THUY LOI UNIVERSITY
CIVIL ENGINEERING FACULTY
HYDRAULIC STRUCTURE DIVISION

SYLLABUS
Educated grade: Undergraduate

HYDRAULIC STRUCTURES DESIGN PROJECT
Code: CVEG4249

1. **Number of credits**: 5
2. **Class hours**: 14 weeks;
3. **Education program for:**

Optional course for Civil Engineering specialised in Water Resources Engineering, Hydraulic Engineering, Structural Engineering, Transportation Engineering, Geotechnical Engineering, Construction Management, Environmental Engineering.

4. **Assessment method**:

Form	No. of times	Description	Time	Weighted
Guidance	1	Continuous assessment of group work implementation on design project	14 weeks	percentage of the final grade
Reviewers	2	Two reviewers assess the design project		
Final examination	1	The examiner board assessment	40 minutes each student	The number of board marks the project

5. Prerequisite conditions:

- *Prerequisite class*: Hydrology, Hydraulic Engineering, Structural Analysis, Soil Mechanics.

- *Prior class*: Mechanics of material, Structural Materials, Reinforced concrete design

- *Parallel class:* Hydraulic systems, Foundation Engineering

- *Others:* None

6. Brief content:

Project will be conducted by 3- to 5-working-group. Academic advisers and students have to discuss to arrange work task to each member. The results include a A4-format report, minimum 3 drawings expressed in A1 or A1-expanded and 1 project recorded CD.

7. Teaching Staff:

No	Name	Academic degree	Phone	Email	Job title
1	Hồ Sỹ Tâm	Assoc. Prof. Dr.	0963725050	tamhs.cttl@tlu.edu.vn	Senior Lecturer, Head of division
2	Nguyễn Quang Hùng	Assoc. Prof. Dr.	0915091173	hungwuhan@tlu.edu.vn	Senior Lectureer, Vice head of division
3	Lê Xuân Khâm	Assoc. Prof. Dr.	0936133789	lexuankham@tlu.edu.vn	Senior Lecturer
4	Lê Thanh Hùng	Assoc. Prof. Dr.	0976712389	hungle@tlu.edu.vn	Senior Lecturer
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17	Lã Bá Thiết	MSc.	0918639935	lbthietcs2@tlu.edu.vn	Lecturer
18	Pham Ngọc Thịnh	Dr.	0947231186	thinhtls@tlu.edu.vn	Lecturer
19	Lê Trung Thành	MSc.	0987897878	letrungthanh@tlu.edu.vn	Lecturer
20	Trương Hồng Sơn	Dr.	0703301310	truonghongson@tlu.edu.vn	Lecturer
21	Trần Duy Quân	Dr.	0979569558	duyquan@tlu.edu.vn	Lecturer

8. Text books & Reference books

Text books:

Thiết kế đê và công trình bảo vệ bờ sông //Phạm Văn Quốc (chủ biên), Nguyễn Chiến. - Hà Nội ::Bách Khoa Hà Nội,,2018.[ISBN 9786049504433] (#000021748)

Reference books:

[1] Phạm Văn Giáp, Nguyễn Ngọc Huệ, Nguyễn Hữu Đẩu, Đinh Đình Trường – Bể cảng và đê chắn sóng. Nhà xuất bản xây dựng, Hà nội, 2000. (#000008306)

[3] TCVN 9902:2016 - Công trình thủy lợi – Yêu cầu thiết kế đê sông. (#000023159)

[4] TCVN 9901:2014 - Công trình thủy lợi – Yêu cầu thiết kế đê biển. (#000023158)

[5] TCVN 8419:2010 - Công trình thủy lợi – Thiết kế công trình bảo vệ bờ sông để chống lũ. (#000023146)

[6] Sổ tay kỹ thuật thuỷ lợi – Nhà xuất bản Nông nghiệp, Hà nội, 2004. (#000016683)

[7] Thuỷ công.Tập 1 //Ngô Trí Viềng chủ biên, Nguyễn Chiến...[và những người khác]. [Tài nguyên điện tử] - Hà Nội ::Xây dựng,,2004. (#000000825);

[8] Thuỷ công.Tập 2/Ngô Trí Viềng [chủ biên], Phạm Ngọc Quý...[và những người khác]. [Tài nguyên điện tử] - Hà Nội ::Xây dựng,,2005. (#000000833);

[9] Giới thiệu và cơ sở thiết kế công trình thủy lợi //Nguyễn Văn Mạo chủ biên, Nguyễn Cảnh Thái, Nguyễn Quang Hùng,..[và những người khác]. - Hà Nội ::Xây dựng,,2013. (#000016566);

[10] Bài giảng công trình trên hệ thống thủy lợi //Nguyễn Chiến, Phạm Ngọc Quý, Nguyễn Văn Mạo. - Hà Nội ::Khoa học tự nhiên và công nghệ,,2012. (#000014535);

