



**TECHNO INDIA UNIVERSITY**  
WESTBENGAL

**COURSE STRUCTURE  
FOR  
2-YEAR M.Sc. PROGRAM  
IN GEOINFORMATICS  
DEPARTMENT OF GEOSPATIAL  
SCIENCE  
SESSION-2025-2027**

**TECHNO INDIA  
UNIVERSITY**



## M.Sc. In Geoinformatics-2025-2027

### Course Structure

### 1<sup>st</sup> Year

#### Semester I

Sl. No.	Paper Code	Paper	Contact hrs./week			Credit
			L	T	P	
<b>Theory</b>						
1	TIU-PGI-T101	Introduction to Geoinformatics	2	1	0	3
2	TIU-PGI-T103	Spatial Data Science Fundamentals	2	1	0	3
3	TIU-PGI-T105	Remote Sensing	3	0	0	3
4	TIU-PGI-T107	Computer and Programming	1	1	0	2
5	TIU-PGI-ES101	Entrepreneurship Skill Development (ESD): Design Thinking & Idea Incubation	2	0	0	2
<b>Practical</b>						
1	TIU-PGI-L101	GIS and Digital Cartography Lab	0	0	4	2
2	TIU-PGI-L103	Spatial Data Handling and Navigation Lab	0	0	4	2
3	TIU-PGI-L105	Introduction to Python	0	0	2	1
4	TIU-PGI-S101	Career Advancement Skill Development (CASD): Scientific Writing and Communication	0	0	4	2
<b>Total Credits</b>						<b>20</b>

#### Semester II

Sl. No.	Paper Code	Paper	Contact hrs./week			Credit
			L	T	P	
<b>Theory</b>						
1	TIU-PGI-T102	Advanced GIS	3	0	0	3
2	TIU-PGI-T104	Digital Image Processing & Pattern Recognition	3	0	0	3
3	TIU-PGI-T106	Advanced Remote Sensing Techniques and Applications	2	1	0	3
4	TIU-PGI-T108	IOT in Geospatial Technology	1	0	0	1
4	TIU-PGI-ES102	Entrepreneurship Skill Development (ESD): Environmental Science and RS/GIS-based EIA	2	1	0	3
5	TIU-PGI-CASD102	Career Advancement Skill Development (CASD): Communicative English	2	0	0	2
<b>Practical</b>						
1	TIU-PGI-L102	GIS & Statistics with R Lab	0	0	4	2
2	TIU-PGI-L104	Digital Image Processing Lab	0	0	4	2
3	TIU-PGI-L106	Advanced Remote Sensing and Digital Photogrammetry Lab	0	0	4	2
4	TIU-PGI-L108	Web-GIS & Google Earth Engine Lab	0	0	2	1
<b>Total Credits</b>						<b>22</b>



**Semester III**

Sl. No	Paper Code	Paper	Contact hrs./week			Credit
			L	T	P	
<b>Theory</b>						
1	TIU-PGI-T201	Geo- Environmental Modelling and Analysis	2	0	0	2
2	TIU-PGI-T203	GeoAI	2	1	0	3
3	TIU-PGI-T205	Enterprise GIS & Geospatial Data Governance	2		0	2
4	TIU-PGI-T207	Research Methodology	2	0	0	2
5	TIU-PGI-ET207A	Geoinformatics in Urban Planning and Infrastructure	3	0	0	3
	TIU-PGI-ET207B	Geoinformatics in Agriculture and Management				
	TIU-PGI-ET207C	Geoinformatics in Disaster Management				
	TIU-PGI-ET207D	Geoinformatics in Water Resources Management				
	TIU-PGI-ET207E	Geoinformatics in Environmental Management				
<b>Practical</b>						
1	TIU-PGI-L201	Geo-environmental Modelling and analysis Lab	0	0	4	2
2	TIU-PGI-L203	Spatial Data Generation (UAV, DGPS) and 3-D image generation Lab	0	0	4	2
3	TIU-PGI-ES201	Entrepreneurship Skill Development (ESD): Enterprise GIS Lab	0	0	2	1
4	TIU-PGI-S201	Career Advancement Skill Development (CASD): Computer Aided Design Lab	0	0	2	1
6	TIU-PGI-P201	Dissertation (Part I)	-	-	-	8
<b>Total Credits</b>						<b>26</b>

**Semester IV**

Sl. No	Paper Code	Paper	Contact hrs./week			Credit
			L	T	P	
<b>Theory</b>						
1	TIU-PGI-T202	Project Management	2	1	0	3
2	TIU-PGI-T204	Entrepreneurship Skill Development (ESD): Organisational Behaviour	2	0	0	2
<b>Practical</b>						
1	TIU-PGI-L202	Web-GIS Dashboarding Lab	0	0	4	2
2	TIU-PGI-S202	Career Advancement Skill Development (CASD): Internship/Field Training				5
3	TIU-PGI-P202	Dissertation Part 2 and Viva	-	-	-	12
4	TIU-PGI-S204	Grand Viva				2
<b>Total Credits</b>						<b>26</b>



Total Credits:

1 <sup>st</sup> Sem Credits	2 <sup>nd</sup> Sem Credits	3 <sup>rd</sup> Sem Credits	4 <sup>th</sup> Sem Credits	Total Credits
20	22	26	26	94

\*\*In addition, each student may successfully complete two recognized online courses per year — such as those offered on MOOC platforms or SWAYAM — for inclusion in their academic transcript.

\*\* All EASD and CASD courses will be evaluated based on sessional assessments



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## Department of Geospatial Science

<b>Program: M.Sc. in Geoinformatics</b>	<b>Year, Semester:</b> 1 <sup>st</sup> Yr, 1 <sup>st</sup> Sem (Program 1 <sup>st</sup> Sem)
<b>Course Title: Introduction to Geoinformatics</b>	<b>Subject Code:</b> TIU-PGI-T101
<b>Contact Hours/Week:</b> 3-0-0 (L-T-P)	<b>Credit:</b> 3

### **COURSE OBJECTIVE:**

Enable the student to:

1. Understand the fundamentals, scope, and applications of Geoinformatics and GIS.
2. Learn geospatial data types, models, databases, and coordinate systems.
3. Develop skills in spatial data management, analysis, remote sensing, and GNSS integration.
4. Apply principles of digital cartography, visualization, and web-based mapping with ethical practices.

### **COURSE OUTCOME:**

On completion of the course, the student will be able to:

<b>CO No.</b>	<b>Course Outcome</b>	<b>Cognitive Level</b>
<b>CO-1</b>	Define Geoinformatics, GIS components, and explain scope and applications.	K1
<b>CO-2</b>	Differentiate between spatial vs. non-spatial data, raster vs. vector models, and apply coordinate systems/projections.	K2
<b>CO-3</b>	Demonstrate skills in spatial database handling, SQL, digitization, and georeferencing.	K3
<b>CO-4</b>	Apply spatial and network analysis, terrain modelling, and hydrological analysis using DEM.	K3
<b>CO-5</b>	Integrate remote sensing and GNSS data with GIS for real-world applications.	K4
<b>CO-6</b>	Design thematic and digital maps, dashboards, and web-based geovisualization with ethical considerations.	K4



**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Introduction to Geographic Information System</b>	<b>10 Hours</b>
Scope and applications of GIS; components; geospatial data types; raster and vector models; coordinate systems and projections; geodatabases; spatial formats; cartographic principles; thematic mapping techniques.		
<b>MODULE 2:</b>	<b>Spatial Data Management &amp; Analysis</b>	<b>10 Hours</b>
Spatial databases and SQL; geospatial data acquisition (field, open data, OSM); georeferencing and digitization; spatial operations (overlay, buffer, dissolve, proximity); network analysis; basics of spatial statistics; case studies in suitability, disaster, and urban growth mapping.		
<b>MODULE 3:</b>	<b>Introduction to Remote Sensing</b>	<b>5 Hours</b>
Role of RS in GIS; electromagnetic spectrum basics; types of remote sensing (optical, thermal, microwave, hyperspectral); platforms and sensors (Landsat, Sentinel, IRS); resolutions; Applications of RS: land use mapping, vegetation indices, change detection.		
<b>MODULE 4:</b>	<b>GNSS &amp; Emerging Technologies</b>	<b>10 Hours</b>
GNSS fundamentals (GPS, GLONASS, GALILEO, BeiDou, IRNSS/NAVIC); GNSS segments; data collection and mobile mapping; integration with GIS; modern trends: WebGIS, Mobile GIS, Google Earth Engine, IoT-GIS, open-source platforms.		
<b>MODULE 5:</b>	<b>Digital Cartography &amp; Geovisualization</b>	<b>10 Hours</b>
Traditional vs. digital cartography; map design principles; symbology and visual hierarchy; advanced thematic maps (choropleth, proportional, cartograms); dashboards, story maps, 3D visualization; web mapping (ArcGIS Online, Mapbox, Leaflet, Google Maps API); big geospatial data visualization; ethical cartography.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References**

1. Campbell, J. B. (2007). *Introduction to Remote Sensing*. Guilford Press.
2. Jensen, J. R. (2004). *Introductory Digital Image Processing: A Remote Sensing Perspective*. Prentice Hall.
3. Joseph, G. (2005). *Fundamentals of Remote Sensing*. United Press India.
4. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2004). *Remote Sensing and Image Interpretation* (Wiley Student Edition). Wiley.
5. Fazal, S. (2008). *GIS Basics*. New Age International Publishers, New Delhi.



6. Harvey, F. (2008). *A Primer of GIS: Fundamental Geographic and Cartographic Concepts*. The Guilford Press, New York.
7. Reddy, M. A. (2008). *Remote Sensing and Geographical Information Systems*. B. S. Publications, Hyderabad.
8. Sahu, K. C. (2007). *Textbook of Remote Sensing and Geographical Information Systems*. Atlantic Publishers, New Delhi.



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## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup>Yr., 1<sup>st</sup> Sem. (Program 1<sup>st</sup> Sem)</b>
<b>Course Title: Spatial Data Science Fundamentals</b>	<b>Subject Code: TIU-PGI-T103</b>
<b>Contact Hours/Week: 3-0-0 (L-T-P)</b>	<b>Credit: 3</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamentals, workflow, and lifecycle of Data Science in the context of geoinformatics.
2. Learn techniques for geospatial and non-spatial data acquisition, preprocessing, and feature engineering.
3. Apply statistical and machine learning methods for analyzing spatial data.
4. Explore practical applications of data science for environmental monitoring, urban planning, and disaster management.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

<b>CO No.</b>	<b>Course Outcome</b>	<b>Cognitive Level</b>
<b>CO-1</b>	Define Data Science concepts, workflow, and explain its role in geoinformatics.	K1
<b>CO-2</b>	Identify and differentiate data types and formats relevant to geospatial applications.	K2
<b>CO-3</b>	Demonstrate skills in data preprocessing, cleaning, transformation, and feature engineering.	K3
<b>CO-4</b>	Apply descriptive statistics, visualization, and dimensionality reduction to geospatial data.	K3
<b>CO-5</b>	Implement machine learning methods (regression, classification, clustering) for spatial datasets.	K4
<b>CO-6</b>	Evaluate real-world applications of data science in land cover mapping, environmental monitoring, and urban planning.	K4



**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Introduction to Data Science</b>	<b>10 Hours</b>
Introduction to Data Science: Definition, and scope of Data Science, Data Science workflow and lifecycle, Role of Data Science in geoinformatics and spatial data analysis, types of data (structured, unstructured, semi-structured, spatial, temporal), Role of data science in spatial decision-making.		
<b>MODULE 2:</b>	<b>Data Acquisition &amp; Preprocessing</b>	<b>10 Hours</b>
Sources of geospatial and non-spatial data (remote sensing, GPS, surveys), Data formats in geoinformatics (tabular, raster, vector, databases), Data cleaning (handling missing values, outliers, duplicates), Data transformation and normalization, feature engineering basics.		
<b>MODULE 3:</b>	<b>Data Analysis Fundamentals</b>	<b>8 Hours</b>
Descriptive statistics (mean, median, standard deviation); visualization (histograms, scatterplots, boxplots, maps); correlation and covariance in spatial context; dimensionality reduction (PCA, t-SNE).		
<b>MODULE 4:</b>	<b>Statistics &amp; Machine Learning Foundation</b>	<b>10 Hours</b>
Probability and distributions; hypothesis testing, ANOVA, regression; supervised vs. unsupervised learning; regression, classification, clustering; methods: k-NN, logistic regression, decision trees, K-means, hierarchical clustering, DBSCAN.		
<b>MODULE 5:</b>	<b>Applications in Spatial Data</b>	<b>7 Hours</b>
Applications in land cover classification, change detection, predictive modeling for environmental monitoring, spatial pattern analysis in urban planning, and geospatial big data for disaster management		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References**

1. Provost, F., & Fawcett, T. (2013). Data Science for Business. O'Reilly.
2. VanderPlas, J. (2016). Python Data Science Handbook. O'Reilly.
3. Han, J., Kamber, M., & Pei, J. (2011). Data Mining: Concepts and Techniques. Elsevier.
4. Tukey, J. W. (1977). Exploratory Data Analysis. Addison-Wesley.
5. Hastie, T., Tibshirani, R., & Friedman, J. (2009). The Elements of Statistical Learning. Springer.
6. Mitchell, T. M. (1997). Machine Learning. McGraw-Hill.
7. Wes McKinney (2018). Python for Data Analysis. O'Reilly.
8. O'Sullivan, D., & Unwin, D. (2010). Geographic Information Analysis. Wiley.
9. Esri (2021). Machine Learning and Data Science in ArcGIS.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 1 <sup>st</sup> Yr.,1 <sup>st</sup> Sem. (Program 1 <sup>st</sup> Sem)
<b>Course Title: Remote Sensing</b>	<b>Subject Code:</b> TIU-PGI-T105
<b>Contact Hours/Week:</b> 3-0-0 (L-T-P)	<b>Credit:</b> 3

### COURSE OBJECTIVE:

1. Enable the student to:
2. Understand the physical principles of electromagnetic radiation and its interaction with the atmosphere and Earth's surface.
3. Learn about remote sensing platforms, sensors, and their resolutions.
4. Acquire knowledge of optical remote sensing, aerial photography, and digital imaging systems.
5. Develop the ability to interpret satellite sensor specifications and perform ground truth validation.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Describe electromagnetic energy, EM spectrum, and interactions with the atmosphere and Earth's surface.	K1
CO-2	Explain types of remote sensing systems, orbits, sensors, and their resolutions.	K2
CO-3	Demonstrate understanding of aerial photography, optical RS principles, and imaging geometry.	K3
CO-4	Differentiate sensor types (framing, scanning, hyperspectral) and digital imaging methods.	K3
CO-5	Analyze specifications of major Earth observation satellites (IRS, Landsat, Sentinel, etc.) for applications.	K4
CO-6	Apply knowledge of ground-truthing instruments, parameters, and field measurement techniques for RS data validation.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Fundamentals of Electromagnetic Radiation</b>	<b>8 Hours</b>
Concept of energy and its conversion; electromagnetic energy; wave and particle models; radiant flux; electromagnetic spectrum; properties of electromagnetic energy in optical, thermal, and microwave regions; Electro Magnetic Radiation (EMR) –atmosphere interactions including absorption, scattering, reflection, refraction, and transmission; types of reflectors; color theory (RGB, IHS, CMYK); and the use of light filters.		
<b>MODULE 2:</b>	<b>Remote Sensing Systems</b>	<b>8 Hours</b>



Different types of remote sensing; satellite orbits and their characteristics; remote sensing satellites; benefits and limitations of remote sensing; features of an ideal remote sensing system; types of sensor resolutions (spatial, spectral, radiometric, temporal); systems for image referencing; an overview of the Indian space program, launch vehicles, and remote sensing satellite missions		
<b>MODULE 3:</b>	<b>Optical Remote Sensing &amp; Aerial Photography</b>	<b>8 Hours</b>
Principles and processes of optical remote sensing; aerial photography and its applications; different types of cameras and their functions; filters and film types; film size and resolution; basics of aerial photography geometry; concepts of scale and vantage point		
<b>MODULE 4:</b>	<b>Digital Imaging &amp; Sensors</b>	<b>7 Hours</b>
Basics of digital imaging; different types of sensors; imaging sensors and their uses; framing and scanning sensor systems; across-track and along-track scanning methods; hyperspectral imaging; and digital framing systems.		
<b>MODULE 5:</b>	<b>Satellite Sensor Specifications</b>	<b>7 Hours</b>
Sensor specifications of major Earth observation satellites, including the IRS series, Resourcesat series, Cartosat series, IKONOS, QuickBird, OrbView, GeoEye, WorldView, Sentinel, Landsat, SPOT, and others.		
<b>MODULE 6:</b>	<b>Ground Truthing</b>	<b>7 Hours</b>
Ground-truth data: its requirements, instruments used for ground truthing, key parameters measured, and factors influencing spectral measurements in remote sensing.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References:**

1. Jensen, J.R. (2006): Remote Sensing of the Environment: An Earth Resource Perspective, Prentice Hall, Upper Saddle River, New Jersey.
2. Lillesand, T.M. and Kiefer, R. W. (1994): Remote Sensing and Image Interpretation, 3rd edition, John Wiley and Sons, New York.
3. Sabins, F.F. (1997): Remote Sensing: Principles and Applications, 3rd edition, W.H. Freeman & Company, New York.



