NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	Master of Computer Application (2-Years Programme)
Course Code:	3MCAD365
Course Title:	Geographic Information System
Course Type:	Departmental Elective
Year of Introduction:	2021-22

Credit Scheme

L	T	Practical Component				C
		LPW	PW	W	S	
3	0	2	-	-	-	4

Course Learning Outcomes (CLO):

At the end of the course, students will be able to –

1. summarize the concepts and practices of Geographic Information Systems (GIS)
2. interpret the types of data models, data input, topology, data management functions and data output
3. analyze spatial data, using GIS analysis tools
4. apply GIS analysis to address geospatial problems and/or research questions.

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
Unit-I	**Fundamentals of GIS:** Introduction to GIS, Basic spatial concepts, Coordinate Systems, GIS and Information Systems, Definitions, History of GIS, Components of a GIS, Hardware, Software, Data, People, Methods, Proprietary and open source Software, Types of data, Spatial, Attribute data, types of attributes, scales/ levels of measurements.	09
Unit-II	**Spatial Data Models**: Database Structures-Relational, Object Oriented, ER diagram, spatial data models, Raster Data Structures, Raster Data Compression, Vector Data Structures, Raster vs Vector Models, TIN and GRID data models, OGC standards, Data Quality.	09
Unit-III	**Data Input and Topology:** Scanner, Raster Data Input, Raster Data File Formats, Vector Data Input, Digitiser, Topology, Adjacency, connectivity and containment, Topological Consistency rules, Attribute Data linking, ODBC, GPS, Concept GPS based mapping.	09
Unit-IV	**Data Analysis:** Vector Data Analysis tools, Data Analysis tools, Network Analysis, Digital Education models, 3D data collection and utilisation.	09
Unit-V	**Applications:** GIS Applicant, Natural Resource Management, Engineering, Navigation, Vehicle tracking and fleet management, Marketing and Business applications, Case studies.	09

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education
3. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publisher
4. Yang, C. Introduction to GIS programming and fundamentals with Python and ArcGIS®. CRC Press.
5. https://automating-gis-processes.github.io/CSC18/index.html#
6. Lawhead, J, Learning geospatial analysis with Python. Packt Publishing Ltd.
7. Lawhead, Joel. Learning Geospatial Analysis with Python: Understand GIS fundamentals and perform remote sensing data analysis using Python 3.7. Packt Publishing Ltd

Suggested List of Experiments:

Sr.	Title	Hours
1	To perform GIS with Python, create basic geometries and Attributes of geometries. Read coordinates from a file and create a geometry	02
2	To study and create a Line or Polygon from a Collection of Point geometries. Create LineStrings that represent the movements.	04
3	To study and read and write data from/to Shapefile. Change the coordinate reference system of the data	02
4	To perform Geocoding, convert addresses into Points (and vice versa). Download data from OpenStreetMap using Python. Reclassify data based on different criteria (custom or common classifiers).	02
5	To conducting the Point in Polygon (PIP) query, create a function for it. Also read data from KML file.	02
6	To understand Spatial queries, make spatial and table joins between layers. Also find the nearest neighbour from Point -objects.	04
7	To study and create a static map visualization.	04
8	To study and create a simple interactive map using either Bokeh or Folium (or both).	02
9	To perform Raster processing, download data automatically from Helsinki area produced by NASA, USGS & Latuviitta. Read raster files and basic attributes from them and visualize raster data.	04
10	To perform Raster processing, Clip raster files based on a Polygon. Merge multiple raster files together and create a raster mosaic. Also summarize raster datasets based on vector geometries.	04

Suggested Case list -NA-