Urban Resilience and Adaptation for India and Mongolia
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Template syllabus of the new/revised courses

Course Name: EVNS 501: GEOGRAPHICAL INFORMATION SYSTEM

Number of credits: 4.5

Period: Spring semester

Coordinator	**S Jayakumar**
Credits	4.5
Lecturers	--
Level	Postgraduate
Host institution	Pondicherry University
Course duration	18 weeks
New/revised	New

Summary

This 4.5 ECTS course provides the fundamentals and basic concepts of Geographical Information System. The basic methods and procedures in Quantum GIS is also taught in the course. The basic operations such as downloading of open source satellite data, geometric correction of topo maps, digitization, head-up interpretation and map composition are also being taught as part of this course.

Target student audiences

Master students majoring in Ecology and Environmental Sciences, Pollution technology and environmental engineering, geosciences, sociology will be the target audiences.

Prerequisites

Required courses (or equivalents): Basic understanding on Mathematics (school higher level), English language skill, computer operation (Windows/Mac).

Aims and objectives

The main course objective is to provide a basic understanding on What is GIS and how it can be used to various fields. This course allows the students to acquire hands-on knowledge and skills on GIS software, data handling, spatial analysis.

The Authentic Tasks are:

General learning outcomes:

By the end of the course, successful students will:

1. Know the basic concepts and fundamentals of geographic information system
2. Handle GIS software independently
3. Know the different between spatial and non-spatial data, data quality and analysis
4. Approach the environmental problems spatially to find suitable solutions.
5. Handle raster and vector maps and other spatial data to integrate into GIS domain
6. Apply the spatial methods and procedures to find solutions to the environmental problem
7. Be able to identify the root cause for the problem
8. Be able to prepare strategic solution to the environmental problem

Overview of sessions and teaching methods

The course will make most of interactive and self-reflective methods of teaching and learning and, where possible, avoid standing lectures and presentations.

Learning methods

- In class Lectures (face-to-face)
- E-learning materials – Video lectures
- Group work – Fieldtrip, data collection, analysis and report presentation
- Literature review and assignment submission

Course outline

Week 1	1. Introduction to GIS
	2. How does GIS work?
	3. Components of GIS
Week 2	4. Cartography and Nature of Maps - 1
	5. Cartography and Nature of Maps - 2
	6. Essential Map elements
Week 3	7. Coordinate system and projection
	8. Attribute data and Thematic Mapping

Week 4	9. Vector data model
	10. Creating thematic map
Week 5	11. Data classification
Week 6	12. Arc Node topology
	13. Polygon arc topology
Week 7	14. Introduction to QGIS
Week 8	15. GIS terms and definitions - 1
	16. GIS terms and definitions - 2
Week 9	17. Topology and Shape files
	18. Selection methods in GIS
Week 10	19. Generalization Problem
Week 11	20. Overlay methods
Week 12	21. Raster data model 1
Week 13	22. Raster data model 2
Week 14	23. Raster data analysis 1
	24. Raster data analysis 2
Week 15	25. QGis Elements - 1
	26. QGis Elements – 2
Week 16	27. Grass gis Elements

Literature

Compulsory

1. Chang, KT, 2017, Introduction to Geographic Information Systems, McGraw Hill Education 4th Editon.
2. Robinson, AH, Morrison, JL, Muehrcke, PC, Kimerling, AJ, Guptill, SC, 2009, Elements of Cartogrphy, 6th Edition, Wiley Publication.
3. Husain, M, 2014, Evolution of Geographical Thought, Rawat Publishing house.

Recommended:

1. Hands-On Geospatial Analysis with R and QGIS https://www.packtpub.com/application-development/hands-geospatial-analysis-r-and-qgis Author: Shammunul Islam Date: November 2018
2. QGIS Tutorials and Tips, downloadable from https://www.qgistutorials.com/en/

Revised Syllabus
GEOGRAPHICAL INFORMATION SYSTEM

EVNS: 501 **CREDITS: 3**

COURSE OBJECTIVE: To instruct the students about the basics of Geographical Information systems and enable them to make effective use of Open source software QGIS/GRASS

UNIT –I Introduction to GIS – definition, concept and history of developments in the field of information systems, Hardware and software requirements for GIS, Cartography - Scale, Coordinate Systems, Projections Essential Map Elements -Map Design and Layout - Attribute data for Thematic Mapping -Data Classification

UNIT –II GIS Vector Data Model - Topology, Shape files -Generalization Problems – Spatial query functions, Selection Methods - Overlay Operations

UNIT –III GIS Raster Data Model, Raster Analysis – local, neighborhood, regional and global operations

UNIT –IV QGIS – elements – QGIS GUI- Menu bar, panels and toolbars, map view and status bar, General tools – color selector, blending mode, zooming and panning, measuring, feature sections, identification, annotation. Managing data – creating layers, exploring data formats and fields.

