Programme	B.Sc. (Hons) Agriculture (Major: Soil Science)	Course Code	Geog-203	Credit Hours	3(2-1)
Course Title	**FUNDAMENTALS OF GIS**				

Course Introduction

This study will focus primarily on GIS-based mapmaking techniques, including map design, symbology, map coordinates and georeferencing systems. Students will cover many important aspects of mapmaking, including map data collection and processing, field methods and GPS, cartographic communication, topographic map reading and analysis, and qualitative and quantitative mapping techniques.

Learning Outcomes

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

1. **Understand GIS Principles**: Explain the basic principles of Geographic Information Systems (GIS) and how they are applied in soil science.
2. **Spatial Data Management**: Demonstrate skills in managing spatial data, including data collection, input, storage, retrieval, and manipulation.
3. **Geospatial Analysis**: Conduct spatial analysis and modeling using GIS tools to solve soil science-related problems.
4. **Mapping and Visualization**: Create and interpret maps and other visual representations of spatial data to effectively communicate soil-related information.
5. **Soil Data Integration**: Integrate various types of soil data (e.g., physical, chemical, biological) with other environmental data in a GIS framework.
6. **Remote Sensing Applications**: Utilize remote sensing techniques to gather and analyze soil and environmental data.

Course Content (Theory)		Assignments/Readings
Week 1	**Unit 1** 1.1. Introduction to GIS: 1.1.1. Definition 1.1.2. Components of GIS	Write a detailed report on the definition of GIS and its components. Include examples of how each component contributes to the overall functionality of GIS. Use diagrams to illustrate the relationships between components.

Week 2	**Unit 2** 2.1. Spatial Data: 2.1.1. Introduction 2.1.2. Types 2.1.3. Sources	
Week 3	**Unit 3** 3.1. GIS Data Structures: 3.1.1. Introduction 3.1.2. Digital file structures: Simple lists, Ordered Sequential Files, Indexed Files	Prepare a report comparing different GIS data structures, including simple lists, ordered sequential files, and indexed files. Discuss the use cases for each structure and their implications for data management.
Week 4	1. Digital database structures for Managing 2. Data: Hierarchical Data Structures, Network systems, Relational Database Management Systems 3. GIS Data Models for Multiple Coverages: Raster Models, Compact storing of Raster Data, Vector Models, Compacting Vector Data Models, Hybrid and Integrated Systems	
Week 5	**Unit 4** 4.1. Spatial Data Modeling: 4.1.2. Introduction 4.1.3. Spatial data models	
Week 6	4.1.4. Spatial data structures	Write a detailed analysis of various digital database structures for managing

	4.1.5. Modeling surfaces	GIS data, such as hierarchical data structures, network systems, and relational database management systems. Include diagrams and examples to illustrate how each structure manages data.
Week 7	4.1.6. Modeling networks 4.1.7. Modeling third and fourth dimensions	
Week 8	**Unit 5** 5.1. Attribute Data Management: 5.1.1. Introduction 5.1.2. Creating a database	
Week 9	5.1.3. Integrating database 5.1.4. Development in database 5.1.5. GIS database applications	Develop a project where you create spatial data models for a given area. Include modeling surfaces, networks, and third and fourth dimensions. Provide detailed descriptions of your models and their applications.
Week 10	**Unit 6** 6.1. Spatial Data Input and Editing	
Week 11	6.1.2. Introduction 6.1.3. Methods of Data Input	

Week 12	1. Data Editing	
Week 13	6.1.5. The Importance of Editing GIS Database 6.1.6. Detecting and Editing Errors	Create a sample GIS database and integrate it with other data sources. Write a report on the process, challenges faced, and solutions implemented. Discuss the development and applications of the database.
Week 14	6.1.7. Projection Changes	
Week 15	6.1.8. Edge Matching	
Week 16	6.1.9. Conflation and Rubber Sheeting 6.1.10. Integrated databases	
Course Content (Practical)		**Assignments/Readings**
Week 1	**Unit 1** 1.1. Spatial Analysis: Techniques of spatial analysis	Practical notebook completion
Week 2	1. GIS Output: 2. Display of Analysis	
Week 3	3. Cartographic output	
Week 4	4. Map design controls	Practical notebook completion
Week 5	5. Non-traditional Cartographic output	
Week 6	6. Technology and GIS output	Practical notebook completion

