

Chaudhary Bansi Lal University

Hansi Road, Prem Nagar, Bhiwani

(A State University Established under Govt. of Haryana Act No 25 of 2014)

ज्ञानाय मार्गदर्शकं भूगोलदर्शनम्।

(Geospatial vision is the guide to knowledge.)



Scheme & Syllabus of M.Sc. Geoinformatics (In accordance with NEP-2020)

DEPARTMENT OF GEOGRAPHY

Approved

PGBOS&R: 15 July 2025

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Programme Learning Outcomes (PLO) of M.Sc. Geoinformatics

PLO 1	Demonstrate advanced knowledge about Geospatial Technology with a critical understanding of the emerging developments and issues relating to the learners domain area.
PLO 2	Demonstrate advanced knowledge and understanding of principles, methods, and techniques applicable to the chosen field of study.
PLO 3	Demonstrate the capacity to extrapolate the acquired knowledge and skills to real-life situations and apply acquired competencies in new/unfamiliar contexts.
PLO 4	Demonstrate the ability to apply the acquired conceptual, operational or technical knowledge and a range of cognitive and practical skills to identify and address problems related to the chosen field of learning.
PLO 5	Demonstrate the apply advanced knowledge relating to research methods to carryout research and investigations to formulate evidence-based solutions to complex and unpredictable problems in the field of Geoinformatics.
PLO 6	Demonstrate the ability to communicate, in a well-structured manner the findings/ results of the research studies undertaken in the field of Geoinformatics
PLO 7	Pursue self-paced and self- directed learning to upgrade knowledge and skills, including research-related skills avoiding unethical practices.

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Chaudhary Bansi Lal University
Scheme of Examination and Syllabus for M.Sc. Geoinformatics
(w.e.f. 2025-26)

M.Sc. Geoinformatics 2025-26

Semester	Course Type	Course Code	Nomenclature of the Paper	Credits	Hours/Week	External Assessment Marks	Internal Assessment Marks	Total Marks	Duration of Exam.
I	CC-1	25PG-GIS-101	Fundamentals of Geospatial Science and Technology	4	4	70	30	100	3 Hours
	CC-2	25PG-GIS-102	Fundamentals of Geographic Information Systems (GIS)	4	4	70	30	100	3 Hours
	CC-3	25PG-GIS-103	Fundamentals of Remote Sensing	4	4	70	30	100	3 Hours
	CC-4	25PG-GIS-104	Digital Cartography (Practical)	4	8	70	30	100	3 Hours
	CC-5	25PG-GIS-105	Digital Image Processing (Practical)	4	8	70	30	100	3 Hours
	DEC - 1	25PG-GIS -106	Applications of Geoinformatics in Environmental Monitoring	4	4	70	30	100	3 Hours
		25PG-GIS -107	Applications of Geospatial Technology in Urban Areas						
		25PG-GIS -108	Introduction to Web GIS and Cloud-Based Mapping						
		25PG-GIS -109	MOOC/SWAYAM						
II	CC-6	25PG-GIS -201	Principles and Applications of Photogrammetry	4	4	70	30	100	3 Hours
	CC-7	25PG-GIS -202	Spatial Analysis and Geoprocessing Techniques	4	4	70	30	100	3 Hours
	CC-8	25PG-GIS -203	Global Navigation Satellite Systems (GNSS) and Applications	4	4	70	30	100	3 Hours
	CC-9	25PG-GIS -204	Digital Photogrammetry and 3D Mapping (Practical)	4	8	70	30	100	3 Hours
	CC-10	25PG-GIS -205	Geospatial Analysis (Practical)	4	8	70	30	100	3 Hours

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DEC-2	25PG-GIS -206	Geoinformatics for Disaster Risk Reduction and Climate Analysis	4	4	70	30	100	3 Hours
	25PG-GIS -207	Geospatial Analysis of Human Settlements and Public Health						
	25PG-GIS -208	Geospatial Data Integration and API-based Mapping Solutions						
	25PG-GIS -209	MOOC/SWAYAM						
IKS/VAC	25PG-GIS -210	Ethics for Geospatial Technology	2	2	35	15	50	3 Hours
Internship	25PG-GIS -211	Industrial Internship	4	-	-	-	100	-

Every student shall undertake an industrial internship of 4-6 weeks duration, carrying 4 credits, during the summer vacation following the Second Semester. Upon completion of the internship, each student must submit a detailed report within fifteen days. A Departmental Committee and/or an External Subject Expert will evaluate the report.

Option -1 PG-I

Semester	Course Type	Course Code	Nomenclature of the Paper	Credits	Hours/Week	External Assessment Marks	Internal Assessment Marks	Total Marks	Duration of Exam.
III	CC-11	25PG-GIS -301	Geospatial Data Analytics and Predictive Modelling	4	4	70	30	100	3 Hours
		25PG-GIS -302	Spatial Database Management and Query Systems (PostGIS/SQL)	4	4	70	30	100	3 Hours
		25PG-GIS -303	Advance Geospatial Analysis and Predictive Modelling (Practical)	4	8	70	30	100	3 Hours
	DEC-3	25PG-GIS -304	Environmental Impact Assessment using Geoinformatics	4	4	70	30	100	3 Hours
		25PG-GIS -305	Social Vulnerability Mapping and Smart Governance						
		25PG-GIS -306	Web GIS and Open Source Mapping Frameworks						
		25PG-GIS -307	MOOC/SWAYAM						
	DEC-4	25PG-GIS -308	Remote Sensing for Natural Resources Management	4	4	70	30	100	3 Hours
		25PG-GIS -309	Big Data and Machine Learning in Geospatial Contexts						
		25PG-GIS -310	Geospatial App Development and Automation						

	25PG-GIS -311	MOOC/SWAYAM					
EEC	25PG-GIS-312	Google Earth Engine: Fundamentals and Applications	2	2	35	15	50 3 Hours
CC-15	25PG-GIS -401	LiDAR Technology and 3D Geospatial Mapping	4	4	70	30	100 3 Hours
CC-16	25PG-GIS -402	Modern Surveying and Mapping Instruments (UAV, DGPS, Total Station)	4	4	70	30	100 3 Hours
CC-17	25PG-GIS -403	Advanced Survey Techniques and Field Mapping (Practical)	4	8	70	30	100 3 Hours
DEC-5	25PG-GIS -404	Geoinformatics in Biodiversity and Ecosystem Services	4	4	70	30	100 3 Hours
	25PG-GIS -405	Geospatial Technology for Socioeconomic Development					
	25PG-GIS -406	Cloud GIS and Server-Side Spatial Architecture					
DEC-6	25PG-GIS -407	MOOC/SWAYAM	4	4	70	30	100 3 Hours
	25PG-GIS -408	Real-Time Environmental Sensor Integration					
	25PG-GIS -409	Geospatial Technology for SDG					
DEC-7	25PG-GIS -410	GeoAI: Artificial Intelligence in Geospatial Analysis	4	4	70	30	100 3 Hours
	25PG-GIS -411	MOOC/SWAYAM					
	25PG-GIS -412	Disaster Resilience Planning and Emergency Mapping					
DEC-7	25PG-GIS -413	Geospatial Analysis of Social Vulnerability and Equity	4	4	70	30	100 3 Hours
	25PG-GIS -414	Entrepreneurship and Innovation in Geospatial Technologies					
	25PG-GIS -415	MOOC/SWAYAM					

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Semester	Course Type	Course Code	Nomenclature of the Paper	Credits	Hours/Week	External Assessment Marks	Internal Assessment Marks	Total Marks	Duration of Exam.
III	CC-09	25PG-GIS -301	Geospatial Data Analytics and Predictive Modelling	4	4	70	30	100	3 Hours
	CC-10	25PG-GIS -302	Spatial Database Management and Query Systems (PostGIS/SQL)	4	4	70	30	100	3 Hours
	CC-11	25PG-GIS -303	Advance Geospatial Analysis and Predictive Modelling (Practical)	4	8	70	30	100	3 Hours
	DEC-3	25PG-GIS -304	Environmental Impact Assessment using Geoinformatics	4	4	70	30	100	3 Hours
		25PG-GIS -305	Social Vulnerability Mapping and Smart Governance						
		25PG-GIS -306	Web GIS and Open Source Mapping Frameworks						
		25PG-GIS -307	MOOC/SWAYAM						
	DEC-4	25PG-GIS -308	Remote Sensing for Natural Resources Management	4	4	70	30	100	3 Hours
		25PG-GIS -309	Big Data and Machine Learning in Geospatial Contexts						
		25PG-GIS -310	Geospatial App Development and Automation						
		25PG-GIS -311	MOOC/SWAYAM						
	EEC	25PG-GIS -312	Google Earth Engine: Fundamentals and Applications	2	2	35	15	50	3 Hours
IV	DEC-05	25PG-GIS -404	Geoinformatics in Biodiversity and Ecosystem Services	4	4	70	30	100	3 Hours
		25PG-GIS -405	Geospatial Technology for Socioeconomic Development						
		25PG-GIS -406	Cloud GIS and Server-Side Spatial Architecture						
		25PG-GIS -407	MOOC/SWAYAM						

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DEC-06	25PG-GIS -408	Real-Time Environmental Sensor Integration	4	4	70	30	100	3 Hours
	25PG-GIS -409	Geospatial Technology for SDG						
	25PG-GIS -410	GeoAI: Artificial Intelligence in Geospatial Analysis						
	25PG-GIS -411	MOOC/SWAYAM						
Project Report	25PG-GIS-400	Dissertation/ Project Report/Internship/ Research Work/ Apprenticeship	12	12	--	--	300	--

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CC-1			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Fundamentals of Geospatial Science and Technology		
Course Code	25PG-GIS-101		
Course Type	CC-1		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the core concepts, history, and interdisciplinary nature of geospatial science. 2. differentiate between spatial and non-spatial data models and geospatial reference systems. 3. apply concepts of data acquisition, cartographic representation, and spatial frameworks. 4. evaluate contemporary geospatial technologies including open-source platforms, cloud GIS, and spatial data infrastructures.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to geospatial science: Definition, evolution, scope, and components (GIS, remote sensing, GNSS, cartography). 2. Applications and interdisciplinary relevance in governance, agriculture, environment, urban planning, and disaster management.		15
II	3. Geospatial data types and characteristics: Spatial vs non-spatial data, raster/vector formats, scale, resolution, accuracy, and metadata. 4. Georeferencing and coordinate systems: GCS, PCS, UTM, datums, ellipsoids, and map projections.		16



III	5. Data acquisition methods: Satellite imagery, aerial photos, UAV/drone surveys, GNSS, and participatory mapping (e.g., OpenStreetMap). 6. Cartographic principles: Map elements, thematic mapping, symbolization, generalization, and layout design.	14	
IV	7. Spatial data models and topology: Raster, vector, TIN, grid, and topological relationships (adjacency, connectivity, containment). 8. Contemporary technologies and initiatives: Cloud GIS, QGIS, PostGIS, Bhuvan, SVAMITVA, Gati Shakti, UN-GGIM, Copernicus, GEOSS.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination: 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Burrough, P. A., & McDonnell, R. A. (1998). <i>Principles of geographical information systems</i> . Oxford University Press.			
2. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). <i>Geographic information systems and science</i> (4th ed.). Wiley.			
3. Chang, K. T. (2019). <i>Introduction to geographic information systems</i> (9th ed.). McGraw-Hill Education.			
4. Jensen, J. R. (2007). <i>Remote sensing of the environment: An Earth resource perspective</i> (2nd ed.). Pearson.			
5. Steiniger, S., & Hunter, A. J. S. (2013). <i>Free and open source GIS software for building a spatial data infrastructure</i> . Springer.			
6. Indian Space Research Organisation. (2021). <i>Bhuvan User Guide</i> . ISRO–NRSC. https://bhuvan.nrsc.gov.in			
7. Ministry of Science & Technology. (2021). <i>Guidelines for acquiring and producing geospatial data and geospatial data services including maps</i> . Government of India. https://dst.gov.in			

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CC-2

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Fundamentals of Geographic Information Systems (GIS)		
Course Code	25PG-GIS-102		
Course Type	CC-2		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the core principles, components, and structure of GIS.. 2. apply geospatial data models and formats for analysis and visualization. 3. perform spatial queries, overlays, and data integration using GIS tools. 4. evaluate recent developments in open-source, cloud-based, and web-enabled GIS platforms.		
Credits	Theory		Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to GIS: Definition, evolution, components (hardware, software, data, people, procedures), and scope of GIS 2. Applications of GIS: Use cases in natural resource management, urban planning, agriculture, disaster management, health, and infrastructure planning.	15
II	3. Spatial data types and formats: Vector and raster models, data formats (shapefile, GeoTIFF, KML), topology, and metadata standards. 4. Coordinate systems and projections: Geographic Coordinate System (GCS), Projected Coordinate System (PCS), UTM, datums, ellipsoids, and projection distortions.	15

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III	5. Data input, editing, and management: GPS/GNSS data integration, digitization, attribute table operations, joins, database design, and DBMS in GIS. 6. Spatial analysis and query: Buffer, overlay, spatial join, proximity analysis, geoprocessing tools, and spatial SQL basics.	15
IV	7. Cartographic output and design: Thematic mapping, map elements (legend, scale, north arrow), classification methods, symbolization, and visual hierarchy. 8. Contemporary GIS technologies and platforms: QGIS, cloud GIS, mobile GIS, Web GIS, GeoServer, OGC standards (WMS/WFS), Bhuvan, OpenStreetMap, NSDI.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination: 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Burrough, P. A., & McDonnell, R. A. (1998). <i>Principles of geographical information systems</i> . Oxford University Press. 2. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). <i>Geographic information systems and science</i> (4th ed.). Wiley. 3. Chang, K. T. (2019). <i>Introduction to geographic information systems</i> (9th ed.). McGraw-Hill Education. 4. Steiniger, S., & Hunter, A. J. S. (2013). <i>Free and open source GIS software for building a spatial data infrastructure</i> . Springer. 5. Heywood, I., Cornelius, S., & Carver, S. (2011). <i>An introduction to geographical information systems</i> (4th ed.). Pearson Education. 6. QGIS Documentation Team. (2023). <i>QGIS user manual and training guide</i> . https://docs.qgis.org 7. Open Geospatial Consortium. (2021). <i>OGC standards and services</i> . https://www.ogc.org		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Fundamentals of Remote Sensing		
Course Code	25PG-GIS-103		
Course Type	CC-3		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. explain the physical principles underlying remote sensing and electromagnetic radiation.. 2. distinguish between various remote sensing platforms and sensors relevant to geographic research. 3. apply image interpretation and classification techniques to extract geographic information. 4. evaluate the role of remote sensing in contemporary geographical applications such as land use, water resources, and disaster studies.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Definition and scope of remote sensing: Evolution, stages, types of remote sensing (passive and active), and significance in geography. 2. Electromagnetic radiation and interaction with Earth surface: Nature of EM radiation, atmospheric windows, spectral reflectance, and signatures of soil, water, and vegetation.	15
II	3. Remote sensing platforms and sensors: Ground-based, aerial, satellite platforms; sensor types (optical, thermal, microwave); spatial, spectral, temporal, and radiometric resolution. 4. Satellite missions and data products: IRS, Landsat, Sentinel, MODIS, and Cartosat series; data acquisition, formats, and download sources (e.g., Bhuvan, EarthExplorer).	15