UNIT –V GRASS – elements – Creating GRASS database with sample data, Raster map, import / export, metadata.

Practical:
1. Introduction to QGIS software
2. Introduction to GRASS software
3. Map reading – SOI topographical map
4. Geometric correction of SOI topographical map
5. Map Editing – Working with editing tools
6. Digitization of feature from SOI topographical map
7. Digitization of feature from Satellite data
8. Editing Attribute data
9. Editing map symbols and labels
10. Map composition

Text Books

4. Chang, KT, 2017, Introduction to Geographic Information Systems, McGraw Hill Education 4th Editon.
5. Robinson, AH, Morrison, JL, Muehrcke, PC, Kimerling, AJ, Guptill, SC, 2009, Elements of Cartogrphy, 6th Edition, Wiley Publication.
6. Husain, M, 2014, Evolution of Geographical Thought, Rawat Publishing house.

Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)
In-class activities (40 hours)			
Lectures	Understanding basic GIS concepts, fundamentals, methodology and tools	Class participation	18 hours
Moderated in-class discussions	Understanding to approach environmental problems spatially and distinguish the factors responsible for the problems	Class participation and preparedness for discussions	7 hours
In-class assignments, field assignment	Understanding various national and international environmental issues in urban and rural areas, preparedness for field study, data quality standards, various methods and procedures available	Class participation and preparedness for assignments	5 hours
Reading and discussion of assigned papers for seminars and preparation for lectures	Understanding the environmental problem, debate the novel approach in the methodology, need for such studies, data and tools utilized.	Class participation, creative and active contribution to discussion	5 hours
Group project presentation	Ability to make presentation, effective communication, critical interpretation of data, response to audience	Quality of group assignments and individual presentations	5 hours
Independent work (100 hours)			
Group work: - Contribution to the group case-study projects - Contribution to the preparation and delivery of	Ability to collect and interpret data, team work, contribution to data integration, problem solving, discussion with members of the group, convey the ideas clearly	Quality of group assignments and individual presentations	30 hours

individual presentation			
Course group assignment	Ability to select a spatial problem, conceptualize and frame data collection, data integration, use the methods learned in the class to analyze the data and prepare solution to the spatial problem and develop strategy	Quality of developed strategy and their presentation	20 hours
Group presentation	Ability to interpret data, to analyze audience, and to use the concepts, tools, and methods for communicating the strategy developed	Quality of group assignments and individual presentations	25 hours
Individual study	Understanding of concepts, spatial tools available, comprehensive knowledge on application of GIS in different fields	Quality of answers to questions in the final examination	25 hours
Total			***140 hours***

Grading

The students' performance will be based on the following:

Assessment

- Progress assessment (40%):
  - Exercise (10%): students have to complete the quiz or seminar of each topic.
  - Homework (10%): 1. Journal paper review (5%), 2. Write-up on GIS data quality standards (5 %) or one essay on raster and vector data analysis (5%)
  - Group report (20%): The entire class will be divided into groups of 5-6 students and be given an option to choose any one of the following topics for group project report.
    - Application of GIS in agriculture
    - Application of GIS in forestry
    - Application of GIS in urban planning
    - Application of GIS in disaster management
    - Application of GIS in soil
    - Application of GIS in Ocean or Wetland management

- Final assessment (60%):
  - Final examination (60%)

Evaluation

Performances of students in each paper are expressed in terms of marks as well as in Letter Grades. In case of fractions the marks shall be rounded off to nearest integer. The class interval for the purpose of awarding the grades can be arrived at by dividing the difference between the highest mark secured and the minimum pass mark by 6 as there are six passing grades. The formula is given below:

K = (X-50)/6

Where, K = class interval, X= the highest mark in the subject.

The grades may be awarded as given in the following Table II.

Table II

Range of Marks in %	Letter Grade	Points for Calculate of CGPA
X to (X-K)+1	O	10
(X-K) to (X-2K)+1	A+	9
(X-2K) to (X-3K)+1	A	8
(X-3K) to (X-4K)+1	B+	7
(X-4K) to (X-5K)+1	B	6
(X-5K) to 50	C	5
Below 50	F	0
Failure due to lack of attendance	FA	0

K should not be rounded off to less than two decimal places. The numbers given in Range of Marks column, (X-K), (X-2K), (X-3K), etc., can be rounded off to the nearest whole number.

In courses where the number of students who have secured 50 marks and above is less than 10 then grading may be given based on the Table III.

Table III

Range of Marks in %	Letter Grade	Points for Calculate of CGPA
81-100	O	10
71-80	A+	9
66-70	A	8

61-65	B+	7
56-60	B	6
50-55	C	5
Below 50	F	0
Failure due to lack of attendance	FA	0

In order to declare the pass, a Student should get
a) A minimum of 40% marks in end-semester exam, and
b) A minimum of 50% marks in aggregate when Internal Assessment and End-Semester marks are added.

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