Annexure-B

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 **Faculty Board: 02 Aug 2025**

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.

Chaudhary Bansi Lal University

Scheme of Examination and Syllabus for M.Sc. Geoinformatics

(w.e.f. 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

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). *Principles of geographical information systems*. Oxford University Press.
2. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic information systems and science* (4th ed.). Wiley.
3. Chang, K. T. (2019). *Introduction to geographic information systems* (9th ed.). McGraw-Hill Education.
4. Jensen, J. R. (2007). *Remote sensing of the environment: An Earth resource perspective* (2nd ed.). Pearson.
5. Steiniger, S., & Hunter, A. J. S. (2013). *Free and open source GIS software for building a spatial data infrastructure*. Springer.
6. Indian Space Research Organisation. (2021). *Bhuvan User Guide*. ISRO–NRSC. https://bhuvan.nrsc.gov.in
7. Ministry of Science & Technology. (2021). *Guidelines for acquiring and producing geospatial data and geospatial data services including maps*. Government of India. https://dst.gov.in

CC-2			
Session: 2025-26			
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	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 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

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). *Principles of geographical information systems*. Oxford University Press.
2. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic information systems and science* (4th ed.). Wiley.
3. Chang, K. T. (2019). *Introduction to geographic information systems* (9th ed.). McGraw-Hill Education.
4. Steiniger, S., & Hunter, A. J. S. (2013). *Free and open source GIS software for building a spatial data infrastructure*. Springer.
5. Heywood, I., Cornelius, S., & Carver, S. (2011). *An introduction to geographical information systems* (4th ed.). Pearson Education.
6. QGIS Documentation Team. (2023). *QGIS user manual and training guide*. https://docs.qgis.org
7. Open Geospatial Consortium. (2021). *OGC standards and services*. https://www.ogc.org

CC-3			
Session: 2025-26			
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

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). *Remote sensing of the environment: An Earth resource perspective* (2nd ed.). Pearson Education.
2. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). *Remote sensing and image interpretation* (7th ed.). Wiley.
3. Campbell, J. B., & Wynne, R. H. (2011). *Introduction to remote sensing* (5th ed.). Guilford Press.
4. Sabins, F. F. (1997). *Remote sensing: Principles and interpretation* (3rd ed.). Waveland Press.
5. Chander, T. (2021). *A textbook of remote sensing and geographical information system*. Alpha Science International.
6. NRSC/ISRO. (2022). *Bhuvan user guide*. https://bhuvan.nrsc.gov.in
7. Google Earth Engine. (n.d.). *Developers guide*. https://developers.google.com/earth-engine

CC-4			
Session: 2025-26			
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	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 = l0x4=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

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
o Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70	
o Seminar/presentation/assignment/quiz/class test etc.:	10		
o 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). *Thematic cartography and geovisualization* (3rd ed.). Pearson.
2. Dent, B. D., Torguson, J. S., & Hodler, T. W. (2008). *Cartography: Thematic map design* (6th ed.). McGraw-Hill.
3. Tyner, J. A. (2010). *Principles of map design*. Guilford Press.
4. Kraak, M. J., & Ormeling, F. J. (2020). *Cartography: Visualization of geospatial data* (4th ed.). Routledge.
5. QGIS Documentation Team. (2023). *QGIS user manual and training guide*. https://docs.qgis.org
6. Brewer, C. A. (2005). *Designing better maps: A guide for GIS users*. Esri Press.

CC-5			
Session: 2025-26			
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 = l0x4=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

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
o Class Participation:	05	Examination (Lab Exercises, Practical Record & Viva) : 70	
o Seminar/presentation/assignment/quiz/class test etc.:	10		
o Field/Lab Performances:	15		

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Jensen, J. R. (2005). *Introductory digital image processing: A remote sensing perspective* (3rd ed.). Prentice Hall.
2. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). *Remote sensing and image interpretation* (7th ed.). Wiley.
3. Richards, J. A., & Jia, X. (2006). *Remote sensing digital image analysis: An introduction* (4th ed.). Springer.
4. Mather, P. M., & Tso, B. (2016). *Classification methods for remotely sensed data* (2nd ed.). CRC Press.
5. Sabins, F. F. (1997). *Remote sensing: Principles and interpretation* (3rd ed.). Waveland Press.
6. European Space Agency. (2022). *SNAP User Manual*. https://step.esa.int
7. USGS. (2023). *EarthExplorer Data Tools and Guides*. https://earthexplorer.usgs.gov

DEC - 1			
Session: 2025-26			
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	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 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

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). *Remote sensing of the environment: An Earth resource perspective* (2nd ed.). Pearson Education.
2. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation* (7th ed.). Wiley.
3. Chang, K. T. (2019). *Introduction to geographic information systems* (9th ed.). McGraw-Hill Education.
4. Gautam, N. C. (2004). *Environmental monitoring and assessment using remote sensing and GIS*. Indian Society of Remote Sensing.
5. Murthy, K. S. R. (2004). *Watershed management and impact assessment using GIS and remote sensing*. Universities Press.
6. NRSC/ISRO. (2021). *Bhuvan thematic services user guide*. https://bhuvan.nrsc.gov.in
7. UNEP. (2022). *Global environmental monitoring system (GEMS) reports and datasets*. https://www.unep.org

DEC - 1			
Session: 2025-26			
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

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). *Remote sensing of the environment: An Earth resource perspective* (2nd ed.). Pearson Education.
2. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation* (7th ed.). Wiley.
3. ESRI. (2016). *GIS for urban and regional planning*. Esri Press.
4. Hall, P. (2014). *Cities of tomorrow: An intellectual history of urban planning and design* (4th ed.). Wiley-Blackwell.
5. NITI Aayog. (2022). *Urban planning capacity in India: Report and recommendations*. https://www.niti.gov.in
6. ISRO-Bhuvan. (2021). *Urban thematic services*. https://bhuvan.nrsc.gov.in
7. MoHUA. (2023). *Smart Cities Mission and AMRUT GIS guidelines*. Ministry of Housing and Urban Affairs, Government of India.

DEC - 1			
Session: 2025-26			
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 - 1		
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	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. 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

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). *Web GIS: Principles and applications*. ESRI Press.
2. Kraak, M. J., & Brown, A. (2000). *Web cartography: Developments and prospects*. Taylor & Francis.
3. Allen, D. W. (2022). *Getting to know Web GIS* (5th ed.). Esri Press.
4. Mitchell, T. (2005). *Web mapping illustrated: Using Open Source GIS toolkits*. O'Reilly Media.
5. Open Geospatial Consortium. (2021). *OGC standards and best practices*. https://www.ogc.org
6. Google Earth Engine Developers. (2023). *GEE documentation and tutorials*. https://developers.google.com/earth-engine
7. Esri. (2023). *ArcGIS Online documentation*. https://doc.arcgis.com/en/arcgis-online