	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Master of Technology**	Year of Regulation	**2025**
Department	**Civil Engineering**	Semester	**II**

Course Code	Course Name	Pre-requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
CE 542	**GIS & Remote Sensing**	**NIL**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	1. To introduce the principles of remote sensing and GIS in environmental applications. 2. To understand the acquisition, processing, and interpretation of satellite data. 3. To familiarize students with GIS tools for spatial data management and analysis. 4. To enable integration of remote sensing and GIS in environmental modeling and monitoring. 5. To apply geospatial technologies in solving real-world environmental and resource management issues.	Course Outcomes	CO1	Able to understand the basic principles of remote sensing and GIS.
			CO2	Be able to analyze satellite imagery for various environmental parameters.
			CO3	Be able to apply GIS tools for spatial data analysis and decision-making.
			CO4	Be able to integrate remote sensing and GIS for environmental modeling and monitoring.
			CO5	Be able to design and implement GIS-based projects.

SYLLABUS

No.	Content	Hours	COs
I	**Fundamentals of Remote Sensing:** Definition, scope and types of remote sensing; Electromagnetic spectrum and energy; interactions; Sensors and platforms: optical, thermal, microwave; Resolution: spatial, spectral, temporal, radiometric; Indian and global satellite missions (IRS, Landsat, Sentinel)	**5**	CO1, CO 2
II	**Image Processing and Interpretation:** Digital image processing: pre-processing, enhancement, classification; Supervised vs. unsupervised classification; Vegetation indices (NDVI), land cover mapping; Change detection techniques; Accuracy assessment and validation	**7**	CO2, CO3, CO4
III	**Fundamentals of GIS:** Definition, components and functions of GIS; Spatial data types: raster and vector; Data models and database structures; Coordinate systems and map projections; GIS software: QGIS, ArcGIS (basic introduction)	**9**	CO2, CO3, CO4
IV	**Spatial Analysis Techniques:** Overlay analysis, buffer, interpolation, reclassification; Network and terrain analysis; Spatial statistics and geostatistical tools; 3D visualization and DEM applications; Georeferencing and digitization	**7**	CO4, CO5
V	**Applications in Environmental Engineering:** Land use/land cover change detection; Watershed and water quality mapping; Soil erosion and landslide susceptibility mapping; Urban sprawl and air quality analysis; Disaster risk and climate vulnerability assessment	**7**	CO4, CO5
VI	**Project Development and Case Studies:** Integration of RS-GIS in environmental impact assessment (EIA); Smart city planning and green infrastructure; Real-time environmental monitoring systems; National geospatial policies and data repositories (Bhuvan, NRSC, NSDI); Hands-on mini project using open-source RS-GIS data	**7**	CO4, CO5
	Total Hours	**42**	

Essential Readings

1. B. E. Turner II, D. S. Guttman, and J. E. Estes, The GIS Handbook, 4th ed. New York, NY, USA: Springer, 2023
2. T. M. Lillesand, R. W. Kiefer, and J. W. Chipman, Remote Sensing and Image Interpretation, 7th ed. Hoboken, NJ, USA: Wiley, 2020.
3. P. A. Burrough, R. A. McDonnell, and C. D. Lloyd, Principles of Geographical Information Systems, 3rd ed. Oxford, U.K.: Oxford Univ. Press, 2022.

Supplementary Readings

1. G. Joseph and C. Jeganathan, Fundamentals of Remote Sensing, 3rd ed. Hyderabad, India: Universities Press, 2022.
2. Q. Weng, Remote Sensing and GIS Integration: Theories, Methods, and Applications, 2nd ed. New York, NY, USA: McGraw Hill, 2021.
3. C. P. Lo and A. K. W. Yeung, Concepts and Techniques of Geographic Information Systems, 3rd ed. Boston, MA, USA: Prentice Hall, 2019.