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III	5. Image interpretation: Elements of visual interpretation, false color composites (FCC), tone, texture, pattern, and association. 6. Digital image processing: Radiometric and geometric corrections, image enhancement, classification techniques (supervised and unsupervised).	15
IV	7. Applications in geography: Land use/land cover mapping, water resource monitoring, agricultural assessment, urban sprawl, deforestation, and disaster management. 8. Recent developments: Use of drones/UAVs, hyperspectral sensors, and cloud-based geospatial platforms (e.g., Google Earth Engine).	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination: 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Jensen, J. R. (2007). <i>Remote sensing of the environment: An Earth resource perspective</i> (2nd ed.). Pearson Education. 2. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). <i>Remote sensing and image interpretation</i> (7th ed.). Wiley. 3. Campbell, J. B., & Wynne, R. H. (2011). <i>Introduction to remote sensing</i> (5th ed.). Guilford Press. 4. Sabins, F. F. (1997). <i>Remote sensing: Principles and interpretation</i> (3rd ed.). Waveland Press. 5. Chander, T. (2021). <i>A textbook of remote sensing and geographical information system</i> . Alpha Science International. 6. NRSC/ISRO. (2022). <i>Bhuvan user guide</i> . https://bhuvan.nrsc.gov.in 7. Google Earth Engine. (n.d.). <i>Developers guide</i> . https://developers.google.com/earth-engine		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Digital Cartography (Practical)		
Course Code	25PG-GIS-104		
Course Type	CC-4		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the basic elements and design principles of digital maps. 2. demonstrate skills in the use of GIS software for digital cartographic production. 3. create thematic and topographic maps using appropriate symbology, layout, and annotation. 4. evaluate cartographic outputs for accuracy, readability, and effective communication of spatial data.		
Credits	Theory		Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Lab Exercises & Practical Record: Students are required to complete all practical exercises outlined in the syllabus, ensuring that at least 7–8 exercises are prepared and documented from each unit. Proper pagination and organization of the record are mandatory for appearing in the final examination.

Instructions for Paper- Setter: The examiner shall set eight exercises based on the syllabus, with two exercises from each unit. Students are required to attempt four exercises, selecting one from each unit. All exercises carry equal marks.

Distribution of Marks for Evaluation

Exercise = $10 \times 4 = 40$

File Record = 15

Viva-voce : 15

Unit	Topics	Contact Hours
I	1. Introduction to GIS Interface and Data Management: Exploring the GIS environment (QGIS/ArcGIS), loading vector and raster datasets, and managing coordinate systems. 2. Understanding Map Scale and Projections: Map scale, CRS transformation, and reprojection of spatial data layers.	30

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II	3. Symbology and Thematic Mapping: Creating single symbol, categorized, and graduated maps (e.g., population density, land cover). 4. Labeling and Annotation: Using dynamic labeling tools, setting placement rules, and using expressions for custom labels.	30
III	5. Map Layout Design and Composition: Building map layouts with essential elements: legend, title, scale bar, north arrow, inset map, and graticules. 6. Exporting and Publishing Maps: Exporting map layouts to image and PDF formats, embedding metadata, and publishing basic web maps.	30
IV	7. Use of Cartographic Plugins in QGIS: Installing and using selected plugins (e.g., QuickMapServices, Map Composer) for enhanced map design. 8. Cartographic Quality Assessment: Reviewing maps for visual hierarchy, symbol clarity, generalization, and layout aesthetics.	30
Total Contact Hours		120
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Practicum	30	➤ Practicum 70
○ Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Field/Lab Performances:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Slocum, T. A., McMaster, R. B., Kessler, F. C., & Howard, H. H. (2009). <i>Thematic cartography and geovisualization</i> (3rd ed.). Pearson. 2. Dent, B. D., Torguson, J. S., & Hodler, T. W. (2008). <i>Cartography: Thematic map design</i> (6th ed.). McGraw-Hill. 3. Tyner, J. A. (2010). <i>Principles of map design</i> . Guilford Press. 4. Kraak, M. J., & Ormeling, F. J. (2020). <i>Cartography: Visualization of geospatial data</i> (4th ed.). Routledge. 5. QGIS Documentation Team. (2023). <i>QGIS user manual and training guide</i> . https://docs.qgis.org 6. Brewer, C. A. (2005). <i>Designing better maps: A guide for GIS users</i> . Esri Press.		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Digital Image Processing (Practical)		
Course Code	25PG-GIS-105		
Course Type	CC-5		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the structure and formats of remotely sensed raster data for digital processing. 2. apply radiometric and geometric corrections to raw satellite imagery. 3. perform image enhancement and classification techniques using remote sensing software. 4. interpret processed images for land cover, change detection, and thematic analysis.		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Lab Exercises & Practical Record: Students are required to complete all practical exercises outlined in the syllabus, ensuring that at least 7–8 exercises are prepared and documented from each unit. Proper pagination and organization of the record are mandatory for appearing in the final examination.

Instructions for Paper- Setter: The examiner shall set eight exercises based on the syllabus, with two exercises from each unit. Students are required to attempt four exercises, selecting one from each unit. All exercises carry equal marks.

Distribution of Marks for Evaluation

Exercise = 10x4=40

File Record = 15

Viva-voce : 15

Unit	Topics	Contact Hours
I	1. Introduction to Digital Image and Software Environment: Understanding raster data structure, loading satellite imagery, and using image processing software (ERDAS Imagine/QGIS/SNAP etc.). 2. Image Subsetting and Band Combination: Creating subsets using AOI; FCC generation by band combination (e.g., Landsat, Sentinel imagery).	30

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II	3. Radiometric and Geometric Correction: Performing atmospheric and sensor corrections; applying ground control points (GCPs) and resampling methods. 4. Image Enhancement Techniques: Contrast stretching, histogram equalization, edge enhancement, and filtering (high-pass/low-pass).	30	
III	5. Vegetation and Index-based Analysis: NDVI, SAVI, and water index calculation using raster band math. 6. Unsupervised Classification: Performing ISODATA/K-means clustering for land cover classification.	30	
IV	7. Supervised Classification: Training sample collection, classification (e.g., Maximum Likelihood), accuracy assessment, and error matrix generation. 8. Change Detection Analysis: Post-classification comparison to assess land cover changes over time using multi-date imagery.	30	
Total Contact Hours		120	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Practicum	30	➤ Practicum	70
○ Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Field/Lab Performances:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Jensen, J. R. (2005). <i>Introductory digital image processing: A remote sensing perspective</i> (3rd ed.). Prentice Hall. 2. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). <i>Remote sensing and image interpretation</i> (7th ed.). Wiley. 3. Richards, J. A., & Jia, X. (2006). <i>Remote sensing digital image analysis: An introduction</i> (4th ed.). Springer. 4. Mather, P. M., & Tso, B. (2016). <i>Classification methods for remotely sensed data</i> (2nd ed.). CRC Press. 5. Sabins, F. F. (1997). <i>Remote sensing: Principles and interpretation</i> (3rd ed.). Waveland Press. 6. European Space Agency. (2022). <i>SNAP User Manual</i> . https://step.esa.int 7. USGS. (2023). <i>EarthExplorer Data Tools and Guides</i> . https://earthexplorer.usgs.gov			

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Applications of Geoinformatics in Environmental Monitoring		
Course Code	25PG-GIS-106		
Course Type	DEC - 1		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the role of geoinformatics in environmental data acquisition, analysis, and decision support. 2. apply remote sensing and GIS techniques to monitor and assess environmental parameters. 3. evaluate spatial and temporal trends in air, water, soil, forest, and land degradation using geospatial tools. 4. integrate multi-source geospatial data for environmental modeling, risk mapping, and reporting.		
Credits	Theory		Practical
	4	0	Total
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to environmental monitoring: Concepts, types, and significance of environmental monitoring; role of geoinformatics in environmental studies. 2. Remote sensing for environmental data: Spectral response patterns of vegetation, soil, and water; satellite data for environmental applications (e.g., Landsat, Sentinel, MODIS).	15
II	3. Land use/land cover (LULC) and change detection: Classification techniques, change analysis, forest cover mapping, and urban sprawl studies. 4. Air and water quality monitoring: Use of geospatial tools for air pollution hotspot mapping, aerosol detection, turbidity, and eutrophication assessment.	15

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III	5. Soil degradation and desertification: Monitoring erosion, salinity, and land degradation using vegetation indices and temporal imagery. 6. Disaster and risk monitoring: Environmental impact of floods, droughts, and forest fires using geospatial indicators and early warning systems.	15
IV	7. GIS for environmental modeling: Watershed modeling, groundwater recharge estimation, and spatial risk analysis using overlay and interpolation. 8. National and global initiatives: Environmental monitoring projects (ENVIS, NRSC-Bhuvan, GEMS, UNEP), legal frameworks, and reporting standards (EIA, SDGs).	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination: 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Jensen, J. R. (2007). <i>Remote sensing of the environment: An Earth resource perspective</i> (2nd ed.). Pearson Education. 2. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). <i>Remote sensing and image interpretation</i> (7th ed.). Wiley. 3. Chang, K. T. (2019). <i>Introduction to geographic information systems</i> (9th ed.). McGraw-Hill Education. 4. Gautam, N. C. (2004). <i>Environmental monitoring and assessment using remote sensing and GIS</i> . Indian Society of Remote Sensing. 5. Murthy, K. S. R. (2004). <i>Watershed management and impact assessment using GIS and remote sensing</i> . Universities Press. 6. NRSC/ISRO. (2021). <i>Bhuvan thematic services user guide</i> . https://bhuvan.nrsc.gov.in 7. UNEP. (2022). <i>Global environmental monitoring system (GEMS) reports and datasets</i> . https://www.unep.org		

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Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Applications of Geospatial Technology in Urban Areas		
Course Code	25PG-GIS-107		
Course Type	DEC - 1		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the relevance of geospatial technologies in urban planning, governance, and infrastructure management.. 2. analyze urban dynamics such as land use change, population density, and urban heat island using satellite data and GIS. 3. apply geospatial tools for transportation planning, slum mapping, and smart city applications. 4. evaluate government-led geospatial initiatives in urban development (e.g., AMRUT, Smart Cities Mission, Gati Shakti).		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Urbanization and geospatial technology: Urbanization trends, challenges, and the role of GIS and remote sensing in urban management. 2. Urban land use/land cover mapping: Classification techniques for urban sprawl analysis, density mapping, and change detection using multi-temporal satellite data.		15
II	3. Urban infrastructure mapping: Geospatial mapping of utilities (roads, water supply, sewerage, electricity), and use of GIS in urban utility management systems. 4. Urban growth modeling: Spatial metrics, built-up area extraction, predictive modeling using CA-Markov, SLEUTH, and AI/ML-based techniques.		15

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III	5. Urban environmental issues: Monitoring urban heat islands, green space analysis, air pollution dispersion modeling, and flood risk zoning. 6. Urban mobility and transport GIS: Network analysis, route optimization, public transport accessibility mapping, and ITS (Intelligent Transport Systems).	15
IV	7. Urban governance and geospatial data: Use of geospatial dashboards, mobile GIS for civic services, participatory GIS, and geotagged asset management. 8. National urban geospatial initiatives: Bhuvan-Urban, AMRUT, Smart Cities Mission, Gati Shakti, GIS-based Master Planning, and integration with SDG 11 indicators.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Jensen, J. R. (2007). <i>Remote sensing of the environment: An Earth resource perspective</i> (2nd ed.). Pearson Education. 2. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). <i>Remote sensing and image interpretation</i> (7th ed.). Wiley. 3. ESRI. (2016). <i>GIS for urban and regional planning</i> . Esri Press. 4. Hall, P. (2014). <i>Cities of tomorrow: An intellectual history of urban planning and design</i> (4th ed.). Wiley-Blackwell. 5. NITI Aayog. (2022). <i>Urban planning capacity in India: Report and recommendations</i> . https://www.niti.gov.in 6. ISRO-Bhuvan. (2021). <i>Urban thematic services</i> . https://bhuvan.nrsc.gov.in 7. MoHUA. (2023). <i>Smart Cities Mission and AMRUT GIS guidelines</i> . Ministry of Housing and Urban Affairs, Government of India.		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	I		
Name of the Course	Introduction to Web GIS and Cloud-Based Mapping		
Course Code	25PG-GIS-108		
Course Type	DEC - I		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the architecture, components, and standards of Web GIS. 2. apply web-based tools and platforms for publishing and sharing spatial data. 3. use cloud-based GIS platforms (e.g., Google Earth Engine, ArcGIS Online) for data visualization and analysis. 4. evaluate open standards and interoperability in the development of web mapping services.		
Credits	Theory		Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Concept and architecture of Web GIS: Client-server model, web services, browser/server interaction, and advantages of web mapping systems. 2. Web GIS components and technologies: HTML, CSS, JavaScript, Leaflet, OpenLayers, Web Map Tile Services (WMTS), and REST APIs.	15
II	3. Web GIS standards and protocols: OGC standards—WMS, WFS, WCS; GeoJSON, KML; interoperability and metadata for web services. 4. Publishing spatial data online: Map design for web display, symbology, tiling, and vector tile mapping; open-source and proprietary platforms.	15

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III	5. Introduction to cloud-based GIS platforms: ArcGIS Online, Google Earth Engine, Mapbox, CARTO—data upload, visualization, and analysis. 6. Geospatial dashboards and real-time mapping: Interactive visualizations using dynamic data streams, IoT integration, and temporal mapping.	15
IV	7. Applications of Web GIS: Disaster response, participatory mapping, citizen science, urban planning, and environmental monitoring. 8. Hands-on tools and frameworks: Building basic web maps with Leaflet/MapLibre, embedding maps in websites, and accessing remote datasets through APIs.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Fu, P., & Sun, J. (2011). <i>Web GIS: Principles and applications</i> . ESRI Press. 2. Kraak, M. J., & Brown, A. (2000). <i>Web cartography: Developments and prospects</i> . Taylor & Francis. 3. Allen, D. W. (2022). <i>Getting to know Web GIS</i> (5th ed.). Esri Press. 4. Mitchell, T. (2005). <i>Web mapping illustrated: Using Open Source GIS toolkits</i> . O'Reilly Media. 5. Open Geospatial Consortium. (2021). <i>OGC standards and best practices</i> . https://www.ogc.org 6. Google Earth Engine Developers. (2023). <i>GEE documentation and tutorials</i> . https://developers.google.com/earth-engine 7. Esri. (2023). <i>ArcGIS Online documentation</i> . https://doc.arcgis.com/en/arcgis-online		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Principles and Applications of Photogrammetry		
Course Code	25PG-GIS-201		
Course Type	CC-6		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the fundamental principles, geometry, and classifications of photogrammetry. 2. apply photogrammetric techniques for accurate spatial data extraction and terrain modeling. 3. analyze aerial and UAV imagery for mapping, feature extraction, and 3D reconstruction. 4. Evaluate the integration of digital photogrammetry in modern geospatial applications including urban and environmental mapping.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to photogrammetry: Definition, history, types (terrestrial, aerial, close-range), and role in geospatial science. 2. Geometry of aerial photographs: Vertical and oblique imagery, scale, tilt, relief displacement, and flight planning.	15
II	3. Elements of image interpretation: Tone, texture, shape, size, pattern, site, and association in aerial photograph analysis. 4. Photographic systems and sensors: Analog and digital cameras, stereoscopy, film types, and filters; camera calibration.	15

