

Module (Course Syllabus) Catalogue 2025-2026

College/ Institute	Erbil Technical Engineering College	
Department	Civil Engineering	
Module Name	Hydraulic Structures	
Module Code	HYS 701	
Degree	Technical Diploma <input type="checkbox"/>	Bachelor <input checked="" type="checkbox"/>
	High Diploma <input type="checkbox"/>	Master <input type="checkbox"/> PhD
Semester	7 th	
Qualification	B.SC	
Scientific Title	Engineer	
ECTS (Credits)	6	
Module type	Prerequisite <input type="checkbox"/>	Core <input checked="" type="checkbox"/> Assist. <input type="checkbox"/>
Weekly hours	4 hrs	
Weekly hours (Theory)	(4) hrs. Class	(162) Total hrs. Workload
Weekly hours (Practical)	(0) hr. Class	(0) Total hrs. Workload
Number of Weeks	15	
Lecturer (Theory)	Assist. Prof. Basil Younus Mustafa; Lecturer Dr. Fahid Abbas Tofiq Assist. Lecturer Ali Dilshad Nooraldeen	
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Lecturer (Practical)	N/A	
E-Mail & Mobile NO.	N/A	
Websites	N/A	

Course Book

Course Description	<p>This course introduces the field of hydraulic structures. Students will apply fundamental hydraulic principles and engineering tools to analyze and design these structures. The curriculum covers the various forces acting on structures and provides a unified framework for designing main bodies, crossings, outlet works, energy dissipators, and diversion works.</p>
Course objectives	<p>The course introduces the fundamentals of hydraulic structures, providing final-year civil engineering students with essential knowledge of their design. It emphasizes applying basic hydraulic principles and engineering tools to analyze and design hydraulic structures in open channels and rivers. Through problem-solving assignments, students will develop practical skills and the ability to address real engineering challenges throughout the semester.</p>
Student's obligation	<ol style="list-style-type: none">1. Attendance & Participation: Attending class is crucial for understanding the course content and participating in discussions. Lectures will not be repeated for absent students.2. Monitoring Attendance: Unattended classes will be recorded, and the attendance list will be forwarded to the Department weekly/monthly.3. Submitting Work: Students are responsible for submitting all required assignments—including homework, reports, and seminars—on time and to a high standard of accuracy.
Required Learning Materials	<p>Teaching-learning materials (TLMs) encompass a wide range of resources. Primary types include digital media (videos, PowerPoint presentations, computers), printed texts (textbooks, books), and presentation tools like overhead projectors. Furthermore, supplementary reading materials—such as articles, reports, assignments, projects, newspapers, and magazines—provide additional context and depth.</p>

Evaluation	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
	Paper Review				
	Assignments	Homework	10%	4,6,10,11	1,2,3,4
		Class Activity	2%	1-12	1-4
		Report	8%	6	1,2,3,4
		Seminar	8%	10	1,2,3,4
		Essay			
		Project			
	Quiz		8%	4,6,8,11	1,2,3,4
	Lab.		N/A		
	Midterm Exam		24%	7-8	1-3
Final Exam		40%	13-15	1-4	
Total		100%			
Specific learning outcome:	<p>Upon successful completion of this course, students will be able to:</p> <p>1- Analyze and design hydraulic structures in compliance with relevant codes of practice, applying fundamental principles to determine energy losses and flow capacity.</p> <p>2- Design weirs, barrages, and associated headworks (including gates, wing walls, and fish ladders) for effective river water diversion into canals.</p> <p>3- Design hydraulic structures for canal and road crossings.</p> <p>4- Evaluate different types of dams and storage works and formulate basic planning proposals.</p>				
Course References:	<ul style="list-style-type: none"> ▪ Key references: <ol style="list-style-type: none"> 1- Theory and design of irrigation structures, II, by R.S. Varsheny & S.C. Gupta. 2- Irrigation & water power engineering, by B.C. Punma & Pande Lal. ▪ Useful references: <ol style="list-style-type: none"> 1- Small earth dams by USBR 2- Earth and earth rock fill dams, by James L. Sherard 				

Course topics (Theory)	Week	Learning Outcome
Ch 1: Introduction	1	1
Ch 2: Hydraulic structures on permeable foundation and seepage problems: Seepage, Causes of failure of hydraulic structures, Design of impervious floor for sub-surface flow.	2	1
Ch 3: Hydraulic Jump & Energy Dissipaters	3	1
Ch 4-1: Canal Head works. Barrage Design criteria.	4, &5	2
Ch 4-2: Design of Vertical Drop Weir	6	2
Ch 5: Canal Regulators: Design of Main Canal Head Regulator	7	2
Ch 6: Canal Crossing Structures: Design of Culverts	8, & 9	3
Ch 7: Storage Works, Reservoir planning, Dams and types of dams	10	4
Ch 8: Gravity dams, Forces acting on gravity dams, Stability requirement of gravity dams, and Elementary profile of a gravity dam	11, &12	4
Ch 9: Embankment dams, Earth dams or earth fill dams, Rock-fill dams.	13	4
Practical Topics N/A	Week	Learning Outcome

Questions Example Design

Ex. A vertical drop weir is to be designed on a river, having the following data: Design Q = 280 m³/s, HFL in the river before construction = 367m, pond level = 366.5 m, river bed level = 363.5 m, waterway width = 40m, allowable afflux =1m, silt factor (f) = 1, safe GE=1/5, retrogression = 0.5m, and the specific gravity of the concrete =2.24. Design, the crest wall level and dimensions.

