

**Title: Geographical Information Systems and Analysis: Theory and Application**

Lecturers: Dr. Ram Avtar, Dr. Christopher Doll, Dr. Kikuko Shoyama

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**Course Description:**

Nowadays, we see/use Geographical Information Systems (GIS) everywhere from your smartphone to your tablet to find the location/transport and other information. GIS is a framework for studying spatial phenomena by allowing users to display, query and analyse large, complex spatial datasets. Much of its functionality lies in the capability to analyse multiple datasets to understand the interplay between various factors, and their effect on outcomes. This course will introduce GIS and the principles of spatial data and their use in many aspects of global environmental analysis from research to management and policy making. This course will introduce students to (1) fundamental concepts of GIS including GIS data storage, coordinate systems, and spatial Analysis. (2) using GIS to display, interrogate and analyse spatial data (3) use GIS for decision support, and (4) understand how GIS is used in online applications. This will be achieved through a series of lectures and hands-on guided training sessions in a variety of application areas that will equip the student with both the theoretical and practical skills to use GIS in future research work. The course is designed around ArcGIS – the world’s leading GIS software package.

**Learning Outcomes:**

The aim of the course is to familiarize students with the theoretical background and practical application of GIS. Students will learn the importance of spatial data in global environment. Students will also learn how to use GIS to handle various spatial data using spatial analysis techniques to generate useful information to solve global environmental problems. The assessment of the course is unusually multifaceted with theoretical, practical and managerial elements. By the end of the course, a student should be able to understand and organise spatial data in order to solve geographic problems using GIS.

**Assessment:**

Attendance and class participation	: 10%
Individual assignments theory based (5x4%)	: 20%
Mid-term examination (5/7 multiple choice questions 2% each); Short answer questions (4/7 5% each)	: 30%
Individual project (practical based)	: 20%
Group work and presentation	: 20%

## Course Outline:

Session	Outline	Date and time
1	GIS introduction and overview (Chris)	6 April (11-12:30)
2	Digitizing editing & structuring of map data (Ram)	7 April (14-15:30)
3	Hands-on-training on Georeferencing & projection & GIS database creation (Ram)	7 April (16-17:30)
4	Conceptual models of spatial information & non- spatial modelling (Chris)	13 April (11-12:30)
5	Hands-on-training on Spatial & non- spatial queries (Chris)	13 April (14-15:30)
6	Spatial data analysis & network analysis (Ram)	20 April (11-12:30)
7	Hands-on-training on Vector and raster based spatial data analysis & network problem (Ram)	20 April (14-15:30)
8	Decision making & Decision support in GIS (Chris)	21 April (11-12:30)
9	Web GIS (Ram)	25 April (11-12:30)
10	Hands-on-training on landslide hazard zonation (Ram)	26 April (11-12:30)
11	Mid-term exam	11 May (14-15:30)
12	Hands-on-training on biodiversity and ecosystem services (Shoyama)	18 May (14-15:30)
13	Hands-on-training on Urban planning (Chris)	25 May (14-15:30)
14	Hands-on-training on Impact of extreme hydro-meteorological events on water resources (Ram/Mishra)	8 June (14-15:30)
15	Final presentation and report	15 June (14-15:30)

## Essential Reading

- An Introduction to Geographic Information Systems by Heywood
- GIS fundamentals: A first text on geographic information systems by Paul Bolstad (Eider press)
- [https://www.itc.nl/Pub/Home/library/Academic\\_output/ITC-GIS-and-Remote-Sensing-Textbooks.html](https://www.itc.nl/Pub/Home/library/Academic_output/ITC-GIS-and-Remote-Sensing-Textbooks.html)
- <http://www.saylor.org/site/textbooks/Essentials%20of%20Geographic%20Information%20Systems.pdf>
- [https://www.itc.nl/library/papers\\_2009/general/PrinciplesGIS.pdf](https://www.itc.nl/library/papers_2009/general/PrinciplesGIS.pdf)
- <http://www.pasda.psu.edu/tutorials/gisbasics.asp>
- [http://library.uoregon.edu/map/map\\_section/listserves\\_tutorials/map\\_Tutorials.html](http://library.uoregon.edu/map/map_section/listserves_tutorials/map_Tutorials.html)