III	5. Stereoscopic vision and parallax: Principles of 3D perception, parallax measurement, height determination using stereo pairs. 6. Digital photogrammetry: Orthoimage generation, interior and exterior orientation, tie points, and digital surface/terrain models (DSM/DTM.	15
IV	7. Photogrammetry with drones (UAVs): Image acquisition, GCPs, structure from motion (SfM), and 3D point cloud generation. 8. Applications: Topographic mapping, cadastral surveys, volumetric analysis, urban modeling, forestry, disaster assessment, and archaeology	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory70
○ Class Participation:	05	Written Examination: 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Wolf, P. R., & Dewitt, B. A. (2000). <i>Elements of photogrammetry: With applications in GIS</i> (3rd ed.). McGraw-Hill. 2. Mikhail, E. M., Bethel, J. S., & McGlone, J. C. (2001). <i>Introduction to modern photogrammetry</i>. Wiley. 3. Kraus, K. (2007). <i>Photogrammetry: Geometry from images and laser scans</i> (2nd ed.). Walter de Gruyter. 4. McGlone, J. C. (Ed.). (2013). <i>Manual of photogrammetry</i> (6th ed.). American Society for Photogrammetry and Remote Sensing (ASPRS). 5. Linder, W. (2015). <i>Digital photogrammetry: A practical course</i> (5th ed.). Springer. 6. Colomina, I., & Molina, P. (2014). <i>Unmanned aerial systems for photogrammetry and remote sensing: A review</i>. ISPRS Journal of Photogrammetry and Remote Sensing, 92, 79–97. 7. USGS. (2020). <i>Photogrammetric engineering and remote sensing standards and manuals</i>. https://www.usgs.gov		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Spatial Analysis and Geoprocessing Techniques		
Course Code	25PG-GIS-202		
Course Type	CC-7		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the theoretical concepts of spatial relationships and spatial data models. 2. Perform spatial queries, overlays, buffering, and proximity analysis using GIS tools. 3. Apply raster and vector-based geoprocessing techniques for spatial decision-making. 4. Analyze and interpret spatial patterns through interpolation, density analysis, and suitability modeling.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to spatial analysis: Concepts of spatial relationships, patterns, and distribution; spatial vs non-spatial analysis. 2. Vector-based analysis techniques: Buffering, overlay operations (union, intersect, identity), spatial joins, and topology validation.	15
II	3. Raster-based analysis techniques: Local, focal, zonal, and global operations; map algebra and conditional operations. 4. Proximity and neighborhood analysis: Euclidean and cost distance, kernel density estimation, Thiessen polygons, and accessibility mapping	15

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III	5. Terrain and surface analysis: Digital Elevation Models (DEMs), slope, aspect, hillshade, viewshed, and watershed delineation. 6. Interpolation techniques: IDW, kriging, spline, natural neighbor, and trend surface analysis for continuous surface generation.	15	
IV	7. Multi-criteria decision analysis (MCDA): Weighted overlay, pairwise comparison, Boolean logic, and suitability analysis using GIS. 8. Geoprocessing automation and tools: Use of ModelBuilder, Python scripting in GIS (ArcPy, PyQGIS), and batch processing for spatial workflows.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination: 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). <i>Geographic information science and systems</i> (4th ed.). Wiley. 2. Burrough, P. A., & McDonnell, R. A. (1998). <i>Principles of geographical information systems</i> . Oxford University Press. 3. Chang, K. T. (2019). <i>Introduction to geographic information systems</i> (9th ed.). McGraw-Hill Education. 4. Tomlin, C. D. (1990). <i>Geographic information systems and cartographic modeling</i> . Prentice Hall. 5. Heywood, I., Cornelius, S., & Carver, S. (2011). <i>An introduction to geographical information systems</i> (4th ed.). Pearson. 6. Mitchell, A. (2012). <i>The ESRI guide to GIS analysis, Volume 2: Spatial measurements and statistics</i> . Esri Press. 7. QGIS Documentation Team. (2023). <i>QGIS user manual</i> . https://docs.qgis.org			

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Global Navigation Satellite Systems (GNSS) and Applications		
Course Code	25PG-GIS-203		
Course Type	CC-8		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the principles, components, and operational segments of GNSS. 2. compare different GNSS constellations and their functioning in positioning and navigation. 3. apply GNSS data acquisition techniques for geospatial mapping and field-survey operations. 4. evaluate real-world applications of GNSS in areas such as agriculture, urban planning, disaster management, and transportation.		
Credits	Theory		Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to GNSS: Concepts of satellite-based navigation, evolution of GNSS, GPS, and basic positioning principles. 2. GNSS system segments: Space segment, control segment, and user segment; signal structure and satellite orbits.	15
II	3. Types of GNSS and global systems: GPS (USA), GLONASS (Russia), Galileo (EU), BeiDou (China), NavIC (India), and augmentation systems (WAAS, GAGAN, EGNOS). 4. Positioning techniques: Absolute vs differential positioning, single-point and real-time kinematic (RTK) methods, and carrier phase tracking.	15

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III	5. Sources of GNSS errors: Ionospheric and tropospheric delays, multipath, satellite geometry (DOP), and signal interference. 6. GNSS equipment and data collection: Types of GNSS receivers (handheld, geodetic, mobile-based), field survey planning, and data logging.	15	
IV	7. Integration with GIS and remote sensing: Coordinate referencing, GNSS-enabled data collection using mobile apps and tablets, mapping applications. 8. Applications of GNSS: Land surveying, precision agriculture, smart transportation, utility mapping, disaster response, and geofencing.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination: 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Misra, P., & Enge, P. (2011). <i>Global positioning system: Signals, measurements, and performance</i> (2nd ed.). Ganga-Jamuna Press.			
2. Hofmann-Wellenhof, B., Lichtenegger, H., & Wasle, E. (2008). <i>GNSS – Global navigation satellite systems: GPS, GLONASS, Galileo, and more</i> . Springer.			
3. El-Rabbany, A. (2002). <i>Introduction to GPS: The global positioning system</i> . Artech House.			
4. Kaplan, E. D., & Hegarty, C. J. (Eds.). (2017). <i>Understanding GPS/GNSS: Principles and applications</i> (3rd ed.). Artech House.			
5. Seeber, G. (2003). <i>Satellite geodesy: Foundations, methods, and applications</i> (2nd ed.). Walter de Gruyter.			
6. Indian Space Research Organisation (ISRO). (2023). <i>NavIC user guide</i> . https://www.isro.gov.in			
7. USGS. (2022). <i>GPS and GNSS technical documentation</i> . https://www.usgs.gov			

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Digital Photogrammetry and 3D Mapping (Practical)		
Course Code	25PG-GIS -204		
Course Type	CC-9		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the workflow and tools used in digital photogrammetry for 3D feature extraction. 2. Perform stereo image processing for elevation and feature mapping using photogrammetric software. 3. Generate orthophotos, DSM/DTM, and 3D models from aerial or UAV imagery. 4. Evaluate spatial accuracy and applications of 3D photogrammetry in urban mapping, infrastructure, and terrain modeling.		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Lab Exercises & Practical Record: Students are required to complete all practical exercises outlined in the syllabus, ensuring that at least 7–8 exercises are prepared and documented from each unit. Proper pagination and organization of the record are mandatory for appearing in the final examination.

Instructions for Paper- Setter: The examiner shall set eight exercises based on the syllabus, with two exercises from each unit. Students are required to attempt four exercises, selecting one from each unit. All exercises carry equal marks.

Distribution of Marks for Evaluation

Exercise = $10 \times 4 = 40$

File Record = 15

Viva-voce : 15

Unit	Topics	Contact Hours
I	1. Introduction to Digital Photogrammetric Workstations: Interface of photogrammetry software (e.g., ERDAS Imagine, Pix4D, Agisoft Metashape); loading stereo images and project setup. 2. Stereo Image Pair Preparation and Orientation: Performing interior, exterior, relative, and absolute orientation of stereo image pairs.	30

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II	3. Parallax Measurement and Elevation Derivation: Extracting height information from stereo pairs using parallax data. 4. Generation of Orthophotos: Orthorectification of aerial or drone images; creating georeferenced ortho-mosaics.	30	
III	5. Digital Surface Model (DSM) and Digital Terrain Model (DTM) Creation: Processing and visualizing terrain surfaces from stereo imagery. 6. 3D Feature Extraction: Extracting and digitizing buildings, roads, and terrain features in 3D environments.	30	
IV	7. Point Cloud and Mesh Generation from UAV Imagery: Structure from Motion (SfM), tie-point generation, dense cloud building, and mesh modeling. 8. Accuracy Assessment and Output Export: Comparing derived data with ground truth; exporting orthophotos, 3D models, and DEMs.	30	
Total Contact Hours		120	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Practicum	30	➤ Practicum	70
○ Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Field/Lab Performances:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Linder, W. (2015). <i>Digital photogrammetry: A practical course</i> (5th ed.). Springer. 2. McGlone, J. C. (Ed.). (2013). <i>Manual of photogrammetry</i> (6th ed.). ASPRS. 3. Wolf, P. R., & Dewitt, B. A. (2000). <i>Elements of photogrammetry with applications in GIS</i> (3rd ed.). McGraw-Hill. 4. Mikhail, E. M., Bethel, J. S., & McGlone, J. C. (2001). <i>Introduction to modern photogrammetry</i> . Wiley. 5. Kraus, K. (2007). <i>Photogrammetry: Geometry from images and laser scans</i> (2nd ed.). Walter de Gruyter. 6. Agisoft LLC. (2023). <i>Agisoft Metashape user manual</i> . https://agisoft.com 7. Pix4D. (2023). <i>Pix4Dmapper technical documentation</i> . https://support.pix4d.com			

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Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Geospatial Analysis (Practical)		
Course Code	25PG-GIS -205		
Course Type	CC-10		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. apply advanced vector and raster geoprocessing operations for spatial decision support. 2. perform spatial modeling techniques including terrain analysis, interpolation, and hydrological modeling. 3. analyze spatial relationships using network analysis, multi-criteria evaluation, and spatial statistics. 4. integrate and automate geospatial workflows using ModelBuilder or scripting tools.		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Lab Exercises & Practical Record: Students are required to complete all practical exercises outlined in the syllabus, ensuring that at least 7–8 exercises are prepared and documented from each unit. Proper pagination and organization of the record are mandatory for appearing in the final examination.			
Instructions for Paper- Setter: The examiner shall set eight exercises based on the syllabus, with two exercises from each unit. Students are required to attempt four exercises, selecting one from each unit. All exercises carry equal marks.			
Distribution of Marks for Evaluation			
Exercise = 10x4=40		File Record = 15	Viva-voce : 15
Unit	Topics		Contact Hours
I	1. Advanced Raster Analysis: Performing focal, zonal, and conditional operations; raster calculator and map algebra. 2. Interpolation and Surface Modeling: Creating continuous surfaces using IDW, Kriging, and Spline methods; comparing accuracy of interpolated surfaces.		30

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II	3. Terrain and Hydrological Analysis: DEM preprocessing, slope and aspect maps, watershed and stream network delineation, flow direction and accumulation. 4. Weighted Overlay and Suitability Modeling: Applying Multi-Criteria Evaluation (MCE) using raster weights, constraint masking, and suitability scoring.	30
III	5. Proximity and Spatial Relationship Analysis: Euclidean distance, buffer analysis, cost distance modeling, and least-cost path identification. 6. Network Analysis: Building network datasets, performing route optimization, service area mapping, and location-allocation analysis.	30
IV	7. Spatial Statistics and Hotspot Mapping: Using Moran's I, Getis-Ord Gi*, and kernel density estimation for pattern and cluster analysis. 8. Automating Workflows: Creating geoprocessing models using ModelBuilder (ArcGIS) or graphical models (QGIS); introduction to Python-based geospatial scripting.	30
Total Contact Hours		120
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Practicum	30	➤ Practicum 70
○ Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Field/Lab Performances:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Burrough, P. A., & McDonnell, R. A. (1998). <i>Principles of geographical information systems</i> . Oxford University Press. 2. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). <i>Geographic information science and systems</i> (4th ed.). Wiley. 3. Mitchell, A. (2012). <i>The ESRI guide to GIS analysis, Volume 2: Spatial measurements and statistics</i> . Esri Press. 4. Heywood, I., Cornelius, S., & Carver, S. (2011). <i>An introduction to geographical information systems</i> (4th ed.). Pearson Education. 5. De Smith, M. J., Goodchild, M. F., & Longley, P. A. (2022). <i>Geospatial analysis: A comprehensive guide</i> (7th ed.). The Winchelsea Press. 6. QGIS Documentation Team. (2023). <i>QGIS user guide and training manual</i> . https://docs.qgis.org 7. ESRI. (2023). <i>ModelBuilder and ArcPy documentation</i> . https://pro.arcgis.com		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Geoinformatics for Disaster Risk Reduction and Climate Analysis		
Course Code	25PG-GIS -206		
Course Type	DEC - 2		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the fundamentals of disaster risk, climate variability, and the role of geoinformatics in risk reduction. 2. apply remote sensing and GIS tools for hazard mapping, vulnerability assessment, and emergency response planning. 3. analyze geospatial climate datasets to study trends, anomalies, and impacts of climate change. 4. integrate geospatial technologies into disaster and climate resilience frameworks, including global and national initiatives.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Disaster risk concepts and classification: Natural vs anthropogenic disasters, risk components (hazard, vulnerability, exposure), Sendai Framework. 2. Role of geoinformatics in disaster management: Remote sensing and GIS applications in hazard detection, monitoring, early warning, and response.	15
II	3. Hazard-specific geospatial applications: Flood inundation mapping, drought monitoring, landslide susceptibility, forest fire risk zones, and cyclonic track mapping. 4. Vulnerability and risk assessment: Multi-criteria analysis for socio-economic vulnerability, risk zonation mapping, and spatial decision support systems (SDSS).	15

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III	5. Geospatial technologies in emergency response: Real-time data acquisition (UAVs, IoT), crowd-sourced mapping, mobile GIS, and disaster dashboards. 6. Introduction to climate systems and climate data: Atmospheric parameters, climate variability, global circulation models (GCMs), and reanalysis datasets.	15	
IV	7. Climate change analysis using geospatial data: Long-term trend analysis, anomalies (temperature, rainfall), land surface temperature (LST), and urban heat islands. 8. National and global programs: NDMA, ISRO-DMS, UNDRR, IPCC, COP, and SDG 13; integration of geospatial data in climate action and resilience strategies.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination:70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Bhatt, B. (Ed.). (2013). <i>Geo-information for disaster management in India</i> . Springer. 2. Cutter, S. L. (2006). <i>Hazards, vulnerability and environmental justice</i> . Earthscan. 3. Jensen, J. R. (2007). <i>Remote sensing of the environment: An Earth resource perspective</i> (2nd ed.). Pearson. 4. Rajeevan, M., & Nanjundiah, R. S. (2013). <i>Climate change over India: Observations and model projections</i> . Ministry of Earth Sciences, GoI. 5. IPCC. (2021). <i>Sixth assessment report: Climate change 2021</i> . https://www.ipcc.ch 6. NDMA. (2016). <i>National disaster management guidelines and GIS applications</i> . https://ndma.gov.in 7. Ghosh, S. (2018). <i>Modelling climate change impacts on hydrology and water resources</i> . Springer.			

