

DAM AND RESERVOIR ENGINEERING

Code CE-845	Credit Hours 3-0
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Course Description

The overall objective of this course is to provide a thorough comprehension of the hydrological, hydraulic, and geotechnical principles that underpin dam engineering. Further, its focus is on discussing seepage control and counter measures, reservoir operation, instrumentation, and dam safety.

Textbook:

1. Iqtidar H. Siddiqui, Dams and Reservoirs: Planning, Engineering, Oxford University Press, 2008.
2. Tariq Ata-ur-Rehman, Dam and Reservoir Engineering, Centre of Excellence in Water Resources Engineering, Lahore, 2008.
3. Max Herzog (Ed.), Practical Dam Analysis, ASCE, Thomas Telford, 1999.
4. Technical Engineering and Design Guides as Adapted from the US Army Corps of Engineers, No. 12, Hydraulic Design of Spillways, ASCE Press, 1995.
5. Hirschfield, Embankment Dam Engineering: Casgrande Volume, John Wiley & Sons, 1973.

Reference Book:

1. V. P. Singh, Dam Breach Modeling Technology, Kluwer Academic, 1996.
2. P. Novak, A. Moffat, C. Nalluri & R. Narayanan, Hydraulic Structures, Taylor & Francis Group, 2001.
3. Technical Engineering and Design Guides as Adapted from the US Army Corps of Engineers, No. 27, Construction Control for Earth and Rockfill Dams, ASCE Press, 1999.
4. Technical Engineering and Design Guides as Adapted from the US Army Corps of Engineers, No. 26, Instrumentation of Embankment Dams and Levees, ASCE Press, 1999.
5. Karen Fisher & David Ramsbottom, River Diversions: A Design Guide, ASCE, Thomas Telford, 2001.
6. USBR, Design of Small Dams, Water Resources Technical Publication, 1974.
7. L. S. James, Earth Rock Dams: Problems of Design and Construction, John Wiley & Sons, 1963.

Prerequisites

Nil

ASSESSMENT SYSTEM FOR THEORY

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

Teaching Plan

Week No	Topics	Learning Outcomes
1	Dams, Types and Classification, Physical Characteristics of Reservoir, Preliminary Investigations for Site Selection, Components, Surveys, Layout. Watershed delineation	Introduction
2-3	Hydrological data, Catchment Water Yield; Reservoir Capacity Sizing, Ripple Mass Curve, Reservoir Operation; Spillway and Diversion Floods, Reservoir Routing.	Dam Hydrology
4	Estimation of Sediment Flow and Sediment Yield, Trap Efficiency, Deposition Distribution, Reservoir Life	Reservoir Sedimentation
5	Consolidation, Characteristics of Foundation, Rock Classification and Characteristics, Geologic Requirements, Dam Site Investigations, Foundation Treatment, Embankment Materials, Field & Lab Tests.	Dam Geology and Foundation
6-8	Force Analysis, Stability Requirements	Stresses in Dams
9	MID TERM EXAM	
10-12	Purpose and Types, Design Criteria, Types, Foundation Design, Seepage Analysis, Control and Mitigation, Embankment Design (Core, Crest, Free Board, Slopes, Materials, Filter, Slope Protection), Stability Analysis	Earth-fill Dam
13-14	Types, Embankment Design, Selection of Rock Materials, Foundation	Rock Filled Dam

	<p>Preparation, Seepage Control, Slope Protection, Stability Analysis. Concrete Dams: Loads, Gravity Dam-Dam Stability, Stress Analysis, Profile Selection; Arch Dam-Layout/Arch Geometry and Profile, Arch Stress Analysis, Thin or Thick Arch, Force Analysis, Abutment Strength; Buttress Dam-Buttress Analysis and Profile Design; Seepage Control. Concrete Face & Rock-fill Dam (CFRD) and RCC Dam, Project Layout, Stability analysis, Hydraulics and Seepage Control, Safety and Risk Assessment, Environmental and Social Impacts, Future Trends and Emerging Technologies.</p> <p>Embankments: Fundamental considerations, Embankment design, Seismic Design, Crest design, Zoning, Upstream slope protection, Rock riprap, Filters, Downstream slope protection, Surface drainage</p>	
15-16	<p>Design Flood, Design Discharge, Location, Energy Dissipation Arrangements. Outlet Works: Types, Tunnels-Design, Lining, Inlet, Trash Racks, Gates and Valves, Energy Dissipation.</p>	Spillways
17	<p>Layout of Tunnels, Headrace, Fore Bay, Penstock, Surge Tanks, Powerhouse, Forebay and Tail Race. Powerhouse Sizing. Dam Construction: River Diversion, Cofferdam.</p>	Hydropower works

	Dam Instrumentation and Safety: Failure-Causes, Controls, Inspection, Instrumentation	
18	End Semester Exams	