Course title: Introduction to geoinformatics

Course code: WSW 169	**No. of credits:** 4	**L-T-P:** 34-10-24	**Learning hours:** 56
Pre-requisite course code and title (if any): None			
Department: Department of Regional Water Studies			
Course coordinator(s): Sherly M A	**Course instructor(s):** Sherly M A		
Contact details: sherly.ma@terisas.ac.in			
Course type: Compulsory Core	**Course offered in:** Semester 1		

Course description

This course introduces the participants to the fundamentals of geospatial technology (Surveying, Remote Sensing, GIS and GPS). This course is intended to introduce the applications of Remote Sensing & GIS techniques in water resources management.

Course objectives

i. To provide a strong fundamental understanding of the GIS and remote sensing technologies.
ii. To understand the basic principle underlying the GIS/model-based management of water resources and environment.

Course content

Module	Topic	L	T	P
1.	**Introduction to Surveying and Remote Sensing** • Elements of Surveying: Basic principle of surveying, Types of surveying, Levelling, Minor instruments of surveying • Introduction to Photogrammetry • Introduction to Remote Sensing: Electromagnetic Radiation (EMR), EMR spectrum and its properties, EMR wavelength regions and their applications • Atmospheric windows, Interaction of EMR with atmosphere and the surface; Sensors and Satellite Resolutions: Spectral, Spatial, Temporal and Radiometric • Digital image: Optical Sensor, Panchromatic & Multispectral Image and its properties, Spectral signatures, Vegetation and Bare soil	10	2	8
2.	**Introduction to GIS and GPS** • Introduction to Geographical information system, concept of spatial and non-spatial data • GIS data model: Raster and Vector • Map: Scale, Projection and Datum, Map design, Rectification and Georeferencing • Introduction to GPS: Single point positioning and Differential positioning • Spatial data: Entry, topology and editing	14	4	14
3.	**GIS and Remote Sensing methods relevant to water resources** • Map algebra: Local, Neighbourhood, Zonal operations • Extraction of water info from topographical maps; Extraction of water Indices using band combination • Digital Image Classification & Land use / land cover mapping	10	4	2

	PRACTICALS 1. Familiarisation with relevant surveying instruments 2. Introduction to ERDAS IMAGINE 2011; File formats. Import / Export of files using ERDAS IMAGINE 3. Study of the Spectral Signature of water and other relevant features 4. Display, analysis and interpretation of black & white images, grey image, pseudo image and FCC 5. Introduction to GIS and GPS software tools 6. Map rectification- Define projection and Reprojection 7. Digital database creation -Point features, Line features, Polygon features 8. Data editing-Removal of errors -Overshoot & Undershoot, Snapping, Topology Creation 9. Feature base: Dissolving, Merging; Layer base: Clipping, Intersection and Union 10. Spatial and Attribute query and Analysis; Map algebra / Math in Raster			
Total		**34**	**10**	**24**

Evaluation criteria:

- Test 1: 10% [module no. 1] [5-6 week]
- Test 2: 10% [module no. 2] [10-12 week]
- Practical: 30% [Regular practical exercises-10%, viva-voce-5%, Exam-15%] [End of Semester]
- Tutorial: 10% [Assignments] [End of Semester]
- End-term exam: 40% [modules 1-3] [End of Semester]

Learning outcomes

- Learning of the basics of surveying, remote sensing, GIS and GPS
- Experience with software relevant to remote sensing, GIS and GPS
- Introduction to selective methods in GIS and remote sensing relevant to water resources management

Pedagogical approach

The course will be delivered through class lectures, lab exercises and tutorials.

Course Reading Materials

- Punmia, B.C., Jain, A. K. and Jain, A. K. (2016), Surveying Vol. I, 17th edition, Laxmi Publications (P) Ltd., New Delhi, India.
- Jensen J. R. (2009), Remote Sensing of the Environment: An Earth Resource Perspective, 2nd edition, Pearsons, New Delhi
- Lillesand T. M., Kiefer, R.W. and Chipman, J. W. (2008), Remote Sensing and Image Interpretation, 6th edition, John Wiley & Sons, New Jersey, USA.
- Chang K.-T. (2006), Introduction to Geographic Information Systems, 1st edition, McGraw-Hill, New York, 2006.
- Burrough, P. A., McDonnell, R. A. and Lloyd, C. D. (2015). Principles of Geographical Information Systems, 3rd edition, Oxford University Press, Oxford, UK.

Advanced Reading Material

- Shamsi, U. M. (2005), GIS Applications for Water, Wastewater, and Stormwater Systems, Taylor and Francis, London.
- Lyon, J. G. (2002), GIS for water resources and watershed management. Lyon JG (ed), 1st edition, Taylor & Francis, London.
- Chen, Y. (2004), GIS and Remote Sensing in Hydrology, Water Resources and Environment, IAHS Press, Centre for Ecology and Hydrology, Wallingford, UK.
- Engman, E. T. and Gurney, R. J. (1991), Remote sensing in hydrology, 1st edition, Chapman and Hall, London.

Recommended journals for reference

Advances in Water Resources
Asian Journal of Geoinformatics
Journal of Water Resources Planning and Management
International Journal of Geoinformatics
International Journal of Remote Sensing

Additional information

Student responsibilities
Classes will be interactive. Students are expected to be regular in attendance, participation, and submission of assignments. They must come prepared with readings when required.

Prepared by: Sherly M. A., Department of Regional Water Studies.

Course reviewers:

1. Dr. S. P. Aggarwal, FIE, Scientist/Engineer "SG" & Head, Water Resources Department, Indian Institute of Remote Sensing, ISRO, Dept. of Space, Govt. of India, 4, Kalidas Road, Dehradun, Uttarakhand - 248 001, India.
2. Prof. R. D. Garg, Professor, Department of Civil Engineering, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand - 247667, India.