

Design of Hydraulic Structures

Code CE-879	Credit Hours 3-0
-----------------------	----------------------------

Course Description

The students will be able to independently analyze and design the hydraulic structures (barrages, cross drainage works, drop structures, Dams and its components, energy dissipation arrangements) and understand the theory on which the design is based.

Text Book:

1. Technical Engineering and Design Guides as Adapted from the US Army Corps of Engineers, No. 12, Hydraulic Design of Spillways, ASCE Press, 1995
2. USBR, Design of Small Dams, Water Resources Technical Publication, 1974
3. Paul Novak, Eric Valentine & Paul Samuels, Hydraulic Modeling, Taylor & Francis, 2004
4. Barbara A. Hauser, Practical Hydraulics Handbook, Lewis Publishers Inc., 1991
5. ASCE Manuals and Reports on Engineering Practice No. 97, Hydraulic Modeling: Concepts and Practice, ASCE Press, 2000

Reference Book:

1. ASCE Manuals and Reports on Engineering Practice No. 79, Steel Penstocks, ASCE Press, 1993
2. ASCE, Civil Engineering Guidelines for Planning and Designing Hydroelectric Developments (Volume 2, 3, 5), ASCE Press, 1989
3. Iqbal Ali, Irrigation & Hydraulic Structures: Theory, Design and Practice, IEE, NED University, Karachi, 1993

Prerequisites

Nil

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Mid Terms	30%
ESE	50%

Teaching Plan

Week No	Topics	Learning Outcomes
1	Introduction	Introduction to course and course outline

2-3	Open Channel Hydraulics	Open channel hydraulics and theory of discharge measuring structures such as weir/notches, Concept of structure calibration, determination of discharge coefficient of different hydraulic structures (gated and ungated)
4-5	Seepage Theories	Seepage Theories and Design of Barrage
6-7	Design of Cross drainage works	Design of Cross drainage works – super passage, aqueduct, siphon, symphonic aqueduct, level crossing; Highway crossings: bridges culverts, and dips/ causeway, Drainage inlet for surface drains.
8	Classification of Dams	Planning and Classification of Dams and Introduction, theory, analysis (static and dynamic) and design of Concrete Gravity Dams
9	MID TERM EXAM	
10-11	Theory and design of drop structures/canal falls.	Theory and design of silt excluding structures, Theory and design of canal outlets.
12-14	Spillways	Selection of spillway layout, Inflow design flood hydrographs, Flood routing, Spillway size and type, Spillway Components, Spillway Types, Free over fall, Ogee, Side channel spillways, Labyrinth spillways, chute spillways, conduit and tunnel spillways, drop inlet, Baffled chute spillways, Culvert spillways. Spillway: Types, properties, and limitations, Hydraulic design of spillway, energy dissipation devices on and below the spillway. Hydraulic design of stilling basins. Dam outlets/tunnels: types, design, lining, bifurcations, energy dissipation, gates/valves, cavitation.
15-16	Hydraulics of Terminal Structures	Design of Deflector buckets, Hydraulic jump basins, basin design about Froude numbers, Rectangular versus trapezoidal stilling basin, Basin depths versus hydraulic heads, Tail water considerations, Stilling basin freeboard, Submerged bucket dissipators, Hydraulic-jump basins, Impact block type basins
17	Concepts of Powerhouse dimensioning	Concepts of Powerhouse dimensioning, layout of penstocks and surge intakes
	End Semester Exams	