Course Syllabus
Geographic Information Systems

August – December 2021

VI Ciclo

Lecturer

Menary, Wayne

I. General course details

Name of the Course:	Geographic Information Systems		
Pre-requisite:	None	**Code:**	10345
Precedent:	None	**Semester:**	2021-2
Credits:	3	**Cycle:**	VI
Hours per week:	4 hours	**Course Mode:**	Remote - Synchronous
Course:	Ing. Gestión Ambiental	**Course coordinator:**	Arauco Livia Mayra marauco@esan.edu.pe

II. Summary

This course introduces students to the fundamentals of Geographical Information Systems (GIS) and Geospatial Technology, including cartography, remote sensing and spatial analysis. It examines the processes involved in the capture, storage, manipulation, analysis, presentation and output of digital geographical data in a GIS and provides opportunities for the development of practical skills in processing data using a leading Open Source GIS software package, Quantum GIS.

III. Course Objectives

To critically understand what GIS is, how GIS is currently used in environmental sciences and management and to apply the acquired knowledge of GIS tools and software to real life situations.

IV. Learning Outcomes

By the end of this course students will be able to:

- Understand the fundamental concepts of Geographic Information Science and Technology
- Demonstrate basic proficiency in the creation and acquisition of spatial data.
- Analyse the fundamentals of GIS data storage and interoperability and remote sensing.
- Apply GIS tools and techniques to resolve real life situations.
- Construct datasets for use in geo-analysis
- Execute the results of a geospatial analysis using appropriate models, terminology, and visualizations.
- Evaluate types of geographic information analysis and geo-statistics.
- Analyse GIS innovations and industry applications.
- Identify, formulate, search for information, and analyze complex engineering problems to reach reasoned conclusions using basic principles of mathematics, natural science, and engineering science.
- Communicate effectively, by understanding and writing reports and design documentation, making presentations, and transmitting and receiving clear instructions.

- Understand and evaluate the impact of solutions to complex engineering problems in a global, economic, environmental, and social context.
- Recognize the need for lifelong learning and the ability to address it in the broader context of technological change.
- Create, select and use modern engineering and information technology techniques, skills, resources and tools, including prediction and modelling, with an understanding of their limitations.

V. Methodology

The course methodology emphasizes active student participation with the Lecturer assuming the role of learning facilitator. The course comprises a series of lectures and computer-based practical sessions using Quantum GIS software. **The computer-based practical sessions will be sequential and supported by video tutorials.** The video tutorials will be available via the course YouTube channel. Students will complete a series of practical assignments designed to provide experience with the software while simultaneously illustrating and reinforcing theoretical concepts.

Contact and communication between the student and lecturer will be via the virtual campus platform, where all the course resources will also be available.

It is strongly recommended that the student read the texts indicated in the bibliography and recommended weekly reading as well as material that will be made available to encourage students to explore topics in greater depth.

VI. Evaluation

The integrated evaluation system is continuous. The grade of the subject is obtained by averaging the continuous evaluation (50%), the partial exam (20%) and the final exam (30%).

The average grade for the continuous assessment results from the average of assessed research reports, integrative activities and creation and presentation of the end of course final project.

The weightings within the continuous evaluation are described in the following table:

PROMEDIO DE EVALUACIÓN PERMANENTE 50%		
Type of evaluation	**Description**	**Weighting %**
Applied Activity Assessments I	Three (3) cartographical design tasks (Presentation of map and summary report)	30
Applied Activity Assessments II	Two (2) **timed** assessments of applied GIS problem solving	30
Project	Environmental problem-solving using GIS skills & techniques acquired during the course. Final project to be submitted as a report and presented orally.	40

The final average grade (FA) is obtained as follows:

FA = (0,20 x MTE) + (0,50 x CEA) + (0,30 x FE)

Where:
FA = Final Average
MTE = Mid-Term Exam
CEA = Continuous Evaluation Average
FE = Final Exam

