

<b>Course title: Water audit and demand management</b>				
<b>Course code:</b> WSW 124		<b>No. of credits:</b> 3	<b>L-T-P:</b> 2-1-0	<b>Learning hours:</b> 42
<b>Pre-requisite course code and title (if any):</b> no prerequisites required				
<b>Department: Department of Regional Water Studies</b>				
<b>Course coordinator:</b> Ms. Ranjana Ray Chaudhuri			<b>Course instructor:</b> Ms. Ranjana Ray Chaudhuri	
<b>Contact details:</b>				
<b>Course type:</b> Compulsory Core			<b>Course offered in:</b> Semester 2	
<b>Course description:</b> Water demand has reached scarcity proportions in some areas while others are severely water stressed. Newer sources of fresh water are difficult to come by forcing us to relook at our existing water sources, water supply systems and current water use efficiencies in various sectors. Sustainable water use demands that we look at treated waste water as a resource. This means that strategies for water audit and assessment of water demands is accurate. This course is designed to equip students with such kind of knowledge and skills. The course will also look at recent water audit initiatives and guidelines from governing bodies.				
<b>Course objectives:</b>				
<ul style="list-style-type: none"> <li>▪ Introduce students to water demand management concepts including techniques to assess water demand for various sectors</li> <li>▪ To use water audit as an efficient water management tool</li> <li>▪ To understand that water audit leads to water conservation</li> <li>▪ To identify challenges in implementation of water audit in various sectors</li> </ul>				
<b>Course contents</b>				
<b>Module</b>	<b>Topic</b>	<b>L</b>	<b>T</b>	<b>P</b>
1	<b>Introduction and basic concepts</b> Protected water supply, estimation of water demand for agricultural, domestic and industrial sectors-factors affecting variation in demand, constraints. Projections for future demands, additional demand management through treated waste water and efficient storm water management. Existing sources of fresh water, intake structures, conveyance of water	6	2	
2	<b>Distribution of water-urban water management</b> Various methods, systems of supply, reservoirs and their capacity, network distribution, rising water stress due to poor distribution, factors and remediation. Leakage detection, prevention, existing condition of pipes, retrofitting for future water demand management	6	2	
3	<b>Water conservation</b> Water conservation as a measure to meet future water demands Conjunctive water use, rain water harvesting techniques, catchment planning, watershed management, institutional and policy aspects	4	2	
4	<b>Water audit and software</b> Steps of water audit, water supply and usage study, process study, discharge analysis, water audit report, benefits of water audit. Introduction to water audit softwares like PODIUMSim, AWWA softwares, IWMI softwares, SCADA, smart cities and smart water networks, leak detection and management methods	6	2	
5	<b>Water audit for irrigation</b> Water demand, irrigation efficiencies, field application efficiency, conveyance efficiency, irrigation challenges, use of more efficient techniques of irrigation, water	8	2	

	audit, implementation <b>Water audit for domestic sector</b> Per capita water requirement, assessment of transmission losses, identification of losses at source, reduction of water requirement at source, water reuse, recycling <b>Water audit in industries</b> Types of industries in India, generation and estimation of water use, audit of the various processes within the industry using water, reduction in water losses. Generation and estimation of waste water at various processes in industrial production, estimation of pollution load. Kind of treatment facilities available at each industry, concept of zero liquid discharge, quantity of water recycled in industry, incentives, policies and implementation, case study			
<b>6</b>	<b>Water pricing, policies</b>	2		
	<b>Total</b>	<b>32</b>	<b>10</b>	
<b>Evaluation criteria:</b>				
Minor 1	15%			
Minor 2	15%			
Tutorial and Quizzes	20%			
Major	50%			
<b>Learning outcomes:</b>				
<ul style="list-style-type: none"> <li>▪ Students will be introduced to latest water audit methods in various sectors.</li> <li>▪ Students will be able to assess water demands and with knowledge of water loss quantification will be able to identify the additional water quantity which may be used gainfully.</li> <li>▪ Ability to determine/quantify water losses in agriculture sector through water audit and apply latest irrigation techniques to improve water use efficiency.</li> <li>▪ Will be able to suggest measures so that each city in the future becomes a water sensitive city.</li> </ul>				
<b>Pedagogical approach:</b>				
Course shall be conducted using black board, power point presentations, MS Excel. Relevant case studies shall be discussed in class so that students are introduced to the latest stage of development in the subject.				
<b>Suggested Readings :</b>				
<b>Textbooks</b>				
Larry M. (2003) Urban Storm Water Management Tools, McGraw Hill Publication.				
Michael A.M. (2008) Irrigation Theory and Practices, 2nd Edition, Vikas Publishing House Private Limited, Noida.				
Suresh R. (2005) Soil and Water Conservation Engineering, 2nd edition, Standard Publishers Distributors.				
<b>Readings</b>				
David S. (1998) Water Supply Management, Kluwer Academic Publisher, Dordrecht.				
Freeze A. and Cherry J.A. (1979) Groundwater, Prentice Hall.				
Larry M. (2003) Urban Water Supply Management Tools, McGraw Hill Publication.				
General Guidelines for Water Audit and Water Conservation, 2005, Central Water Commission, Ministry of Water Resources, Government of India				
<b>Journals</b>				
Journal of Urban Water				
Journal of Cleaner Production				
AWWA journal				

**Additional information (if any): NA**

**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 water audit problems in cities, industries and rural areas and use tools taught in class to solve such problems.

**Course reviewers**

1. Professor A.K. Keshari, 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