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Geospatial Analysis of Human Settlements and Public Health		
Course Code	25PG-GIS -207		
Course Type	DEC - 2		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the spatial dimensions of human settlements and health systems using geospatial technologies. 2. apply remote sensing and GIS tools to analyze urban growth, slums, infrastructure, and spatial inequalities. 3. analyze spatial epidemiology, disease mapping, and public health accessibility using geospatial datasets. 4. integrate geoinformatics in planning for sustainable settlements, public health services, and resilience.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Concepts and indicators of human settlements: Population density, urban-rural typologies, housing, infrastructure, and sustainable development indicators. 2. Geospatial mapping of settlements: Land use/land cover classification, slum mapping, urban sprawl, impervious surface extraction, and informal settlements.	15
II	3. Urban growth analysis and modeling: Change detection, spatial metrics, urban heat islands, land consumption rate, and growth prediction using CA-Markov. 4. Infrastructure and accessibility mapping: Mapping utilities (roads, sanitation, health facilities), and service coverage using network analysis.	15

III	5. Introduction to public health GIS: Principles of spatial epidemiology, types of health data, and geocoding of health events. 6. Disease mapping and analysis: Incidence/prevalence mapping, kernel density estimation, cluster analysis, and risk zoning (malaria, COVID-19, etc.).	15
IV	7. Health accessibility and equity: Service area analysis, spatial interaction models, health vulnerability indices, and underserved area identification. 8. Geospatial tools for health and settlement planning: Use of dashboards, mobile GIS, participatory mapping, and government initiatives (e.g., AMRUT, NHM, Swachh Bharat).	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Cromley, E. K., & McLafferty, S. L. (2012). <i>GIS and public health</i> (2nd ed.). Guilford Press. 2. Goodchild, M. F., & Janelle, D. G. (Eds.). (2004). <i>Spatially integrated social science</i> . Oxford University Press. 3. Pacione, M. (2005). <i>Urban geography: A global perspective</i> (2nd ed.). Routledge. 4. Gatrell, A. C., & Elliott, S. J. (2014). <i>Geographies of health: An introduction</i> (3rd ed.). Wiley-Blackwell. 5. UN-Habitat. (2020). <i>World cities report: The value of sustainable urbanization</i> . https://unhabitat.org 6. WHO. (2021). <i>GIS for health and environment: Training modules and case studies</i> . https://www.who.int 7. Esri. (2022). <i>GIS and public health solutions guide</i> . https://www.esri.com		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Geospatial Data Integration and API-based Mapping Solutions		
Course Code	25PG-GIS -208		
Course Type	DEC - 2		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the architecture, formats, and standards for geospatial data integration from heterogeneous sources. 2. utilize APIs and Web services to access, visualize, and manipulate spatial datasets in real time. 3. develop interactive mapping solutions using JavaScript libraries, RESTful services, and cloud-hosted spatial data. 4. evaluate open geospatial standards and platforms for scalable geospatial web applications and mobile GIS solutions.		
Credits	Theory		Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Geospatial data integration concepts: Sources of spatial data (vector, raster, tabular, IoT), interoperability, spatial ETL (Extract, Transform, Load) processes. 2. Data formats and interoperability: GeoJSON, KML, GML, shapefiles, WKT; transformation between coordinate systems and data schemas.	15
II	3. Open geospatial standards: OGC standards (WMS, WFS, WCS), INSPIRE directive, metadata standards (ISO 19115), and schema validation. 4. Introduction to APIs for geospatial access: REST and SOAP-based services, API endpoints for Google Maps, Mapbox, OpenStreetMap, ArcGIS REST.	15

III	5. Building custom maps using JavaScript libraries: Leaflet, MapLibre, Deck.gl, CesiumJS—basics of layers, markers, tiles, interactivity, and events. 6. Cloud-based geospatial platforms: ArcGIS Online, CARTO, Google Earth Engine, GeoServer, and cloud storage of spatial datasets.	15
IV	7. Mobile GIS and real-time integration: Geotagging, GPS sensor feeds, mobile data collection (Survey123, KoBoToolbox), and real-time dashboards. 8. Use cases and applications: Smart cities, environmental monitoring, logistics, utilities management, and citizen engagement platforms using APIs	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Fu, P., & Sun, J. (2011). <i>Web GIS: Principles and applications</i> . Esri Press. 2. Allen, D. W. (2022). <i>Getting to know Web GIS</i> (5th ed.). Esri Press. 3. Mitchell, T. (2005). <i>Web mapping illustrated: Using open source GIS toolkits</i> . O'Reilly Media. 4. QGIS Documentation Team. (2023). <i>QGIS user guide</i> . https://docs.qgis.org 5. Open Geospatial Consortium (OGC). (2022). <i>OGC standards and best practices</i> . https://www.ogc.org 6. Google Developers. (2023). <i>Google Maps API documentation</i> . https://developers.google.com/maps 7. Mapbox. (2023). <i>Mapbox GL JS documentation</i> . https://docs.mapbox.com		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	II		
Name of the Course	Ethics for Geospatial Technology		
Course Code	25PG-GIS -211		
Course Type	VAC		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the foundational ethical principles and responsibilities in geospatial science and practice. 2. evaluate the social, legal, and environmental implications of geospatial data collection, sharing, and application. 3. apply ethical reasoning to cases involving privacy, surveillance, data bias, and the use of emerging geospatial technologies. 4. develop awareness of institutional, national, and international frameworks governing ethical geospatial practices.		
Credits	Theory		Total
	2	0	2
Teaching Hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner shall set five questions, including two questions from each unit, taking into consideration the Course Learning Outcomes (CLOs). In addition, one compulsory question (Question No. 1) shall be included, consisting of seven short parts that collectively cover the entire syllabus. The examinee will be required to attempt three questions in total: one question from each of the selected units and the compulsory Question No. 1. The compulsory question will carry 07 marks, while each long-answer question will carry 14 marks (each).

Unit	Topics	Contact Hours
I	1. Foundations of ethics in science and technology: Professional ethics, moral responsibility, and ethical decision-making in spatial contexts. 2. Ethical issues in geospatial data acquisition and use: Consent, data quality, positional accuracy, misinformation, and the risks of surveillance.	15




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II	3. Legal and institutional frameworks: Geospatial data policies, intellectual property rights, open data ethics, and institutional guidelines (e.g., NSDI, OGC). 4. Emerging technologies and ethical challenges: AI in GIS, UAVs/drones, geofencing, real-time tracking, digital divide, and case studies in public health, disaster, and urban planning.	15
Total Contact Hours		30
Suggested Evaluation Methods		
Internal Assessment: 15		End Term Examination: 35
➤ Theory	15	➤ Theory 35
○ Class Participation:	04	Written Examination: 35
○ Seminar/presentation/assignment/quiz/class test etc.:	04	
○ Mid-Term Exam:	07	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. DiBiase, D., DeMers, M., Johnson, A., Kemp, K., Taylor Luck, A., Plewe, B., & Wentz, E. (2007). <i>The GIS professional ethics project</i>. Cartography and Geographic Information Science, 34(2), 133–144. 2. Obermeyer, N. J., & Pinto, J. K. (2007). <i>Managing geographic information systems</i> (2nd ed.). Guilford Press. 3. Curry, M. R. (1997). <i>The digital individual and the private realm: The role of GIS, confidentiality, and privacy</i>. Transactions in GIS, 2(1), 45–56. 4. GSDI Association. (2012). <i>Spatial data infrastructure manual for the Americas: Legal and ethical issues</i>. GSDI Publications. 5. Wright, D., Goodchild, M. F., & Proctor, J. D. (1997). <i>GIS: Tool or science? Demystifying the persistent ambiguity of GIS as “tool” versus “science”</i>. Annals of the Association of American Geographers, 87(2), 346–362. 6. OGC. (2022). <i>Open Geospatial Consortium policy and ethics guidelines</i>. https://www.ogc.org 7. Goodchild, M. F. (2007). <i>Citizens as sensors: The world of volunteered geography</i>. GeoJournal, 69(4), 211–221.		

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Geospatial Data Analytics and Predictive Modelling		
Course Code	25PG-GIS -301		
Course Type	C-11		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the principles and workflows of geospatial data analytics and their applications. 2. Apply statistical and machine learning techniques to spatial data for pattern recognition and prediction. 3. Develop predictive models using geospatial variables for real-world problems in environment, urban planning, and agriculture.. 4. Integrate GIS, remote sensing, and data science tools to perform geospatial modeling and validation.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to geospatial analytics: Concepts of spatial data science, structured vs unstructured geospatial data, types of spatial patterns, and geospatial decision support systems. 2. Data preprocessing and spatial statistics: Data cleaning, normalization, handling missing data; exploratory spatial data analysis (ESDA); spatial autocorrelation (Moran's I, Geary's C), hotspot and cluster analysis.	15
II	3. Machine learning for geospatial prediction: Overview of machine learning; supervised learning (Random Forest, SVM, Decision Trees); unsupervised learning (K-means, PCA); feature engineering with spatial data. 4. Spatio-temporal modelling and forecasting: Time series modelling with spatial dimensions, trend surface analysis, spatio-temporal interpolation, and satellite-data driven predictive frameworks.	15

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III	5. Regression and spatial modelling: Linear regression, multivariate regression, logistic regression, geographically weighted regression (GWR), and model performance metrics (RMSE, R ² , AIC). 6. Software tools and environments: Integration of Python/R with GIS; use of GeoPandas, Scikit-learn, PySAL, and R-Spatial; working with Jupyter Notebooks and open-source spatial databases (PostGIS).	15	
IV	7. Model validation and accuracy assessment: Cross-validation, bootstrapping, confusion matrix, ROC curve, kappa statistics, and validation with ground truth data and independent datasets. 8. Applications and case studies: Land use and land cover prediction, urban expansion modelling, flood risk and disaster forecasting, disease mapping, agriculture yield estimation, and smart city analytics.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination: 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. de Smith, M. J., Goodchild, M. F., & Longley, P. A. (2020). <i>Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools</i> . Winchelsea Press. 2. Kang-tsung, C. (2017). <i>Introduction to Geographic Information Systems</i> (8th ed.). McGraw-Hill Education. 3. Mitchell, A. (2009). <i>The ESRI Guide to GIS Analysis: Volume 2: Spatial Measurements and Statistics</i> . ESRI Press. 4. Jensen, J. R., & Jensen, R. R. (2013). <i>Introductory Geographic Information Systems</i> . Pearson. 5. Lwoga, E., & Sife, A. S. (2017). <i>Big Data in GIS and Remote Sensing: Applications and Challenges</i> . IGI Global. 6. Kuhn, M., & Johnson, K. (2013). <i>Applied Predictive Modeling</i> . Springer. 7. O'Sullivan, D., & Unwin, D. (2010). <i>Geographic Information Analysis</i> (2nd ed.). John Wiley & Sons.			

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Spatial Database Management and Query Systems (PostGIS/SQL)		
Course Code	25PG-GIS -302		
Course Type	C-12		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the structure, design, and principles of spatial databases in a GIS environment. 2. implement and manage spatial databases using open-source systems such as PostgreSQL/PostGIS. 3. develop and execute spatial queries using SQL to extract, analyze, and manage geospatial data. 4. apply spatial database techniques for real-world GIS applications in urban planning, environment, and resource management.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to Spatial Databases: Database concepts, RDBMS vs spatial databases, components of spatial databases, data types, primary and foreign keys, data normalization, and ER diagrams. 2. PostgreSQL and PostGIS Fundamentals: Installing and configuring PostgreSQL and PostGIS; spatial data types (geometry, geography), raster data handling, spatial indexing, constraints, and performance optimization.	15
II	3. SQL for Geospatial Queries: Introduction to SQL syntax; spatial functions for querying (e.g., ST_Intersects, ST_Buffer, ST_Within, ST_Distance); spatial joins; subqueries and views; attribute vs spatial queries. 4. Database Design and Management: Schema design for spatial applications, relational schema creation, import/export of shapefiles and GeoJSON, versioning and backup strategies, and database normalization.	15

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Advanced Geospatial Analysis and Predictive Modelling (Practical)		
Course Code	25PG-GIS -303		
Course Type	CC-13		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. apply advanced spatial analysis techniques using GIS and remote sensing data. 2. develop predictive models using machine learning algorithms on geospatial datasets. 3. use open-source tools (Python, R, QGIS, Google Earth Engine) for spatial analytics and modelling. 4. design and execute application-based geospatial modelling projects in environment, urban planning, or agriculture.		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Lab Exercises & Practical Record: Students are required to complete all practical exercises outlined in the syllabus, ensuring that at least 7–8 exercises are prepared and documented from each unit. Proper pagination and organization of the record are mandatory for appearing in the final examination.

Instructions for Paper- Setter: The examiner shall set eight exercises based on the syllabus, with two exercises from each unit. Students are required to attempt four exercises, selecting one from each unit. All exercises carry equal marks.

