Course title: Applied geoinformatics for water resources

Course code: WSW 178	**No. of credits:** 3	**LTP distribution:** 28-6-16	**Learning hours:** 42

Pre-requisite course code and title (if any): WSW 169 (Introduction to Geoinformatics)

Department: Department of Regional Water Studies

Course coordinator(s): Vinay Kumar Sinha	**Course instructor(s):** Vinay Kumar Sinha

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Course type: Compulsory Core	**Course offered in:** Semester 2

Course Description

This course introduces the participants to the fundamentals of advanced geospatial technology, namely, Remote sensing and Geographic Information Systems (GIS). It prepares the candidate for geospatial modelling and analysis for water resources.

Course objectives

The course provides skills in use of geospatial techniques and related technologies required for solving real-world problems in the context of water resources management. This course provides an overview of cutting-edge remote sensing and GIS techniques that are by and large being used by water professionals. The students will be equipped with unique knowledge and skills necessary for sustainable management of water resources.

This course will be offered to students of M.Tech. (Water Resource Engineering and Management) and pre-Ph.D. Students from other programs willing to pursue doctoral studies in water resources. The students are suggested to read different books, magazines and peer reviewed journals.

Course content

	Topic	**L**	**T**	**P**
Module 1: Remote Sensing Sensor and its application in water resources				
1	Introduction to Thermal Infrared (TIR) Remote Sensing: History of TIR remote sensing, TIR properties and Atmospheric Windows, Thermal Radiation Laws, Thermal properties of terrain, TIR Sensors	2		
2	Hyperspectral remote sensing: Features and advantages, Hyperspectral remote sensing of soil and vegetation, Atmospheric correction	2	2	
3	Microwave Remote Sensing: Active and passive microwave remote sensing, Active microwave system components, RADAR Environmental Considerations, SAR remote sensing from space, RADAR Inferometry, Passive microwave remote sensing	2		
Module 2: Application of Geospatial model in water resources				
4	Introduction to Geospatial model: Flow Chart, Source of Geospatial data in Water Resources	2		
5	Digital elevation model: DEM generation, Contouring, Topography based hydrologically corrected DEM, DTM, DSM, TIN and its application in Water Resources	4	2	
6	Hydrological Cycle: Factors influencing watershed hydrology, physical processes in watershed and basic concepts of hydrological modelling	2	2	
Module 3: Geospatial models				
7	Terrain indices for Water Resources: Slope, Aspect of Slope, Curvature, Viewshed and Hillshade	2		
8	Basics of Hydrological Analysis: flow direction, flow accumulation, drainage network extraction, watershed delineation	2		
9	Geostatistical tools: Interpolation and pattern analysis	2		

10	Advanced hydrological tools: Hydrodynamic model and Soil and Water Assessment tool; Snow melts runoff modelling, Rainfall Run-off modelling, and Groundwater modelling.	8		
	PRACTICALS			
1	Terrain Analysis			2
2	Hydrological tool e.g SWAT Model			2
3	Geostatistical analysis			2
4	Hydrodynamic model e.g MIKE Flood			4
5	SRM model			4
6	GALDIT model			2
Total		**28**	**6**	**16**

Evaluation criteria

2 minor tests: 10% each
Practical: 30%
Tutorial: 10%
End-term exam: 40%

Learning outcomes

1. The student will get equipped to analyse geo-information problems encountered in professional practice and develop appropriate methods for studying and/or solving the problems, develop and design appropriate methods for geospatial framework data collection and processing.
2. The student will be able to generate, integrate, analyse and visualize spatial data within the area of water resources management.
3. The student would be able to formulate and carry out interdisciplinary research in geospatial modelling of water resources.

Materials

Suggested Readings:

- 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.
- Lo, C.P. and Yeung, A.K.W. (2009), Concepts and Techniques of Geographic Information Systems, 2nd edition, PHI Learning Private Limited, New Delhi.
- Bedient, B. P. and Huber, C. W. (2002). Hydrology and floodplain analysis, 3rd edition, Prentice Hall, USA.
- Bastiaanssen, W.G.M. (1998), Remote sensing in water resources management: the state of the art, Technical report, Colombo, Sri Lanka: IWMI. URL: http://publications.iwmi.org/pdf/H022865.pdf
- Engman, E. T. and Gurney, R. J. (1991), Remote sensing in hydrology, 1st edition, Chapman and Hall, London.
- 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.

Journals

- Water Resources Management
- International Journal of Applied Earth Observation
- Hydrological Processes
- Remote Sensing of the Environment

Additional information (if any): None

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.

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 - 248001, India.
2. Prof. R. D. Garg, Professor, Department of Civil Engineering, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand - 247667, India.