VII. Programme Content

WEEK	*CONTENTS*	*ACTIVITIES / EVALUATION*
UNIT OF LEARNING I: Communication and Geographic Understanding. **1.** Understand the fundamental concepts of Geographic Information Science and Technology **2.** Demonstrate basic level proficiency in the creation of spatial data. **3.** Select and combine appropriate visual variables to clearly represent geospatial data and communicate map content		
1° 23rd to 28th August	**Introduction to Geographic Information Systems (GIS) & Spatial Thinking.** 1.1 The Geospatial Revolution 1.2 The Changing Nature of Place 1.3 Geospatial Enquiry 1.4 GIS in Action Video Activity: https://youtu.be/poMGRbfgp38 Read Chapter 1 of Bolstad, Paul (2016). GIS Fundamentals: A first text on geographic information systems, 4th edition. *Chapters "Methods and Tools" & "GIS for Beginners"* in Foresman, J and UNEP (2002). My Community, Our Earth: A Student Project Guide to Sustainable Development and Geography.	Presentación del silabo en todos contenidos. Presentación de la metodología del curso. Revisión de guía (pautas) para el desarrollo de los trabajos encargados (Incluye explicación del instrumento de evaluación) Revisión de la Guía para presentación de trabajos escritos en la Universidad ESAN (normas APA) Spatial knowledge Quiz Week 1 Quiz QGIS Practical I
2° 30th August to 4th September	**Geodesy, Map Projections and Coordinate Systems** 2.1 Historical Cartography 2.2 Scale and Time 2.3 Coordinate Systems 2.4 Latitude and Longitude 2.5 Map Projections Video Activity: https://youtu.be/nMrhuKoE3cI Read *Chapter 1* of Sobel, D & Andrewes, WJH (1998). The Illustrated Longitude: The True Story of the Lone Genius Who Solved the Greatest Scientific Problem of His Time. Read: Chapters 2 & 3 of Bolstad, Paul (2016). GIS Fundamentals: A first text on geographic information systems, 4th edition.	QGIS Practical II Week 2 Quiz **Evaluation** AAAI Nº 1

3° 6th to 11th September	**Cartography and Visualization, I** 3.1 GIS and maps 3.2 Data acquisition 3.3 Map characteristics 3.4 Map design and production 3.5 Data Classification	QGIS Practical III Week 3 Quiz **Evaluation** AAAI Nº 2
	Video Activity: https://youtu.be/CWM1fftxxdg https://youtu.be/TUTmg1iVX8E Read *Chapters 1, 2, 3, & 5 of* Kraak, MJ & Ormeling, F (2010). Cartography: Visualization of Geospatial Data.	
4° 13th to 18th September	**Cartography and Visualization II** 4.1 Creative Inspiration 4.2 Layout design 4.3 Fonts 4.4 Colours 4.5 Features	QGIS Practical IV Week 4 Quiz **Evaluation** AAAI Nº 3
	Read: *Chapters 2, 3, 4 & 5 of* Peterson, G (2015). GIS Cartography: A Guide to Effective Map Design. Second Edition.	
UNIT OF LEARNING II: Principles of GI and Cartography. Part II provides students with the opportunity to acquire the skills and techniques required to become proficient GIS professionals. **1.** Analyse the fundamentals of GIS data storage and interoperability and remote sensing. **2.** Evaluate and apply different types of geospatial analysis techniques **3.** Construct datasets for use in geo-analysis **4.** Execute the results of a geospatial analysis using appropriate models, terminology and visualizations.		
5° 20th to 25th September	**Geospatial Analysis I:** Vector Operations, Single Layer Analysis, Multiple Layer Analysis 5.1 Introduction – Input, Operations, and Output 5.2 Selection and Classification 5.3 Dissolve 5.4 Proximity Functions and Buffering 5.5 Overlay 5.6 Network Analysis	QGIS Practical V Week 5 Quiz
	Read: Chapter 9 of Bolstad, Paul (2016). GIS Fundamentals: A first text on geographic information systems, 4th edition.	
6° 27th September to 2nd October	**Geospatial Analysis II:** Raster data Basic Geoprocessing with Rasters 6.1 Map Algebra 6.2 Local Functions 6.3 Neighbourhood, Zonal and Global Functions	QGIS Practical VI Week 6 Quiz