<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1st Yr., 1<sup>st</sup> Sem. (Program 1<sup>st</sup> Sem)</b>
<b>Course Title: Computer and Programming</b>	<b>Subject Code: TIU-PGI-T107</b>
<b>Contact Hours/Week: 1-1-0 (L-T-P)</b>	<b>Credit: 2</b>

**COURSE OBJECTIVE:**

Enable the student to:

1. Understand the fundamentals of computer systems, data representation, and storage devices.
2. Learn the difference between data and information, and factors affecting computer performance.
3. Gain knowledge of programming concepts, data types, operators, and control structures.
4. Acquire basic skills in modern programming environments, including HTML, CSS, Python, and R.

**COURSE OUTCOME:**

On completion of the course, the student will be able to:

**COURSE OUTCOME:**

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Describe computer systems, their components, and applications for individual and organizational use.	K1
CO-2	Explain the process of data handling, conversion, and representation in different number systems.	K2
CO-3	Demonstrate understanding of data storage devices, performance factors, and drive standards.	K3
CO-4	Apply programming fundamentals, including variables, operators, conditional statements, and loops.	K3
CO-5	Utilize introductory web technologies and programming environments such as HTML, CSS, Python, and R.	K4

**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Computer Fundamentals</b>	<b>5 Hours</b>
Introduction to computers, components (CPU, memory), and types of computers; History, generations, and basic characteristics of computers; Understanding hardware, software, data, and information.		
<b>MODULE 2:</b>	<b>Operating System (e.g., Windows XP/7/10/11):</b>	<b>5 Hours</b>
Introduction to the operating system and its functions; Desktop settings, control panel, and basic system operations; Using accessories like MS Paint and WordPad.		
<b>MODULE 3:</b>	<b>Microsoft Office Suite (Word, Excel, PowerPoint)</b>	<b>5 Hours</b>



Word Processing: Creating and formatting documents.; Spreadsheets: Using Excel for calculations and data management; Presentations: Creating slides using PowerPoint.

<b>MODULE 4:</b>	<b>Internet and Email</b>	<b>5 Hours</b>
Basics of the internet and web browsers; Creating and managing an email account; Using search engines and social networking sites.		
<b>MODULE 5:</b>	<b>Computer Security</b>	<b>5 Hours</b>
Introduction to computer viruses and antivirus software; Basics of troubleshooting and system maintenance.		
<b>MODULE 6:</b>	<b>Various Software</b>	<b>5 Hours</b>
Web technologies ; HTML, CSS ; Python ; R etc.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

**References:**

1. Computers Are Your Future by Catherine LaBerta
2. Introduction to Programming Using Python by Y. Daniel Liang
3. Programming Logic and Design by Joyce Farrell
4. HTML and CSS: Design and Build Websites by Jon Duckett

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<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 1 <sup>st</sup> Yr.,1 <sup>st</sup> Sem. (Program 1 <sup>st</sup> Sem)
<b>Course Title:</b> Entrepreneurship Skill Development (ESD): <b>Design Thinking &amp; Idea Incubation</b>	<b>Subject Code:</b> TIU-PGI-ES101
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 2

**COURSE OBJECTIVE:**

Enable the student to:

1. Understand the concept and scope of entrepreneurship in the geospatial domain.
2. Explore problem identification and opportunity recognition in GIS, RS, and geoinformatics applications.
3. Gain basic skills in team building, idea generation, and interdisciplinary collaboration.
4. Develop awareness of regulatory, ethical, and intellectual property issues in geospatial entrepreneurship.

**COURSE OUTCOME:**

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the fundamentals of entrepreneurship and the geospatial industry landscape.	K1
CO-2	Identify geospatial problems and opportunities in urban, agricultural, environmental, and logistics domains.	K2
CO-3	Demonstrate team formation strategies and brainstorming methods for idea generation.	K3
CO-4	Analyze the regulatory environment for geospatial business (drone rules, mapping guidelines, licensing).	K3
CO-5	Evaluate ethical issues in geospatial entrepreneurship including IPR, data ethics, and privacy.	K4
CO-6	Propose innovative geospatial solutions aligned with societal and industrial needs.	K4

**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Introduction to Geospatial Entrepreneurship</b>	<b>7 Hours</b>
Entity of entrepreneurs; Fundamentals of entrepreneurship; GIS/RS/Geospatial science entrepreneurship; Indian and global geospatial industry overview; success stories and case examples.		
<b>MODULE 2:</b>	<b>Identifying Geospatial Opportunities</b>	<b>7 Hours</b>



Opportunity mapping in urban planning, agriculture, climate monitoring, disaster management, logistics, environmental monitoring; use of problem–solution frameworks; case studies of Indian startups.		
<b>MODULE 3:</b>	<b>Team Formation &amp; Idea Generation</b>	<b>8 Hours</b>
Brainstorming techniques; ideation frameworks (SCAMPER, Design Thinking); interdisciplinary roles (GIS analyst, programmer, domain expert, business developer); team dynamics in startups.		
<b>MODULE 4:</b>	<b>Regulatory &amp; Ethical Issues in Geospatial Ventures</b>	<b>8 Hours</b>
Indian Drone Rules 2021, Survey of India guidelines, geospatial data policies; licensing and permissions; IPR and patents; data ethics, privacy, inclusivity, and responsible innovation.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

**References:**

1. Bygrave, W. D., & Zacharakis, A. (2010). The Portable MBA in Entrepreneurship. Wiley.
2. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2017). Entrepreneurship. McGraw-Hill.
3. Choudhury, S. (2021). National Geospatial Policy, 2021. Ministry of Science & Technology, Government of India.
4. DGCA (2021). Drone Rules, 2021. Directorate General of Civil Aviation, Government of India.
5. Esri (2020). Geospatial Industry Outlook Report. Esri Press/Online Resources.

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**Department of Geospatial Science**

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup> Yr., 1<sup>st</sup> Sem. (Program 1<sup>st</sup> Sem)</b>
<b>Course Title: GIS and Digital Cartography Lab</b>	<b>Subject Code: TIU-PGI-L101</b>
<b>Contact Hours/Week: 0-0-4 (L-T-P)</b>	<b>Credit: 2</b>

**COURSE OBJECTIVE:**

Enable the student to:

1. Gain hands-on experience in GIS software environments for spatial data handling.
2. Learn vector and raster data creation, editing, management, and analysis techniques.
3. Develop practical skills in thematic mapping, cartography, and map composition.
4. Explore digital and web-based cartography for interactive visualization and communication.

**COURSE OUTCOME**

On completion of the course, the student will be able to:

<b>CO No.</b>	<b>Course Outcome</b>	<b>Cognitive Level</b>
<b>CO-1</b>	Demonstrate ability to navigate GIS software interfaces, load spatial datasets, and perform basic data handling.	K1
<b>CO-2</b>	Apply techniques for digitization, attribute management, and geodatabase creation.	K2
<b>CO-3</b>	Execute spatial and network analyses, including overlay, buffer, proximity, and terrain analysis.	K3
<b>CO-4</b>	Design thematic maps using classification methods, symbology, and visualization techniques.	K3
<b>CO-5</b>	Construct professional-quality map layouts and digital atlases following cartographic principles.	K4
<b>CO-6</b>	Create, publish, and share interactive maps and story maps on web-based platforms.	K4

**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Fundamentals of GIS &amp; Data Handling</b>	<b>10 Hours</b>
GIS environment, interface, toolbars; loading and visualizing raster & vector data; metadata, coordinate systems, map projections; reprojection and datum transformation.		



<b>MODULE 2:</b>	<b>Vector Data Creation &amp; Editing</b>	<b>12 Hours</b>
Create/edit point, line, polygon layers; digitization from imagery; attribute table management; tabular joins; geodatabase structuring. cartographic principles; thematic mapping techniques.		
<b>MODULE 3:</b>	<b>Spatial Analysis Techniques</b>	<b>12 Hours</b>
Buffer, clip, union, dissolve, intersect; proximity & overlay analysis; Simple site suitability; network analysis (routing, service areas); DEM/DSM and terrain analysis (slope, aspect, watershed).		
<b>MODULE 4:</b>	<b>Thematic Mapping &amp; Visualization</b>	<b>8 Hours</b>
Symbology; classification methods (equal interval, quantile, natural breaks); choropleth, dot density, graduated & proportional symbols; labeling/annotation; export maps.		
<b>MODULE 5:</b>	<b>Map Composition &amp; Digital Cartography</b>	<b>8 Hours</b>
Map layout design (title, legend, scale bar, grids); inset maps; color and font choices; prepare thematic map series and digital atlas.		
<b>MODULE 6:</b>	<b>Interactive Cartography</b>	<b>10 Hours</b>
Create interactive maps; design story maps; publish maps online; embed in reports/websites; explore dashboards and online atlases.		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

### Refernces

1. Campbell, J. B. (2007). *Introduction to Remote Sensing*. Guildford Press.
2. Jensen, J. R. (2004). *Introductory Digital Image Processing: A Remote Sensing Perspective*. Prentice Hall.
3. Joseph, G. (2005). *Fundamentals of Remote Sensing*. United Press India.
4. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2004). *Remote Sensing and Image Interpretation*. Wiley. (Wiley Student Edition).
5. Nag, P., & Kudra, M. (1998). *Digital Remote Sensing*. Concept Publishing, New Delhi. Rees, W. G. (2001). *Physical Principles of Remote Sensing*. Cambridge University Press.



<b>Program: M.Sc. in Geoinformatics</b>	<b>Year, Semester:</b> 1 <sup>st</sup> Yr., 1 <sup>st</sup> Sem. (Program 1 <sup>st</sup> Sem)
<b>Course Title: Spatial Data Handling and Navigation Lab</b>	<b>Subject Code:</b> TIU-PGI-L103
<b>Contact Hours/Week:</b> 0-0-4 (L-T-P)	<b>Credit:</b> 2

**COURSE OBJECTIVE:**

Enable the student to:

1. Acquire hands-on skills in downloading, visualizing, and preprocessing satellite imagery.
2. Learn basic image refinement, enhancement, and aerial photo interpretation techniques.
3. Understand principles of photogrammetry, including scale, parallax, and relief displacement.
4. Develop practical competence in GPS data collection, mapping, and integration with RS data.

**COURSE OUTCOME**

On completion of the course, the student will be able to:

<b>CO No.</b>	<b>Course Outcome</b>	<b>Cognitive Level</b>
<b>CO-1</b>	Identify sources of satellite imagery, understand metadata, and visualize RS data.	<b>K1</b>
<b>CO-2</b>	Apply image preprocessing techniques such as layer stacking, band ratios, and composites.	<b>K2</b>
<b>CO-3</b>	Demonstrate image enhancement and mosaicing for final output generation.	<b>K3</b>
<b>CO-4</b>	Analyze aerial photographs for scale, relief displacement, and interpretation of land features.	<b>K3</b>
<b>CO-5</b>	Collect, process, and map GPS data for spatial applications.	<b>K4</b>
<b>CO-6</b>	Integrate RS and GPS data in a mini-project for real-world field applications.	<b>K4</b>

**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Image Download &amp; Visualisation</b>	<b>8 Hours</b>
Sources of free satellite images; downloading procedures; image formats and metadata; importing and visualising satellite images.		
<b>MODULE 2:</b>	<b>Image Pre-processing</b>	<b>12 Hours</b>



Layer stacking of multispectral data; band extraction; FCC & TCC creation; Visual interpretation of land features.		
<b>MODULE 3:</b>	<b>Image Refinement &amp; Visual Image Interpretation</b>	<b>8 Hours</b>
Subsetting (AOI extraction); mosaicing of multiple images; basic enhancement		
<b>MODULE 4:</b>	<b>Aerial Photogrammetry &amp; Interpretation</b>	<b>16 Hours</b>
Principles of aerial photography; scale determination; relief displacement & parallax-based height calculation; flight planning; photo interpretation (tone, texture, shape, size, pattern, association); measurement of distance, height, area.		
<b>MODULE 5:</b>	<b>GPS Fundamentals &amp; Applications</b>	<b>16 Hours</b>
GPS principles; data types (waypoints, tracks, routes); field data collection; mapping ground features; mini-project integrating GPS data with aerial/RS imagery.		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

**References :**

1. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). Remote Sensing and Image Interpretation (7th ed.). Wiley.
2. Campbell, J. B., & Wynne, R. H. (2011). Introduction to Remote Sensing (5th ed.). Guilford Press.
3. Joseph, G. (2005). Fundamentals of Remote Sensing (2nd ed.). Universities Press.
4. Wolf, P. R., Dewitt, B. A., & Wilkinson, B. E. (2014). Elements of Photogrammetry with Applications in GIS (4th ed.). McGraw Hill.
5. American Society for Photogrammetry and Remote Sensing (ASPRS). (2019). Manual of Photogrammetry (6th ed.). ASPRS.
6. Hofmann-Wellenhof, B., Lichtenegger, H., & Collins, J. (2001). GPS: Theory and Practice (5th ed.). Springer.
7. Misra, P., & Enge, P. (2011). Global Positioning System: Signals, Measurements, and Performance (2nd ed.). Ganga-Jamuna Press.
8. Natural Resources Canada (NRCan). (2003). Fundamentals of Remote Sensing: A Canada Centre for Remote Sensing Textbook. NRCan.
9. Sabins, F. F., & Ellis, J. M. (2000). Remote Sensing: Principles and Interpretation (3rd ed.). Waveland Press.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup>Yr., 1<sup>st</sup> Sem. (Program 1<sup>st</sup> Sem)</b>
<b>Course Title: Introduction to Python</b>	<b>Subject Code: TIU-PGI-L105</b>
<b>Contact Hours/Week: 0-0-2 (L-T-P)</b>	<b>Credit: 1</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamentals of Python programming language and its syntax.
2. Learn to use functions, modules, and standard libraries effectively.
3. Gain knowledge of input/output operations, file handling, and error management.
4. Explore geospatial data analysis using Python packages such as GeoPandas, Folium, and Rasterio.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Define Python basics, including syntax, data types, operators, and control structures.	K1
CO-2	Explain the use of strings, numeric types, conversions, and logical operations in Python.	K2
CO-3	Apply programming skills to write user-defined functions, use modules, and implement standard Python libraries.	K3
CO-4	Demonstrate file handling, input/output operations, and error handling in Python programs.	K3
CO-5	Analyze geospatial data formats and apply Python packages such as GeoPandas, Folium, and Rasterio for spatial analysis.	K4
CO-6	Evaluate the role of Python in geoinformatics by integrating data analysis, visualization, and geospatial applications.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Exploring Computers</b>	<b>5 Hours</b>
Introduction to Python Language - IDLEs (Google Colab, Anaconda etc) Dynamic Types, Naming Conventions, String Values, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Control Flow and Syntax, Indenting, The if Statement, Relational Operators, Logical Operators.		
<b>MODULE 2:</b>	<b>Processing Data</b>	<b>5 Hours</b>



Functions and Modules -Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Functions - "First Class Citizens", Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Modules, Standard Modules – sys, Standard Modules – math, Standard Modules – time, The ‘dir’ Function.		
<b>MODULE 3:</b>	<b>Data &amp; Number Representation</b>	<b>6 Hours</b>
I/O and Error Handling In Python -Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Using Pipes as Data Streams, Handling IO Exceptions, Working with Directories, Metadata, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions.		
<b>MODULE 4:</b>	<b>Data Storage</b>	<b>7 Hours</b>
Python Packages for Geospatial Data Analysis – Understanding geospatial data formats (GeoJSON, GeoTIFF, Geopackage (GPKG) etc.); Geopandas – Plotting with GeoPandas; Folium for interactive maps, Rasterio and Geoplot.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

**References:**

1. Dive into Python, Mike
2. Learning Python, 4th Edition by Mark Lutz
3. Programming Python, 4th Edition by Mark Lutz



## Department of Geospatial Science

Program: <b>M.Sc in Geoinformatics</b>	Year, Semester: 1 <sup>st</sup> Yr.,1st Sem. (Program 1 <sup>st</sup> Sem)
Course Title: <b>Career Advancement &amp; Skill Development – I (CASD-I): Scientific Writing and Communication</b>	Subject Code: TIU-PGI-S101
Contact Hours/Week: 0–0–4 (L–T–P)	Credit: 2

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the importance of scientific and technical communication in research and industry.
2. Acquire skills in academic writing, referencing, and ethical publishing practices.
3. Develop competence in visualization, presentation, and oral communication for technical content.
4. Gain experience in preparing research proposals, manuscripts, and science communication outputs.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the role and forms of scientific and technical communication in geoinformatics.	K1
CO-2	Demonstrate academic writing skills in structuring research papers, reports, and dissertations.	K2
CO-3	Apply referencing tools and ethical standards in research writing and geospatial data handling.	K3
CO-4	Create effective posters, presentations, and infographics using visualization tools and data storytelling techniques.	K3
CO-5	Prepare research proposals and manuscripts aligned with academic and industry requirements.	K4
CO-6	Communicate scientific ideas effectively through oral, written, and media channels to expert and non-expert audiences.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Introduction to Scientific &amp; Technical Communication</b>	10 Hours
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Role of communication in research/industry; oral, written, graphical communication; challenges in technical communication; audience-centric approaches.		
<b>MODULE 2:</b>	<b>Academic Writing in Geoinformatics</b>	10 Hours
Structure of technical documents: abstracts, research papers, reports, dissertations; style, clarity, tone; avoiding errors in scientific writing.		
<b>MODULE 3:</b>	<b>Referencing &amp; Research Ethics</b>	10 Hours
Citation styles (APA, IEEE, Harvard, etc.); reference managers; plagiarism, paraphrasing, summarizing; ethical handling of geospatial data/publications.		
<b>MODULE 4:</b>	<b>Visualization &amp; Presentation Skills</b>	10 Hours
Poster, presentation, infographic preparation; tools: Excel, Canva, ArcGIS StoryMaps; principles of data storytelling and visualization in GIS/RS.		
<b>MODULE 5:</b>	<b>Research Proposal &amp; Manuscript Preparation</b>	10 Hours
Proposal writing: objectives, hypotheses, methodology; journal selection; manuscript drafting; peer review and responding to reviewers; editor communication.		
<b>MODULE 6:</b>	<b>Oral &amp; Media Communication</b>	10 Hours
Elevator pitches; oral presentations and Q&A; communicating with policy makers and non-experts; blogs, articles, social media outreach for GIS/RS.		
<b>TOTAL LECTURES</b>		60 Hours

**References:**

1. Alley, M. (2018). *The Craft of Scientific Writing* (4th ed.). Springer.
2. Day, R. A., & Gastel, B. (2016). *How to Write and Publish a Scientific Paper* (8th ed.). Cambridge University Press.
3. Glasman-Deal, H. (2020). *Science Research Writing: For Non-native Speakers of English* (2nd ed.). World Scientific.
4. Belcher, W. L. (2019). *Writing Your Journal Article in Twelve Weeks: A Guide to Academic Publishing Success* (2nd ed.). University of Chicago Press.
5. Tufte, E. R. (2001). *The Visual Display of Quantitative Information*. Graphics Press.



