

Course title: Integrated watershed and river basin management				
Course code: WSW 164	No. of credits 3	L-T-P 32-10-0	Learning hours: 42	
Pre-requisite course code and title (if any): No prerequisites required				
Department: Department of Regional Water Studies				
Course coordinator(s): Ms. Ranjana Ray Chaudhury		Course instructor(s): Ms. Ranjana Ray Chaudhury		
Contact details: ranjana.chaudhuri@terisas.ac.in				
Course type: Compulsory Core		Course offered in: Semester 2		
Course Description				
<p>Watershed is considered to be the basic core for planning and management of water resources. Since a watershed is bound by natural drainage pattern, optimum utilization of natural resources including water must cater to the needs of the complex interactions between the various parts of the watershed. Each module has been chosen so that students gain knowledge and skill to understand and address numerous diverse problems faced by different kinds of watershed. River basin management includes the larger perspective where irrigation, drinking water and industrial water demand between competing regions but be met sustainably such that discharges and water withdrawals are monitored carefully so as not to compromise river water quality and surrounding ecosystem.</p>				
Course objectives				
<ul style="list-style-type: none"> ▪ To discuss different aspects of water resource development and management on watershed basis and reflect on certain technical aspects which need to be looked at from river basin point of view. ▪ To develop skills to analyse various complex problems of watershed using typing watershed modelling techniques for rainfall runoff and soil erosion. ▪ To understand sustainable watershed approach for water quality management, storm water management, flood management and drought management. 				
Course content				
Module	Topic	L	T	P
1	Introduction and basic concepts: Concept of watershed and river basin, characteristics of watershed behavior, effects of land use changes. Land capability and suitability classification, watershed development in India, common guidelines.	4		
2	Measurement of climate and hydrological parameters: Measurement of hydrological parameters like rainfall, suspended sediment and bed load in small channels and streams.	4		
3	Integrated river basin management: Strategic planning of water resources development, prioritise limited resources, managing irrigation, industrial and drinking water demands, protection of sensitive water bodies, riparian areas. Water policing for pollution load, discharge and withdrawal controls at different river sections. Monitoring data, management of concessionaires/big developers case study of stressed river basins, sustained development. Conjunctive use of ground water	8	2	
4	Watershed modeling Hydrologic processes: Standard modeling approaches, overall description of different hydrologic processes. Modeling of rainfall-runoff process with SCS methodology, modifications relevant for Indian conditions. Discussion along with a case study Erosion processes including wind erosion: Factors affecting erosion, Types of erosion. Assessment of erosion, modelling erosion using USLE, RUSLE, introduction to few other models, Indian studies, case study. Control measures for soil erosion Causes of landslides in watersheds having hilly terrain.	6	2	
5	Crop water Planning with special reference to different agro-ecological zones in India	2		
6	Drought management Definition, causes and impacts, management objectives and short term and long terms strategic measures to counter vulnerability due to drought	2	1	

7	Storm water and flood management, management of water quality Storm water management, design of drainage system. Case studies on urban flood damage due to changing land use pattern. Sources and types of pollution, case study from a watershed which has experienced rapidly industrialization	4	4	
8	Water conservation Recycling, reuse, wasteland reclamation, use of decision support systems in watershed management	2	1	
		32	10	
Evaluation criteria				
Minor 1	15%			
Minor 2	15%			
Tutorial, Case study	20%			
Major	50%			
Learning outcomes				
<ul style="list-style-type: none"> ▪ The ability to understand and analyse watersheds and river basins for wholesome sustainable development, protection of source water. ▪ Watersheds no longer comprise agricultural land only but have undergone industrialization and urbanization, so competency will be developed by students to analyse field problems and devise efficient water management techniques and soil management techniques. ▪ Students will be able to determine the causes of stress in different river basins and work towards remediation techniques for restoration of river and ecosystem health. ▪ Overall students will develop skills for detection, rehabilitation and conservation using participatory implementation of techniques for integrated watershed and river basin management 				
Pedagogical approach				
<p>Course shall be conducted using black board, power point presentations, MS Excel. Case study analysis will be given importance so that different water management problems may be discussed for different watershed properties. The class shall be divided into groups and each group will be expected to take a typical stressed watershed or river basin and discuss to adversities faced by them and suggest remediation/restoration techniques using skills learnt during the course.</p>				
Materials				
Textbooks				
<p>Sharda V.N., Sikka A.K. and Juyal G.P. (2006). <i>Participatory Integrated Watershed Management: A Field Manual</i>, Central Soil and Water Conservation Research and Training Institute, 218, Kaulagarh Road, Dehradun.</p> <p>Tideman E.M. (1999). <i>Watershed Management–Guidelines for Indian Conditions</i>, Omega Scientific Publishers, New Delhi.</p>				
Suggested Readings				
<p>Dhruva N.V.V., Sastry G. and Patnaik U.S. (1990). <i>Watershed Management</i>, Indian Council of Agricultural Research, New Delhi.</p> <p>Frevert R.K., Schwab G.O., Edminster T.W. and Barnes K.K. (2009). <i>Soil and Water Conservation Engineering</i>, 4th Ed, John Wiley and Sons, New York.</p> <p>Jones C., Palmer R.M., Motkaluk S. and Walters M. (2002). <i>Watershed Health Monitoring: Emerging Technologies</i>, Lewis Publishers, Boca Raton, Florida</p> <p>Murty, J.V.S.(2004). <i>Watershed Management</i>, 2nd Edition. New Age International Publishers, New Delhi.</p> <p>Rao K.V.S. (2003). <i>Watersheds: Comprehensive Development</i>, B.S. Publications, Hyderabad.</p> <p>Sharda V.N., Juyal G.P., Prakash C. and Joshi B.P. (2007). <i>Training Manual, Soil Conservation and Watershed Management Volume I-III</i>, Central Soil and Water Conservation Research and Training Institute, Dehradun.</p>				

Singh G., Venkataraman C., Sastry G. and Joshi B.P. (1990). *Manual of Soil and Water Conservation Practices*, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Suresh R. (2002). *Soil and Water Conservation Engineering*, Standard Publishers Distributors, New Delhi.

Journals

Hydrology Journal, Indian Association of Hydrologists.

Journal of Soil and Water Conservation, Central Soil and Water Conservation, Research and Training Institute, Dehradun

The Science of the Total Environment

Environmental Modelling and Software

Ecological Modelling

Student responsibilities

Attendance and class participation will be given utmost importance. All assignments should be submitted as per the timeline. Students will be expected to take up typical watershed problems in cities, hills, semi-arid and arid regions using tools taught in class to solve such problems.

Course reviewers

1. Professor N.K. Garg, Department of Civil Engineering, IIT, Delhi, Hauz Khas, New Delhi
2. Dr. Narendra . Kanhe, Principal, Guru Nanak Institute of Engg. and Management, Dahegaon, Near Radha Soami Satsang Place, Katol Road, Nagpur