	6.4 Introduction to Terrain Analysis Read: Chapter 10 of Bolstad, Paul (2016). GIS Fundamentals: A first text on geographic information systems, 4th edition.	
7° 4th to 9th October	**Geospatial Analysis III:** 7.1 Introduction to Terrain Analysis 7.2 Spatial Estimation and Interpolation 7.3 Cartographic Modelling Read: Chapter 11 of Bolstad, Paul (2016). GIS Fundamentals: A first text on geographic information systems, 4th edition.	QGIS Practical VII Week 7 Quiz
8° 11th to 16th October	**MID-TERM EXAMS**	
9° 18th to 23rd October	**Geospatial Data Acquisition & Management** 9.1 Geographic Data Acquisition 9.2 Geospatial Database Management 9.3 File Formats 9.4 Data Quality 9.5 Crowdsourced GIS: Data, Sources, Quality & Collection Strategies Read: *Chapter 2 of* Kraak, MJ & Ormeling, F (2010). Cartography: Visualization of Geospatial Data Read: *Chapter 4 of* Bolstad, Paul (2016). GIS Fundamentals: A first text on geographic information systems, 4th edition. Read: Capineri, C, et al (2016). European Handbook of Crowdsourced Geographic Information.	QGIS Practical VIII Week 9 Quiz **Evaluation** AAA II Nº 1
10° 25th to 30th October	**Introduction to Remote Sensing I** 10.1 History and Scope of Remote Sensing 10.2 Electromagnetic radiation 10.3 Mapping Cameras, Digital Imagery and Image Interpretation 10.4 Earth Observation Satellites Read: *Chapters 1 & 2 of* Campbell (2011) Introduction to Remote Sensing.	SNAP Practical I QGIS Practical IX Week 10 Quiz
11° 2nd to 6th November	**Introduction to Remote Sensing II** 11.1 Image Classification 11.2 Change Detection 11.3 Applications in Plant Sciences, Earth Sciences, Land Use and Land Cover and Global Remote Sensing Read: *Chapters 3 & 6 of* Campbell (2011) Introduction to Remote Sensing.	SNAP Practical II QGIS Practical X Week 11 Quiz

UNIT OF LEARNING III: GIS Analysis in Action: Understanding Our World. 10 Apply GIS tools and techniques to resolve real life situations. 11 Analyse GIS innovations and industry applications.		
12° 8th to 13th November	**Environmental Applications of GIS I** 12.1 The Fours Stages of Emergency Management 12.2 Geospatial Approaches and Technology in Emergency Management Case Study: GIS and Catastrophe Risk Management Read: *Chapter 2 of* Tomaszewski, B., (2014). Geographic Information Systems (GIS) for Disaster Management.	SNAP Practical III QGIS Practical XI Week 12 Quiz **Evaluation** AAA II Nº 2.
13° 15th to 20th November	**Environmental Applications of GIS II** Case Study: GIS and Earth Observation for Sustainable Development I –Climate Change	SNAP Practical IV QGIS Practical XII Week 13 Quiz
14° 22nd to 27th November	**Environmental Applications of GIS III** Case Study: GIS and Earth Observation for Sustainable Development II –Forest Monitoring and Management	SNAP Practical V QGIS Practical XIII Week 14 Quiz
15° 29th November to 4th December	**Course Summary & Final project presentations**	**Evaluation** Final Project Presentation
16º 6th to 11th December	**FINAL EXAMS**	

VIII. Bibliography

- Bolstad, Paul (2016). GIS Fundamentals: A first text on geographic information systems, 4th edition.
- Campbell (2011) Introduction to Remote Sensing. 5th Edition.
- Capineri, C, Haklay, M, Huang, H, Antoniou, V, Kettunen, J, Ostermann, F and Purves, R (2016). European Handbook of Crowdsourced Geographic Information. London: Ubiquity Press.
- Foresman, J and UNEP (2002). My Community, Our Earth: A Student Project Guide to Sustainable Development and Geography.
- Kraak, MJ & Ormeling, F (2010). Cartography: Visualization of Geospatial Data. Third Edition. Pearson Education Limited.
- Peterson, G (2015). GIS Cartography: A Guide to Effective Map Design. Second Edition.
- Sobel, D & Andrewes, WJH (1998). The Illustrated Longitude: The True Story of the Lone Genius Who Solved the Greatest Scientific Problem of His Time.
- Tomaszewski, B., (2014). Geographic Information Systems (GIS) for Disaster Management.

IX. Lecturer

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