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## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup> Yr., 2<sup>nd</sup> Sem. (Program 2<sup>nd</sup> Sem)</b>
<b>Course Title: Advanced GIS</b>	<b>Subject Code: TIU-PGI-T102</b>
<b>Contact Hours/Week: 3-0-0 (L-T-P)</b>	<b>Credit: 3</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Understand advanced raster, vector, and spatial statistical GIS techniques for complex geospatial analysis.
2. Develop skills in workflow automation, scripting, and spatial database management for efficient data handling.
3. Explore 3D GIS, immersive technologies, and web-based geospatial frameworks for visualization and decision support.
4. Critically evaluate cloud GIS, governance, and emerging trends (AI/ML, big data, participatory GIS) in modern geoinformatics.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
<b>CO-1</b>	Perform advanced raster and vector analysis including MCDA, dasymetric mapping, and network analysis.	<b>K3</b>
<b>CO-2</b>	Apply spatial statistical techniques (interpolation, regression, hotspot analysis) for modeling spatial patterns.	<b>K3</b>
<b>CO-3</b>	Design and implement geospatial workflows using ModelBuilder, scripting, and spatial databases.	<b>K3</b>
<b>CO-4</b>	Demonstrate understanding of 3D GIS, immersive VR/AR workflows, and their applications.	<b>K3</b>
<b>CO-5</b>	Explain Web GIS concepts, principles, and standards, and evaluate advantages over desktop GIS.	<b>K2</b>
<b>CO-6</b>	Critically evaluate GIS governance, ethics, and participatory approaches for inclusive decision support.	<b>K4</b>

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Advanced Raster &amp; Vector GIS Analysis</b>	<b>7 Hours</b>
Raster suitability (weighted overlay, map algebra); dasymetric mapping; MCDA in GIS; network analysis (service areas, allocation, optimal routing); social equity mapping; case studies on siting and land-use conflict.		
<b>MODULE 2:</b>	<b>Spatial Modeling &amp; Geostatistics</b>	<b>6 Hours</b>



Pattern analysis (hotspot, spatial autocorrelation); interpolation (IDW, kriging, co-kriging); regression modeling (OLS, GWR, spatial regression); VGI and crowdsourced GIS; story maps and web applications.		
<b>MODULE 3:</b>	<b>Advanced Geospatial Workflows &amp; Automation</b>	<b>6 Hours</b>
ModelBuilder automation; Python scripting (arcpy); batch processing; spatial database design (PostGIS/ArcGIS Pro); advanced cartography (multi-scale, dashboards, time-enabled maps); integrating multi-source data.		
<b>MODULE 4:</b>	<b>3D GIS &amp; Immersive Technologies (VR/AR)</b>	<b>8 Hours</b>
Evolution 2D→3D GIS; 3D data types (point clouds, TINs, voxels); 3D spatial analysis (visibility, volumetrics); VR/AR workflows; platforms: ArcGIS Urban, Cesium, Unity/Unreal (conceptual); case studies: digital twins, heritage visualization, participatory planning.		
<b>MODULE 5:</b>	<b>Fundamentals of Web GIS</b>	<b>9 Hours</b>
Definition & scope of Web GIS; client-server architecture; essential elements (server, client, protocols); components: web apps, base maps, operational layers, geodatabases; types of web maps; advantages over desktop GIS; interoperability & standards (GML, SVG, WMS/WFS). Interactive web maps & workflows; Internet Map Servers (IMS) architecture; Web GIS architectures: thin client, thick client, hybrid; deployment issues (bandwidth, scalability, response time); future directions: distributed GIS, middleware, SOA, cloud GIS, real-time & AI/ML		
<b>MODULE 6:</b>	<b>Mobile GIS</b>	<b>9 Hours</b>
Native, hybrid, companion apps; online/offline workflows; sync patterns RTK/PPK, differential correction, positional accuracy, metadata capture, Domains, contingent fields, repeats, attachments, barcodes/QR, conditional Required fields, geometry rules, on-device vs server validation, audit trails. Tile/vector packages, basemap strategies, sync conflict resolution. ArcGIS Field Maps/Survey123/QuickCapture, QField, Mergin, KoBoToolbox, custom SDKs.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References:**

1. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic Information Science and Systems* (4th ed.). Wiley.
2. Burrough, P. A., McDonnell, R. A., & Lloyd, C. D. (2015). *Principles of Geographical Information Systems* (3rd ed.). Oxford University Press.
3. O’Sullivan, D., & Unwin, D. (2010). *Geographic Information Analysis* (2nd ed.). Wiley.
4. Fu, P., & Sun, J. (2020). *Web GIS: Principles and Applications* (2nd ed.). Esri Press.
5. Kraak, M. J., & Brown, A. (2001). *Web Cartography: Developments and Prospects*. Taylor & Francis.
6. Mitchell, A. (2012). *The Esri Guide to GIS Analysis, Volume 3: Modeling Suitability, Movement, and Interaction*. Esri Press.
7. Esri (2021). *ArcGIS Pro, ArcGIS Urban & ArcGIS Online Documentation*. Esri.
8. Goodchild, M. F. (2007). “Citizens as sensors: The world of volunteered geography.” *GeoJournal*, 69(4), 211–221.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup> Yr., 2<sup>nd</sup> Sem. (Program 2<sup>nd</sup> Sem.)</b>
<b>Course Title: Digital Image Processing and Pattern Recognition</b>	<b>Subject Code: TIU-PGI-T104</b>
<b>Contact Hours/Week: 3-0-0 (L-T-P)</b>	<b>Credit: 3</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Understand advanced GIS concepts including raster/vector analysis, spatial modeling, and statistical GIS.
2. Develop skills in workflow automation, spatial databases, and Python-based GIS scripting.
3. Gain knowledge of photogrammetry, LiDAR, and UAV techniques for 3D mapping and DEM generation.
4. Apply advanced GIS and photogrammetry in environmental, urban, disaster, and infrastructure applications.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain fundamentals of visual image interpretation and analysis for optical, thermal, and radar images.	K1
CO-2	Describe data formats, preprocessing techniques, and correction methods in digital image processing.	K2
CO-3	Apply image enhancement techniques including contrast stretching, histogram methods, and filtering.	K3
CO-4	Perform image transformations such as band ratios, indices, PCA, Fourier, and image fusion.	K3
CO-5	Demonstrate supervised and unsupervised classification methods and accuracy assessment.	K4
CO-6	Evaluate digital image processing outputs for geospatial and environmental applications.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Visual Image Interpretation</b>	<b>9 Hours</b>
Visual Image Interpretation: Reading, measuring, and analyzing images. Key elements of optical image interpretation (location, size, shape, shadow, tone, color, texture, pattern, height/depth, site,		



situation, and association), interpretation of thermal image, interpretation of radar images using tone, color, shape, structure, size, speckle and texture.		
<b>MODULE 2:</b>	<b>Fundamentals and Processing</b>	<b>9 Hours</b>
Fundamental of Digital Image processing, data formats (BIP, BIL, BSQ), header information, preprocessing steps including destriping, missing scan line correction, random noise removal, vignetting correction, sun angle and topographic correction, atmospheric correction, geometric correction, resampling and interpolation, mosaicking, and subsetting.		
<b>MODULE 3:</b>	<b>Image Enhancement</b>	<b>9 Hours</b>
Image Enhancement: magnification, reduction, and color-composites, contrast enhancement (contrast stretch, min–max stretch, average and standard deviation stretch, piecewise stretch), histogram methods (equalization, normalization), and density slicing, thresholding. Filtering approaches include convolution filters, statistical filters, frequency-domain filters, and crisp filters.		
<b>MODULE 4:</b>	<b>Image Transformation</b>	<b>9 Hours</b>
Image Transformation: Addition, subtraction, multiplication, band ratio, indices, principal component transformation (PCT), colour space transformation, Fourier transformation, image fusion techniques.		
<b>MODULE 5:</b>	<b>Pattern Recognition and Classification</b>	<b>9 Hours</b>
Introduction to Pattern Recognition: Definition of patterns, features, and classes, Role of pattern recognition in geospatial image analysis; Feature Extraction & Selection: Types of features: spectral, spatial, textural, and shape features. Dimensionality reduction and feature selection methods (e.g., PCA); Classification, Concepts of information class and spectral class; Supervised classification: minimum distance, maximum likelihood, parallelepiped, feature space classifier; Unsupervised classification: K-means clustering, ISODATA clustering; Object based classification, accuracy assessment methods, post-classification processing.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References:**

1. Jensen, J. R. (2006). Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall, Upper Saddle River, NJ.
2. Lillesand, T. M., & Kiefer, R. W. (1994). Remote Sensing and Image Interpretation (3rd ed.). John Wiley & Sons, New York.
3. Sabins, F. F. (1997). Remote Sensing: Principles and Applications (3rd ed.). W. H. Freeman & Company, New York.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup> Yr., 2<sup>nd</sup> Sem. (Program 2<sup>nd</sup> Sem)</b>
<b>Course Title: Advanced Remote Sensing Techniques and Applications</b>	<b>Subject Code: TIU-PGI-T106</b>
<b>Contact Hours/Week: 3-0-0 (L-T-P)</b>	<b>Credit: 3</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Understand advanced concepts of thermal, microwave, hyperspectral, and LiDAR remote sensing.
2. Gain knowledge of physical principles, sensors, data preprocessing, and imaging geometry.
3. Apply advanced remote sensing techniques for land, ocean, atmosphere, and urban studies.
4. Explore applications of advanced RS in environmental monitoring, natural resource management, disaster management, and 3D modeling.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the physical principles and applications of thermal remote sensing and thermal sensors.	K1
CO-2	Describe principles, geometry, and sensor systems of microwave RS and its applications.	K2
CO-3	Demonstrate understanding of hyperspectral imaging, data preprocessing, and applications in resource monitoring.	K3
CO-4	Apply interferometric SAR and microwave datasets for terrain, soil moisture, and disaster studies.	K3
CO-5	Analyze LiDAR systems for DSM/DTM generation, canopy mapping, and 3D reconstruction.	K4
CO-6	Integrate multi-sensor (thermal, microwave, hyperspectral, LiDAR) data for advanced environmental and geospatial applications.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Thermal Remote Sensing</b>	<b>11 Hours</b>
Radiant vs. kinetic temperature; blackbody radiation; thermal imaging concepts; thermal capacity, conductivity, inertia; sensors (Landsat TIR, ASTER, MODIS, ECOSTRESS); applications in		



LST, urban heat islands, geothermal studies, forest fire detection.		
<b>MODULE 2:</b>	<b>Microwave Remote Sensing</b>	<b>11 Hours</b>
Passive microwave remote sensing, active microwave remote sensing, radar bands, polarization. Spatial resolution of radar, real aperture radar, synthetic aperture radar, speckle, Radar imaging geometry (slant range, ground range, layover, foreshortening, shadow), surface roughness, dielectric properties of terrain, airborne and space-borne radar systems. Microwave sensors: Scatterometers, Radiometers, SAR (ERS, RADARSAT, Sentinel-1, RISAT). Applications: soil moisture, flood mapping, sea ice studies, terrain mapping, disaster management. Interferometric SAR.		
<b>MODULE 3:</b>	<b>Hyperspectral Remote Sensing</b>	<b>12 Hours</b>
Hyperspectral Remote Sensing : Principles of hyperspectral imaging, Imaging spectrometers and sensor systems (AVIRIS, Hyperion, PRISMA, EnMAP), Hyperspectral data characteristics (high spectral resolution, data volume), Spectral signatures of vegetation, soil, minerals, and water. Data preprocessing: atmospheric correction, noise reduction, dimensionality reduction (PCA, MNF), Applications: mineral exploration, precision agriculture, vegetation health monitoring, water quality, land cover classification		
<b>MODULE 4:</b>	<b>LiDAR Remote Sensing</b>	<b>11 Hours</b>
Components & principles of LiDAR scanning; airborne & spaceborne profilers; advantages & limitations; DSM/DTM generation; LiDAR accuracy; canopy surface height mapping; terrestrial laser scanning; building extraction & 3D reconstruction; applications in forestry, urban & infrastructure mapping.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References:**

1. Jensen, J. R. (2006). *Remote Sensing of the Environment: An Earth Resource Perspective*. Prentice Hall, Upper Saddle River, NJ.
2. Lillesand, T. M., & Kiefer, R. W. (1994). *Remote Sensing and Image Interpretation* (3rd ed.). John Wiley & Sons, New York.
3. Sabins, F. F. (1997). *Remote Sensing: Principles and Applications* (3rd ed.). W. H. Freeman & Company, New York.
4. Rees, W. G. (2013). *Physical Principles of Remote Sensing* (3rd ed.). Cambridge University Press.
5. Vosselman, G., & Maas, H.-G. (2010). *Airborne and Terrestrial Laser Scanning*. CRC Press.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup> Yr.,2<sup>nd</sup> Sem. (Program 2<sup>nd</sup> Sem)</b>
<b>Course Title: IoT in Geospatial Technology</b>	<b>Subject Code: TIU-PGI-T108</b>
<b>Contact Hours/Week: 1-0-0 (L-T-P)</b>	<b>Credit: 1</b>

**COURSE OBJECTIVE:**

Enable the student to:

1. Understand the fundamentals of IoT and its integration with geospatial technologies.
2. Explore real-time data streaming and spatial analytics for IoT applications.
3. Analyze big data challenges in IoT-GIS integration.
4. Evaluate applications, challenges, and future trends of IoT in geospatial science.

**COURSE OUTCOME:**

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the fundamentals of IoT and its geospatial significance.	K2 (Understand)
CO-2	Identify IoT sensor data sources and integrate them with GIS dashboards.	K3 (Apply)
CO-3	Apply real-time spatial analytics (alerts, thresholds, geofencing) to IoT data.	K4 (Analyze)
CO-4	Examine big data characteristics and processing for spatiotemporal insights.	K4 (Analyze)
CO-5	Evaluate IoT-GIS applications, challenges, and future trends in smart environments.	K5 (Evaluate)

**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Introduction to IoT &amp; Geospatial Technology</b>	<b>3 Hours</b>
IoT fundamentals: sensors, devices, connectivity; GPS & GNSS; IoT-GIS integration.		
<b>MODULE 2:</b>	<b>Real-Time Location Data &amp; Streaming</b>	<b>3 Hours</b>



IoT sensor types (vehicles, smart meters, soil/environmental sensors); data streams (apps, social media, urban sensors); cloud streaming (AWS, Azure, Cisco IoT) linked to GIS dashboards.		
<b>MODULE 3:</b>	<b>Real-Time Spatial Analytics</b>	<b>3 Hours</b>
Geospatial analytics for IoT: alerts, thresholds, geofencing; case examples (bus tracking, smart parking, traffic sensors); ArcGIS Velocity, Esri GeoEvent Server, open-source alternatives.		
<b>MODULE 4:</b>	<b>Big Data &amp; Geanalytics</b>	<b>3 Hours</b>
IoT big data: volume, velocity, variety; storage & processing in GIS; spatiotemporal patterns, predictive insights, time-series visualization.		
<b>MODULE 5:</b>	<b>Applications, Challenges &amp; Future Directions</b>	<b>3 Hours</b>
Applications: smart cities, environmental monitoring, agriculture, disaster management; challenges: interoperability, scalability, privacy & cybersecurity; future: edge/fog computing, AI/ML, 5G & beyond.		
<b>TOTAL LECTURES</b>		<b>15 Hours</b>

**References:**

1. Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. *Computer Networks*, 54(15), 2787–2805. Elsevier.
2. Perera, C., Zaslavsky, A., Christen, P., & Georgakopoulos, D. (2014). Context aware computing for the Internet of Things: A survey. *IEEE Communications Surveys & Tutorials*, 16(1), 414–454. IEEE.
3. Esri (2021). *Real-Time GIS and the Internet of Things*. Esri Press / ArcGIS Documentation.
4. Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. *Future Generation Computer Systems*, 29(7), 1645–1660. Elsevier.
5. Miorandi, D., Sicari, S., De Pellegrini, F., & Chlamtac, I. (2012). Internet of Things: Vision, applications and research challenges. *Ad Hoc Networks*, 10(7), 1497–1516. Elsevier.
6. Gupta, P., & Quamar, R. (2019). *IoT and Big Data Analytics: Concepts, Tools and Applications*. Springer.
7. Rao, P. V. (2018). *Geospatial Technologies and Internet of Things: A Practical Guide*. CRC Press.
8. Zeng, D., Guo, S., & Cheng, Z. (2011). The Web of Things: A survey. *Journal of Communications*, 6(6), 424–438.
9. Cisco Systems (2020). *Cisco IoT Solutions Overview*. Cisco White Paper.
10. Government of India (2022). *National Geospatial Policy & IoT Applications in Smart Cities*. Ministry of Science & Technology.