Distribution of Marks for Evaluation

Exercise = 10x4=40

File Record = 15

Viva-voce : 15

Unit	Topics	Contact Hours
I	1. Exploratory Spatial Data Analysis (ESDA): Spatial autocorrelation using Moran's I and Getis-Ord Gi* in GeoDa/QGIS. 2. Hotspot and Cluster Analysis: Identifying spatial clusters and outliers using spatial statistics tools.	30

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II	3. Regression Modelling in Spatial Context: OLS and Geographically Weighted Regression (GWR) using QGIS or R. 4. Supervised Machine Learning Models: Land use/land cover classification using Random Forest and SVM in Google Earth Engine or Python.	30
III	5. Unsupervised Modelling and Dimensionality Reduction: K-means clustering and Principal Component Analysis (PCA) on raster datasets. 6. Time-Series and Spatio-Temporal Modelling: NDVI time-series trend analysis for crop or forest monitoring using Earth Engine.	30
IV	7. Python for Spatial Data Modelling: Using GeoPandas, Scikit-learn, and PySAL for spatial machine learning. 8. Project Work: Application-Based Modelling: Mini-project on predictive mapping for any one domain (e.g., flood risk, disease outbreak, deforestation, urban sprawl).	30
Total Contact Hours		120
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Practicum	30	➤ Practicum 70
○ Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Field/Lab Performances:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. de Smith, M. J., Goodchild, M. F., & Longley, P. A. (2020). <i>Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools</i> . Winchelsea Press. 2. Kuhn, M., & Johnson, K. (2013). <i>Applied Predictive Modeling</i> . Springer. 3. O'Sullivan, D., & Unwin, D. (2010). <i>Geographic Information Analysis</i> (2nd ed.). Wiley. 4. Mitchell, A. (2012). <i>The ESRI Guide to GIS Analysis, Volume 3: Modeling Suitability, Movement, and Interaction</i> . ESRI Press. 5. Jensen, J. R. (2015). <i>Introductory Digital Image Processing</i> (4th ed.). Pearson. 6. Chakraborty, S. (2022). <i>Spatial Data Science with Python</i> . Packt Publishing. 7. Google Earth Engine Documentation: https://developers.google.com/earth-engine		



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DSE-03

Session: 2025-26

Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Environmental Impact Assessment using Geoinformatics		
Course Code	25PG-GIS -304		
Course Type	DEC-3		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the principles, policies, and legal frameworks of Environmental Impact Assessment (EIA). 2. apply geoinformatics tools (GIS, Remote Sensing, GPS) for impact prediction, monitoring, and analysis. 3. interpret spatial data to assess environmental consequences of development projects across sectors. 4. design and evaluate EIA workflows and prepare geospatially informed environmental management plans.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to EIA and Legal Frameworks: Overview of EIA objectives, types (rapid, strategic), and key stages; Indian EIA Notification (2006) and global guidelines (World Bank, UNEP). 2. Geoinformatics in Baseline Studies: Application of remote sensing and GIS for land use, vegetation, hydrology, and demographic baseline mapping; environmental indices (NDVI, LST, NDWI).	15
II	3. Impact Modelling and Suitability Analysis: GIS-based buffer analysis, overlay, terrain assessment (DEM), pollution mapping, and spatial multi-criteria decision-making. 4. Hydrology and Hazard Risk Mapping: Watershed analysis, flood/drought mapping, and geospatial modeling of landslide and industrial hazard zones.	15

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III	5. Predictive Modelling and Scenario Analysis: Land use change, environmental degradation modelling, and development impact simulations using geospatial tools. 6. Mitigation Planning and EMP Design: Use of GIS in planning greenbelts, noise barriers, risk zones; visualizing environmental management plans (EMP).	15	
IV	7. Participatory Tools and WebGIS: Community mapping, participatory GIS, WebGIS dashboards, and mobile survey tools for inclusive EIA practices. 8. Applications and Case Studies: Real-world EIA examples in infrastructure, mining, power, and SEZs; effectiveness of geoinformatics in EIA governance.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination:70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Canter, L. W. (1996). <i>Environmental Impact Assessment</i> (2nd ed.). McGraw-Hill. 2. Glasson, J., Therivel, R., & Chadwick, A. (2012). <i>Introduction to Environmental Impact Assessment</i> (4th ed.). Routledge. 3. Singh, J. S., & Gupta, S. R. (2017). <i>Ecology, Environmental Science and Conservation</i> . S. Chand Publishing. 4. Chang, K. T. (2019). <i>Introduction to Geographic Information Systems</i> (8th ed.). McGraw-Hill. 5. Burrough, P. A., & McDonnell, R. A. (1998). <i>Principles of Geographical Information Systems</i> . Oxford University Press. 6. Gupta, R. P. (2017). <i>Remote Sensing Geology</i> . Springer. 7. Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India. (2020). <i>EIA Manual and Notification</i> . 8. World Bank. (2017). <i>Environmental Assessment Sourcebook</i> . World Bank Technical Paper No. 139.			

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Social Vulnerability Mapping and Smart Governance		
Course Code	25PG-GIS -305		
Course Type	DEC-3		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the conceptual foundations of social vulnerability and its relevance in disaster risk and urban governance. 2. apply geospatial tools to map and analyze socio-economic vulnerability indicators and spatial inequalities. 3. evaluate the role of GIS, remote sensing, and participatory technologies in smart and inclusive governance. 4. design data-driven solutions for resilience building, public service delivery, and resource allocation using geoinformatics.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to Social Vulnerability and Resilience: Concepts of vulnerability, exposure, sensitivity, and adaptive capacity; frameworks for social vulnerability assessment (e.g., PAR model, HVCA); socio-economic and demographic drivers of vulnerability. 2. Geospatial Indicators of Social Vulnerability: Selection and mapping of indicators such as poverty, literacy, housing quality, gender, disability, access to healthcare and infrastructure; spatial inequality, marginalization, and urban informality.	15
II	3. Spatial Analysis Techniques for Vulnerability Mapping: Overlay analysis, weighted overlay, index modelling (Social Vulnerability Index - SoVI); GIS-based multi-criteria analysis; use of census, household surveys, and open-source data (e.g., DHS, OSM). 4. Remote Sensing for Urban and Disaster Contexts: Land use and land cover change, urban sprawl, flood and heat risk zones; integrating hazard layers with population data for risk assessment.	15

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III	5. Smart Governance and Data-Driven Decision Making: Concepts of smart cities, open data governance, e-governance tools; integration of GIS in urban service delivery, citizen engagement, resource planning, and transparency. 6. Participatory Mapping and Community GIS: Use of PGIS and VGI (Volunteered Geographic Information) for local knowledge capture; platforms such as OpenStreetMap, KoBoToolbox, and Survey123.	15
IV	7. Technology Platforms and Case Applications: Use of WebGIS, dashboards, spatial APIs, and mobile GIS for vulnerability analysis and governance; case studies from urban poor mapping, pandemic response, and disaster mitigation. 8. Policy Frameworks and Ethical Considerations: NDMA guidelines, Sendai Framework for DRR, urban resilience plans, ethics of mapping vulnerable populations, privacy, and inclusion.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory
○ Class Participation:	05	Written Examination: 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Cutter, S. L. (2006). <i>Hazards, Vulnerability and Environmental Justice</i>. Earthscan. 2. Fotheringham, A. S., Brunsdon, C., & Charlton, M. (2000). <i>Quantitative Geography: Perspectives on Spatial Data Analysis</i>. Sage Publications. 3. Goodchild, M. F., & Glennon, J. A. (2010). <i>Crowdsourcing Geographic Information for Disaster Response: A Research Frontier</i>. International Journal of Digital Earth, 3(3), 231–241. 4. Batty, M. (2018). <i>Inventing Future Cities</i>. MIT Press. 5. UNDRR. (2015). <i>Sendai Framework for Disaster Risk Reduction 2015–2030</i>. United Nations. 6. DeLyser, D., Herbert, S., Aitken, S. C., Crang, M., & McDowell, L. (2010). <i>The SAGE Handbook of Qualitative Geography</i>. SAGE Publications. 7. Rajan, S. C. (2020). <i>Tools and Techniques for Smart Governance</i>. Routledge India.		

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Session: 2025-26

Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Web GIS and Open Source Mapping Frameworks		
Course Code	25PG-GIS -306		
Course Type	DEC-3		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the architecture and principles of Web GIS and web-based geospatial services. 2. Explore open-source mapping frameworks and standards for dynamic web mapping. 3. Develop and publish interactive web maps using JavaScript libraries and open geospatial APIs. 4. Evaluate cloud-based spatial data infrastructures and deploy solutions for real-time geospatial applications.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Fundamentals of Web GIS: Architecture of Web GIS, client-server model, web mapping vs desktop GIS, components of a Web GIS system, and benefits of web-based GIS dissemination. 2. Web Mapping Standards and Services: Open Geospatial Consortium (OGC) standards – WMS, WFS, WCS, WMTS; INSPIRE directive; metadata standards (ISO 19115); service publishing and consumption.	15
II	3. Data Formats and Interoperability: GeoJSON, KML, GML, shapefiles, WKT/WKB; handling and transformation between coordinate systems and schemas. 4. Open Source GIS Servers and Platforms: Introduction to GeoServer, MapServer, QGIS Server; publishing vector and raster services; managing spatial layers and SLD styling.	15

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III	5. JavaScript Mapping Libraries: Introduction to Leaflet, OpenLayers, MapLibre, Deck.gl; creating interactive maps with base layers, markers, pop-ups, legends, and geocoding. 6. APIs for Geospatial Applications: REST and SOAP-based APIs; accessing and integrating spatial data from Google Maps, Mapbox, OpenStreetMap, ArcGIS REST services	15
IV	7. Cloud GIS and Real-Time Data Integration: Overview of cloud GIS (ArcGIS Online, Google Earth Engine, CARTO); real-time mapping from GPS/mobile sensors; dashboards for dynamic monitoring. 8. Use Cases and Applications: Smart cities, environmental monitoring, citizen science, disaster response, public health, and infrastructure planning using open web GIS solutions.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination: 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Fu, P., & Sun, J. (2020). <i>Web GIS: Principles and Applications</i> (2nd ed.). ESRI Press. 2. Hall, B., & Leahy, M. (2022). <i>Open Source GIS: A GRASS GIS Approach</i> . Springer. 3. Brunsdon, C., & Comber, L. (2018). <i>An Introduction to R for Spatial Analysis and Mapping</i> . SAGE. 4. Mitchell, T. (2005). <i>Web Mapping Illustrated: Using Open Source GIS Toolkits</i> . O'Reilly Media. 5. Neteler, M., & Mitasova, H. (2008). <i>Open Source GIS: A GRASS GIS Approach</i> (3rd ed.). Springer. 6. Steiniger, S., & Hunter, A. J. S. (2013). <i>Free and Open Source GIS Software for Building a Spatial Data Infrastructure</i> . GeoJournal, 78(1), 21–40. 7. OpenLayers and Leaflet Documentation – https://leafletjs.com / https://openlayers.org		

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Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Remote Sensing for Natural Resources Management		
Course Code	25PG-GIS -308		
Course Type	DEC-4		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the principles of remote sensing and its relevance to natural resource assessment. 2. analyze and interpret satellite data for monitoring land, water, forests, and minerals. 3. apply digital image processing techniques for thematic mapping and change detection. 4. evaluate remote sensing applications in sustainable management of natural resources through case studies.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Remote Sensing for Resource Management: Basic principles of electromagnetic radiation; interaction of EMR with vegetation, water, soil, and minerals; types of sensors and platforms; resolution characteristics. 2. Image Preprocessing and Interpretation: Radiometric and geometric correction techniques; visual interpretation for natural resource features; enhancement techniques; preparation of interpretation keys and ground truthing methods.		15

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II	3. Land Use and Agricultural Resource Mapping: Land use/land cover classification and change detection; crop monitoring, acreage estimation, and yield forecasting; soil mapping and land degradation assessment using remote sensing. 4. Water Resource Assessment: Surface water mapping, reservoir sedimentation studies, floodplain delineation, and drought monitoring using NDWI, SPI; groundwater prospecting using lineament analysis and remote sensing indicators.	15
III	5. Forest and Biodiversity Monitoring: Forest cover mapping, forest type classification, deforestation and degradation assessment; biodiversity habitat studies, fragmentation analysis using high-resolution satellite imagery. 6. Geological and Mineral Resource Mapping: Lithological, structural, and geomorphological mapping; mineral exploration using multispectral and hyperspectral remote sensing; geomorphological indicators for terrain evaluation.	15
IV	7. Integrated Natural Resource Management: Use of multi-temporal and multi-source datasets; integrating remote sensing with GIS for watershed management, ecological zoning, and resource sustainability modeling. 8. Applications and Case Studies: Applications from national programs (NRIS, Bhuvan, FASAL, NNRMS); use of remote sensing in agriculture, forestry, water management, and environmental planning; global initiatives (GEO, FAO, UNEP) in resource monitoring.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory
○ Class Participation:	05	Written Examination: 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Jensen, J. R. (2015). <i>Introductory Digital Image Processing</i> (4th ed.). Pearson. 2. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). <i>Remote Sensing and Image Interpretation</i> (7th ed.). Wiley. 3. Chuvieco, E. (2016). <i>Fundamentals of Satellite Remote Sensing</i> (2nd ed.). CRC Press. 4. Roy, P. S. (2020). <i>Remote Sensing for Natural Resource Management and Monitoring</i> (3rd ed.). Rawat Publications. 5. Campbell, J. B., & Wynne, R. H. (2011). <i>Introduction to Remote Sensing</i> (5th ed.). Guilford Press. 6. NRSC/ISRO. (2022). <i>Remote Sensing Applications: Natural Resources</i> . [ISRO Bhuvan Resources] 7. FAO. (2017). <i>Guidelines for Earth Observation for Natural Resources Monitoring</i> . Rome: UN FAO.		

