Design of Hydraulic Structures

01CI0711

Objective of the Course:

- To design hydraulic structures as an integrated part of water resources project
- To develop an understanding of the principles of design of earth dams, gravity dams, spillways, and energy dissipation devices.
- To understand site selection criteria for different types of dams.
- To know function of various hydraulic structure of irrigation project.

Credit Earned: 04

Prerequisite: Basics of Irrigation Engineering

Student's learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Select a suitable type of Dam and its site.
2. Compute various forces, and stresses acting on the gravity dam and check safety factors.
3. Locate the Phreatic line and carry out seepage analysis.
4. Design of Ogee and Chute spillway.
5. Explain various energy dissipation devices.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	01	00	04	50	30	20	25	25	150

Detailed Syllabus

Sr. No	Topic name	Hours
1	**Types of Dams and Site Exploration**	**04**
	1.1 Introduction and definition, Classification of Dam and Types of Dam	01
	1.2 Site section, merit, and demerits of the dam	01
	1.3 Subsurface exploration, Foundation treatment methods	02

2	**Gravity Dam**	**12**
	2.1 Definition, Forces Acting on Dam	02
	2.2 Causes of failures of Dam, Design criteria of a dam	02
	2.3 Principal and Shear stresses	02
	2.4 Stability analysis of Gravity dam	02
	2.5 Design of Gravity Dam	02
	2.6 Joints and Galleries in Dams	02
3	**Earth and Rock-fill Dams**	**12**
	3.1 Introduction and Definition, Classification of Non-Rigid Dam, causes of failure of earthen dam	02
	3.2 Preliminary profile of earth dam, construction materials	02
	3.3 Cutt off, Seepage control measure & drainage system	02
	3.4 Typical section, site selection, construction	02
	3.5 Stability analysis of slope and foundation	02
	3.6 Design consideration in Earthquake Region, Rock fill dams	02
4	**Spillways and Gates**	**08**
	4.1 Definition and types of spillway and components	02
	4.2 Design of ogee spillway	02
	4.3 Design of chute spillway	02
	4.4 spillway gates, aeration, and galleries	02
5	**Energy Dissipators**	**06**
	5.1 Energy Dissipation by Hydraulic Jump	02
	5.2 Location of a hydraulic jump, Design criteria for stilling basins, and their design	02
	5.3 IS standardized basin, various methods and design of ED	02
	TOTAL	**42**

List of Tutorials

Sr. No	Topic name
1	Site investigation & foundation treatment.
2	Compute different forces acting on gravity dam
3	Figure out principal and shear stresses
4	Design of concrete gravity dam-1
5	Design of concrete gravity dam-2
6	Stability analysis of concrete gravity dam
7	Primary cross section of earthen dam
8	Compute phreatic line in earthen dam
9	Stability Analysis for earthen dam
10	Design of ogee spillways-1
11	Design of ogee spillway-2

12	Design of chute spillway-1.
13	Design of chute spillway-2.
14	Methods of Energy Dissipation

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	20%	45%	10%	10%	10%

Instructional Method and Pedagogy:

1 Prerequisites of the course and its pattern shall be discussed at the commencement of the course.
2 Lectures shall be conducted in the classroom using various teaching aids.
3 Presence in all academic sessions is mandatory which shall carry 5% marks of the total internal evaluation.
4 A minimum of two internal exams will be conducted and an average of two will be considered as a part of a 15% overall evaluation.
5 At the end of each unit/topic, an assignment based on the course content shall be given to the students which shall carry 5% weightage for timely completion and submission of the assigned work.
6 The assignments/tutorials/technical visits are planned in such a way that they coverthe practical aspects of the course contents.

Recommended Study Material

1. Irrigation Engineering and Hydraulic Structures by S K Garg
2. Irrigation and Water Resources Engineering by G L Asawa
3. Irrigation Water Resources and Water Power Engineering by Dr. P. M. Modi
4. Theory and Design of Hydraulic Structures Vol. 1 and 2 by R. S. Varshney, S.C. Gupta, R.L. Gupta
5. Irrigation Engineering and Hydraulic Structures by S K Sharma
6. Irrigation Engineering and Hydraulic Structures by S R Sahasrabudhe
7. Irrigation Engineering and Hydraulic Structures by Dr. V C Agarwal
8. Irrigation and Water Power Engineering by Dr. B. C. Punamia

Web Links

1. https://eopcw.com/find/course/736/courses