## Department of Geospatial Science

Program: <b>M.Sc in Geoinformatics</b>	Year, Semester: 1 <sup>st</sup> Yr., 2 <sup>nd</sup> Sem. (Program 2 <sup>nd</sup> Sem)
Course Title: Entrepreneurship Skill Development (ESD): <b>Environmental Science and RS/GIS-based EIA</b>	Subject Code: TIU-PGI-ES102
Contact Hours/Week: 2-1-0 (L-T-P)	Credit: 3

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamentals of environmental science, ecosystems, and biodiversity.
2. Learn about natural resources, their management, and sustainability challenges.
3. Gain theoretical knowledge of environmental problems, governance, and global climate issues.
4. Acquire an in-depth understanding of EIA processes, methodologies, and legal frameworks.
5. Apply Remote Sensing (RS) and GIS tools in environmental monitoring and EIA case studies

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Demonstrate understanding of ecological principles, environmental systems, and biodiversity.	K1
CO-2	Discuss natural resources, sustainable management, and environmental ethics.	K2
CO-3	Explain major environmental problems, pollution types, and climate change issues.	K2
CO-4	Describe environmental policies, governance structures, and EIA legal frameworks.	K3
CO-5	Apply principles and methodologies of EIA in planning and evaluation.	K3
CO-6	Evaluate the role of RS/GIS in EIA, environmental monitoring, and case-specific assessments.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Fundamentals of Environmental Science</b>	<b>9 Hours</b>
Concept of environment, ecosystems, ecological balance; energy flow, food chains, food webs, biogeochemical cycles; biodiversity and conservation strategies.		
<b>MODULE 2:</b>	<b>Natural Resources &amp; Management</b>	<b>9 Hours</b>



Renewable vs non-renewable resources; land, water, forest, and mineral resources; sustainable management strategies; environmental ethics.		
<b>MODULE 3:</b>	<b>Environmental Issues &amp; Challenges</b>	<b>9 Hours</b>
Air, water, soil, and noise pollution (causes, effects, controls); climate change, global warming, ozone depletion; waste management; sustainable development.		
<b>MODULE 4:</b>	<b>Environmental Policy &amp; Governance</b>	<b>9 Hours</b>
Indian environmental acts and policies (EIA Notification, EPA 1986); global agreements (UNFCCC, CBD, Paris Agreement); roles of UNEP, IPCC.		
<b>MODULE 5:</b>	<b>Principles &amp; Methods of EIA</b>	<b>9 Hours</b>
EIA concept, scope, and process; screening, scoping, baseline data, impact prediction, mitigation; methodologies (checklists, matrices, overlays, CBA); Environmental Management Plan (EMP).		
<b>MODULE 6:</b>	<b>RS/GIS Applications in EIA</b>	<b>9 Hours</b>
RS/GIS in environmental monitoring; land use change, water, air pollution, biodiversity; geospatial modeling for cumulative impacts; case studies in mining, urban, coastal projects.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

#### References:

1. Canter, L. W. (1996). *Environmental Impact Assessment*. McGraw-Hill.
2. Glasson, J., Therivel, R., & Chadwick, A. (2012). *Introduction to Environmental Impact Assessment* (4th ed.). Routledge.
3. Smith, R. L., & Smith, T. M. (2015). *Elements of Ecology* (9th ed.). Pearson.
4. Barrow, C. J. (1997). *Environmental and Social Impact Assessment: An Introduction*. Edward Elgar.
5. Jain, R. K., Urban, L. V., & Stacey, G. S. (2000). *Environmental Impact Analysis: A New Dimension in Decision Making*. McGraw-Hill.
6. Nath, B., Hens, L., Compton, P., & Devuyt, D. (2017). *Environmental Management and Impact Assessment*. Routledge.
7. Petts, J. (Ed.). (1999). *Handbook of Environmental Impact Assessment* (Vol. 1 & 2). Wiley.
8. Vanclay, F., & Esteves, A. M. (2011). *New Directions in Social Impact Assessment: Conceptual and Methodological Advances*. Edward Elgar.
9. Jensen, J. R. (2007). *Remote Sensing of the Environment: An Earth Resource Perspective* (2nd ed.). Pearson.
10. Esri (2020). *GIS for Environmental Management*. Esri Press.



## Department of Geospatial Science

Program: <b>M.Sc in Geoinformatics</b>	Year, Semester: 1 <sup>st</sup> Yr., 2 <sup>nd</sup> Sem. (Program 2 <sup>nd</sup> Sem)
Course Title: Career Advancement Skill Development (CASD): <b>Communicative English</b>	Subject Code: TIU-PGI-CASD102
Contact Hours/Week: 2-0-0 (L-T-P)	Credit: 2

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the principles and barriers of effective communication.
2. Improve vocabulary, semantics, and sentence structures for academic and professional contexts.
3. Acquire practical writing skills for reports, resumes, cover letters, and workplace communication.
4. Develop non-verbal and presentation skills for career advancement.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the concepts, context, and barriers of communication.	K1
CO-2	Demonstrate proficiency in semantics, synonyms, antonyms, homophones, and sentence structures.	K2
CO-3	Apply appropriate communication strategies using non-verbal skills, paralanguage, and body language.	K3
CO-4	Write resumes, cover letters, memos, notices, and reports with accuracy and clarity.	K3
CO-5	Distinguish between different types of writing (expository, descriptive, argumentative, narrative, etc.) and apply them effectively.	K4
CO-6	Evaluate communication outputs for accuracy, brevity, clarity, and appropriateness in professional contexts.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Concepts in Communication</b>	<b>10 Hours</b>
Communication as sharing; context; roles of speaker/writer & listener/reader; medium; barriers; principles of accuracy, brevity, clarity, appropriateness; non-verbal skills; paralanguage & body language.		



<b>MODULE 2:</b>	<b>Semantics &amp; Syntax</b>	<b>10 Hours</b>
Vocabulary: synonyms, antonyms, homophones, homonyms; form and function of words; syntax and sentence structures; verb patterns & their usage.		
<b>MODULE 3:</b>	<b>Writing Skills</b>	<b>10 Hours</b>
Types of writing (expository, descriptive, analytic, argumentative, narrative); resumes, CVs & cover letters; memos & notices; basics of formal reports.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

References:

1. Raman, M., & Sharma, S. (2015). Technical Communication: Principles and Practice (3rd ed.). Oxford University Press.
2. Lesikar, R. V., Pettit, J. D., & Flatley, M. E. (2009). Lesikar's Basic Business Communication (11th ed.). Tata McGraw-Hill.
3. Rizvi, M. A. (2017). Effective Technical Communication. McGraw-Hill.
4. Murphy, R. (2019). English Grammar in Use (5th ed.). Cambridge University Press.
5. Gerson, S. J., & Gerson, S. M. (2016). Technical Writing: Process and Product (8th ed.). Pearson.

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## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup> Yr.,2<sup>nd</sup> Sem. (Program 2<sup>nd</sup> Sem)</b>
<b>Course Title: GIS &amp; Statistics with R Lab</b>	<b>Subject Code: TIU-PGI-L102</b>
<b>Contact Hours/Week: 0-0-4 (L-T-P)</b>	<b>Credit: 2</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Reinforce theoretical learning in advanced GIS through practical exercises.
2. Develop competence in raster, vector, and statistical GIS analysis.
3. Build skills in automation of geoprocessing workflows.
4. Transition into R for statistical GIS and spatial modeling.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Perform advanced raster and vector GIS operations including buffer, overlay, network analysis and terrain analysis.	K3
CO-2	Apply spatial statistics in GIS such as hotspot analysis, autocorrelation, and interpolation.	K3
CO-3	Design and execute geoprocessing workflows using ModelBuilder and Python scripting.	K3
CO-4	Demonstrate use of RStudio and R packages (sf, terra, spdep, tmap) for spatial data handling and visualization.	K3
CO-5	Implement spatial statistical methods in R including Moran's I, Geary's C, regression models, and zonal statistics.	K4
CO-6	Integrate GIS preprocessing with R-based statistical modeling in a capstone mini-project.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Advanced GIS – Raster &amp; Vector Analysis</b>	<b>12 Hours</b>
Buffer, overlay, dissolve, proximity analysis; raster reclassification, weighted overlay, raster calculator; terrain analysis (slope, aspect, hillshade); site suitability mapping.		
<b>MODULE 2:</b>	<b>Spatial Modeling &amp; Statistics in GIS</b>	<b>12 Hours</b>



Hotspot analysis (Getis-Ord $G_i^*$ ), cluster detection; Moran's I; interpolation (IDW, Kriging); case study: Eg: rainfall or groundwater potential mapping.		
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<b>MODULE 3:</b>	<b>Geoprocess Automation</b>	<b>12 Hours</b>
Introduction to RStudio; packages (sf, terra, spdep, tmap); importing GIS data; plotting thematic maps; regression with spatial attributes.		
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<b>MODULE 4:</b>	<b>R for Statistical GIS</b>	<b>12 Hours</b>
Moran's I, Geary's C; regression (OLS, GWR); raster statistics (zonal stats, NDVI/rainfall correlation); capstone mini-project.		
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<b>MODULE 5:</b>	<b>Spatial Statistics &amp; Modeling in R</b>	<b>12 Hours</b>
Concepts of information vs. spectral class; supervised classification (minimum distance, maximum likelihood, parallelepiped, feature space); unsupervised classification (K-means, ISODATA); accuracy assessment; post-classification processing.		
<hr/>		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

**References:**

1. Pebesma, E., & Bivand, R. S. (2025). *Spatial Data Science: With Applications in R*. Münster: Universität Münster & Norwegian School of Economics.
2. Pebesma, E., & Bivand, R. S. (2025). *Spatial Data Science: With Applications in R*. Münster: Universität Münster & Norwegian School of Economics.
3. Moraga, P. (2023). *Spatial Statistics for Data Science: Theory and Practice with R*. Chapman & Hall/CRC.
4. Bivand, R. S., Pebesma, E., & Gómez-Rubio, V. (2008). *Applied Spatial Data Analysis with R*. Springer.
5. Fotheringham, A. S., Oshan, T. M., & Li, Z. (2023). *Multiscale Geographically Weighted Regression: Theory and Practice*. CRC Press.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 1<sup>st</sup> Yr., 2<sup>nd</sup> Sem. (Program 2<sup>nd</sup> Sem)</b>
<b>Course Title: Digital Image Processing Lab</b>	<b>Subject Code: TIU-PGI-L104</b>
<b>Contact Hours/Week: 0-0-4 (L-T-P)</b>	<b>Credit: 2</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Reinforce theoretical concepts of digital image processing through practical exercises.
2. Develop hands-on experience in image preprocessing, enhancement, and transformation.
3. Acquire skills in digital classification, accuracy assessment, and thematic map preparation.
4. Apply advanced digital image analysis for environmental and geospatial applications

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Perform visual interpretation of satellite images including band combinations and image profiling.	K3
CO-2	Apply georeferencing, mosaicking, and subsetting techniques to prepare analysis-ready data.	K3
CO-3	Demonstrate contrast enhancement, filtering, indices calculation, PCA, and image fusion.	K3
CO-4	Execute supervised and unsupervised classification, object-based analysis, and accuracy assessment.	K4
CO-5	Design map outputs, pseudo-color images, and thematic layers using classification results.	K4
CO-6	Integrate modeler workflows and reflectance calculations for advanced digital image analysis.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Visual Image Interpretation</b>	<b>12 Hours</b>
Opening and viewing images (zoom, pan), band combinations, accessing image information, pixel inquiry, multilayer display, image coordinates, header files, saving outputs, and creating image profiles by selecting appropriate bands.		
<b>MODULE 2:</b>	<b>Georeferencing &amp; Subsetting</b>	<b>12 Hours</b>



Georeferencing methods (image-to-image, image-to-ground, image-to-map), mosaicking, applying Area Of Interest (AOI) tools, and performing spatial and spectral subsetting.		
<b>MODULE 3: Image Enhancement &amp; Transformation 12 Hours</b>		
Contrast enhancement, filter (convolution and crisp filter), index (VI, NDVI, SAVI, NDBI), Principal Component transformation (PCT), Color Space transformation, FFT, fusion, change detection.		
<b>MODULE 4: Image Classification &amp; Accuracy 12 Hours</b>		
Supervised and Unsupervised classification, accuracy assessment, layer stack, sub-pixel classification, object-based classification, post-classification filtering, pseudo color image preparation, map composition, import/export.		
<b>MODULE 5: Modeler &amp; Reflectance 12 Hours</b>		
Using Modeler for workflows; reflectance calculation methods and outputs.		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

**References:**

1. Richards, J. A., & Jia, X. (2006). Remote Sensing Digital Image Analysis: An Introduction (4th ed.). Springer.
2. Jensen, J. R. (2015). Introductory Digital Image Processing: A Remote Sensing Perspective (4th ed.). Pearson.
3. Gonzalez, R. C., & Woods, R. E. (2018). Digital Image Processing (4th ed.). Pearson.
4. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). Remote Sensing and Image Interpretation (7th ed.). Wiley.
5. Schowengerdt, R. A. (2007). Remote Sensing: Models and Methods for Image Processing (3rd ed.). Academic Press.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	Year, Semester: 1 <sup>st</sup> Yr., 2 <sup>nd</sup> Sem. (Program 2 <sup>nd</sup> Sem)
<b>Course Title: Advanced Remote Sensing</b>	<b>Subject Code: TIU-PGI-L106</b>
<b>Contact Hours/Week: 0-0-4 (L-T-P)</b>	<b>Credit: 2</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Reinforce concepts of thermal, microwave, hyperspectral, and LiDAR remote sensing through hands-on analysis.
2. Develop skills in preprocessing, enhancement, and interpretation of advanced RS datasets.
3. Gain experience in classification, accuracy assessment, and change detection using multi-sensor data.
4. Apply advanced RS tools for environmental, urban, and 3D mapping applications.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
<b>CO-1</b>	Perform thermal image preprocessing and generate land surface temperature and heat anomaly maps.	<b>K3</b>
<b>CO-2</b>	Apply microwave RS analysis including speckle filtering, backscatter interpretation, and flood/soil moisture mapping.	<b>K3</b>
<b>CO-3</b>	Demonstrate hyperspectral preprocessing, spectral signature extraction, and mineral/vegetation analysis.	<b>K3</b>
<b>CO-4</b>	Process and analyze LiDAR point clouds for DSM/DTM generation, canopy mapping, and 3D reconstruction.	<b>K4</b>
<b>CO-5</b>	Integrate multi-sensor RS data (thermal, microwave, hyperspectral, LiDAR) for applied geospatial studies.	<b>K4</b>
<b>CO-6</b>	Design and present a mini-project demonstrating advanced RS techniques for real-world applications.	<b>K4</b>

### COURSE CONTENT:

<b>MODULE 1:</b>	Thermal Remote Sensing Lab	<b>12 Hours</b>
Importing and preprocessing thermal images (Landsat TIR/ASTER); emissivity correction; LST mapping; urban heat island analysis; geothermal anomaly mapping.		
<b>MODULE 2:</b>	Microwave Remote Sensing Lab	<b>12 Hours</b>



Handling SAR data (Sentinel-1, RISAT); radiometric calibration; speckle filtering; backscatter analysis; flood mapping; soil moisture extraction; InSAR basics (DEM generation).		
<b>MODULE 3:</b>	Hyperspectral Remote Sensing Lab	<b>12 Hours</b>
Importing hyperspectral datasets (AVIRIS/Hyperion/EnMAP); atmospheric correction; noise reduction; PCA/MNF; spectral library building; mineral/vegetation health mapping.		
<b>MODULE 4:</b>	LiDAR Data Processing Lab	<b>12 Hours</b>
Importing LiDAR point clouds; filtering ground vs non-ground points; DSM/DTM generation; canopy height model; 3D city/building reconstruction; forest biomass estimation.		
<b>MODULE 5:</b>	Digital Photogrammetry	<b>12 Hours</b>
Multi-sensor data integration (thermal + SAR + hyperspectral + LiDAR); accuracy assessment; change detection; final mini-project: environmental monitoring, urban study, or disaster application.		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

**References:**

1. Richards, J. A., & Jia, X. (2006). Remote Sensing Digital Image Analysis (4th ed.). Springer.
2. Jensen, J. R. (2015). Introductory Digital Image Processing: A Remote Sensing Perspective (4th ed.). Pearson.
3. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). Remote Sensing and Image Interpretation (7th ed.). Wiley.
4. Schowengerdt, R. A. (2007). Remote Sensing: Models and Methods for Image Processing (3rd ed.). Academic Press.
5. Vosselman, G., & Maas, H.-G. (2010). Airborne and Terrestrial Laser Scanning. CRC Press.



