

Branch Name:	CIVIL ENGINEERING
Program Code:	ET106
Course Title:	Design of Hydraulic Structures
Course Code:	2ET1060606T
Pre-requisite Course:	Basic Knowledge of Fluid Mechanics, Hydrology and Water Resources engineering and Irrigation Engineering

Course Objective:

CO-1: To study the fundamental concept, design and maintenance of hydraulic structures.

CO-2: To provide basic understanding of dam outlet works and drop structures.

CO-3: To understand the various energy dissipaters and hydraulic jumps.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	3	1	-	4	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	<u>Elementary Dam Engineering:</u> Introduction - Classification of dams, their merits and demerits - concrete and embankment dams characteristics - site selection of dam and selection of type of dam.	03	10
2	<u>Concrete Gravity Dam:</u> Definition - Forces acting on the Dam - Causes of failure of Dams - Design criteria for Gravity Dams, Principal and Shear stresses - elementary and practical profile of gravity dam - low and high gravity dam - Stability Analysis of a Gravity Dam + Design of Gravity Dams - joints and galleries in dam.	12	25
3	<u>Earth and Rock-fill Dam:</u> Introduction, definition and classification - Causes of failure of Earth dams - Design principles - Profile of an Earth Dam - Side slopes and Protection Measures for Earth Dams - Material and construction - Cut off and Seepage Control Measures - Drainage system - Typical Sections of Earth Dams - Selection of Dam section - Construction of Earth Dams - Phreatic line in earth dam - Stability analysis and stresses - Design of Earth Dams, Rock fill Dams.	12	25

4	<u>Dam outlet works:</u> Spillways and its types – Design of Ogee spillway - cavitation on spillway – design features - Design of a Chute spillways – plunge pools - Aeration Galleries - Spillway crest Gates - Sluices in dam	05	15
5	<u>Drop structure:</u> Sarda fall – Glacis fall –Design principles - Cross regulator, head regulator and their functions	05	15
6	<u>Energy Dissipators:</u> Energy Dissipation below Overflow Spillways - Energy Dissipation by Hydraulic Jump - Design criteria for Stilling Basins and their design - Various methods of Energy Dissipation and their design	05	10

List of Reference Books:

1. Irrigation Engineering and Hydraulic Structures by S R Sahasrabudhe
2. Irrigation Engineering and Hydraulic Structures by Dr. V C Agarwal
3. Irrigation and Water Power Engineering by Dr. B.C.Punamia,
4. Irrigation Engineering and Hydraulic Structures by S K Garg
5. Irrigation and Water Resources Engineering by G L Asawa
6. Irrigation Water Resources and water power Engineering by Dr.P.M.Modi
7. Theory and Design of Hydraulic Structures Vol. 1 and 2 by R.S.Varshney, S.C. Gupta, R.L. Gupta
8. Irrigation Engineering and Hydraulic Structures by S K Sharma
9. Irrigation and Hydraulic Structures: Theory, Design and Practice by Iqbal Ali
10. Hydraulic Engineering of Dams by Willi H. Hager, Robert M. Boes, Michael Pfister, Anton J. Schleiss
11. Hydraulics of Spillways and Energy Dissipators by Rajnikant M. Khatsuria

Course Outcome:

After successful completion of the course the students shall be able to:

1. Choose suitable type of Dam and its sites for construction.
2. Calculate forces, stresses on gravity dam and check various factor of safety against overturning, sliding and shear friction factor.
3. Locate phreatic line and carryout seepage and stability analysis of Embankment dam under various hydraulic conditions.
4. Design of an ogee spillway and a chute spillway.
5. Design canal fall and regulation works
6. Suggest suitable energy dissipation measures

Activities: Visit different hydraulic structures and submit the report to the institute.

E-Resources (If any):

<http://nptel.ac.in/>

Course Learning Outcomes (CLO):

After successful completion of the course the students shall be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Choose suitable type of Dam and its sites for construction.	
CLO2	Calculate forces, stresses on gravity dam and check various factor of safety against overturning, sliding and shear friction factor.	
CLO3	Locate phreatic line and carryout seepage and stability analysis of Embankment dam under various hydraulic conditions.	
CLO4	Design of an ogee spillway and a chute spillway.	
CLO5	Design canal fall and regulation works	
CLO6	Suggest suitable energy dissipation measures	

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO1															
CLO2															
CLO3															
CLO4															
CLO5															
CLO6															

H: High, M: Medium, L: Low