COURSE CODE	**GIE-471**
COURSE NAME	**GIS PROGRAMMING**
CREDIT HOURS	Theory: 02
	Practical: 01
	Total: 03
CONTACT HOURS	Theory: 32
	Practical: 48
	Total: 80
PREREQUISITE	Nil

MODE OF TEACHING:

Instruction:	Two hours of lecture per week	67%
Practical:	Three hours of Lab work per week	33%

COURSE DESCRIPTION:

This course is designed to equip students with the essential skills and knowledge necessary to automate geospatial tasks, enhance the capabilities of Geographic Information Systems (GIS), and solve complex spatial problems through programming. This course provides a strong foundation in the use of programming languages such as Python, which is widely adopted in the GIS industry for data manipulation, spatial analysis, and geoprocessing automation.

COURSE OBJECTIVES:

To provide core principles of GIS, including spatial data types, geodatabases, projections, and spatial analysis techniques. This forms the basis for understanding how GIS programming can enhance workflows.

To learn Python from scratch or building upon existing knowledge to apply it in the context of GIS software like ArcGIS, QGIS, and open-source libraries such as GDAL, OGR, Fiona, Shapely, and GeoPandas.

To develop scripts to automate repetitive tasks such as data conversion, data preprocessing, and spatial analysis, allowing for more efficient workflows and faster processing of geospatial datasets.

To provide a foundation for customized geospatial applications using programming platforms such as Python and JAVA.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, students will be able to:

S.No.	CLO	Domain	Taxonomy Level	PLO
1	Demonstrate theoretical background and advanced level concept of GIS programming	Cognitive	2	1
2	Design a structured and well documented GIS programs	Cognitive	5	3
3	Develop a complete application using GIS programming	Cognitive	5	5

TOPICS COVERED:

Theory:

Week	Topics
1	Fundamentals of geo-processing, Fundamentals of Python
2	Usage of variables and special datatypes, Naming conventions and reserved words
3	testing and printing variable values, Looping and control structures
4	Debugging, optional and required parameters
5-6	Objects, properties and methods, the OO paradigm
7-8	Object Model Diagrams, The geo-processor object introduction
9	Functions and parameters, passing and returning values, Multiple inputs and complex parameter passing
10-11	Selections and sets, SQL basics, Writing results to disk, various formats, and switches
12-13	Advanced topics and further directions
14	Num.py for numerical modeling
15	Java Topology Suite
16	Architecture of ArcObjects
17	Main ArcObjects classes, classes, and interfaces (Feature Layer, Feature Class, Feature, Feature Cursor, etc.) other useful modules
18	**ESE**

Practical:

No.	Topics
1	Looping statements
2	Getting and setting object parameters
3	Creating features and feature classes
4	Editing layer's display properties
5	Changing/editing and summarizing attribute data
6	Exploring the geo-processor object,
7	Java Topology Suite

8	Looping statements
9	Getting and setting object parameters
10	Projects

Books:

Text

- Eric Pimpler (2013), “Programming ArcGIS 10.1 with Python Cookbook”.

Reference Books

- Bugg, K.E. (2003), “GIS Programming: Prepare for the Gathering Storm”, GEO World.
- Kropla, B. (2005), “Beginning MapServer: Open Source GIS Development”, 1st Edition, Apress, Co. ISBN: 1590594908
- Ralston, B. A. (2001), “Developing GIS Solutions with Map Objects and Visual Basic”, Onword Press, New York. ISBN: 0766854388
- Rigaux, P., Scholl, M. and Voisard, A. (2001), “Spatial Databases: With Application to GIS” 1st Edition, Morgan Kaufmann. ISBN: 1558605886.

ASSESMENT SYSTEM:

1. **CLOs Assessment**

Cognitive	**Psychomotor**	**Affective**
Spreadsheet	Rubrics	Rubrics

2. **Relative Grading**

Theoretical / Instruction			67%
	Assignments 10%		
	Quizzes 10%		

	Mid Exams 30%		
	End Semester Exam 50%		
Practical Work			33%
Laboratory Work		*70%*	
	Laboratory Assignment 70%		
	Semester Project 30%		
Viva/Quiz		*30%*	
Total			100%