## Department of Geospatial Science

<b>Program:</b> M.Sc. Geoinformatics	<b>Year, Semester:</b> 1 <sup>st</sup> Yr., 2 <sup>nd</sup> Sem. (Program 2 <sup>nd</sup> Sem)
<b>Course Title:</b> WebGIS & Google Earth Engine Lab	<b>Subject Code:</b> TIU-PGI-L108
<b>Contact Hours/Week:</b> 0–0–2 (L–T–P)	<b>Credit:</b> 1

### COURSE OBJECTIVE:

Enable the student to:

1. Gain practical exposure to WebGIS platforms for publishing, sharing, and visualizing spatial data.
2. Learn customization of interactive web maps using open-source libraries and OGC standards.
3. Develop skills in Google Earth Engine (GEE) for large-scale geospatial data analysis.
4. Apply cloud-based geospatial workflows for thematic applications and project development.

### COURSE OUTCOME:

CO No.	Course Outcome	Cognitive Level
CO-1	Demonstrate understanding of WebGIS concepts, architecture, and platforms for publishing spatial data.	K3
CO-2	Create customized web maps and dashboards using open-source tools and OGC web services.	K3
CO-3	Apply Google Earth Engine for image display, band math, and time-series analysis.	K3
CO-4	Perform advanced GEE applications including classification, change detection, and export of geospatial products.	K4
CO-5	Integrate GEE outputs with WebGIS platforms for end-to-end geospatial solutions.	K4
CO-6	Develop and present a mini-project using WebGIS/GEE addressing real-world geospatial challenges.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Fundamentals of WebGIS</b>	<b>6 Hours</b>
WebGIS concepts, client–server architecture; GeoServer, Leaflet, Mapbox; publishing GIS layers on ArcGIS Online/QGIS Cloud; basic interactive map creation.		
<b>MODULE 2:</b>	<b>WebGIS Development &amp; Visualization</b>	<b>9 Hours</b>



Customized web maps (Leaflet/Mapbox); handling GeoJSON/KML/shapefiles; raster data via tiles & WMS; OGC services (WMS, WFS, WMTS); dashboards & story maps.		
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<b>MODULE 3:</b>	<b>Introduction to Google Earth Engine</b>	<b>9 Hours</b>
GEE overview; Code Editor & JavaScript API; importing datasets (Landsat, Sentinel, MODIS, CHIRPS); band math (NDVI, NDBI, NDWI); time-series vegetation analysis.		
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<b>MODULE 4:</b>	<b>Advanced Google Earth Engine Applications</b>	<b>9 Hours</b>
Image classification (supervised & unsupervised); change detection; exporting results (images, charts, CSV, shapefiles); integrating GEE outputs into WebGIS.		
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<b>MODULE 5:</b>	<b>Mini-Project in WebGIS/GEE</b>	<b>9 Hours</b>
Case-based project (urban expansion, deforestation, floods/droughts, air quality); creation of web map/dashboard; presentation & reporting.		
<hr/>		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References:**

1. Fu, P., & Sun, J. (2020). *Web GIS: Principles and Applications* (2nd ed.). Esri Press.
2. Hall, G. B., & Leahy, M. G. (2008). *Open Source Approaches in Spatial Data Handling*. Springer.
3. Kumar, S. (2019). *Practical Handbook of Remote Sensing*. CRC Press.
4. Gorelick, N., Hancher, M., Dixon, M., Ilyushchenko, S., Thau, D., & Moore, R. (2017). "Google Earth Engine: Planetary-scale geospatial analysis for everyone." *Remote Sensing of Environment*, 202, 18–27.
5. Esri (2021). *ArcGIS Online Help & Developer Documentation*. Esri.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Geo-Environmental Modelling and Analysis</b>	<b>Subject Code:</b> TIU-PGI-T201
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable the student to:

1. Reinforce concepts of thermal, microwave, hyperspectral, and LiDAR remote sensing through hands-on analysis.
2. Develop skills in preprocessing, enhancement, and interpretation of advanced RS datasets.
3. Gain experience in classification, accuracy assessment, and change detection using multi-sensor data.
4. Apply advanced RS tools for environmental, urban, and 3D mapping applications.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
<b>CO-1</b>	Perform thermal image preprocessing and generate land surface temperature and heat anomaly maps.	<b>K3</b>
<b>CO-2</b>	Apply microwave RS analysis including speckle filtering, backscatter interpretation, and flood/soil moisture mapping.	<b>K3</b>
<b>CO-3</b>	Demonstrate hyperspectral preprocessing, spectral signature extraction, and mineral/vegetation analysis.	<b>K3</b>
<b>CO-4</b>	Process and analyze LiDAR point clouds for DSM/DTM generation, canopy mapping, and 3D reconstruction.	<b>K4</b>
<b>CO-5</b>	Integrate multi-sensor RS data (thermal, microwave, hyperspectral, LiDAR) for applied geospatial studies.	<b>K4</b>
<b>CO-6</b>	Design and present a mini-project demonstrating advanced RS techniques for real-world applications.	<b>K4</b>

### COURSE CONTENT:

MODULE 1:	Foundations of Spatial & Environmental Modeling	8 Hours
Reading, measuring, analyzing images; elements of interpretation (location, size, shape, shadow, tone, color, texture, pattern, height/depth, site, situation, association); interpretation of thermal and radar images using tone, color, shape, size, speckle, texture.		



<b>MODULE 2:</b>		<b>7 Hours</b>
Identifying spatial patterns and clusters; hotspot mapping; spatial autocorrelation (conceptual); neighborhood/district comparisons; case studies: Disease clusters, Urban air pollution, biodiversity hotspots		
<b>MODULE 3:</b>	<b>Environmental Applications</b>	<b>7 Hours</b>
LULC change modeling (urbanization, deforestation); site suitability (AHP, MCDA); hydrological & flood modeling; soil erosion and degradation (USLE/RUSLE concepts); groundwater potential mapping; case: Bengal delta flood hazard, soil fertility.		
<b>MODULE 4:</b>	<b>Predictive Modeling, Risk &amp; Scenario Building</b>	<b>8 Hours</b>
Regression (basic & GWR); tree-based models (CART, Random Forest); scenario-building (urban growth, climate change impacts); uncertainty & ethics in modeling; DSS in planning; case: Urban sprawl, crop suitability, climate adaptation and wildlife management.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

**References:**

1. Burrough, P. A., & McDonnell, R. A. (1998). *Principles of Geographical Information Systems*. Oxford University Press.
2. O’Sullivan, D., & Unwin, D. (2010). *Geographic Information Analysis* (2nd ed.). Wiley.
3. de Smith, M. J., Goodchild, M. F., & Longley, P. A. (2018). *Geospatial Analysis: A Comprehensive Guide*. The Winchelsea Press.
4. Fotheringham, A. S., Brunson, C., & Charlton, M. (2002). *Geographically Weighted Regression: The Analysis of Spatially Varying Relationships*. Wiley.
5. Clarke, K. C. (2014). *Analytical and Computer Cartography*. Pearson.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: GeoAI</b>	<b>Subject Code:</b> TIU-PGI-T203
<b>Contact Hours/Week:</b> 3-0-0 (L-T-P)	<b>Credit:</b> 3

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the foundations and evolution of GIS into Web and Mobile GIS ecosystems.
2. Learn web cartography principles and frameworks for interactive visualization.
3. Explore integration of spatial databases, cloud computing, IoT, and big geospatial data in WebGIS.
4. Evaluate cutting-edge geospatial web technologies (AI, AR/VR, Digital Twins) and their applications in planning, environment, and disaster management.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the evolution of WebGIS and its role in modern geospatial applications.	K1
CO-2	Apply principles of web cartography to design effective online visualization frameworks.	K2
CO-3	Analyze the role of spatial databases, cloud platforms, IoT, and real-time streams in WebGIS.	K3
CO-4	Assess integration frameworks combining WebGIS with mobile and enterprise systems.	K3
CO-5	Evaluate case studies of WebGIS applications in disaster management, urban planning, and environment.	K4
CO-6	Critically examine future geospatial web technologies including AI, AR/VR, and Digital Twins.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Introduction to GeoAI</b>	<b>9 Hours</b>
Fundamentals of Artificial Intelligence and Machine Learning, Scope of AI in geoinformatics (GeoAI overview), GeoAI vs. traditional GIS and remote sensing approaches, Data-driven approaches in geospatial science (big geospatial data, cloud, IoT + AI), Applications of GeoAI in urban studies, environment, disaster management, and natural resource monitoring		
<b>MODULE 2:</b>	<b>Machine Learning for Geospatial Data:</b>	<b>9 Hours</b>



Types of learning (supervised, unsupervised, reinforcement learning), Regression and classification techniques, Decision trees, random forests, SVMs for spatial data, Clustering techniques for geospatial analysis (K-means, ISODATA), Feature extraction and selection from geospatial datasets		
<b>MODULE 3:</b>	<b>Deep Learning in Geospatial Domain:</b>	<b>9 Hours</b>
Introduction to neural networks and deep learning, Convolutional Neural Networks (CNNs) for image classification, segmentation, and object detection in remote sensing, Recurrent Neural Networks (RNNs) for spatio-temporal data analysis, U-Net and encoder-decoder models for geospatial image classification and Transfer learning for geospatial tasks		
<b>MODULE 4:</b>	<b>GeoAI Tools &amp; Frameworks</b>	<b>9 Hours</b>
GeoAI Tools, Platforms, and Frameworks: Python for GeoAI (NumPy, Pandas, scikit-learn, TensorFlow, PyTorch, Keras), Geospatial libraries and APIs (GDAL, Rasterio, Geopandas), Cloud-based GeoAI platforms (Google Earth Engine, AWS SageMaker, Microsoft Azure AI, Esri GeoAI tools)		
<b>Module 5</b>	<b>Applications &amp; Ethical Issues</b>	<b>9 Hours</b>
Applications GeoAI for land cover/land use classification. Object detection and change detection in satellite imagery, Smart cities and urban analytics with GeoAI. AI for disaster, prediction and management (flood, wildfire, cyclone, landslide), Ethical issues, biases, and challenges in GeoAI research, Future directions of GeoAI		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

### References

1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
2. Géron, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. O'Reilly Media.
3. Li, W., & Hsu, W. (2021). GeoAI: Artificial Intelligence for Earth Observation and Geospatial Applications. Springer.
4. Zhang, C., & Zhu, X. (2018). GeoAI: Spatially Explicit Artificial Intelligence Techniques for Geographic Knowledge Discovery. Springer.
5. Zhu, X., Tuia, D., Mou, L., Xia, G. S., Zhang, L., Xu, F., & Fraundorfer, F. (2017). Deep learning in remote sensing: A review. ISPRS Journal of Photogrammetry and Remote Sensing.
6. Esri. (2021). GeoAI Resources.
7. TensorFlow Documentation: <https://www.tensorflow.org>
8. PyTorch Documentation: <https://pytorch.org>
9. Google Earth Engine Developers Guide: <https://developers.google.com/earth-engine>
10. GDAL Documentation: <https://gdal.org>



## Department of Geospatial Science

<b>Program: M.Sc. in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Enterprise GIS &amp; Geospatial Data Governance</b>	<b>Subject Code:</b> TIU-PGI-T205
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the principles, components, and architectures of Enterprise GIS.
2. Learn frameworks of geospatial data governance, including roles, workflows, and standards.
3. Evaluate issues of data quality, metadata management, and interoperability.
4. Explore national and international policies, legal frameworks, and ethical issues in geospatial governance.
5. Analyze real-world case studies and assess emerging trends in enterprise GIS and governance.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the concepts, scope, and architectures of Enterprise GIS.	K1
CO-2	Demonstrate knowledge of governance frameworks, maturity models, and roles in geospatial data management.	K2
CO-3	Apply standards of data quality, metadata, and interoperability in enterprise environments.	K3
CO-4	Analyze legal, policy, and ethical aspects of geospatial governance at national and global levels.	K4
CO-5	Evaluate case studies of governance practices and design governance strategies for organizations.	K4
CO-6	Critically assess ethical issues, biases, and challenges in GeoAI research and future directions.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Enterprise GIS Concepts &amp; Architectures</b>	<b>6 Hours</b>
Definition & scope of Enterprise GIS; components: databases, servers, services; client-server and cloud vs on-premise deployments; integration with ERP/IoT/BI systems; case examples.		



<b>MODULE 2:</b>	<b>Data Governance Frameworks &amp; Roles</b>	<b>6 Hours</b>
Principles: ownership, stewardship, custodianship; governance frameworks & maturity models; roles (data stewards, custodians, committees); workflows of data lifecycle; stakeholder engagement & policy drafting.		
<b>MODULE 3:</b>	<b>Data Quality, Metadata &amp; Interoperability</b>	<b>6 Hours</b>
Data quality parameters (accuracy, timeliness, completeness); metadata standards (ISO 19115, FGDC, Dublin Core); interoperability & OGC standards (WMS, WFS, WCS, GeoPackage); catalogues & portals; schema management.		
<b>MODULE 4:</b>	<b>Geospatial Laws, Policies &amp; Ethics</b>	<b>6 Hours</b>
Indian policies: NGP 2022, RS Data Policy, NSDI; global: INSPIRE (EU), US Geospatial Data Act, UN-GGIM; licensing (Creative Commons, INSPIRE); ethical issues: privacy, inclusivity, bias; risk management & legal compliance.		
<b>MODULE 5:</b>	<b>Governance in Practice &amp; Emerging Trends</b>	<b>6 Hours</b>
Case studies: Caltrans CTDATA, Montana plan, India's NSDI; governance committees & documents; monitoring & KPIs; future directions: distributed GIS, AI/ML, blockchain, cloud governance; student seminar on roadmap design.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

## References

1. Dessers, E. (2019). *Designing Enterprise GIS: Applying Theories into Practice*. Springer.
2. Onsrud, H. J. (2013). *Legal and Policy Frameworks for Geospatial Data*. CRC Press.
3. Rajabifard, A., & Coleman, D. (Eds.). (2012). *Spatially Enabling Government, Industry and Citizens: Research and Development Perspectives*. GSDI Association.
4. National Geospatial Policy, 2022. Department of Science & Technology, Government of India.
5. Federal Geographic Data Committee (FGDC). *Geospatial Data Act of 2018 (US)*.
6. European Commission (2007). *INSPIRE Directive: Establishing Infrastructure for Spatial Information in the EU*.
7. UN-GGIM (2019). *Principles of Geospatial Information Management*. United Nations.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 2<sup>nd</sup> yr , 1<sup>st</sup> Sem.(Program 3<sup>rd</sup> Sem)</b>
<b>Course Title: Research Methodology</b>	<b>Subject Code: TIU-PGI-T207</b>
<b>Contact Hours/Week: 2-0-0 (L-T-P)</b>	<b>Credit: 2</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamental concepts, types, and processes of research.
2. Formulate research problems, questions, and hypotheses effectively.
3. Learn data collection, sampling strategies, and analytical approaches across quantitative, qualitative, and mixed-methods designs.
4. Acquire skills in writing literature reviews, research proposals, and reports.
5. Practice ethical, legal, and reproducible standards of academic research.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
<b>CO-1</b>	Explain the foundations, paradigms, and principles of good research design.	<b>K1</b>
<b>CO-2</b>	Select appropriate sampling methods, data collection instruments, and sources.	<b>K2</b>
<b>CO-3</b>	Apply basic descriptive and inferential statistical tools for quantitative analysis.	<b>K3</b>
<b>CO-4</b>	Conduct qualitative and mixed-methods research using coding, thematic, and triangulation approaches.	<b>K3</b>
<b>CO-5</b>	Demonstrate ethical integrity in research practices, including plagiarism avoidance, data management, and participant rights.	<b>K4</b>
<b>CO-6</b>	Prepare literature reviews, research proposals, and reports in line with academic publishing standards.	<b>K4</b>

### COURSE CONTENT:

MODULE 1:	Foundations of Research & Research Design	6 Hours
Nature & types of research (basic, applied, action); research process steps; paradigms (positivist, interpretivist, constructivist); variables & operationalisation; research questions/hypotheses; validity & reliability.		



