

Course title: Aquatic eco-system management						
Course code: WSW 154	No. of credits: 3	L-T-P distribution: 22-6-28 (including 4 days of field visit)	Learning hours: 42			
Pre-requisite course code and title (if any): Ecology/Biodiversity and Conservation						
Department: Department of Regional Water Studies						
Course coordinator(s): Prof. J K Garg			Course instructor(s): Prof. J K Garg			
Contact details: jk.garg@terisas.ac.in						
Course type	Compulsory Core		Course offered in: Semester 2			
Course description Aquatic Eco-system play an important role in ecosystem functioning. Their management, governance and conservation however remain neglected not because of lack of awareness but due to lack of capacity and complexities involved in their assessment of management needs. Wetlands categorized as Protected Areas in India are mostly governed by the Wildlife Protection Act of 1972. Biodiversity studies on aquatic eco-systems are mostly restricted to a few charismatic fish species, aquatic plants, water birds etc. This course on Aquatic Eco-system Management shall focus on the needs and approaches to aquatic eco-system management and their conservation in India.						
Course objectives						
<ul style="list-style-type: none"> ▪ To understand the ecology of the aquatic ecosystems, their contribution to human well-being. ▪ To develop hands on ability to undertake rapid biodiversity monitoring of wetlands. ▪ To develop an ability to understand issues related to best practices in aquatic ecosystems management, and preparation of management plans for conservation action. 						
Course content						
Modules	Topic			L	T	P
1	Basic Concepts on Ecology of Aquatic Systems An introduction to ecology of Aquatic Ecosystems: Fresh water and Marine. Definition and classification of Wetlands: Wetlands as Ecosystems and part of River Basin. Distribution and typology. Wetland Habitat and Ecology. Physico-chemical parameters Hydrology and Soils. Unusual and Extreme habitats Biodiversity in Wetland Systems: Aquatic Organisms: Microbes, Phyto and zooplanktons, Plants and Invertebrates and Vertebrates. Wetland Functions and Values; Ecosystem services. Nutrient cycling in aquatic systems. Productivity, trophic states and eutrophication. Freshwater ecosystems Tutorial: <i>Ecosystem services by Wetlands. Case study of a wetland system in Delhi</i> Practical: Basics on Taxonomy and Enumeration of Phyto and Zooplanktons. Estimation of Chlorophyll.			6	2	2
2	Issue of Wetlands Conservation and Management Threat analysis and management Planning: Natural and Human impacts; major threats to wetlands. Indexes of biological integrity. Setting management objectives and priorities. Integrated Coastal Zone management. Key aspects of Wetland management planning; Preparing a Management Plan. Collating baseline information using assessment tools approaches to assessment of aquatic bio-diversity. Management for migratory water fowl, fisheries, amphibians, reptiles and mammals. Management of aquatic weeds. Monitoring of Wetlands. Managing hydrology; Control of Siltation and Pollution. Involvement of local communities in conservation of Wetlands.			8	2	0

