

Course title: Economic and financial evaluation of water infrastructure				
Course code: WSW 147		No. of credits: 4	L-T-P: 42-14-0	Learning hours: 56
Pre-requisite course code and title (if any): Basic calculus and linear algebra				
Department: Department of Regional Water Studies				
Course coordinator(s): Dr. Sukanya Das & Dr. Arun Kansal			Course instructor(s): Dr. Sukanya Das & Dr. Arun Kansal	
Contact details: sukanya.das@terisas.ac.in ; akansal@terisas.ac.in				
Course type: Core			Course offered in: Semester 2	
Course description A beginner's course to develop understanding of basics of water economics and able to conduct financial evaluation of water infrastructure and related services for decision-making.				
Course objectives <ol style="list-style-type: none"> 1. Lay the foundation for understanding economic concepts in water 2. To learn the concept of water pricing 3. Understand financial appraisal methods 				
Course content				
Module	Topic	L	T	P
1.	Introduction to water economics 1.1 Characteristics of water as an economic good- Infrastructure, Incentives and Institutions 1.2 1.3 Relevance and interaction of different streams of economic theory to water resources Market failure in the water sector 1.4 Externalities in the context of water resources	10	0	0
2.	2.1 Basic macro-economic- GDP/GNP, Fiscal policies, monetary policies, financial institutions.	4	2	0
3.	Financial evaluation methods 3.1 Introduction to inflation, discount rates, price index, base year, depreciation 3.2 Cash flow diagram and financial mathematics 3.3 Financial performance indicators- NPV, payback period, equalised annual cost, CBR, IRR 3.4 Depreciation methods, tax considerations 3.5 Risk and Uncertainly 3.6 Social-cost benefit analysis and its applications. Hands on with few water toolkits.	12	8	0
4.	Water Pricing- Water Availability and Use in India by different sectors- Agricultural, Domestic and Industrial; over time and future projections. 4.1 Economic concepts like Law of Demand, Elasticity of Demand and its relevance to pricing water; Introduction to consumer and producer surplus; Opportunity costs; Externalities- positive and negative 4.2 Economic methodologies for estimation of demand and value of water in different sectors 4.3 Measures for improving water use efficiency in Agriculture including economics of irrigation efficiency and resource conserving technologies, Ground water use and exploitation- current vs future, Impacts of Prices of inputs and outputs other than water. 4.4 Tariff structures: Concepts like Fixed charges vs volumetric pricing. 4.5 Different tariff structures in different Indian cities for domestic and Industrial water. 4.6 Cost recovery: - Concepts like marginal cost pricing, fixed and operating	12	4	0

	costs, full cost pricing of water, problems faced by Indian water utilities			
5.	Financing Water Infrastructure and Services 5.1 Elements of financing- equity, Debt, grants, insurance and regulations 5.2 Parties to financing and partnership models, 5.3 Irrigation financing including role of water user associations	4		0
	Total	42	14	0
<p>Evaluation criteria: Group work, presentation, and individual assignment will be part of learning process to improve understanding.</p> <p>Test 1: Written test [at the end of teaching of modules 1 and 2] -- 10%</p> <p>Test 2: Submission of assignment [end of module 3] - 20%</p> <ol style="list-style-type: none"> Any cases from the water sector for undertaking a cost benefit analysis. Structure of submission: The assignment will consist of introduction, background of the study location, methodology, followed by analysis and conclusion Indicators of assessment: structure (weightage: 10% clarity in the steps for estimation of the results (weightage: 70%); datasets used (weightage: 10%) conclusion (weightage: 10%); <p>Test 3: group assignment and a role play game will be conducted linking water related issues in the context of India [at the end of teaching of module 3, 4 and 5] -- 40%</p> <p>Assignments will be given as an individual or group to judge the clarity of the methods they have learnt and its area of application</p> <p>Test 4: Written test [at the end of the semester, full syllabus] -- 30%</p>				
<p>Learning outcomes: Upon completion of the course the student will be able to-</p> <ol style="list-style-type: none"> Understand the basics of economics of water [test 1] Able to handle financial evaluation [test 2] Able to conduct simple policy analysis in water-related issues. [test3 and test 4] 				
<p>Pedagogical approach: Class interaction, teaching and discussion, group assignment, case studies presentation and role play</p>				
<p>Reading Materials (* = compulsory readings) Tietenberg, T. 2001 Environmental and Natural Resource Economics. Addison Wesley Publication</p> <p>Briscoe, John, and R. P. S. Malik. <i>India's water economy: Bracing for a turbulent future</i>. New Delhi: Oxford University Press, 2006.</p> <p>Module 1</p> <p>*Tietenberg, T. 2001 Environmental and Natural Resource Economics. Addison Wesley Publication</p> <p>*Olmstead, S.M. (2010). The economics of water quality. <i>Review of Environmental Economics and Policy</i>, 4(1): 44-62. https://doi.org/10.1093/reep/rep016.</p> <p>Green, Colin. <i>Handbook of water economics: principles and practice</i>. John Wiley & Sons, 2003.</p> <p>Zilberman, David, and Leslie Lipper. "10 The economics of water use." <i>Handbook of environmental and resource economics</i> (2002): 141.</p> <p>Krishna Raj (2017) "Economics of Water: Understanding India's Water Balance in a Globalized Economy" <i>Productivity Journal</i> Vol. 57 No 4, January-March 2017.</p> <p>Module 2</p> <p>*Tietenberg, T. 2001 Environmental and Natural Resource Economics. Addison Wesley Publication</p>				

Green, Colin. *Handbook of water economics: principles and practice*. John Wiley & Sons, 2003.