<b>MODULE 2:</b>	<b>Sampling, Data Collection &amp; Instruments</b>	<b>6 Hours</b>
Probability & non-probability sampling; sample size; data collection: surveys, interviews, observation, focus groups; questionnaire & interview design; secondary/archival data; reference management tools; pilot testing.		
<b>MODULE 3:</b>	<b>Quantitative Methods &amp; Analysis</b>	<b>6 Hours</b>
Descriptive statistics (mean, median, dispersion, variance, standard deviation), correlation & regression (basics), introduction to advanced methods (ANOVA, multivariate basics), assumptions & limitations, interpreting statistical outputs		
<b>MODULE 4:</b>	<b>Qualitative &amp; Mixed Methods</b>	<b>6 Hours</b>
Qualitative designs: case study, ethnography, narrative/content analysis, coding & thematic analysis, mixed-methods: sequential/concurrent designs, validity & trustworthiness in qualitative work, triangulation & integration		
<b>MODULE 5:</b>	<b>Ethics, Reporting &amp; Reproducibility</b>	<b>6 Hours</b>
Research ethics (informed consent, confidentiality), plagiarism & intellectual property rights (IPR), data management & sharing, writing literature reviews, proposals, and reports, publication & peer review process, reproducibility, open science, transparency		
<b>MODULE 6:</b>	<b>Inferential Statistics &amp; Hypothesis Testing</b>	
Foundations of inferential statistics: sampling distributions, central limit theorem, hypothesis formulation & testing (null vs alternative), significance levels, p-values, Type I & Type II errors, statistical power, parametric tests: t-tests (independent, paired), ANOVA (one-way basics), non-parametric tests: chi-square, Mann–Whitney U, Kruskal–Wallis, confidence intervals & effect size, practical interpretation of outputs		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

## TECHNO INDIA UNIVERSITY REFERENCES

1. Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE.
2. Kothari, C. R., & Garg, G. (2019). *Research Methodology: Methods and Techniques* (4th ed.). New Age International.
3. Neuman, W. L. (2014). *Social Research Methods: Qualitative and Quantitative Approaches* (7th ed.). Pearson.
4. Kumar, R. (2019). *Research Methodology: A Step-by-Step Guide for Beginners* (5th ed.). SAGE.
5. Walliman, N. (2017). *Research Methods: The Basics* (2nd ed.). Routledge.
6. Punch, K. F. (2013). *Introduction to Social Research: Quantitative and Qualitative Approaches* (3rd ed.). SAGE.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Geoinformatics in Urban Planning and Infrastructure</b>	<b>Subject Code:</b> TIU-PGI-ET207A
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the role of geoinformatics in urban planning and infrastructure development.
2. Gain hands-on knowledge of datasets and methods for urban mapping and analysis.
3. Apply GIS/RS techniques for growth monitoring, zoning, and accessibility.
4. Develop decision-support outputs for sustainable and smart city planning.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain fundamentals of urban planning and infrastructure in a GIS context.	K2
CO-2	Prepare and manage spatial datasets for land use, transport, and utilities.	K3
CO-3	Apply GIS/RS tools for analyzing growth, zoning, and accessibility.	K3
CO-4	Perform network and service area analysis for infrastructure optimization.	K3
CO-5	Integrate multi-temporal remote sensing data to monitor urban change.	K4
CO-6	Design geoinformatics-based decision-support products for smart urban planning.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Foundations of Research &amp; Research Design</b>	<b>7 Hours</b>
Concepts of urban systems: land use, housing, utilities, and transport; GIS/RS in urban planning: data sources (satellite imagery, LiDAR, UAV, census); Standards in urban geospatial datasets		



(scales, projections, metadata); Case examples: Smart Cities Mission, AMRUT projects in India.		
<b>MODULE 2:</b>	<b>Sampling, Data Collection &amp; Instruments</b>	<b>8 Hours</b>
Urban Infrastructure & Land Use Applications (8 Hours) – Mapping urban infrastructure: roads, water, electricity, telecom, sanitation; Integration of CAD data into GIS for utilities and facilities; Urban land use classification from remote sensing; Zoning, building footprint, and density mapping; Case study: land use and infrastructure mapping for metropolitan areas.		
<b>MODULE 3:</b>	<b>Quantitative Methods &amp; Analysis</b>	<b>7 Hours</b>
Urban Growth and Sprawl Monitoring (7 Hours) – Change detection using multi-temporal RS data; Indicators: Shannon’s entropy, spatial metrics, density gradient; Types of urban sprawl: ribbon, edge, leapfrog, scattered; Temporal studies of expansion in Indian cities (e.g., Kolkata Metropolitan Area); Case exercise: sprawl detection and growth trend analysis.		
<b>MODULE 4:</b>	<b>Qualitative &amp; Mixed Methods</b>	<b>8 Hours</b>
Decision-Support Systems for Sustainable Cities (8 Hours) – Multi-criteria decision analysis (MCDA) for site suitability; Accessibility studies: transport, health, education, emergency services; Urban vulnerability mapping (heat islands, pollution exposure); Geo-dashboards and story maps for stakeholder communication.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

### REFERENCES

1. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). Geographic Information Systems & Science. Wiley.
2. Batty, M. (2013). The New Science of Cities. MIT Press.
3. Yeh, A. G. O. (2002). Urban Planning and GIS. GeoJournal.
4. Clarke, K. C. (2019). Getting Started with Geographic Information Systems. Pearson.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Geoinformatics in Agriculture and Management</b>	<b>Subject Code:</b> TIU-PGI-ET207B
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the role of geoinformatics in agricultural resource management.
2. Gain hands-on skills in crop monitoring, soil and land suitability mapping.
3. Apply GIS and remote sensing for irrigation planning, drought and pest/disease monitoring.
4. Explore UAVs, GNSS, and precision farming tools for sustainable agriculture.
5. Integrate decision-support frameworks for agricultural planning and management.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Describe spatial datasets for agriculture (soil, crop, climate, water).	K2
CO-2	Process remote sensing data and vegetation indices (NDVI, EVI) for crop monitoring.	K3
CO-3	Conduct land capability and agro-ecological zoning using geospatial tools.	K3
CO-4	Apply GIS/RS for irrigation planning, drought assessment, and pest/disease mapping.	K3
CO-5	Evaluate precision agriculture tools (UAVs, GNSS, IoT) for farm-level management.	K4
CO-6	Develop decision-support outputs for sustainable agricultural planning.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Remote Sensing for Agriculture</b>	<b>7 Hours</b>
Basics of agricultural remote sensing; Multi-spectral and hyperspectral applications; Vegetation indices: NDVI, EVI, SAVI, LAI; Crop acreage and yield estimation; Case examples: wheat yield mapping, rice acreage estimation in India.		
<b>MODULE 2:</b>	<b>Soil and Land Suitability Analysis</b>	<b>8 Hours</b>
Soil mapping: fertility, pH, organic matter, salinity; Terrain analysis: slope, aspect, elevation, drainage for		



land evaluation; Agro-ecological zoning and FAO frameworks; GIS-based land suitability modeling (multi-criteria evaluation); Case study: crop suitability analysis (rice, wheat, sugarcane).

<b>MODULE 3:</b>	<b>Crop Monitoring and Irrigation Management</b>	<b>7 Hours</b>
Crop pattern mapping using temporal remote sensing; Crop health monitoring and stress detection (thermal indices, chlorophyll mapping); Pest/disease detection through RS and UAV imagery; Irrigation management: evapotranspiration mapping, drought severity indices; Case discussion: monitoring drought-prone agriculture in semi-arid India.		
<b>MODULE 4:</b>	<b>Precision Agriculture and Decision-Support Systems</b>	<b>8 Hours</b>
Precision agriculture concepts: variable rate application, soil–plant–water interactions; UAVs, GNSS, and IoT-based smart farming applications; Farm-level spatial databases: yield maps, soil moisture, sensor integration; Decision-support dashboards for farmers and policymakers; Mini-project: precision farming application using RS + GIS datasets.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

### REFERENCES

1. Jensen, J. R. (2015). Remote Sensing of the Environment: An Earth Resource Perspective. Pearson.
2. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). Remote Sensing and Image Interpretation (7th ed.). Wiley.
3. Hatfield, J. L., & Gitelson, A. A. (2019). Application of Vegetation Indices for Agricultural Remote Sensing. Agronomy Journal.
4. Mulla, D. J. (2013). Twenty Five Years of Remote Sensing in Precision Agriculture. Remote Sensing.
5. Tiwari, K. N., et al. (2017). Geoinformatics Applications in Agricultural Water Management. Springer.

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## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Geoinformatics in Disaster Management</b>	<b>Subject Code:</b> TIU-PGI-ET207C
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the disaster management cycle and the role of geoinformatics.
2. Gain skills in hazard mapping and disaster risk assessment using GIS/RS.
3. Integrate vulnerability and exposure datasets for multi-hazard risk modeling.
4. Apply geospatial tools for disaster response, early warning, and recovery.
5. Develop decision-support systems to strengthen disaster resilience.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the concepts of disaster management cycle and hazard typologies.	K2
CO-2	Collect and prepare hazard datasets for GIS-based analysis.	K3
CO-3	Map hazard susceptibility zones using GIS/RS methods.	K3
CO-4	Assess vulnerability and risk by integrating social, economic, and physical factors.	K3
CO-5	Apply geoinformatics for scenario modeling, early warning, and impact simulations.	K4
CO-6	Design geospatial decision-support outputs for disaster mitigation and resilience.	K4

### COURSE CONTENT:

MODULE 1:	Fundamentals of Disaster Management & Geoinformatics	7 Hours
Disaster management cycle: prevention, preparedness, response, recovery; Types of hazards: natural (flood, cyclone, landslide, earthquake) and anthropogenic; Role of GIS, Remote Sensing, and GPS in disaster management; Data sources: satellite imagery (optical, radar), DEMs, crowd-sourced data; Case examples: NDMA framework, Sendai Framework for Disaster Risk Reduction.		



<b>MODULE 2:</b>	<b>Hazard Mapping and Susceptibility Analysis</b>	<b>8 Hours</b>
Flood hazard mapping: inundation models, rainfall–runoff integration; Landslide susceptibility mapping: terrain factors, slope stability analysis; Cyclone hazard modeling: wind speed, storm surge, coastal vulnerability; Earthquake hazard zonation using seismic and geological datasets; Case study: flood susceptibility mapping in Ganga-Brahmaputra basin.		
<b>MODULE 3:</b>	<b>Vulnerability, Exposure, and Risk Assessment</b>	<b>7 Hours</b>
Components of risk: hazard × exposure × vulnerability; Social vulnerability mapping (population density, poverty, gender); Physical vulnerability (infrastructure, housing, critical facilities); Multi-hazard risk analysis and composite risk indices; Case discussion: vulnerability assessment in urban flood-prone areas.		
<b>MODULE 4:</b>	<b>Decision-Support Systems for Disaster Resilience</b>	<b>8 Hours</b>
Scenario modeling and impact assessment under climate change; Early warning systems using geoinformatics and sensor networks; Emergency logistics and evacuation route planning; Web-GIS and dashboards for disaster response coordination; Mini-project: design of GIS-based multi-hazard risk decision-support tool.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

## REFERENCES

1. Alexander, D. (2018). *Natural Disasters*. CRC Press.
2. Singh, R. B. (2014). *Remote Sensing and GIS for Natural Hazards and Disaster Management*. Springer.
3. Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). *Social Vulnerability to Environmental Hazards*. Social Science Quarterly.
4. Kappes, M., et al. (2012). *Challenges of Multi-Hazard Risk Assessment*. Natural Hazards



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Geoinformatics in Water Resources Management</b>	<b>Subject Code:</b> TIU-PGI-ET207D
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable the student to:

1. Understand hydrological and hydrogeological principles in relation to geoinformatics.
2. Apply GIS/RS techniques for watershed and drainage analysis.
3. Map groundwater potential, recharge, and aquifer zones.
4. Monitor surface water bodies and water quality using geospatial tools.
5. Develop decision-support systems for sustainable water resource management.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain hydrological and groundwater concepts within a geoinformatics framework.	K2
CO-2	Prepare and manage hydrological datasets (DEM, rainfall, discharge, aquifer).	K3
CO-3	Delineate watersheds and analyze morphometric parameters using GIS.	K3
CO-4	Assess groundwater potential and recharge areas using multi-criteria evaluation.	K3
CO-5	Monitor water quality and surface water dynamics using RS and GIS datasets.	K4
CO-6	Design geospatial decision-support strategies for sustainable water resource planning.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Hydrology and Geoinformatics Fundamentals</b>	<b>7 Hours</b>
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Hydrological cycle and processes: precipitation, infiltration, runoff, evapotranspiration; Hydrogeology: aquifer types, groundwater occurrence, recharge/discharge processes; Spatial datasets for water studies: DEMs, rainfall, streamflow, soil, geology; Role of RS and GIS in water resources planning and management; Case example: integration of rainfall and runoff data for catchment studies.		
<b>MODULE 2:</b>	<b>Watershed and Drainage Analysis</b>	<b>8 Hours</b>
DEM-based watershed delineation using ArcHydro and QGIS; Stream network and drainage density mapping; Morphometric analysis: slope, aspect, relief ratio, form factor, bifurcation ratio; Runoff modeling and estimation of catchment response; Case study: watershed prioritization for soil and water conservation.		
<b>MODULE 3:</b>	<b>Groundwater Potential and Recharge Mapping</b>	<b>7 Hours</b>
Remote sensing indicators of groundwater (lineaments, landforms, vegetation, geology); Multi-criteria decision analysis (MCDA, AHP) for groundwater potential zonation; Recharge zone mapping and groundwater vulnerability assessment; Aquifer delineation and 3D subsurface modeling; Case example: groundwater prospect mapping in semi-arid India.		
<b>MODULE 4:</b>	<b>Water Quality Monitoring and Decision Support</b>	<b>8 Hours</b>
Remote sensing of water bodies: spectral indices (NDWI, MNDWI, turbidity, chlorophyll); Water quality parameters: salinity, pH, TDS, BOD, COD mapping with GIS; Drought and flood monitoring with geoinformatics tools; Web-GIS and dashboards for water allocation and policy planning; Mini-project: mapping water scarcity zones or water quality risk analysis.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

## REFERENCES

1. Maidment, D. R. (1993). *Handbook of Hydrology*. McGraw-Hill.
2. Fetter, C. W. (2018). *Applied Hydrogeology*. Pearson.
3. Lillesand, T., Kiefer, R., & Chipman, J. (2015). *Remote Sensing and Image Interpretation*. Wiley.
4. Todd, D. K., & Mays, L. W. (2005). *Groundwater Hydrology*. Wiley.
5. Singh, V. P. (2016). *Watershed Hydrology*. Springer.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 2<sup>nd</sup> yr , 1<sup>st</sup> Sem.(Program 3<sup>rd</sup> Sem)</b>
<b>Course Title: Geoinformatics in Environmental Management</b>	<b>Subject Code: TIU-PGI-ET207E</b>
<b>Contact Hours/Week: 2-0-0 (L-T-P)</b>	<b>Credit: 2</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Understand environmental challenges and the role of geoinformatics in their management.
2. Use GIS and RS for monitoring pollution, land degradation, and biodiversity loss.
3. Apply geospatial tools for Environmental Impact Assessment (EIA).
4. Assess ecosystem services and sustainability indicators.
5. Develop decision-support tools for climate adaptation and environmental policy.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Describe environmental datasets and monitoring approaches using GIS and RS.	K2
CO-2	Map pollution, deforestation, and land degradation using geospatial techniques.	K3
CO-3	Analyze biodiversity loss and ecosystem services through spatial modeling.	K3
CO-4	Apply GIS/RS in Environmental Impact Assessment and ecological monitoring frameworks.	K3
CO-5	Develop scenarios for climate change impact and sustainability planning.	K4
CO-6	Create decision-support outputs for environmental governance and policy.	K4

### COURSE CONTENT:



<b>MODULE 1:</b>	<b>Fundamentals of Environmental Geoinformatics</b>	<b>7 Hours</b>
Environmental systems and geospatial data needs; Types of environmental datasets: land, air, water, biodiversity; Remote sensing for environmental monitoring: spectral indicators (NDVI, NDBI, NDWI, AQI proxies); Case examples: GIS in monitoring SDG indicators (climate, clean water, biodiversity).		
<b>MODULE 2:</b>	<b>Pollution and Land Degradation Mapping</b>	<b>8 Hours</b>
Air quality mapping: PM2.5, AQI, spatial interpolation methods; Water quality assessment: turbidity, salinity, chlorophyll, pollutants; Soil degradation mapping: salinity, erosion, desertification risk; Remote sensing of land degradation: UNEP/FAO frameworks; Case study: land degradation assessment in India's drylands..		
<b>MODULE 3:</b>	<b>Biodiversity, Ecosystem Services, and EIA</b>	<b>7 Hours</b>
Habitat mapping and fragmentation analysis; Biodiversity indicators from RS/GIS datasets; Ecosystem services mapping: carbon sequestration, provisioning and regulating services; Role of GIS in Environmental Impact Assessment (EIA); Case study: GIS-based biodiversity vulnerability mapping.		
<b>MODULE 4:</b>	<b>Climate Change and Environmental Decision-Support</b>	<b>8 Hours</b>
Climate change monitoring using remote sensing (temperature, vegetation stress, rainfall anomalies); Vulnerability and resilience assessment frameworks; Decision-support dashboards for policy and environmental governance; Geo-visualization for participatory environmental planning; Mini-project: climate vulnerability and ecosystem service mapping.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

## References

1. Turner, M. G., Gardner, R. H., & O'Neill, R. V. (2015). *Landscape Ecology in Theory and Practice*. Springer.
2. Richards, J. A., & Jia, X. (2013). *Remote Sensing Digital Image Analysis*. Springer.
3. Campbell, J. B., & Wynne, R. H. (2011). *Introduction to Remote Sensing* (5th ed.). Guilford.
4. Margules, C. R., & Pressey, R. L. (2000). *Systematic Conservation Planning*. Nature.
5. Eastman, J. R. (2016). *IDRISI TerrSet: Geospatial Monitoring and Modeling System*. Clark Labs.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Geo- Environmental Modeling and analysis Lab</b>	<b>Subject Code:</b> TIU-PGI-L201
<b>Contact Hours/Week:</b> 0-0-4 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable the student to:

1. Acquire knowledge of advanced GIS methods for environmental applications.
2. Apply GIS to analyze healthcare, hydrological, geological, land use, and hazard datasets.
3. Develop predictive and scenario-based environmental models.
4. Evaluate and communicate risk, vulnerability, and planning outputs for decision support..