Answer: q_{avg} (average discharge intensity) = $\frac{280}{40} = 7 \text{ m}^3/\text{s}/\text{m}$

Scour depth, R = $1.35 * \left(\frac{q_{avg}^2}{f}\right)^{\frac{1}{3}} = 1.35 * \left(\frac{7^2}{1}\right)^{\frac{1}{3}} = 4.94 \text{ m}$

and V = $\frac{q}{R} = \frac{7}{4.94} = 1.417 \text{ m}/\text{s}$, then $\frac{V^2}{2g} = \frac{1.417^2}{2*9.81} = 0.1 \text{ m}$

DS HFL = River HFL before construction = 367 m

US HFL = DS HFL + Afflux = 367+ 1 =368 m

$$\text{US TEL} = \text{US HFL} + \frac{v^2}{2g} = 368 + 0.1 = 368.1 \text{ m}$$

$$\text{DS TEL} = \text{DS HFL} + \frac{v^2}{2g} = 367 + 0.1 = 367.1 \text{ m}$$

$$\text{Actual DS HFL} = 367 - 0.5 = 366.5 \text{ m}$$

$$\text{US bed level} = \text{river bed level} = 363.5 \text{ m}$$

$$q = C H_e^{3/2} \Rightarrow \text{for weir } q_{\text{act}} = q_{\text{avg}} \Rightarrow 7 = 1.7 * H_e^{3/2} \Rightarrow H_e = 2.57 \text{ m}$$

$$\text{Crest level of the weir} = \text{US TEL} - H_e = 368.1 - 2.57 = 365.53 \text{ m}$$

$$\text{Pond level at US of the weir} = 366.5 \text{ m}$$

Pond level is higher than crest level of the weir this difference will be controlled by crest shutter:

$$\text{Height of crest shutter (S)} = \text{pond level} - \text{crest level} = 366.5 - 365.53 = 0.97 \text{ m}$$

$$\text{Height of weir crest wall (H)} = \text{crest level} - \text{US floor bed level} = 365.53 - 363.5 = 2.03 \text{ m}$$

Top width of the crest wall (a) will be the greatest of the followings

$$a = \frac{H_e}{\sqrt{G_s}} = \frac{2.57}{\sqrt{2.24}} = 1.717 \text{ m}$$

$$a = \frac{3 * 2.57}{2 * 2.24} = 1.721 \text{ m}$$

$$\text{and } a = S + 1 = 0.97 + 1 = 1.97 \text{ m}$$

Provide a = 2 m.

$$M_o = \frac{\gamma_w * d * H^2}{2}$$

$$d = \text{water head over crest} = \text{US HFL} - \text{Crest level} = 368 - 365.53 = 2.47 \text{ m}$$

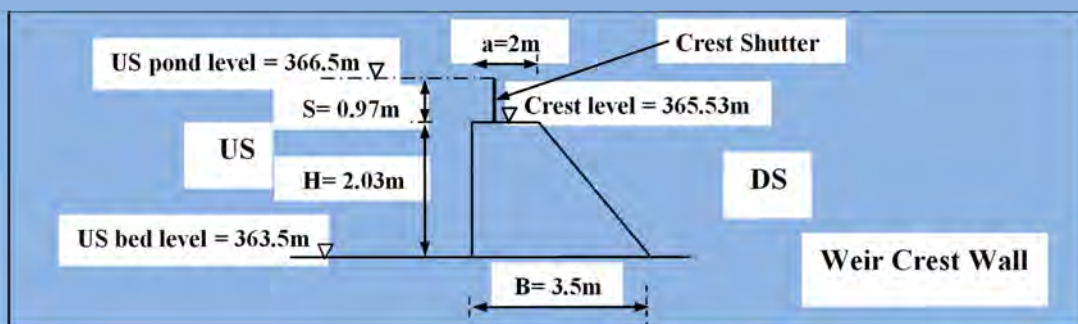
$$M_o = \frac{1 * 2.47 * 2.03^2}{2} = 5.089 \text{ tom. m}$$

$$M_r = \left\{ \frac{\gamma_w * H * (G_s - 1)}{6} \right\} * \{B^2 + a * B - a^2\} = \left\{ \frac{1 * 2.03 * (2.24 - 1)}{6} \right\} * \{B^2 + 2 * B - 2^2\}$$

$$M_r = 0.4195 \{B^2 + 2B - 4\}$$

$$M_o = M_r \Rightarrow 5.089 = 0.4195 \{B^2 + 2B - 4\}$$

$$B = 3.15 \text{ m, provide } B = 3.5 \text{ m}$$



Extra notes:

External Evaluator

I have reviewed the course book and syllabus and confirm they comprehensively cover the essential topics of Hydraulic Structures Design for fourth-year civil engineering students. The materials are approved.



Prof. Dr. Mereen Hassan Fahmi
Professor in Civil Engineering