[11] Dikes and Revetments design, maintenance and safety assessment //Krystian W.Pilarczyk ed;..[và những người khác]. - Netherlands ::A.A.Balkema Publishers,,1998. (#000018827)

9. Detailed content:

No.	Content (1)	Teaching & learning activities (2)	Hours		
			Theory	Exercise	Practice
1	**I. FUNDAMENTAL DATA** **1.1. Natural condition** - Geographical location, topographic features, geomorphology of site area, F~Z~V relations; - Meteorological and hydrological conditions: general meteorological features, rain regime, wind regime, temperatures, vapour at the site area, design annual flow, design flood, sediment, Q~Z relation at different headwork lines; - Geological conditions: + Overall geology of the area;	* Lecturer -Self introduction of lecturer - Introduction of syllabus, examination, text book…			1 week

	+ Geology of site area like reservoir hollow, headwork; - Hydrogeological conditions - The availability of construction materials: earth-fill, rock, sand, soil, distance to transport, exploitation condition, and other engineering properties of materials. **1.2. Economic condition and welfare of people** - The condition of economy and welfare of people; - The hydraulic status quo and the necessity of constructing the headwork; - The water master plan of this region; - The orientation of economy development; **1.3. Function of the structures:** general task of Hydraulic Structure Project.				
2	**II. ALTERNATIVES OF HEADWORK CONSTRUCTION** **2.1. Technical solution** **2.2. Structure grade and the design criteria** - Determine the structure grade; - Determine the design criteria; **2.3. The position of headwork lines:** Analysis to select one HS alignment. **2.4. Understand some HS parameters** - The dead water level (DWL) - The normal water level (NWL), the utility storage… - Having knowledge of flood regulation to determine design flood water level (DFL) and check flood water level (CFL). **2.5. Arrangement of headwork**: Analysis the conditions to select structure alignment and type of dam, spillway, culvert, hydropower	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) - Implement of the work			2 weeks

	plan, penstock, anti-landslide structure, sheet piling and other components.				
3	**III. TECHNICAL DESIGN OF HEADWORKS** ***3.1. FOR DESIGN PROJECT OF EARTH-FILL DAM*** **3.1.1 Dam design** - Determine the basic dimensions of dam; - Determine the basic structures of cut-offs for dam body and foundation and drainage components; - Seepage calculation: + Based on topography and geology choose several relevant sections (minimum 3 sections) to calculate the total seepage discharge (for NWL) + Calculate seepage at the highest section of the dam to check seepage stability and determine the position of the saturated line to count the overall stability (NWL, DFL, and CFL) - Stability check for the downstream slope at the most unfavourable cross-section (DFL); - Details of structures: slope protection, drainage component, foundation treatment, retaining wall, inspection galleries, grout curtain, anti-landslide embankment's components, sheet piles,…	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			6 weeks
4	**3.1.2 Chute spillway design** - Hydraulic calculation: required to determine with different ranks of discharge (at least 5 ranks) determine the water surface profile in the outlet channel and the energy dissipation structures; - Detail composition: Spillway crest, retaining wall, dissipation device, drainage filter,	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology.			

	transformational and operational bridges, gates and chute. - Stability of spillway: at least check the stability of 1 in 2 situations: + Spillway crest stability (gated-spillway); + Retaining wall stability of the spillway (for the most critical section);	- Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			
5	**3.1.3a Culvert design (hydraulic reservoir) – encouraged** - Functions and design parameters: Q, Z_{head} of channel, $Z_{sediment}$; - Hydraulic calculation for culvert; - Detail composition selection; **3.1.3b Energy line (for hydropower reservoir) – encouraged** - Composition of inlet structure and piping system - Hydraulic calculation of the inlet - Detail composition selection	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			
6	**SPECIAL SUBJECT** **3.1.4 Volume of the headwork calculation and the estimated cost** (with applying BIM design) **3.1.5 Construction diversion (compulsory for hydropower reservoir, stimulate for**	* Lecturer: - Lecturing - Query - Use practical images and problems			5 weeks

	students execute reservoir served for irrigation) – encouraged - Construction duration and the alternative of flow diversion over years - Hydraulic calculation for 1 alternative **3.1.6 Other content – encouraged** - Economical calculation - Environmental impact assessment	- Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			
7	***3.2. FOR DESIGN PROJECT OF GRAVITY CONCRETE DAM*** **3.2.1 Non-spillway concrete dam** - Concrete dam form: gravity concrete dam - Design the cross-section of concrete dam - Design the grout curtain; - Stability check for 2 load combinations: normal load combination (NLB) and extreme load combination (ELC); - Detail composition and placement of them: dam crest, draining gallery, dam segment, joint…	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			6 weeks
8	**3.2.2 Spillway**	* Lecturer: - Lecturing - Query			