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Apply GIS to healthcare and environmental health datasets for disease and risk analysis.	K3
CO-2	Demonstrate watershed and hydrological modeling for water resource assessment.	K3
CO-3	Integrate geological and geo-environmental datasets for hazard and groundwater modeling.	K3
CO-4	Evaluate land use/land cover dynamics using predictive and scenario-based spatial models.	K4
CO-5	Design hazard, risk, and climate vulnerability maps for environmental planning and decision-making.	K4
CO-6	Execute a mini-project applying spatial-environmental modeling concepts to real-world case studies.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Healthcare &amp; Environmental Modeling</b>	<b>12 Hours</b>
Spatial epidemiology: disease mapping & environmental correlates; Hotspot detection: vector-borne diseases (malaria, dengue, cholera); Healthcare accessibility & service delivery modeling.		
<b>MODULE 2:</b>	<b>Watershed &amp; Hydrological Modeling</b>	<b>12 Hours</b>
DEM-based watershed delineation and terrain modelling; Surface runoff/ soil erosion/water balance analysis; Hydrological models		



<b>MODULE 3:</b>	<b>Geological &amp; Geo-environmental Modeling</b>	<b>12 Hours</b>
Lithology, lineament, structural geology mapping; 3D subsurface & aquifer modelling; Geological hazard assessment: landslides, slope stability, subsidence; Case study: groundwater potential mapping.		
<b>MODULE 4:</b>	<b>Land Use/Land Cover Change &amp; Predictive Modeling</b>	<b>12 Hours</b>
Remote sensing-based classification & change detection; Land-use change simulation (CA-Markov, ANN, scenario-based); Drivers of land dynamics: climate, urbanization, agriculture.		
<b>MODULE 5:</b>	<b>Hazard, Risk &amp; Climate Vulnerability Mapping</b>	<b>12 Hours</b>
Flood/cyclone/coastal hazard mapping; Multi-hazard risk & vulnerability assessment; Climate adaptation & decision-support frameworks;		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

**References:**

1. Burrough, P. A., & McDonnell, R. A. (1998). Principles of Geographical Information Systems. Oxford University Press.
2. O'Sullivan, D., & Unwin, D. (2010). Geographic Information Analysis (2nd ed.). Wiley.
3. de Smith, M. J., Goodchild, M. F., & Longley, P. A. (2018). Geospatial Analysis: A Comprehensive Guide. The Winchelsea Press.
4. Bonham-Carter, G. (2014). Geographic Information Systems for Geoscientists: Modelling with GIS. Pergamon.
5. Eastman, J. R. (2016). IDRISI TerrSet Manual: Geospatial Monitoring and Modeling System. Clark Labs.





## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> yr , 1 <sup>st</sup> Sem.(Program 3 <sup>rd</sup> Sem)
<b>Course Title: Spatial Data Generation (UAV, DGPS) and 3-D Image Generation Lab</b>	<b>Subject Code:</b> TIU-PGI-L203
<b>Contact Hours/Week:</b> 0-0-4 (L-T-P)	<b>Credit:</b> 2

### COURSE OBJECTIVE:

Enable students to:

1. Plan and design UAV/DGPS field surveys with regulatory, safety, and ethical compliance.
2. Acquire skills in DGPS/RTK/PPK surveying for accurate ground control.
3. Conduct UAV-based surveys with RGB/thermal payloads.
4. Apply digital photogrammetry for orthomosaics, DEM/DSM, and point cloud generation.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
<b>CO-1</b>	Design UAV/DGPS survey plans considering safety, regulatory, and ethical compliance.	<b>K3</b>
<b>CO-2</b>	Collect and validate accurate positional data using DGPS/RTK/PPK techniques.	<b>K3</b>
<b>CO-3</b>	Execute UAV surveys with RGB/thermal payloads and integrate them with ground control points.	<b>K3</b>
<b>CO-4</b>	Process UAV and DGPS datasets to generate orthomosaics, DEMs/DSMs, and 3D point clouds.	<b>K4</b>
<b>CO-5</b>	Integrate ground-truth environmental data (soil, thermal, vegetation) with UAV/DGPS outputs for validation.	<b>K4</b>
<b>CO-6</b>	Prepare metadata, validation reports, and deliverables adhering to QA/QC and FAIR data principles.	<b>K4</b>

### COURSE CONTENT:

MODULE 1:	Field Survey Planning, Safety & Compliance	12 Hours
Mission objectives, AOI definition, deliverables; DGCA Drone Rules 2021 & Digital Sky portal; site reconnaissance, weather checks, risk assessment, crew roles; ethics & privacy. Outcome: Approved survey plan + risk checklist + compliance record.		



<b>MODULE 2:</b>	<b>Control Networks &amp; High-Accuracy Positioning (DGPS/RTK/PPK)</b>	<b>12 Hours</b>
Base-rover setups; GCP/CP planning; observation practices; error handling & corrections; coordinate validation; trade-offs between RTK, PPK, and full GCP networks. <b>Outcome:</b> corrected coordinates + control map + quality-checked report.		
<b>MODULE 3:</b>	<b>UAV Image Acquisition (RGB &amp; Thermal)</b>	<b>12 Hours</b>
UAV survey planning (altitude, overlap, payloads); pre-flight checks, calibration, flight logs; RGB & thermal payloads; capturing imagery with GCP integration. Outcome: UAV image dataset (RGB/thermal) + GCP/CP documentation.		
<b>MODULE 4:</b>	<b>Digital Photogrammetry &amp; 3-D Image Generation</b>	<b>12 Hours</b>
Image orientation & triangulation; orthorectification & mosaicking; DEM/DSM generation; point cloud creation & visualization; applications: 3D city models, forestry, cadastral mapping.		
<b>MODULE 5:</b>	<b>Ground Truthing &amp; Validation</b>	<b>12 Hours</b>
Soil moisture (TDR), thermal profiling, vegetation/land cover notes; linking ground-truth with UAV/DGPS outputs; accuracy assessment (RMSE, checkpoints); metadata preparation & reporting with FAIR principles. Outcome: Ground-truth dataset + validation report + metadata package.		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

## REFERENCES

1. Jensen, J. R. (2006). Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall.
2. Wolf, P. R., & Dewitt, B. A. (2000). Elements of Photogrammetry with Applications in GIS. McGraw-Hill.
3. Kavanagh, B. F. (2009). Surveying: Principles and Applications. Pearson.
4. ASPRS (2023). Positional Accuracy Standards for Digital Geospatial Data. American Society for Photogrammetry and Remote Sensing.
5. DGCA (2021). Drone Rules, 2021 and Digital Sky Portal. Government of India.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 2<sup>nd</sup> yr , 1<sup>st</sup> Sem.(Program 3<sup>rd</sup> Sem)</b>
<b>Course Title: Entrepreneurship Skill Development (ESD): Enterprise GIS Lab</b>	<b>Subject Code: TIU-PGI-ES201</b>
<b>Contact Hours/Week: 0-0-2 (L-T-P)</b>	<b>Credit: 1</b>

### COURSE OBJECTIVE:

Enable students to:

1. Gain practical experience in setting up and administering an enterprise GIS environment.
2. Learn to publish, secure, and manage feature, tile, and imagery services.
3. Apply metadata standards, cataloguing, and interoperability protocols for geospatial data.
4. Practice governance frameworks including stewardship, QA/QC workflows, and continuity planning.
5. Deliver a mini-implementation of an enterprise GIS solution for real-world scenarios.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Set up an enterprise GIS workspace with accounts, groups, roles, and content management.	K3
CO-2	Publish, secure, and monitor feature, tile, and imagery services, and build lightweight web apps.	K3
CO-3	Create standards-compliant metadata, catalogs, and interoperable services (OGC/REST).	K4
CO-4	Apply governance frameworks including stewardship roles, QA/QC gates, and review workflows.	K4
CO-5	Demonstrate operational continuity by monitoring services, simulating outages, and implementing backup/restore drills.	K4
CO-6	Deliver an enterprise GIS mini-implementation with governance documentation, metadata, and KPIs.	K5

### COURSE CONTENT:

MODULE 1:	Enterprise GIS Foundations & Workspace Setup	6 Hours
Orientation to enterprise components & usage; accounts, roles, groups; content lifecycle; publishing hosted and cached services; sharing & access control. Deliverable: Org diagram, content inventory, sharing matrix.		



<b>MODULE 2:</b>	<b>Services, Apps &amp; Performance</b>	<b>6 Hours</b>
Publish feature, tile, imagery services; compare storage/performance; build 2 lightweight web apps (dashboard/story map); test responsiveness and document trade-offs. <b>Deliverable:</b> App URLs/screenshots + performance note.		
<b>MODULE 3:</b>	<b>Metadata, Catalogs &amp; Interoperability</b>	<b>6 Hours</b>
Apply ISO/FGDC metadata; export/import records; expose services via OGC (WMS/WFS) & REST; register in catalogs with tags; validate completeness. <b>Deliverable:</b> Metadata XML + mini catalog/index page.		
<b>MODULE 4:</b>	<b>Governance in Practice: Stewardship, QA/QC &amp; Continuity</b>	<b>6 Hours</b>
Assign data steward roles; define workflows (staging, Quality Assurance (QA)/Quality Control (QC), prod; create QA checklists & release notes; monitor service health; simulate outage & restore; draft continuity plan. <b>Deliverable:</b> Governance pack (roles, workflow, QA, DR note).		
<b>MODULE 5:</b>	<b>Capstone: Enterprise GIS Mini-Implementation</b>	<b>6 Hours</b>
Team project: publish authoritative layers with metadata, secure with roles, build decision-support app; prepare governance docs, data dictionary, KPIs. <b>Deliverable:</b> App/demo, service inventory, metadata files, governance pack, KPI sheet.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

## REFERENCES

1. Zeiler, M. (2010). Modeling Our World: The Esri Guide to Geodatabase Concepts (2nd ed.). Esri Press.
2. Esri (2021). ArcGIS Enterprise Administration Resources. Esri Documentation.
3. FGDC (2013). Content Standard for Digital Geospatial Metadata (CSDGM). Federal Geographic Data Committee.
4. ISO 19115:2014. Geographic Information – Metadata. International Organization for Standardization.
5. Onsrud, H. J. (2013). Legal and Policy Frameworks for Geospatial Data. CRC Press.
6. Rajabifard, A., & Coleman, D. (2012). Spatially Enabling Government, Industry and Citizens. GSDI Association.
7. Case studies: Caltrans CTDATA, Montana GIS Governance, India NSDI (available online).



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 2<sup>nd</sup> yr , 1<sup>st</sup> Sem.(Program 3<sup>rd</sup> Sem)</b>
<b>Course Title: Career Advancement Skill Development (CASD): Computer Aided Design Lab</b>	<b>Subject Code: TIU-PGI-S201</b>
<b>Contact Hours/Week: 0-0-2 (L-T-P)</b>	<b>Credit: 1</b>

### COURSE OBJECTIVE:

Enable students to:

1. Understand the principles of Computer Aided Design (CAD) and its role in geospatial sciences.
2. Develop technical skills in creating 2-D and 3-D CAD drawings for mapping and surveying applications.
3. Apply CAD for terrain modeling, infrastructure planning, and geospatial visualization.
4. Integrate CAD outputs with GIS and related geoinformatics workflows for real-world applications.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain CAD concepts and their importance for surveying, mapping, and spatial planning.	K1
CO-2	Create 2-D CAD drawings (maps, base plans, cadastral layouts) with correct dimensions and annotations.	K2
CO-3	Demonstrate 3-D CAD modeling for terrain, contours, profiles, and visualization.	K3
CO-4	Apply CAD in geospatial applications such as infrastructure mapping, road alignment, and utilities.	K3
CO-5	Integrate CAD data with GIS platforms using standard file formats and workflows.	K4
CO-6	Produce geospatial design deliverables and project documentation with cartographic quality.	K4

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Introduction to Computer Aided Design</b>	<b>5 Hours</b>
CAD basics; scope in geospatial sciences; CAD vs GIS vs AM/FM; coordinate systems & units; CAD interfaces; file formats (DWG, DXF) and their relevance for GIS.		



<b>MODULE 2:</b>	<b>2-D Drafting for Geoinformatics</b>	<b>7 Hours</b>
Drawing primitives (points, lines, polygons, circles, arcs); editing commands; layer management; text, dimensions, annotations; preparation of topographic maps, cadastral layouts, and base plans.		
<b>MODULE 3:</b>	<b>3-D Modeling in CAD</b>	<b>6 Hours</b>
Wireframe, surface, and solid modeling; extrusion, loft, revolve; terrain modeling (DTM), contours, and cross-sections; rendering, shading, and perspectives.		
<b>MODULE 4:</b>	<b>CAD in Geospatial Applications</b>	<b>6 Hours</b>
Integration of CAD with GNSS, RS, and photogrammetry data; CAD in urban planning, infrastructure, and utilities mapping; road alignment, pipeline routing; CAD–GIS data exchange workflows.		
<b>MODULE 5:</b>	<b>CAD Project &amp; Case Studies</b>	<b>6 Hours</b>
Mini-project: site plan/toposheet preparation; case studies: surveying, civil engineering, land administration, and urban design; documentation, plotting, print layouts.		
<b>TOTAL LECTURES</b>		<b>30 Hours</b>

## REFERENCES

1. Wolf, P. R., & Ghilani, C. D. (2014). *Elementary Surveying: An Introduction to Geomatics*. Pearson.
2. Autodesk (2018). *AutoCAD and Civil 3D Training Manuals*. CAD Centre/Autodesk.
3. Zeiler, M. (1999). *Modeling Our World: The ESRI Guide to Geodatabase Design*. Esri Press.
4. Madsen, D. A., & Madsen, D. P. (2016). *Engineering Drawing and Design* (6th ed.). Cengage Learning.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> Yr.,1 <sup>st</sup> Sem. (Program 3 <sup>rd</sup> Sem)
<b>Course Title: Dissertation (Part 1)</b>	<b>Subject Code:</b> TIU-PGI-P201
<b>Total Engagement Hours:</b> 300 (Experiential Learning)	<b>Credit:</b> 8

### COURSE OBJECTIVE:

Enable students to:

1. Gain research training through independent project work.
2. Formulate research problems, design methodologies, and conduct preliminary investigations.
3. Collect, preprocess, and analyze geospatial data using relevant tools and workflows.
4. Develop research writing, presentation, and scientific communication skills.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Formulate a research problem with clear objectives and significance.	K4 (Analyze)
CO-2	Conduct an extensive literature review and identify knowledge gaps.	K4 (Analyze)
CO-3	Develop a research design including methodology, datasets, and tools.	K5 (Evaluate)
CO-4	Collect and preprocess relevant datasets (field, UAV, satellite, socio-economic, etc.).	K3 (Apply)
CO-5	Perform preliminary analysis and interpret initial findings.	K4 (Analyze)
CO-6	Prepare an interim dissertation report with chapters (Intro, Literature Review, Methods, Preliminary Results).	K6 (Create)

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Research Problem &amp; Objectives</b>	<b>50 Hours</b>
Topic identification; defining scope, aims, hypotheses; preparing concept notes and research questions.		
<b>MODULE 2:</b>	<b>Literature Review &amp; Gap Analysis</b>	<b>60 Hours</b>
Collection/review of papers, reports, policies; annotated bibliography; synthesis; gap identification.		



<b>MODULE 3:</b>	<b>Research Design &amp; Methodology</b>	<b>60 Hours</b>
Dataset identification (primary, secondary); tools/software (GIS, RS, modeling, stats); workflows; ethics, reproducibility.		
<b>MODULE 4:</b>	<b>Data Collection &amp; Preprocessing</b>	<b>80 Hours</b>
Field surveys (DGPS, UAV, ground truth, socio-economic surveys); secondary/satellite data acquisition; preprocessing (corrections, database prep).		
<b>MODULE 5:</b>	<b>Preliminary Analysis &amp; Reporting</b>	<b>50 Hours</b>
Exploratory analysis; pilot runs of models; draft chapters (Intro, Lit Review, Methods, Preliminary Results).		
<b>TOTAL LECTURES</b>		<b>300 Hours</b>



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## Department of Geospatial Science

Program: <b>M.Sc in Geoinformatics</b>	Year, Semester: 2 <sup>nd</sup> Yr., 2 <sup>nd</sup> Sem. (Program 4 <sup>th</sup> Sem)
Course Title: <b>Project Management</b>	Subject Code: TIU-PGI-T202
Contact Hours/Week: 2-1-0 (L-T-P)	Credit: 3

### COURSE OBJECTIVE:

Enable the student to:

1. Understand the concepts, frameworks, and life cycle of project management.
2. Develop skills in project planning, scheduling, costing, and risk assessment.
3. Apply governance, ethics, sustainability, and quality management in projects.
4. Critically evaluate traditional vs. agile/hybrid methodologies and emerging project trends.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain project life cycles, frameworks (PMBOK, PRINCE2, Agile), and the role of project governance.	K2 (Understand)
CO-2	Prepare project charters, scope statements, WBS, schedules, and cost estimates.	K3 (Apply)
CO-3	Analyze project risks, stakeholder engagement, communication plans, and quality management processes.	K4 (Analyze)
CO-4	Evaluate monitoring & control techniques including EVM, dashboards, and change management.	K5 (Evaluate)
CO-5	Compare and contrast predictive, agile, and hybrid methodologies with reference to real-world contexts.	K4 (Analyze)
CO-6	Design a mini project plan integrating scope, schedule, cost, risk, and sustainability considerations.	K6 (Create)

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Foundations of Project Management</b>	<b>8 Hours</b>
Definition of projects vs operations; project life cycle models (predictive, agile, hybrid); PMBOK/PMI/PRINCE2 overview; project constraints (time, cost, scope, quality); governance, stakeholders; role of project manager and team.		
<b>MODULE 2:</b>	<b>Initiation &amp; Planning</b>	<b>5 Hours</b>
Project charter & business case; scope definition & WBS; scheduling (activity sequencing, duration, Gantt, CPM, PERT); cost estimation; resource & communication planning.		