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DSE-4			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Big Data and Machine Learning in Geospatial Contexts		
Course Code	25PG-GIS -309		
Course Type	DEC-4		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the characteristics and challenges of big geospatial data and its sources. 2. apply machine learning algorithms to analyze spatial patterns and trends in large geospatial datasets. 3. integrate big data platforms and cloud computing tools for scalable geospatial analytics. 4. design and evaluate geospatial machine learning workflows for real-world environmental, urban, and planning applications.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Big Geospatial Data: Characteristics of big data (volume, velocity, variety); sources of geospatial big data (satellite imagery, IoT, mobile GIS, crowdsourced data); challenges in storage, processing, and analysis. 2. Geospatial Data Infrastructure and Cloud Platforms: Big data architectures (Hadoop, Spark); spatial data processing with GeoMesa, GeoSpark, and Dask; introduction to cloud-based platforms (Google Earth Engine, AWS, Microsoft Planetary Computer).		15

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DSE-4			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Big Data and Machine Learning in Geospatial Contexts		
Course Code	25PG-GIS -309		
Course Type	DEC-4		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the characteristics and challenges of big geospatial data and its sources. 2. apply machine learning algorithms to analyze spatial patterns and trends in large geospatial datasets. 3. integrate big data platforms and cloud computing tools for scalable geospatial analytics. 4. design and evaluate geospatial machine learning workflows for real-world environmental, urban, and planning applications.		
Credits	Theory		Practical
	4	0	Total 4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Big Geospatial Data: Characteristics of big data (volume, velocity, variety); sources of geospatial big data (satellite imagery, IoT, mobile GIS, crowdsourced data); challenges in storage, processing, and analysis. 2. Geospatial Data Infrastructure and Cloud Platforms: Big data architectures (Hadoop, Spark); spatial data processing with GeoMesa, GeoSpark, and Dask; introduction to cloud-based platforms (Google Earth Engine, AWS, Microsoft Planetary Computer).		15



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II	3. Machine Learning Concepts for Spatial Data: Overview of machine learning types (supervised, unsupervised, reinforcement learning); model training, validation, and testing; evaluation metrics (accuracy, RMSE, precision-recall). 4. Supervised Learning Techniques: Regression (linear, logistic), decision trees, random forests, support vector machines (SVM); applications in LULC classification, crop yield estimation, and urban sprawl prediction.	15
III	5. Unsupervised and Deep Learning Approaches: Clustering (K-means, DBSCAN), principal component analysis (PCA), and neural networks (CNNs, RNNs); use cases in image segmentation, terrain classification, and object detection. 6. Spatio-Temporal Analysis and Modelling: Handling time-series satellite data; trend detection and anomaly identification; spatio-temporal kriging and prediction using ML models.	15
IV	7. Data Visualization and Dashboarding: Spatial visualization of results using Python (GeoPandas, Folium, Bokeh) and integration with dashboards (Power BI, Tableau, Google Data Studio) for decision support. 8. Case Studies and Applications: Smart agriculture (yield forecasting, pest prediction), disaster response (flood mapping, damage assessment), urban analytics (heat islands, mobility), environmental monitoring (deforestation, air quality).	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Lary, D. J., Alavi, A. H., Gandomi, A. H., & Walker, A. L. (2016). <i>Machine learning in geosciences and remote sensing</i>. Geoscience Frontiers, 7(1), 3–10. 2. Miller, H. J., & Goodchild, M. F. (2015). <i>Data-driven geography</i>. GeoJournal, 80(4), 449–461. 3. Karpatne, A., Ebert-Uphoff, I., Ravela, S., Babaie, H. A., & Kumar, V. (2019). <i>Machine learning for the geosciences: Challenges and opportunities</i>. IEEE Transactions on Knowledge and Data Engineering, 31(8), 1544–1554. 4. Raj, P. & Deka, G. C. (Eds.). (2019). <i>Big Data Analytics: Systems, Algorithms, Applications</i>. Chapman and Hall/CRC. 5. Gerke, M. & Xiao, J. (2021). <i>Deep Learning for Geospatial Data</i>. ISPRS Journal of Photogrammetry and Remote Sensing. 6. Google Earth Engine Documentation – https://developers.google.com/earth-engine 7. GeoAI Resources by ESRI and GitHub open-source ML + GIS libraries.		

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DSE-4			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Geospatial App Development and Automation		
Course Code	25PG-GIS -310		
Course Type	DEC-4		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand geospatial application architecture and modern web/mobile app development principles. 2. Develop interactive geospatial applications using open-source libraries and APIs. 3. Automate GIS workflows using scripting tools and cloud-based services. 4. Deploy scalable geospatial applications with real-time data integration and user interaction.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Geospatial App Development: Concepts of web GIS and mobile GIS; architecture of client-server applications; development stack overview (HTML, CSS, JS, Python, Flask/Django); overview of app life cycle. 2. Geospatial APIs and Data Integration: Working with Google Maps API, Mapbox, OpenStreetMap, and ArcGIS REST API; geocoding, routing, basemap switching, marker clustering, and spatial querying.		15



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II	3. Web Mapping Libraries:Developing interactive web maps using Leaflet, OpenLayers, and Deck.gl; adding layers, interactivity, and widgets; understanding tiles, WMS/WFS, and WebGL visualizations. 4. Backend and Server-Side Development: Building RESTful services using Python (Flask, FastAPI); setting up spatial databases with PostGIS; integrating with GeoServer for map services.	15	
III	5. Automation of Geospatial Workflows:Scripting spatial data processing with Python using GeoPandas, PyQGIS, Fiona, and Rasterio; batch processing, data conversion, map generation, and report automation.. 6. Mobile GIS and Real-time Apps:Creating mobile-responsive geospatial apps; integration of real-time GPS and sensor feeds; mobile frameworks (React Native, Flutter) for location-based services (LBS).	15	
IV	7. Deployment and Hosting of Geospatial Apps:Version control (Git), app hosting on GitHub Pages, Netlify, or Heroku; managing user authentication and security; cloud deployment using AWS/GCP.. 8. Project-Based Learning and Use Cases:Development of small-scale apps for disaster response, urban infrastructure monitoring, citizen mapping, and environmental reporting; UI/UX considerations in geospatial apps.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination:70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Fu, P. (2018). <i>Getting to Know Web GIS</i> (3rd ed.). ESRI Press. 2. Mitchell, T. (2005). <i>Web Mapping Illustrated: Using Open Source GIS Toolkits</i> . O'Reilly Media. 3. Hall, B., & Leahy, M. (2022). <i>Open Source GIS: A GRASS GIS Approach</i> . Springer. 4. Grinberg, M. (2018). <i>Flask Web Development: Developing Web Applications with Python</i> . O'Reilly Media. 5. PostGIS Project. (2023). <i>PostGIS Documentation</i> . https://postgis.net/documentation 6. Google Maps and Leaflet API Docs – https://leafletjs.com , https://developers.google.com/maps 7. Shah, M., & Shilpkar, R. (2021). <i>Geospatial Technologies for Smart Cities</i> . Springer.			



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EEC			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	III		
Name of the Course	Google Earth Engine: Fundamentals and Applications		
Course Code	25PG-GIS-312		
Course Type	EEC		
Level of the course	500-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the fundamentals and architecture of Google Earth Engine (GEE). 2. access and analyze geospatial datasets using GEE JavaScript and Python APIs. 3. apply image processing techniques and remote sensing indices using GEE. 4. demonstrate application of GEE in real-world natural resource and environmental monitoring.		
Credits	Theory	Practical	Total
	2	0	2
Teaching Hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner shall set five questions, including two questions from each unit, taking into consideration the Course Learning Outcomes (CLOs). In addition, one compulsory question (Question No. 1) shall be included, consisting of seven short parts that collectively cover the entire syllabus. The examinee will be required to attempt three questions in total: one question from each of the selected units and the compulsory Question No. 1. The compulsory question will carry 07 marks, while each long-answer question will carry 14 marks (each).			
Unit	Topics		Contact Hours
I	1. Introduction to Google Earth Engine: Overview of cloud-based geospatial platforms; architecture and advantages of GEE; user interface and code editor; accessing the data catalog—satellite, climate, land use, and socio-economic datasets. 2. Scripting and Visualization in GEE: JavaScript syntax and functions in GEE; loading, filtering, and visualizing vector and raster datasets; reducers, mapping functions, and charting tools; introduction to Python API.		15



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II	3. Image Processing and Indices: Image preprocessing: cloud masking, mosaicking, and compositing; calculation of remote sensing indices (NDVI, NDWI, LST); classification methods—supervised and unsupervised; accuracy assessment.	15	
	4. Applications and Case Studies: Use cases in forest monitoring, agriculture (crop mapping), water resources, land use/land cover change detection; exporting results and visualizing outputs using Earth Engine Apps		
Total Contact Hours		30	
Suggested Evaluation Methods			
Internal Assessment: 15		End Term Examination: 35	
➤ Theory	15	➤ Theory	35
○ Class Participation:	04	Written Examination: 35	
○ Seminar/presentation/assignment/quiz/class test etc.:	04		
○ Mid-Term Exam:	07		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Gorelick, N., et al. (2017). <i>Google Earth Engine: Planetary-scale geospatial analysis for everyone</i> . Remote Sensing of Environment, 202, 18–27.			
2. Tamiminia, H., et al. (2020). <i>Google Earth Engine for Geospatial Big Data Applications</i> . ISPRS Journal of Photogrammetry and Remote Sensing, 164, 152–170.			
3. Bassi, A. (2023). <i>Hands-On Google Earth Engine with Python</i> . Packt Publishing.			
4. GEE Developers Guide – https://developers.google.com/earth-engine			
5. Kumar, L. (Ed.). (2019). <i>Remote Sensing for Agriculture and Ecosystem Monitoring</i> . CRC Press			

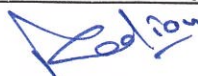
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CC-15			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	LiDAR Technology and 3D Geospatial Mapping		
Course Code	25PG-GIS -401		
Course Type	CC-15		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the principles and components of LiDAR systems for geospatial data collection. 2. analyze LiDAR point cloud data for terrain modeling, feature extraction, and 3D visualization. 3. apply 3D mapping techniques using LiDAR for urban, forestry, and infrastructure applications. 4. evaluate data integration and processing techniques in LiDAR-based geospatial workflows.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to LiDAR Technology: Definition and working principles of LiDAR (Light Detection and Ranging); history and development of LiDAR systems; comparison with other remote sensing techniques; advantages and limitations of LiDAR. 2. Components and Types of LiDAR Systems: Detailed study of LiDAR system components: laser scanner, GPS, IMU, waveform recorders; types of LiDAR systems: airborne, terrestrial, mobile, and bathymetric; pulse return types: single vs multiple, waveform vs discrete return.		15
II	3. LiDAR Data Acquisition and Flight Planning: Flight planning for aerial LiDAR surveys; scan geometry and point density; accuracy considerations; error sources and correction methods; GNSS-IMU integration; mission execution and ground control. 4. LiDAR Point Cloud Processing: Point cloud generation and georeferencing; filtering and classification (ground, vegetation, buildings); noise removal; generating Digital Terrain Models (DTM), Digital Surface Models (DSM), and Canopy Height Models (CHM).		15

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III	5. 3D Modeling and Visualization: TIN and voxel-based 3D modeling; mesh creation and rendering; urban 3D mapping; extraction of features such as buildings, power lines, and road networks; visualization techniques using QGIS, CloudCompare, and ArcGIS Pro 6. Applications of LiDAR Technology: Forestry applications: biomass estimation, tree height measurement; urban and infrastructure mapping; flood modeling and hydrological analysis; archaeological site mapping; transportation corridor monitoring.	15	
IV	7. LiDAR Data Formats, Standards, and Tools: Data formats: LAS, LAZ, ASCII; metadata and documentation; ASPRS standards and OGC compliance; use of open-source and proprietary software: LAStools, TerraScan, FUSION, PDAL, and GRASS. 8. Integration, Challenges, and Future Trends: Integration with GIS and remote sensing; big data and cloud-based processing (e.g., AWS, GEE); automation in classification and feature extraction; current research trends and advancements in LiDAR technology.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination: 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Shan, J., & Toth, C. K. (2018). <i>Topographic Laser Ranging and Scanning: Principles and Processing</i> (2nd ed.). CRC Press. 2. Maune, D. F. (Ed.). (2010). <i>Digital Elevation Model Technologies and Applications: The DEM Users Manual</i> (2nd ed.). ASPRS. 3. Vosselman, G., & Maas, H. G. (2010). <i>Airborne and Terrestrial Laser Scanning</i> . Whittles Publishing. 4. Wehr, A., & Lohr, U. (1999). <i>Airborne Laser Scanning—An Introduction and Overview</i> . ISPRS Journal of Photogrammetry and Remote Sensing, 54(2-3), 68–82. 5. Khoshelham, K., & Oude Elberink, S. (2012). <i>Accuracy and Resolution of Kinect Depth Data for Indoor Mapping Applications</i> . Sensors, 12(2), 1437–1454. 6. ASPRS Standards Committee. (2021). <i>ASPRS Positional Accuracy Standards for Digital Geospatial Data</i> . 7. OpenTopography – https://opentopography.org 8. USGS LiDAR Handbook – https://usgs.gov			

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CC-16			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Modern Surveying and Mapping Instruments (UAV, DGPS, Total Station)		
Course Code	25PG-GIS -402		
Course Type	CC-16		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the principles and functioning of modern surveying instruments including UAVs, DGPS, and Total Stations. 2. apply accurate field data acquisition techniques using modern geospatial instruments. 3. analyze, process, and integrate data collected from Total Station, DGPS, and UAVs into GIS environments. 4. evaluate the suitability and limitations of each surveying method for various geospatial applications.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Modern Surveying: Evolution of surveying techniques; classification of surveying methods; comparison between traditional and modern surveying instruments; role in geospatial science and decision-making. 2. Fundamentals of Total Station: Principle and components of Total Station; electronic distance measurement (EDM); angle measurement; field procedures for topographic surveys; error sources and calibration.		15
II	3. Applications of Total Station Data: Data collection and transfer; data processing for contour mapping, layout marking, and area/volume estimation; integration with CAD and GIS systems. 4. Differential GPS (DGPS) Technology: Working principle and configuration of DGPS; static and kinematic surveying; base and rover operation; correction techniques (RTK, PPK); accuracy assessment and error mitigation.		15

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III	5. UAV Systems for Surveying: Overview of drone platforms: fixed-wing, rotary-wing, VTOL; components (airframe, autopilot, sensors, camera); mission planning, flight execution, and safety guidelines. 6. UAV Data Acquisition and Processing: Aerial triangulation, orthophoto generation, and point cloud extraction; Structure from Motion (SfM); DEM/DSM generation; data integration with GIS; accuracy assessment techniques.	15	
IV	7. Comparative Analysis and Integration: Comparison of Total Station, DGPS, and UAV-based surveys in terms of accuracy, cost, and efficiency; multi-sensor integration; workflow standardization and quality assurance. 8. Case Studies and Applications: Real-world applications in urban planning, agriculture, construction, disaster management, and infrastructure monitoring; best practices and emerging trends in surveying..	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination:70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Ghilani, C. D. (2017). <i>Adjustment Computations: Spatial Data Analysis</i> (5th ed.). Wiley. 2. Bannister, A., Raymond, S., & Baker, R. (1998). <i>Surveying</i> (7th ed.). Pearson Education. 3. Agarwal, R. K., & Tiwari, R. P. (2011). <i>Modern Surveying Instruments and Their Applications</i> . Khanna Publishers. 4. Colomina, I., & Molina, P. (2014). <i>Unmanned Aerial Systems for Photogrammetry and Remote Sensing</i> . ISPRS Journal of Photogrammetry and Remote Sensing, 92, 79–97. 5. Wolf, P. R., & Ghilani, C. D. (2014). <i>Elementary Surveying: An Introduction to Geomatics</i> (14th ed.). Pearson. 6. Uren, J., & Price, B. (2010). <i>Surveying for Engineers</i> (5th ed.). Palgrave Macmillan. 7. DGCA Guidelines for UAV Operation – https://dgca.gov.in			




CC-17			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Advanced Survey Techniques and Field Mapping (Practical)		
Course Code	25PG-GIS-403		
Course Type	CC-17		
Level of the course	600-599		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Operate modern surveying instruments such as Total Station, DGPS, and UAVs for spatial data collection. 2. Execute field survey techniques and workflows for topographic, cadastral, and infrastructure mapping. 3. Process and analyze field data using appropriate software for DEM/DSM generation, contouring, and georeferencing. 4. Prepare accurate maps and reports integrating ground-survey data with GIS tools.		
Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Lab Exercises & Practical Record: Students are required to complete all practical exercises outlined in the syllabus, ensuring that at least 7–8 exercises are prepared and documented from each unit. Proper pagination and organization of the record are mandatory for appearing in the final examination.			
Instructions for Paper- Setter: The examiner shall set eight exercises based on the syllabus, with two exercises from each unit. Students are required to attempt four exercises, selecting one from each unit. All exercises carry equal marks.			
Distribution of Marks for Evaluation			
Exercise = 10x4=40		File Record = 15	Viva-voce : 15
Unit	Topics		Contact Hours
I	1. Introduction to Survey Equipment: Familiarization with Total Station, DGPS, and UAV components; field setup, calibration, and safety protocols. 2. Traverse Survey Using Total Station: Conducting closed and open traverse surveys; measuring angles and distances; adjustment of traverse and plotting..		30

