River Flood Modeling

Course Code	Credit Hours
CE-813	3+0

Course Description

The main objective of this course is to explain the main flood management problems. This is done by taking a holistic view of the governing processes of flood generation and propagation. Further, this course helps the students identify the proper modeling methodology for a given problem and utilize their hands-on experience in the step-by-step modeling procedure (geometry, bathymetry, boundary conditions, forcing) needed to carry out a practical study with industry standard packages.

Textbook:

1. Knight D. & Sham Seldin A. (2010). River Basin Modelling for Flood Risk Mitigation. Taylor & Francis.
2. Singh V. P. &Frevert D. K. (2005). Watershed Models. CRC Press.
3. Cunge, J.A., Holly, F.M., Verwey, A. (1980). Practical Aspects of Computational River Hydraulics, Pitman, London, 420 pages [ISBN 0-273-08442-9]
4. Pinder, G.F., Gray, W.G. (1977). Finite Element Simulation in Surface and Subsurface Hydrology. Academic Press, New York, 295 pages [ISBN 01-25569505]

Reference Book:

1. Rodi, W. (1993). Turbulence Models and their Application in Hydraulics. IAHR Monograph, Balkema, The Netherlands, 116 pages [ISBN 90-5410-150-4]
2. Vreugdenhil, C.B. (1989). Computational Hydraulics: an Introduction. Berlin Springer, 182 p. + fig., ref
3. Vries, M. de (1993). Use of Models for River Problems. Studies and Reports in hydrology 51, UNESCO [ISBN 92-3-102861-8]

Prerequisites. Nil

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Mid Terms	30%
End Semester Exam	50%

Teaching Plan

Week No	Topics	Learning Outcomes
1-3	Application domains of Hydroinformatics: floods, urban systems and environment Introduction to floods and flooding. Introduction to urban floods and urban water systems. Introduction to environmental systems. Climate change and its impact on hydrology	Be conversant with flooding dynamics and use modern tools to manage floods
4-7	Environmental processes and water quality. Environmental processes. Water quality problems from a modeling point of view: outfalls, BOD-DO, eutrophication, toxic substances, best technical means approach, water quality objectives approach; Properties of the natural system from a modeling point of view, residence times, time scales of transport processes compared with those of water quality processes, spatial scales of phenomena, link between transport of substances and water quality processes.	Understand the environmental implications of flooding and assess it through water quality indices
8	Climate change problematic. Global, regional and local climate models, development of climate change	Understand the role and importance of Climate Change on rainfall-runoff

	scenarios. Effects of climate variability on the hydrology that affects rainfall-runoff processes in river-basins.	
9	**Mid Semester Exam**	
10-13	New data sources to support flood modeling. Introduction to new generation of data to support river flood modeling. Remote sensing, satellite and air-borne flood imagery, wireless sensors to assist inundation modeling, freely and globally available space -borne data to monitor floods.	Be proficient to use new data sources from satellite imagery to combat floods and limit its damages
14	Introduction to 1D2D, 2D Modeling Introduction to the basic principles of 1D2D and 2D modeling River Flood Modeling and 1D Flood Routing	
15-16	Nature and characteristics of floods: flood analysis – e.g. flood probability - probability and return period analysis of hydrological events and design floods - and estimation of peak flows (using Flood Estimation Handbook (FEH and ReFH) methods, catchment characteristics method, storm hydrographs and unit hydrograph methods. River Flooding Modeling: The significance of overbank flow, floodplain behaviour and stage discharge prediction (using the Ackers Method and Conveyance Estimate System);	Learn to apply proficiently latest flood modeling tools to manage floods

	Modeling flood propagation - flood routing; Hydrological methods – Muskingum, reservoir routing, HEC-HMS; 1D hydraulic flood routing/modeling in rivers; The Conveyance Estimate System; modeling resistance for discharge estimation; Introduction to 'HEC-RAS' software; Discussion of sustainable flood alleviation methods	
17-18	**End Semester Exam**	