<b>MODULE 3:</b>	<b>Execution, Monitoring &amp; Control</b>	<b>8 Hours</b>
Execution phase: resource allocation, team management; quality assurance; risk management (identification, analysis, response); monitoring & controlling (EVM, variance analysis, change control); integration of changes; performance metrics & dashboards.		
<b>MODULE 4:</b>	<b>Closure, Governance &amp; Ethics</b>	<b>8 Hours</b>
Project closure: acceptance, documentation, handover; contract closure; lessons learned; governance frameworks; ethics (conflict of interest, professional conduct); sustainability and compliance.		
<b>MODULE 5:</b>	<b>Agile, Hybrid &amp; Emerging Trends</b>	<b>8 Hours</b>
Agile methodologies (Scrum, Kanban, Lean); hybrid models; digital PM tools (MS Project, cloud PM platforms); program & portfolio management; AI/ML in PM; managing distributed/remote teams; sustainability in projects.		
<b>MODULE 6:</b>	<b>Case Studies &amp; Capstone Workshop</b>	<b>8 Hours</b>
Real-world case studies (construction, IT, infrastructure, social projects); group discussion & critique; capstone workshop: students draft mini project plan (charter, schedule, risk, budget); peer review; student presentations.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

**References:**

1. Project Management Institute (2021). A Guide to the Project Management Body of Knowledge (PMBOK Guide) (7th ed.). PMI.
2. Kerzner, H. (2017). Project Management: A Systems Approach to Planning, Scheduling, and Controlling (12th ed.). Wiley.
3. Meredith, J. R., & Mantel, S. J. (2017). Project Management: A Managerial Approach (9th ed.). Wiley.
4. Larson, E. W., & Gray, C. F. (2021). Project Management: The Managerial Process (8th ed.). McGraw-Hill.
5. Wysocki, R. K. (2019). Effective Project Management: Traditional, Agile, Extreme (8th ed.). Wiley.
6. Schwaber, K., & Sutherland, J. (2020). The Scrum Guide. Scrum.org.
7. Esri (2022). Project Management for GIS Projects: Best Practices. Esri Press (online resources).



## Department of Geospatial Science

<b>Program: M.Sc. Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> Yr., 2 <sup>nd</sup> Sem. (Program 4 <sup>th</sup> Sem)
<b>Course Title: Entrepreneurship Skill Development (ESD):</b> Organisational Behaviour	<b>Subject Code:</b> TIU-PGI-ES202
<b>Contact Hours/Week:</b> 2-0-0 (L-T-P)	<b>Credit:</b> 3

### COURSE OBJECTIVE:

Enable the student to:

1. Familiarize with the core principles, levels, and scope of Organizational Behavior.
2. Understand how individual characteristics and group processes influence organizational performance.
3. Explore motivation, leadership, and cultural dimensions in organizational contexts.
4. Apply OB concepts to HRM, management practices, and organizational design.

### COURSE OUTCOME:

CO No.	Course Outcome	Cognitive Level
CO-1	Explain the scope, principles, and levels of organizational behavior.	<b>K2 (Understand)</b>
CO-2	Analyze how perception, personality, attitudes, and emotions influence workplace behavior.	<b>K3 (Apply)</b>
CO-3	Apply theories of learning, motivation, and interpersonal dynamics to workplace contexts.	<b>K3 (Apply)</b>
CO-4	Evaluate leadership styles, power, and politics in organizational settings.	<b>K4 (Analyze)</b>
CO-5	Assess group dynamics, organizational culture, and structural design and their impact on performance.	<b>K4 (Analyze)</b>
CO-6	Formulate strategies for managing organizational change, resistance, and development interventions.	<b>K5 (Evaluate)</b>

### COURSE CONTENT:

<b>MODULE 1:</b>	<b>Foundations of Organisational Behaviour</b>	<b>9 Hours</b>
Definition & scope; assumptions & principles; levels of OB (individual, group, organization); historical development; OB & HRM; emerging issues in OB.		



<b>MODULE 2:</b>	<b>Individual Behavior in Organizations</b>	<b>9 Hours</b>
Perception principles & biases; attribution; learning theories; personality determinants & workplace implications; attitudes (formation, job satisfaction, prejudice); emotions & stress management.		
<b>MODULE 3:</b>	<b>Motivation &amp; Interpersonal Dynamics</b>	<b>9 Hours</b>
Motivation processes; content & process theories; workplace motivators; trust & psychological contract; cooperation vs competition; conflict types, levels, management styles; negotiation.		
<b>MODULE 4:</b>	<b>Leadership, Power &amp; Team Dynamics</b>	<b>9 Hours</b>
Power sources & organizational politics; leadership theories (traits, styles, contingency, contemporary); team dynamics (development, challenges, groupthink); virtual & cross-cultural teams.		
<b>MODULE 5:</b>	<b>Organizational Systems, Culture &amp; Change</b>	<b>9 Hours</b>
Culture levels, dimensions, strong vs weak cultures; organizational change: resistance, OD interventions; structure & design (dimensions, departmentalization, socio-technical systems); boundary spanning & adaptation.		
<b>TOTAL LECTURES</b>		<b>45 Hours</b>

## REFERENCES

1. Robbins, S. P., & Judge, T. A. (2019). *Organizational Behavior* (18th ed.). Pearson.
2. Luthans, F. (2015). *Organizational Behavior: An Evidence-Based Approach* (13th ed.). McGraw-Hill.
3. Newstrom, J. W. (2015). *Organizational Behavior: Human Behavior at Work* (14th ed.). McGraw-Hill.
4. Greenberg, J. (2013). *Behavior in Organizations* (10th ed.). Pearson.
5. Ivancevich, J. M., Konopaske, R., & Matteson, M. T. (2019). *Organizational Behavior and Management* (11th ed.). McGraw-Hill.



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester: 2<sup>nd</sup> Yr.,2<sup>nd</sup> Sem. (Program 4<sup>th</sup> Sem)</b>
<b>Course Title: WebGIS Dashboarding Lab</b>	<b>Subject Code: TIU-PGI-L202</b>
<b>Contact Hours/Week: 0-0-4 (L-T-P)</b>	<b>Credit: 2</b>

**COURSE OBJECTIVE:**

Enable the student to:

1. Gain hands-on training in Web GIS platforms for building dashboards and interactive maps.
2. Learn cloud-based spatial data management, visualization, and customization.
3. Develop skills in dashboard design, storytelling, and interactive web application creation.
4. Practice collaborative sharing, user roles, and permissions in organizational Web GIS environments.
5. Apply storytelling and dashboarding for real-world spatial decision support.

**COURSE OUTCOME:**

<b>CO No.</b>	<b>Course Outcome</b>	<b>Cognitive Level</b>
<b>CO-1</b>	Set up and configure Web GIS accounts and organize spatial content.	<b>K3 (Apply)</b>
<b>CO-2</b>	Import, edit, and manage spatial datasets from multiple sources in Web GIS.	<b>K3 (Apply)</b>
<b>CO-3</b>	Apply symbology, labeling, and pop-up customization for interactive visualization.	<b>K4 (Analyze)</b>
<b>CO-4</b>	Design and publish dashboards, web apps, and story maps for professional use.	<b>K4 (Analyze)</b>
<b>CO-5</b>	Manage sharing, permissions, and collaboration in organizational Web GIS environments.	<b>K4 (Analyze)</b>
<b>CO-6</b>	Integrate dashboards and story maps into thematic projects for decision support.	<b>K5 (Evaluate)</b>



**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Introduction to Web GIS &amp; Account Setup</b>	<b>12 Hours</b>
Web GIS vs desktop GIS; account types (public, organizational, developer); UI overview; content management; navigation and adding layers. Outcome: Students configure a Web GIS workspace.		
<b>MODULE 2:</b>	<b>Data Management &amp; Visualization</b>	<b>12 Hours</b>
Importing datasets (Shapefile, CSV, KMZ, GPX, WMS/WFS); symbolization (points, lines, polygons, heatmaps); labeling; clustering; dynamic pop-ups with text, charts, media.		
<b>MODULE 3:</b>	<b>Editing, Data Creation &amp; Customization</b>	<b>12 Hours</b>
Drawing/editing features online; attribute management; expressions (Arcade/others) for custom labels/pop-ups; filters, dynamic updates, conditional styling		
<b>MODULE 4:</b>	<b>Dashboard &amp; Web App Design</b>	<b>12 Hours</b>
Creating dashboards (maps, charts, indicators, filters); designing Instant/Configurable Apps; responsive layouts; case study: disaster/urban monitoring dashboard.		
<b>MODULE 5:</b>	<b>Collaboration, Story Maps &amp; Deployment</b>	<b>12 Hours</b>
User roles, permissions, groups; sharing content (private, group, org, public); Story Maps (templates, layouts, media); final project: thematic dashboard + story map.		
<b>TOTAL LECTURES</b>		<b>60 Hours</b>

**REFERENCES**

1. Fu, P., & Sun, J. (2020). *Web GIS: Principles and Applications* (2nd ed.). Esri Press.
2. Esri (2021). *ArcGIS Dashboards and StoryMaps Documentation*. Esri.
3. Kraak, M.-J., & Brown, A. (2001). *Web Cartography: Developments and Prospects*. Taylor & Francis.
4. Google Earth Engine Developers Guide – <https://developers.google.com/earth-engine>
5. GeoServer & OGC Standards – <https://geoserver.org> / <https://www.ogc.org>



## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> Yr.,2 <sup>nd</sup> Sem. (Program 4 <sup>th</sup> Sem)
<b>Course Title: Career Advancement Skill Development: Internship and Field Training</b>	<b>Subject Code:</b> TIU-PGI-S202
<b>Contact Hours/Week:</b> (Experiential Learning) 200 hours minimum	<b>Credit:</b> 5

### COURSE OBJECTIVE:

1. Gain exposure to real-world industry, laboratory, or R&D environments.
2. Apply classroom knowledge to practical and professional settings.
3. Develop essential skills in teamwork, communication, and problem-solving.
4. Build an understanding of workflows, technologies, and practices in industry and research.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Course Outcome	Cognitive Level (K level)
CO-1	Apply theoretical knowledge in an industry or research setting.	K3 (Apply)
CO-2	Analyze workflows, technologies, and practices in professional environments.	K4 (Analyze)
CO-3	Demonstrate professional skills such as teamwork, communication, and problem-solving.	K3 (Apply)
CO-4	Prepare technical reports and presentations summarizing internship activities and outcomes.	K6 (Create)
CO-5	Reflect on personal skill development and career planning through internship experience.	K5 (Evaluate)
CO-6	Engage ethically and responsibly with organizational practices and professional standards.	K3 (Apply)



**COURSE STRUCTURE:**

**Duration:** Minimum of 200 hours (minimum 4 weeks, during semester or summer).

**Workplace:** Industry, Laboratory, R&D Centre, Government, or NGO projects.

**Tasks:** Assigned by host organization (examples: data collection, processing, analysis, project support, report preparation).

**Faculty Role:** Supervisor assigned for monitoring progress and evaluating outcomes.

**Deliverables:** Internship logbook, interim progress review, final report, and seminar presentation.



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## Department of Geospatial Science

<b>Program: M.Sc in Geoinformatics</b>	<b>Year, Semester:</b> 2 <sup>nd</sup> Yr., 2 <sup>nd</sup> Sem. (Program 4 <sup>th</sup> Sem)
<b>Course Title: Dissertation Part 2 and Viva</b>	<b>Subject Code:</b> TIU-PGI-P202
<b>Total Engagement Hours:</b> 300 (Experiential Learning)	<b>Credit:</b> 12

### COURSE OBJECTIVE:

Enable students to:

1. Carry forward the research initiated in Dissertation Part I to full execution.
2. Complete data collection, processing, and analysis using appropriate tools.
3. Interpret results critically, situating them within existing scholarship.
4. Prepare a comprehensive dissertation and defend it in a viva voce examination.

### COURSE OUTCOME:

On completion of the course, the student will be able to:

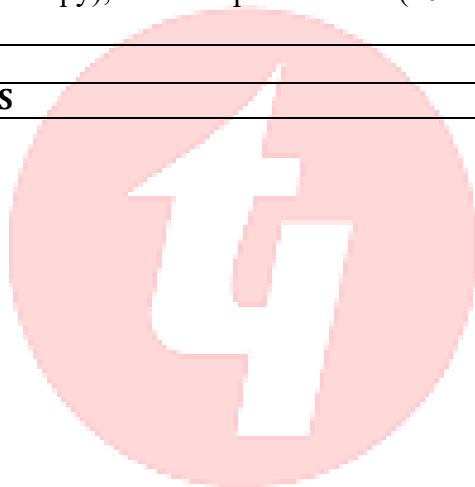
CO No.	Course Outcome	Cognitive Level (K level)
CO-1	Execute the research methodology designed in Dissertation Part I.	<b>K3 (Apply)</b>
CO-2	Collect, process, and analyze complete datasets using advanced techniques.	<b>K4 (Analyze)</b>
CO-3	Interpret findings critically and connect them with literature.	<b>K5 (Evaluate)</b>
CO-4	Prepare a structured, plagiarism-free dissertation following academic standards.	<b>K6 (Create)</b>
CO-5	Present and defend research outcomes with clarity and confidence.	<b>K5 (Evaluate)</b>
CO-6	Demonstrate academic integrity, ethics, and professional communication.	<b>K3 (Apply)</b>

### COURSE CONTENT:

MODULE 1:	Research Execution	80 Hours
Completion of pending/extended data collection (field, lab, secondary); application of models/software; validation and error checking.		



<b>MODULE 2:</b>	<b>Data Analysis &amp; Interpretation</b>	<b>80 Hours</b>
Tabulation, visualization (maps, charts, tables); comparative analysis with published work; identification of trends, innovations, or new contributions.		
<b>MODULE 3:</b>	<b>Dissertation Writing</b>	<b>80 Hours</b>
Preparation of chapters: Introduction, Literature Review, Methodology, Results, Discussion, Conclusion, References, Appendices; formatting and plagiarism check.		
<b>MODULE 4:</b>	<b>Submission &amp; Viva Voce</b>	<b>60 Hours</b>
Final submission (print + digital copy); research presentation (20–25 minutes); viva voce defense before expert panel.		
<b>TOTAL ENGAGEMENT HOURS</b>		<b>300 Hours</b>



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## Department of Geoinformatics

<b>Program: M.Sc. in Geoinformatics</b>	<b>Year, Semester: 2<sup>nd</sup> Yr., 2<sup>nd</sup> Sem. (Program 4<sup>th</sup> Sem)</b>
<b>Course Title: Career Advancement and Skill Development : Grand Viva</b>	<b>Subject Code: TIU-PGI-S204</b>
<b>Contact Hours/Week: 0-0-4 (L-T-P)</b>	<b>Credit: 2</b>

### COURSE OBJECTIVE:

Enable the student to:

1. Develop professional, communication, and career-readiness skills for industry and academia.
2. Build competence in scientific communication through oral, poster, and dissertation defense formats.
3. Assess and integrate comprehensive subject knowledge of Geoinformatics and related domains.
4. Demonstrate confidence and professional ethics in research defense, workplace interviews, and professional roles.

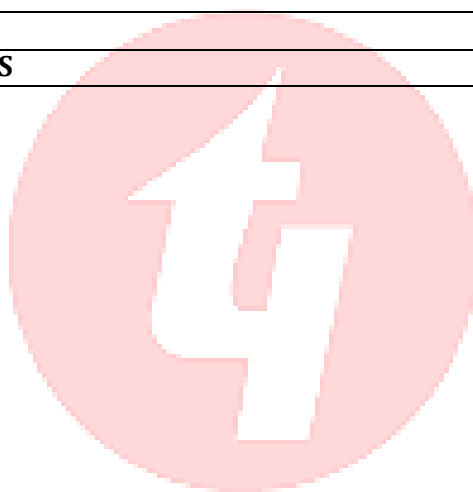
### COURSE OUTCOMES

CO No.	Course Outcome	Cognitive Level (K level)
CO-1	Prepare professional CVs, resumes, and demonstrate effective workplace readiness.	K3 (Apply)
CO-2	Present scientific research confidently in oral, poster, and thesis defense formats.	K4 (Analyze)
CO-3	Integrate and articulate knowledge across Geoinformatics and allied domains in viva examinations.	K5 (Evaluate)
CO-4	Defend dissertation and subject knowledge effectively before expert examiners.	K5 (Evaluate)
CO-5	Demonstrate teamwork, communication, and professional ethics during mock viva and interview practice.	K3 (Apply)
CO-6	Reflect on skills gained for academic, industry, and research career progression.	K6 (Create)



**COURSE CONTENT:**

<b>MODULE 1:</b>	<b>Professional Training</b>	<b>20 Hours</b>
CV/resume writing, cover letters, LinkedIn profile, networking; Industry readiness: interviews (HR & technical), teamwork, workplace ethics; Scientific communication: abstracts, executive summaries, oral & poster presentations; Defense preparation: thesis defense strategies, mock viva, articulation & confidence building.		
<b>MODULE 2:</b>	<b>Scientific and Technical Communication</b>	<b>70 Hours</b>
Comprehensive viva voce covering full M.Sc. Geoinformatics curriculum (core, supportive, dissertation, etc.); subject-specific oral tests; interdisciplinary & applied case study discussions; dissertation defense.		
<b>TOTAL ENGAGEMENT HOURS</b>		<b>90 Hours</b>



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