



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch: Civil (Water Resource Engineering)**

**Course / Subject Code: ME01033031**

**Course / Subject Name: Remote Sensing And Spatial Data Analysis**

w. e. f. Academic Year:	2024-25
Semester:	1 <sup>st</sup> Semester
Category of the Course:	PEC

<b>Prerequisite:</b>	Primary knowledge of Remote Sensing, GIS, and water resources engineering,
<b>Rationale:</b>	The students will get an in-depth understanding of remote sensing and spatial data analysis with a specific focus on applications in water resource engineering. Students will learn how to use remote sensing technologies to analyze spatial data relevant to water resources, including hydrological modeling, watershed management, and flood risk assessment. The course combines theoretical knowledge with practical skills through hands-on lab sessions.

## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand the principles and techniques of remote sensing.	R,U
02	Process spatial data relevant to water resource engineering.	U,A,N
03	Apply remote sensing and GIS tools to analyze hydrological and watershed data.	U,N,E
04	Conduct spatial data analysis for flood risk assessment and water resource management.	R,U,N,E,C
05	Develop skills in integrating remote sensing data with hydrological models.	

*\*Revised Bloom's Taxonomy (RBT)*



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### Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

### Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to geospatial technologies: Fundamentals of remote sensing, remote sensing principles and techniques, types of remote sensing, Electromagnetic spectrum, interaction of EMR, atmospheric window, remote sensing usefulness in water resources engineering, Different remote sensing missions.	9	19
2.	Image processing: Image interpretation, Image enhancement and visualization, Image classification techniques, equipment, techniques of data acquisition, satellite and sensors, digital image processing, types of resolutions.	9	19
3.	Introduction to GPS: Working principles of GPS, measurement and mapping techniques, DGPS, Drone technology and its applications. Introduction to GIS: Georeferenced data, data input and output, data quality and management, GIS analysis function, Implementation of GIS, ArcGIS, QGIS, online data sources for data downloading, introduction to BHUVAN portal, USGS Earth Explorer, OpenStreetMap, HydroSHEDS.	10	24



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4.	Geospatial analysis: DEM, TIN, slope map, aspect map, stream order, Watershed delineation, Monitoring and mapping of surface water bodies, land use/land cover changes, Change detection and time-series analysis, morphometric analysis, flood mapping and monitoring.	9	19
5.	Different geospatial technology software: Salient features, capabilities and limitations, application of RS, GIS, GPS, Drone in water resources engineering, case studies, Introduction to India Water Resources Information System.	8	19
<b>Total</b>		<b>45</b>	<b>100</b>

### Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	20	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

### References/Suggested Learning Resources:

#### (a) Books:

1. A.M. Chandra and S.K. Ghosh, Remote Sensing and Geographical information System, Narosa Publishing House, New Delhi, 2006.
2. Bhatta B., Remote Sensing and GIS, Oxford University Press, New Delhi, 2008.
3. Stan Aronoff, "Geographical Information Systems", WDL Publications, Ottawa, Canada, 1989.
4. Lo C.P. and Yeung Albert K.W., Concepts and Techniques of Geographical Information Systems, Prentice-Hall of India Pvt. Ltd. New Delhi, 2006.
5. Ian Heywood et al., Geographical Information System, Pearson, 2019.
6. Gibson P.J. and Power C.H., Introductory Remote Sensing, Rotledge London, 2000.

#### (b) Open source software and website:

1. <https://qgis.org/en/site/forusers/download.html>
2. <https://bhuvan.nrsc.gov.in/home/index.php>
3. <https://earthexplorer.usgs.gov/>
4. <https://scihub.copernicus.eu/>



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5. <https://earthengine.google.com/>

PO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program .
PO4	An ability to apply advanced knowledge and skills appropriate to civil engineering.
PO5	An ability to think critically and apply appropriate logic, analysis, judgment and decision making and to function as an effective member or leader of engineering teams to achieve common goals.
PO6	An ability to use appropriate techniques, skills, and modern engineering tools necessary for engineering practice and commit to professional ethics and responsibilities.

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