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II	3. Topographic Survey and Contouring: Field data collection using Total Station; generation of contour maps, slope, and aspect using GIS. 4. DGPS-Based Surveying and Post-Processing: Static and RTK surveys; data logging and downloading; differential correction and accuracy analysis.	30
III	5. UAV Flight Planning and Data Capture: Mission planning using ground control points (GCPs); autonomous drone survey; legal compliance and safety checks.. 6. Drone Image Processing and Orthomosaic Creation: Processing UAV imagery using Structure-from-Motion (SfM); orthophoto generation, DSM/DTM extraction.	30
IV	7. Field Mapping for Thematic Applications: Data collection for land use, utilities, or disaster mapping; integration with satellite imagery and base maps. 8. Map Layout Design and Reporting: Preparation of professional maps (scale, legend, north arrow, coordinates); field report writing and data interpretation.	30
Total Contact Hours		120
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Practicum	30	➤ Practicum 70
○ Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Field/Lab Performances:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Ghilani, C. D. (2017). <i>Adjustment Computations: Spatial Data Analysis</i> (5th ed.). Wiley. 2. Wolf, P. R., & Ghilani, C. D. (2014). <i>Elementary Surveying: An Introduction to Geomatics</i> (14th ed.). Pearson. 3. Agarwal, R. K., & Tiwari, R. P. (2011). <i>Modern Surveying Instruments and Their Applications</i> . Khanna Publishers. 4. Uren, J., & Price, B. (2010). <i>Surveying for Engineers</i> (5th ed.). Palgrave Macmillan. 5. Kavanagh, B. F. (2017). <i>Surveying with Construction Applications</i> (8th ed.). Pearson. 6. DroneDeploy, Pix4D, or OpenDroneMap Documentation 7. DGPS and UAV operational manuals & DGCA regulations – https://dgca.gov.in		

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DEC-5			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Geoinformatics in Biodiversity and Ecosystem Services		
Course Code	25PG-GIS -404		
Course Type	DEC-5		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the role of geospatial technologies in biodiversity assessment and ecosystem service evaluation. 2. Apply remote sensing and GIS tools for habitat mapping, species distribution modeling, and ecosystem monitoring. 3. Analyze and interpret spatial data related to ecological processes, landscape change, and environmental conservation. 4. Evaluate geospatial frameworks for managing biodiversity hotspots, conservation areas, and ecological corridors.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Biodiversity and Ecosystem Services: Definitions and types of biodiversity (genetic, species, ecosystem); ecosystem services (provisioning, regulating, supporting, cultural); threats to biodiversity; overview of ecological and spatial data. 2. Remote Sensing in Biodiversity Monitoring: Use of optical, multispectral, hyperspectral, and radar data for vegetation classification, habitat condition assessment, and land cover change detection.		15
II	3. GIS for Habitat Mapping and Species Distribution: Ecological niche modeling (e.g., MaxEnt), suitability mapping, fragmentation analysis, and spatial patterns of species richness and endemism. 4. Landscape Ecology and Connectivity Analysis: Principles of landscape ecology; metrics for fragmentation, patch dynamics, edge effects; corridor and connectivity modeling using least-cost path and circuit theory.		15

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III	5. Geospatial Approaches to Ecosystem Services Assessment: Mapping carbon sequestration, water regulation, soil fertility, and pollination services using GIS and remote sensing; ecosystem service modeling tools (e.g., InVEST, ARIES).. 6. Conservation Planning and Biodiversity Hotspot Analysis: Use of spatial tools in identifying protected areas, biosphere reserves, and critical wildlife habitats; gap analysis, prioritization of conservation zones.	15
IV	7. Data Sources, Policies, and Frameworks: Global and national biodiversity databases (GBIF, IUCN Red List, BSI, ENVIS, NRSC); CBD, IPBES, and Indian policies on biodiversity and environment.. 8. Applications and Case Studies: Use cases in forest biodiversity, wetlands, coastal ecosystems, and agro-biodiversity; community-based biodiversity mapping; integrating traditional ecological knowledge (TEK) with geospatial analysis.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Turner, W., et al. (2003). <i>Remote sensing for biodiversity science and conservation</i> . Trends in Ecology & Evolution, 18(6), 306–314. 2. Giri, C. (2016). <i>Remote Sensing of Land Use and Land Cover: Principles and Applications</i> . CRC Press. 3. Moilanen, A., Wilson, K. A., & Possingham, H. P. (2009). <i>Spatial Conservation Prioritization: Quantitative Methods and Computational Tools</i> . Oxford University Press. 4. Boyd, J., & Banzhaf, S. (2007). <i>What are ecosystem services?</i> Ecological Economics, 63(2-3), 616–626. 5. Naidoo, R., & Ricketts, T. H. (2006). <i>Mapping the economic benefits of ecosystem services</i> . PLoS Biology, 4(11), e360. 6. Tallis, H., et al. (2011). <i>InVEST 2.0 User's Guide</i> . Natural Capital Project. 7. GBIF Data Portal – https://www.gbif.org 8. Indian Biodiversity Portal – https://indiabiodiversity.org		

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Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Geospatial Technology for Socioeconomic Development		
Course Code	25PG-GIS -405		
Course Type	DEC-5		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the concepts of socioeconomic development and their spatial dimensions using geospatial technologies. 2. Apply GIS, remote sensing, and GPS tools for planning, monitoring, and evaluating development programs. 3. Analyze spatial data for resource distribution, infrastructure planning, and poverty mapping. 4. Evaluate the role of geospatial technology in smart governance, rural development, and social equity.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Socioeconomic Development and Geospatial Relevance: Concept and indicators of socioeconomic development; spatial inequality and social vulnerability; significance of geospatial technology in development planning. 2. Spatial Data Sources for Socioeconomic Analysis: Census data, household surveys, satellite imagery, OpenStreetMap, and crowd-sourced data; integration of statistical and spatial data.		15
II	3. GIS for Infrastructure and Urban Development: Geospatial applications in urban infrastructure planning, transportation network analysis, slum mapping, and urban poverty assessment. 4. Geospatial Analysis for Rural and Agricultural Development: Land resource mapping, crop productivity assessment, irrigation planning; watershed management and rural connectivity using GIS.		15

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III	5. Social Vulnerability and Poverty Mapping: Techniques for mapping poverty, literacy, health, and sanitation; use of weighted overlay, social vulnerability index (SoVI), and multi-criteria decision analysis. 6. Geospatial Support for Governance and Public Services: Applications in smart cities, e-governance, asset mapping, and land records modernization; geospatial dashboards for real-time monitoring.	15	
IV	7. Disaster Risk Reduction and Resilience Planning: Community risk mapping for floods, droughts, and pandemics; geospatial support in social protection schemes and resilience building. 8. Case Studies and National Initiatives: SVAMITVA, PMGSY GIS, Digital India Land Records Modernization Programme (DILRMP), AMRUT, National GIS, and global programs like UN SDGs using geospatial indicators..	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination:70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Goodchild, M. F., & Janelle, D. G. (2010). <i>Toward Critical Spatial Thinking in the Social Sciences and Humanities</i> . GeoJournal, 75(1), 3–13. 2. Thakur, P. K., Aggarwal, S. P., & Garg, P. K. (2017). <i>Geoinformatics for Natural Resource Management</i> . Springer. 3. Bhatta, B. (2010). <i>Analysis of Urban Growth and Sprawl from Remote Sensing Data</i> . Springer. 4. United Nations. (2020). <i>Global Indicator Framework for the Sustainable Development Goals (SDGs)</i> . 5. Jensen, J. R. (2015). <i>Remote Sensing of the Environment: An Earth Resource Perspective</i> . Pearson. 6. National Remote Sensing Centre (NRSC) – <i>GIS for Governance and Planning Manuals</i> . 7. ESRI. (2019). <i>GIS for Sustainable Development</i> . ESRI Press. 8. Government of India. (2021). <i>SVAMITVA Scheme Guidelines</i> .			

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DEC-5			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Cloud GIS and Server-Side Spatial Architecture		
Course Code	25PG-GIS -406		
Course Type	DEC-5		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the architecture and concepts of Cloud GIS and server-based geospatial platforms. 2. Evaluate server-side frameworks for publishing, managing, and sharing spatial data services. 3. Apply open-source and proprietary cloud GIS solutions for large-scale geospatial applications. 4. Integrate APIs and real-time spatial data streams into cloud-based geospatial systems for decision-making.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Cloud GIS and Spatial Web Architecture: Cloud computing concepts and service models (IaaS, PaaS, SaaS); benefits and challenges of cloud-based GIS; comparison with desktop GIS. 2. Cloud GIS Platforms and Ecosystem: Overview of major platforms: ArcGIS Online, Google Earth Engine, CARTO, AWS Location Services, and Mapbox Cloud; open-source solutions like GeoNode.		15
II	3. Server-Side GIS Architecture: Client-server model, REST and SOAP services, geoprocessing services; server-side rendering and caching; load balancing and scalability.. 4. Geospatial Web Services and OGC Standards: Standards for interoperability (WMS, WFS, WCS, WMTS); service publishing using GeoServer and MapServer; schema validation and ISO 19115 metadata..		15

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III	5. Data Management in Cloud GIS: Storage formats for raster/vector in cloud; NoSQL and spatial databases (PostGIS, MongoDB); data synchronization and backup strategies. 6. APIs and Integration with Cloud GIS: RESTful APIs for map services; integration with Google Maps API, Mapbox, and OpenLayers; building interactive dashboards for real-time data visualization..	15	
IV	7. Real-Time Spatial Data Processing: Streaming IoT and GPS data into cloud systems; event-driven architectures; using MQTT and WebSockets for real-time geospatial analytics. 8. Applications and Case Studies: Smart cities, disaster management dashboards, precision agriculture, and environmental monitoring using cloud GIS; security and privacy in cloud spatial data.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination:70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Fu, P., & Sun, J. (2020). <i>Web GIS: Principles and Applications</i> (2nd ed.). ESRI Press. 2. Maguire, D., & Longley, P. (2015). <i>GIS: Theory, Techniques, Applications and Management</i> . John Wiley & Sons. 3. Steiniger, S., & Hunter, A. J. S. (2013). <i>Free and Open Source GIS Software for Building a Spatial Data Infrastructure</i> . GeoJournal, 78(1), 21–40. 4. GeoServer Project. (2023). <i>GeoServer User Manual</i> . Retrieved from https://geoserver.org 5. PostGIS Development Group. (2023). <i>PostGIS Documentation</i> . Retrieved from https://postgis.net 6. Singh, R. P. (2022). <i>Cloud Computing for Geospatial Applications</i> . Springer. 7. Open Geospatial Consortium (OGC) Standards – https://www.ogc.org 8. Google Earth Engine Documentation – https://developers.google.com/earth-engine			

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DEC-6			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Real-Time Environmental Sensor Integration		
Course Code	25PG-GIS-408		
Course Type	DEC-6		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the principles and types of environmental sensors and their role in geospatial data acquisition. 2. Analyze the architecture of real-time data acquisition, transmission, and integration with GIS platforms. 3. Apply IoT frameworks, APIs, and communication protocols for environmental monitoring systems. 4. Evaluate real-world applications of real-time sensor networks in environmental and disaster management.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Real-Time Sensor Networks: Overview of environmental monitoring systems; characteristics of real-time data; applications in air, water, soil, and weather monitoring. 2. Types of Environmental Sensors: Air quality sensors (PM2.5, CO₂, NO₂), soil moisture and temperature sensors, water quality sensors, meteorological sensors; calibration and accuracy issues.		15
II	3. IoT Architecture for Environmental Sensing: Sensor nodes, gateways, and cloud platforms; edge computing; protocols for communication (MQTT, CoAP, HTTP); data acquisition workflows. 4. Real-Time Data Transmission and Integration: Wireless communication technologies: GSM, LoRa, ZigBee, Wi-Fi; data ingestion pipelines; integration with cloud GIS (ArcGIS Online, AWS IoT Core, Google Cloud IoT)..		15

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III	5. APIs and Middleware for Sensor Data Handling: RESTful APIs, WebSockets, and MQTT brokers; platforms like ThingsBoard, Node-RED; database integration (PostGIS, NoSQL for sensor streams). 6. Spatial Analytics with Real-Time Data: Data visualization on dashboards; mapping air quality, water level, and soil moisture in real-time; geospatial time-series analysis; anomaly detection..	15
IV	7. Standards, Security, and Interoperability: OGC Sensor Web Enablement (SWE) standards (SensorML, SOS); ISO metadata standards; cybersecurity challenges in IoT-based geospatial systems. 8. Applications and Case Studies: Smart agriculture, urban air quality monitoring, flood early warning systems, climate observation networks, disaster risk reduction using real-time sensing..	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Pottie, G. J., & Kaiser, W. J. (2000). <i>Wireless Integrated Network Sensors</i> . Communications of the ACM, 43(5), 51–58. 2. Misra, S., & Woungang, I. (2016). <i>Guide to Wireless Sensor Networks</i> . Springer. 3. Evans, D. (2011). <i>The Internet of Things: How the Next Evolution of the Internet Is Changing Everything</i> . Cisco Internet Business Solutions Group. 4. Fu, P., & Sun, J. (2020). <i>Web GIS: Principles and Applications</i> . ESRI Press. 5. OGC Sensor Web Enablement Standards – https://www.ogc.org 6. Google Cloud IoT Documentation – https://cloud.google.com/iot 7. ArcGIS Real-Time Analytics Documentation – ESRI. 8. LoRa Alliance. (2021). <i>LoRaWAN Specification</i> .		