	<p>Environmental Flows: The River ecosystems and their natural flow regimes. Concept and History of environmental flows, Methodologies for the assessment of Environmental Flows. Impact of flow alteration on biota. Environmental flow assessment in India.</p> <p><i>Case studies on Environmental Flows: Experiences of South Asia</i></p>			
3	<p>Wetland Conservation in India and the World</p> <p>Wetlands in India: Wetlands of Ramsar significance in India; Wetland policy. National Wetland Rules 2010. Wetland related Institutional arrangements: Functioning of Lake Development Authorities. Trans-boundary waters</p> <p>Major Wetlands of the World: Ramsar Convention; Wetland conservation <i>vis a vis</i> other Conventions (CBD, CMS, CITES, UNFCCC). Conservation issues of major wetlands of the World.</p> <p><i>A case study on Environmental Impact Assessment related to a Wetland in India. Preparation for the assignment on a Wetland Conservation</i></p>	5	2	0
4	<p>Field study on revival and restoration of a Wetland</p> <p>Wetlands Restoration.</p> <p>Field visit to a Wetland in India (Chilka /Keoladeo Birds Sanctuary, Bharatpur Rajasthan / Any other Ramsar Site): to study restoration and revival efforts. In field lectures.</p>	3	0	26
	Total	22	6	28
<p>Evaluation criteria</p> <p>Minor tests I: 10%</p> <p>Minor test II : 10%</p> <p>Assignment report : 30%</p> <p>Presentation based on assignment : 20%</p> <p>End-term exam: 30%</p>				
<p>Learning outcomes</p> <p>Upon completion of this course, students will be able to:</p> <ul style="list-style-type: none"> • Define wetland and very wetland types, including inland as well as coastal • Understand wetland functions, values, and ecosystem services • Acquire knowledge of the important ecological and hydrological principles for understanding of dynamics of various types of ecosystems and wetlands • Learn approaches for wetland rehabilitation and restoration • Know about various conventions relevant to wetlands and other aquatic systems 				
<p>Pedagogical approach</p> <p>The course will be an amalgamation of theory on aquatic biology interspersed with a deeper understanding of management needs of fresh water aquatic systems. Students will delve through case studies in India, undertake monitoring of biological and physico -chemical parameters of wetlands, undertake root cause analysis to the threats wetland are subjected to and learn preparation of management plans as per the national and global best practices guidelines guide-lines. The course will apprise the students of the national and global policy environment <i>vis a vis</i> wetland management conservation and priorities.</p>				
<p>Materials</p> <p>Dodds, Walter K. (2002). <i>Freshwater Ecology. Concepts and Environmental Applications</i>. Elsevier Science. Academic Press. California.</p> <p>Gopal B. (1995). <i>Handbook of Wetland Management</i>, World Wide Fund for Nature India. New Delhi (Revised Edition being planned by author)</p> <p>Gopal B. (2013). <i>Environmental Flows. An introduction for water resource managers</i>. National Institute of Ecology. New Delhi</p> <p>Wetzel, Robert G and (2010). <i>Limnological analysis</i>. Springer Science. New York.</p>				

Wetzel Robert G. .2001. *Lake and river ecosystems*. Elseiver. Academic Press. USA.
An integrated Wetland assessment toolkit. IUCN.
Ramsar Convention Handbooks
Handbooks on Wetland Management by Convention on Biological Diversity.
Standard methods for examination of water and wastewater. (1998) .20th edition. American Public Health association (AHPA), American Water Works Association.
Integrated Coastal Zone management.

Case studies: Environmental Impact assessment (EIA): Studies of the Teesta River basins (Eg.)

Websites: www.ramsar.org, www.cbd.int,

Suggested Readings

Fraser, L.H. and P.A. Keddy (Eds). *The World's largest wetlands: Ecology and Conservation*. Cambridge University Press, UK

Kar, Devashish. (2013). *Wetlands and lakes of the world*. Springer. New Delhi.

Krishnamurthy, J., Sharachandra Lele and R. Jayakumar. (2006). *Hydrology and watershed services in the Western Ghats of India*. Tata McGraw – Hill Publishing Company Limited. New Delhi.

Journals

Biological Conservation

Diversity and Distributions

Journal of Wetland Ecology

Journal of Applied Ecology

Lakes and Reservoirs: research and management

Landscape Ecology

Wetland Ecology and Management

Additional information (if any)

Guest Lectures will be organized on specialized topics as mentioned in course content.

Student responsibilities

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

Course reviewers

1. Prof Brij Gopal, School of Environmental Sciences, Jawahar Lal Nehru University, New Delhi.
2. Dr. Joachim Schmerbeck, Associate Professor, TERI University, New Delhi
3. Dr. Parikshit Gautam, ex Director, Wetland Conservation Division, WWF – India
4. Trans-boundary Water initiative, International Union for Conservation of Nature-(IUCN) India.