sensing is recommended as a good introduction to remote sensing. It is available for free from: https://www.researchgate.net/publication/324537528_Conservation_Technology_Series_Issue_4_SATELLITE_REMOTE_SENSING_FOR_CONSERVATION
* The Ordnance survey, Guide to coordinate systems in Great Britain is: https://www.ordnancesurvey.co.uk/docs/support/guide-coordinate-systems-great-britain.pdf?awc=2495_1472758581_2be7907c343c32b09a8d5171103197d7

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
To be determined based on demand		To be determined

Session:

Approved:

Course Director Signature:
Date of Last Modifications: 20-8 2022

(Updated May 2018)

MODULE TIMETABLE

Module Code:	**CL961**	**Module Title:**	**Geographic Information Systems**

Brief Description of Assessment:

- Weekly MyPlace Quizzes testing knowledge of that week's lectures, textbook and tutorials (20%)
- Portfolio of 3 independent GIS projects. Each project submission consists of 1 page text and 1 page visuals. Optionally 1 project can be presented as a short video. Week 3: feedback on first project ideas. Week 5: Draft project submission. Week 11: Submission final 3 projects.

Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Project Submission	Online Test Choose an item.	Choose an item. Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Choose an item. Choose an item.	Project Submission Choose an item.	Choose an item.

Semester	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Two	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item.