Week 7	7. Spatial Analysis: Techniques of spatial analysis-Practical Demonstration	
Week 8	8. Spatial Analysis: Techniques of spatial analysis- Practical Demonstration	Practical notebook completion
Week 9	**Unit 2** 2.1. GIS Project Design and Management: 2.1.1. Introduction	
Week 10	2.1.2. Problem identification	
Week 11	2.1.3. Designing a data model	Practical notebook completion
Week 12	2.1.4. Project management	
Week 13	2.1.5. Implementation problems	
Week 14	2.1.6. Project evaluation	Practical notebook completion
Week 15	2.1.7. GIS Project Design and Management	
Week 16	2.1.8. GIS Project Design and Management	

Textbooks and Reading Material

- Environmental Systems Research Institute (ESRI) 1993: Understanding GIS: The ARC/INFO method. John Wiley & Sons, New York.
- Found, W. C. 1971: A theoretical approach to rural land-use patterns. Edward Arnold London.
- Garnett, A. 1945: The interpretation of topographical maps, Ltd., George G. Harrap & Co. London.
- Huxhold, W.E. 1991: An Introduction to Urban Geographic Information Systems, Oxford University Press. Oxford.
- Johson et al. 1992: Geographic Information System and Mapping, American Society for Testing and Materials.
- Lillesand, T. M. & Kiefer, R. W. 1994: Remote Sensing and Image Interpretation, John Wiley & Sons, New York.

- Lo, C. P. 1976: Geographical Applications of Aerial Photography, Crane Russak, New York
- Lyon J. G. & McCarthy J. (edit) 1995: Wetland and Environmental Applications of GIS, CRC Press Inc, USA.
- Masser, I. & Blackmore, M. 1991: Handling Geographic Information, Longman, London.
- Mather, A. S. 1986: Land Use, Longman, London.
- Mather, P.M. 1993: Geographical Information Handling - Research and Applications, John Wiley & Sons, New York.
- Peuquet, D. J. & Marble, D. F. 1990: Introductory Readings in Geographic Information Systems Taylor & Francis London.
- Rhind, D. W., Googchild, M. F. and Maguire, D. J. (edit) 1991: Geographical Information Systems: Principles and Applications, Longman Group UK.
- Rhind, D. W., Googchild, M. F. and Maguire, D. J. (edit) 1991: Geographical Information Systems: Principles and Applications, Longman Group, UK.
- Scholten, H.J. & Stillwell, C.H. 1990: Geographic Information Systems for Urban and Regional Planning, Kulwer Academic Publications.

Teaching Learning Strategies

- Multimedia
- White Board
- Group discussion
- Quiz/Assignments
- Demonstration/Activity

Assignments: Types and Number with Calendar

- Write a detailed report on the definition of GIS and its components. Include examples of how each component contributes to the overall functionality of GIS. Use diagrams to illustrate the relationships between components.
- Prepare a report comparing different GIS data structures, including simple lists, ordered sequential files, and indexed files. Discuss the use cases for each structure and their implications for data management.
- Write a detailed analysis of various digital database structures for managing GIS data, such as hierarchical data structures, network systems, and relational database management systems. Include diagrams and examples to illustrate how each structure manages data.
- Develop a project where you create spatial data models for a given area. Include modeling surfaces, networks, and third and fourth dimensions. Provide detailed descriptions of your models and their applications.
- Create a sample GIS database and integrate it with other data sources. Write a report on the process, challenges faced, and solutions implemented. Discuss the development and applications of the database.

- Practical notebook completion

Assessment

Sr. No.	Elements	Weightage	Details
•	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
•	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
•	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.