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Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Geospatial Technology for SDG		
Course Code	25PG-GIS-409		
Course Type	DEC-6		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the role of geospatial technology in implementing and monitoring the UN Sustainable Development Goals (SDGs). 2. identify spatial indicators for SDG targets and integrate remote sensing and GIS for SDG mapping. 3. apply geospatial tools for decision-making in poverty reduction, climate resilience, urban development, and environmental sustainability. 4. evaluate global and national initiatives that use geoinformatics for SDG reporting and governance.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to SDGs and Geospatial Framework: Overview of the UN 2030 Agenda; 17 SDGs and 169 targets; geospatial readiness for SDG monitoring; role of Earth observation and GIS. 2. Spatial Indicators and Data Sources for SDGs: Definition and selection of geospatial indicators; data sources – satellite imagery, census, crowd-sourced data; integration of geospatial and statistical data.		15
II	3. Remote Sensing for Environmental SDGs: Applications in SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land); forest monitoring, biodiversity, and coastal ecosystems mapping. 4. Geospatial Applications for Social and Economic SDGs: SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health), and SDG 11 (Sustainable Cities); poverty mapping, agricultural productivity, and urban resilience.		15

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III	5. GIS for Infrastructure and Resource Planning: Role in SDG 6 (Clean Water), SDG 7 (Affordable Energy), and SDG 9 (Infrastructure); water resource mapping, renewable energy site selection, transport networks. 6. Geospatial Analytics for SDG Monitoring and Reporting: Use of GIS dashboards and big data analytics for SDG progress tracking; integration with national and global SDG platforms (UN SDG Global Database, GEO SDG).	15	
IV	7. Policy Frameworks and Global Initiatives: UNGGIM Geospatial Roadmap, Group on Earth Observations (GEO) for SDGs, Bhuvan Panchayat, Digital Earth initiatives, and Indian NSDI efforts for SDG mapping.. 8. Case Studies and Future Trends: Case studies from India and global contexts (smart villages, climate adaptation planning); role of AI, IoT, and cloud GIS in achieving SDGs; future opportunities and challenges.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination: 70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. United Nations. (2015). <i>Transforming Our World: The 2030 Agenda for Sustainable Development</i> . United Nations. 2. Goodchild, M. F., & Li, L. (2021). <i>Geospatial Analysis for Sustainable Development Goals</i> . ISPRS Journal of Photogrammetry and Remote Sensing. 3. UN-GGIM. (2018). <i>Integrated Geospatial Information Framework (IGIF)</i> . United Nations. 4. Esri. (2019). <i>GIS for Sustainable Development Goals</i> . ESRI Press. 5. GEO. (2020). <i>Earth Observations in Support of the Sustainable Development Goals</i> . Group on Earth Observations. 6. Jensen, J. R. (2015). <i>Remote Sensing of the Environment: An Earth Resource Perspective</i> . Pearson. 7. NRSC/ISRO. (2021). <i>Bhuvan Portal for SDG Applications</i> . https://bhuvan.nrsc.gov.in 8. United Nations SDG Global Indicator Database – https://unstats.un.org/sdgs			

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DEC-6			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	GeoAI: Artificial Intelligence in Geospatial Analysis		
Course Code	25PG-GIS-410		
Course Type	DEC-6		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the concepts and scope of Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL) in geospatial contexts. 2. apply AI and ML algorithms for spatial data analysis, classification, prediction, and pattern recognition. 3. evaluate GeoAI frameworks for large-scale geospatial data analytics, image segmentation, and decision-making. 4. implement AI-driven solutions for real-world geospatial applications in agriculture, urban planning, and disaster management.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Overview of GeoAI: definition, evolution, and applications; basics of AI, ML, and DL; differences between traditional GIS and AI-driven analytics. 2. Machine Learning for Geospatial Data: Supervised learning (regression, classification), unsupervised learning (clustering, dimensionality reduction), evaluation metrics (accuracy, RMSE, F1 score) for spatial datasets.		15
II	3. Deep Learning Techniques for Remote Sensing: Convolutional Neural Networks (CNN) for image classification; object detection and segmentation; applications in satellite imagery analysis. 4. AI for Spatial Pattern Recognition and Prediction: Hotspot detection, anomaly detection, land-use change modeling, and predictive analytics using ML algorithms like Random Forest, SVM, and Gradient Boosting.		15

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III	5. Spatio-Temporal Modeling with AI: Time-series analysis using RNN and LSTM; forecasting environmental variables (temperature, NDVI, precipitation); disaster risk prediction. 6. AI Frameworks and Tools for GeoAI: TensorFlow, PyTorch, Scikit-learn for geospatial data; integration with GeoPandas, Rasterio, Google Earth Engine; cloud-based GeoAI platforms.	15	
IV	7. Ethical and Computational Challenges in GeoAI: Bias and fairness in AI models, data privacy concerns, model interpretability; computational cost and scalability in processing big geospatial data. 8. Applications and Case Studies: Agricultural monitoring, urban growth prediction, biodiversity mapping, flood and landslide prediction, transportation planning using AI-based geospatial models.	15	
Total Contact Hours		60	
Suggested Evaluation Methods			
Internal Assessment: 30		End Term Examination: 70	
➤ Theory	30	➤ Theory	70
○ Class Participation:	05	Written Examination:70	
○ Seminar/presentation/assignment/quiz/class test etc.:	10		
○ Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Janowicz, K., Gao, S., McKenzie, G., Hu, Y., & Bhaduri, B. (2020). <i>GeoAI: Spatially Explicit Artificial Intelligence Techniques for Geographic Knowledge Discovery and Beyond</i> . International Journal of Geographical Information Science, 34(4), 625–636. 2. Karpatne, A., Ebert-Uphoff, I., Ravela, S., Babaie, H. A., & Kumar, V. (2019). <i>Machine Learning for the Geosciences: Challenges and Opportunities</i> . IEEE Transactions on Knowledge and Data Engineering, 31(8), 1544–1554. 3. Lary, D. J., Alavi, A. H., Gandomi, A. H., & Walker, A. L. (2016). <i>Machine Learning in Geosciences and Remote Sensing</i> . Geoscience Frontiers, 7(1), 3–10. 4. Chollet, F. (2021). <i>Deep Learning with Python</i> (2nd ed.). Manning Publications. 5. Gerke, M., & Xiao, J. (2021). <i>Deep Learning for Geospatial Data</i> . ISPRS Journal of Photogrammetry and Remote Sensing. 6. Google Earth Engine Documentation – https://developers.google.com/earth-engine 7. TensorFlow and PyTorch Documentation for Geospatial AI. 8. Goodchild, M. F., & Li, L. (2021). <i>Geospatial Big Data and GeoAI</i> . ISPRS Journal of Photogrammetry and Remote Sensing.			

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Part A - Introduction

Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Disaster Resilience Planning and Emergency Mapping		
Course Code	25PG-GIS-412		
Course Type	DEC-7		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. Understand the concepts of disaster risk reduction, resilience planning, and emergency response frameworks. 2. Apply geospatial tools for hazard, vulnerability, and risk mapping in different disaster scenarios. 3. Design emergency mapping solutions using remote sensing, GIS, and real-time data for decision support systems. 4. Evaluate strategies for integrating geospatial technology in disaster preparedness and resilience planning.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	1. Introduction to Disaster Risk and Resilience: Types of disasters (natural and anthropogenic); concepts of hazard, vulnerability, exposure, and risk; disaster risk reduction (DRR) frameworks; resilience principles and Sendai Framework. 2. Disaster Resilience Planning Concepts: Preparedness, mitigation, response, and recovery; community-based resilience planning; multi-hazard risk assessment; climate resilience strategies.score) for spatial datasets.	15
II	3. Geospatial Data for Disaster Management: Remote sensing datasets (optical, radar, LiDAR) for disaster mapping; DEMs for terrain analysis; socio-economic and infrastructure datasets for vulnerability analysis. 4. Hazard Mapping and Vulnerability Assessment: Techniques for hazard zoning (flood, earthquake, landslide, cyclone); social vulnerability mapping using GIS; multi-criteria decision analysis for risk evaluation.	15

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III	5. Emergency Mapping and Real-Time Monitoring: Rapid mapping for emergency response; UAV-based data acquisition; real-time monitoring using IoT and crowd-sourced data; dashboards for situational awareness.. 6. Decision Support Systems and Early Warning: Integration of GIS in emergency operation centers; early warning systems for floods, cyclones, and wildfires; spatial decision support tools for resource allocation..	15
IV	7. Policy Frameworks and Standards: NDMA guidelines, SDMA roles, INSARAG protocols; global standards for emergency mapping (OGC standards, ISO); ethical considerations in emergency data sharing.. 8. Applications and Case Studies: Post-disaster damage assessment (e.g., floods, earthquakes, tsunamis); resilience planning for urban areas; case studies from India and global contexts..	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Coppola, D. P. (2015). <i>Introduction to International Disaster Management</i> (3rd ed.). Butterworth-Heinemann. 2. Cutter, S. L. (2012). <i>Hazards, Vulnerability and Environmental Justice</i> . Routledge. 3. Alexander, D. (2018). <i>Natural Disasters</i> . Routledge. 4. ESRI. (2019). <i>GIS for Disaster Management</i> . ESRI Press. 5. National Disaster Management Authority (NDMA). (2020). <i>National Disaster Management Guidelines</i> . Government of India. 6. UNDRR. (2015). <i>Sendai Framework for Disaster Risk Reduction 2015–2030</i> . United Nations. 7. OGC Emergency Mapping Standards – https://www.ogc.org 8. Google Crisis Response and OpenStreetMap Disaster Mapping resources.		

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Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Geospatial Analysis of Social Vulnerability and Equity		
Course Code	25PG-GIS-413		
Course Type	DEC-7		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the concepts of social vulnerability, inequality, and spatial justice in the context of geospatial analysis. 2. identify and map social vulnerability indicators using geospatial data sources and methods. 3. design emergency mapping solutions using remote sensing, GIS, and real-time data for decision support systems. 4. evaluate geospatial tools and approaches for inclusive planning, disaster resilience, and policy-making.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Social Vulnerability and Equity: Concept of vulnerability, exposure, and resilience; determinants of social vulnerability (poverty, gender, age, health, education); frameworks for measuring vulnerability and equity. 2. Data Sources and Social Indicators: Census data, demographic surveys, open government datasets, crowd-sourced data; indicators for vulnerability (income, housing, access to services); integrating spatial and non-spatial data.		15
II	3. Geospatial Techniques for Vulnerability Mapping: GIS-based mapping of poverty, marginalization, and social exclusion; weighted overlay and composite index methods; vulnerability hotspot analysis. 4. Remote Sensing Applications in Social Contexts: Using satellite data for mapping urban slums, population density, and service accessibility; night-time light imagery for socio-economic proxies..		15

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III	5. Spatial Inequality and Equity Analysis: Measures of spatial inequality (Gini index, Theil index); accessibility modeling (healthcare, education, transport); spatial autocorrelation and cluster analysis for inequity detection. 6. Geospatial Tools for Risk and Disaster Vulnerability: Social vulnerability in disaster-prone regions; hazard and exposure overlays; integration with hazard risk maps for multi-risk assessment.	15
IV	7. Participatory GIS and Community Mapping: Role of participatory GIS (PGIS) and volunteered geographic information (VGI) in mapping social vulnerability; tools like OpenStreetMap, KoBoToolbox, and mobile data collection. 8. Case Studies and Policy Frameworks: Applications in urban planning, rural development, disaster resilience, and climate justice; NDMA guidelines, UN SDGs, and Sendai Framework; ethical considerations in mapping vulnerable populations.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). <i>Social Vulnerability to Environmental Hazards</i> . Social Science Quarterly, 84(2), 242–261. 2. Fotheringham, A. S., Brunson, C., & Charlton, M. (2000). <i>Quantitative Geography: Perspectives on Spatial Data Analysis</i> . SAGE Publications. 3. Goodchild, M. F., & Glennon, J. A. (2010). <i>Crowdsourcing Geographic Information for Disaster Response: A Research Frontier</i> . International Journal of Digital Earth, 3(3), 231–241. 4. UNDRR. (2015). <i>Sendai Framework for Disaster Risk Reduction 2015–2030</i> . United Nations. 5. Esri. (2019). <i>GIS for Social Equity and Governance</i> . ESRI Press. 6. United Nations. (2020). <i>Global Indicator Framework for Sustainable Development Goals</i> . 7. Batty, M. (2018). <i>Inventing Future Cities</i> . MIT Press. 8. Indian Census and National Data Portals – https://censusindia.gov.in		

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DEC-7			
Session: 2025-26			
Part A - Introduction			
Name of Programme	M.Sc. Geoinformatics		
Semester	IV		
Name of the Course	Entrepreneurship and Innovation in Geospatial Technologies		
Course Code	25PG-GIS-414		
Course Type	DEC-7		
Level of the course	600-699		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO)	1. understand the principles of entrepreneurship and innovation in the geospatial technology sector. 2. identify emerging trends and opportunities for start-ups in geospatial services and applications. 3. develop business models and strategies for geospatial product development and commercialization. 4. evaluate policies, funding mechanisms, and ethical aspects of geospatial entrepreneurship.		
Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		
Part B- Contents of the Course			
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.			
Unit	Topics		Contact Hours
I	1. Introduction to Entrepreneurship and Innovation: Concepts of entrepreneurship, intrapreneurship, and innovation; significance in geospatial industry; differences between product-based and service-based ventures. 2. Geospatial Industry Landscape and Market Trends: Overview of geospatial technologies (GIS, Remote Sensing, GPS, UAVs, LiDAR, IoT, GeoAI); current global and Indian geospatial market trends; role in smart cities, disaster management, agriculture, and location-based services.		15
II	3. Business Models in Geospatial Domain: Types of business models: subscription-based, SaaS, consulting services, data-as-a-service; case studies of successful geospatial companies. 4. Ideation, Design Thinking, and Innovation Process: Stages of idea generation; design thinking for geospatial solutions; user-centric innovation; prototyping and product development.		15

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III	5. Start-up Ecosystem and Funding Opportunities: Government initiatives (Startup India, Geospatial Policy 2022), venture capital, angel investors, incubation centers, and crowdfunding; intellectual property rights (IPR) and patenting. 6. Technology Platforms and Tools for Start-ups: Cloud GIS, open-source tools (QGIS, GeoServer, OpenLayers), APIs, mobile app development frameworks; automation and scalability considerations.	15
IV	7. Challenges, Ethics, and Policy Frameworks: Data privacy, security, and ethical issues; national and international geospatial regulations; compliance with Geospatial Guidelines 2021. 8. Case Studies and Future Directions: Case studies of geospatial start-ups in India and globally (e.g., MapMyIndia, ESRI, Carto, Google Maps services); trends in GeoAI, AR/VR, and geospatial analytics for future innovation.	15
Total Contact Hours		60
Suggested Evaluation Methods		
Internal Assessment: 30		End Term Examination: 70
➤ Theory	30	➤ Theory 70
○ Class Participation:	05	Written Examination:70
○ Seminar/presentation/assignment/quiz/class test etc.:	10	
○ Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2017). <i>Entrepreneurship</i> (10th ed.). McGraw-Hill Education. 2. Drucker, P. F. (2006). <i>Innovation and Entrepreneurship: Practice and Principles</i> . Harper Business. 3. Schiliro, D. (2020). <i>Innovation and Entrepreneurship: Practice, Theory, and Research</i> . Nova Science Publishers. 4. ESRI. (2019). <i>GIS and Business: Innovation for Growth</i> . ESRI Press. . 5. Ministry of Science & Technology, Government of India. (2022). <i>Guidelines for Indian Geospatial Economy and Innovation</i> . 6. Startup India Portal – https://www.startupindia.gov.in 7. National Geospatial Policy 2022 – Department of Science & Technology (DST), Government of India. 8. Osterwalder, A., & Pigneur, Y. (2010). <i>Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers</i> . Wiley.		



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