Whittington, Dale. "The economic benefits of potable water supply projects to households in developing countries." (1994).

Module 3

Handbook for the Economic Analysis of Water Supply Projects 1999. Economics and Development Resource Center. Asian Development Bank.

Sam Godfrey, Pawan Labhassetwar, Satish Wate. "Greywater reuse in residential schools in Madhya Pradesh, India—A case study of cost–benefit analysis". *Resources, Conservation and Recycling* 53 (2009) 287–293

Fahimuddin. "Drinking Water Collection And Cost-Benefit Analysis Of A Rural Water Supply Scheme In Uttarakhand State".. *Journal of Rural Development*, Vol. 31, No. (1) pp. 1 – 15; NIRD, Hyderabad.

Grimsey, D., & Lewis, M. K. (2002). Evaluating the risks of public private partnerships for infrastructure projects. *International journal of project management*, 20(2), 107-118.

Furlong, Casey, Saman De Silva, Kein Gan, Lachlan Guthrie, and Robert Considine. "Risk management, financial evaluation and funding for wastewater and stormwater reuse projects." *Journal of environmental management* 191 (2017): 83-95.

Module 4

*Dinar, Ariel, and Kurt Schwabe, eds. *Handbook of Water Economics*. Edward Elgar Publishing, 2015.

*Dinar, Ariel, Víctor Pochat, and José Albiac-Murillo, eds. *Water pricing experiences and innovations*. New York: Springer International Publishing, 2015.

*Murty, Maddipati Narasimha, A. J. James, and Smita Misra. *Economics of water pollution*. Oxford University Press, 1999.

Whittington, Dale. "Possible adverse effects of increasing block water tariffs in developing countries." *Economic Development and Cultural Change* 41, no. 1 (1992): 75-87

Isha Ray. "Get the Price Right': Water Prices and Irrigation Efficiency". *Economic and Political Weekly*, Vol. 40, No. 33 (Aug. 13-19, 2005), pp. 3659-3668

Tushaar Shah, Neha Durga, Shilp Verma and Rahul Rathod. "Solar Power as Remunerative Crop" Water Policy Research Highlight-10. IWMI.

N. Nagaraj, K. Shankar and M. G. Chandrakanth. "Pricing of Irrigation Water in Cauvery Basin: Case of Kabini Command" *Economic and Political Weekly*, Vol. 38, No. 43 (Oct. 25-31, 2003), pp. 4518-4520

Rogers, Peter, Ramesh Bhatia, and Annette Huber. *Water as a social and economic good: How to put the principle into practice*. Stockholm: Global Water Partnership, 1998..

Um, WooChong. "2007 Benchmarking and Data Book of Water Utilities in India." (2007).

Gupta, Anjali Sen. "Cost Recovery in Urban Water Services: Select Experiences in Indian Cities." (2011).

Module 5

Water, and Sanitation Program (World Bank). South Asia. *Running water in India's cities: a review of five*

recent public-private partnership initiatives. Water and Sanitation Program, 2014.

Dwivedi, Gaurav. "Public private partnerships in water sector." (2010.)

Additional readings

Balasubramanya, Soumya, Barbara Evans, Richard Hardy, Rizwan Ahmed, Ahasan Habib, N. S. M. Asad, Mominur Rahman et al. "Towards sustainable sanitation management: Establishing the costs and willingness to pay for emptying and transporting sludge in rural districts with high rates of access to latrines." *PloS one* 12, no. 3 (2017): e0171735.

Vaidyanathan, A. *Water resource management: institutions and irrigation development in India*. Oxford University Press, 1999.

Additional information (if any)

Student responsibilities

The students are expected to submit assignments in time and come prepared with readings when provided.

Prepared by: Sukanya Das, Department of Policy Studies, Meera Bhatia Mehrotra (Guest Faculty), Department of Regional water studies.

Course Reviewers:

1. Dr Soumya Balasubramanya, Research Group Leader - Water Innovations in Transforming Economies, IWMI, Colombo
2. Dr. Krishna Raj, Professor, Center for Economic Studies and Policy (CESP), Institute for Social and Economic Change (ISEC), Bangalore
3. Prof Paul.P Appasamy, Honorary Professor, Madras School of Economics