CLASS/MODULE DESCRIPTOR 2019/20

CL961 Geographical Information Systems (GIS)

Registrar: Dr Elsa João **Main contact: Dr Yannick Kremer (yannick.kremer@strath.ac.uk)**	**Taught To (Programme):** 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)	
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 2**
Assumed Pre-requisites: None	**Compulsory/ optional/ elective class** 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)	**Academic Level: 5**

Class Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Coursework	Project	Private Study	**Total**
8		20		54	18	100

Class Aim(s)

This module provides a thorough introduction to the field of Geographical Information Systems and spatial analysis. The course covers the key theoretical principles but it also provides many practical hands-on exercises using current state-of-the-art GIS software. By capturing, manipulating, integrating and displaying digital spatial data, a wide range of different analyses can be carried out, ranging from engineering (e.g. site selection, flood risk, transport planning, impact of construction), environmental science (e.g. soil erosion, health and disease, pollutant transport, hydrology, landscape visual impact assessment, wildlife preservation) to policy making (e.g. urbanization, deforestation, spatial distribution of crime). The module demonstrates how GIS can be used for spatial query and analysis. Students will develop skills to apply GIS independently to real world datasets and problems.

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, QGIS (open source) and Google Earth

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

LO4 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 lectures, group discussions, case studies and presentations by practitioners. The following topics will be covered in the lectures and practicals:

- What is a Geographical Information System (GIS)?
- 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.
- Talk and workshop by ESRI on Story Maps.
- 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.

N.B. the class runs over nine weeks (3 hours per week). There is one reading and project work week.

Assessment Criteria

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) and MyPlace mini-quizzes after each lecture and practical (20% 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.

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. Each class involves a practical using GIS software, this 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 Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessments.

Principles of Assessment and Feedback (*https://www.strath.ac.uk/staff/policies/academic/*)

1. Assessment and feedback promote effective student learning. Learning is assessed by coursework during which the students develop 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 encouraged. Early on the students will submit two portfolio project ideas for constructive feedback. One of the portfolio projects will be submitted early and receive early feedback. Students are encouraged to use peer-review to improve their portfolio projects.

2. Assessment and feedback practices promote effective student learning. Each lecture includes a practical. Online video clips are available demonstrating key steps in the practicals. MyPlace mini-quizzes are used to assess the practicals.

3. Assessment criteria for the GIS portfolio are communicated clearly to the students.

4. Assessment and feedback procedures are reviewed annually.

5. The assessment by portfolio enables students to choose projects fitting to their field of study and potential future employers, ensuring appropriateness to the students professional context.

Recommended Reading

Heywood, I., Cornelius, S. and Carver, S. (2002), *An Introduction to Geographical Information Systems*, 2nd ed. Harlow, England; New York: Prentice Hall. **[Strathclyde Main Library D 910.285 HEY]**

Additional reading:

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

PLEASE NOTE:
Students need to gain a summative mark of ~~40%~~ / 50% ***(please delete as appropriate)*** **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 ~~exam~~ / coursework / ~~viva~~** ***(please delete as appropriate).***

Resit Arrangements

Assignment (100%)

Approved

Programme Director Signature:
Date of Last Modifications:

(Updated 22nd November 2018)

Assessment and Feedback Schedule

Class Code	CL961	Class Title	Geographical Information Systems (GIS)

Brief Description of Assessment

The course will be assessed by MyPlace quizzes (20%) and by a written assignment (80%). For the written assignment students develop a portfolio of 3 small GIS projects. Each project in the portfolio needs to be documented by a one page visual element (e.g. maps, graphs, animations, visualization, website) and one page text explaining the visual element. The text needs to contain:

- Motivation: why is this analysis important, what question do you seek to answer.
- Brief description of data sources, processing and analysis, using a flow chart. This must include a brief discussion of potential sources of errors in the data and analysis.
- Results: discuss your findings
- Conclusion and discussion: How does your data answer the question that motivated this analysis.
- References

At most one portfolio project can be purely cartographic (i.e. purely presenting existing data, no significant transformation or analysis of the data). At most one portfolio project can consist exclusively of landscape visualization. At least two projects must demonstrate a significant analytical component (i.e. we learn something new from the data, for example by combining and comparing it with other data sets, spatial analysis, modelling or remote sensing).

Each portfolio project will be weighted equally in the determination of the final grade. Individually each portfolio project will be assessed based on the following criteria:

- Appropriate use of GIS and spatial analysis. (25%)
- Scientific and technical quality of the analysis. (25%)
- Visual quality of the visual elements. (25%)
- Writing. (25%)

Indicate in the tables below the Hand-Out (H), Submission (S) and Feedback (F) dates for each lab report/coursework/project and the timing of each Exam/Class Test (E), (T). Include duration of exam in brackets (e.g. E (2)).

Semester 1

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period

Semester 2

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Portfolio (80%)	1,2,3,4	100	I	**H**	S Submit two portfolio ideas for feedback	F Feedback portfolio ideas		S Submit first portfolio project for feedback		F Feedback first portfolio project			**S** Submit all 4 portfolio projects		**F**
MyPlace quizzes (20%)				HSF	HSF	HSF	HSF		HSF	HSF	HSF	HSF			