	- Determine the real profile of spillway to fit to the concrete dam and the structure of the spillway - Hydraulic calculation: + Check the possibility of discharge through the outlet + Energy dissipation (minimum 5 ranks of discharge). If select the type of ski-jump spillway - Spillway stability calculation: for two load combinations + Normal load combination + Extreme load combination - Details of components	- Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			
9	**3.2.3a Culvert design (hydraulic reservoir) – encouraged** - Functions and design parameters: Q, Zhead of channel, Zsediment - Hydraulic calculation for culvert - Detail composition selection **3.2.3b Energy line (for hydropower reservoir) – encouraged** - Composition of inlet structure and piping system - Hydraulic calculation of the inlet - Detail composition selection	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			

10	**SPECIAL SUBJECT** **3.2.4 Volume of the headwork calculation and the estimated cost** (with applying BIM design) **3.2.5 Construction diversion (compulsory for hydropower reservoir, stimulate for students execute reservoir served for irrigation) – encouraged** - Construction duration and the alternative of flow diversion over years - Hydraulic calculation for 1 alternative **3.2.6 Other contents (encouraged)** - Economical calculation - Environmental impact assessment	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			5 weeks
	3.3. FOR DESIGN PROJECT OF DIKES AND SHORE PROTECTION STRUCTURES ***3.3.1 Fundamental data*** **3.3.1.1 Natural condition** - Geographical location, topographic features, geomorphology of site area, F~Z~V relations; - Meteorological and hydrological conditions: general meteorological features, rain regime, wind regime, temperatures, vapour at the site area, design annual flow, design flood, sediment, Q~Z relation at different headwork lines; - Geological conditions: + Overall geology of the area; + Geology of site area like reservoir hollow, headwork;	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary)			1 week

	- Hydrogeological conditions - The availability of construction materials: earth-fill, rock, sand, soil, distance to transport, exploitation condition, and other engineering properties of materials. **3.3.1.2 Economic condition and welfare of people** - The condition of economy and welfare of people; - The hydraulic status quo and the necessity of constructing the headwork; - The water master plan of this region; - The orientation of economy development; **3.3.1.3 Function of the structures:** general task of Hydraulic Structure Project.	Implement of the work			
11	**3.3.1 Dike design** - Determine the basic dimensions of Levee; - Determine the basic structures of Levee and drainage components; - Seepage calculation: + Based on topography and geology choose several relevant sections; + Calculate seepage at the highest section of the Levee to check seepage stability and determine the position of the saturated line to count the overall stability; - Stability check for the both sides of Levee at the most unfavourable cross-section; - Details of structures: slope protection, drainage component, foundation treatment, anti-landslide components, sheet piling, …	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			4 weeks

12	**3.3.2 Culvert design** - Functions and design parameters: Q, Z_{head} of channel, $Z_{sediment}$; - Hydraulic calculation for culvert; - Detail composition selection;				4 weeks
13	**3.3.3 SPECIAL SUBJECT** **3.3.3.1 Volume of the headwork calculation and the estimated cost** (with applying BIM design) **3.3.3.2 Construction technology – encouraged** - Construction duration and proper sheet piling technology; - Stability check; **3.3.3.3 Other content – encouraged** - Economical calculation - Environmental impact assessment				5 weeks
	3.4. FOR DESIGN PROJECT OF BARRIER SYSTEM ***3.4.1 Fundamental data*** **3.4.1.1 Natural condition** - Geographical location, topographic features, geomorphology of site area, F~Z~V relations; - Meteorological and hydrological conditions: general meteorological features, rain regime, wind regime, temperatures, vapour at the site area, design annual flow, design flood, sediment, Q~Z relation at different headwork lines; - Geological conditions: + Overall geology of the area; + Geology of site area like reservoir hollow, headwork; - Hydrogeological conditions	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary)			1 week

	- The availability of construction materials: earth-fill, rock, sand, soil, distance to transport, exploitation condition, and other engineering properties of materials. **3.4.1.2 Economic condition and welfare of people** - The condition of economy and welfare of people; - The hydraulic status quo and the necessity of constructing the headwork; - The water master plan of this region; - The orientation of economy development; **3.4.1.3 Function of the structures:** general task of Hydraulic Structure Project.	Implement of the work			
14	**3.4.2 Barrier design** - Determine the basic dimensions of Barrier; - Determine the basic structures of Barrier and construction method on soft ground; - Stability calculation: + Based on topography and geology choose several relevant sections; + Choose a reasonable type of piles on soft ground; - Stability check for the whole HS at the most unfavourable cross-section; - Details of structures: gated-weir; anti-landslide components, sheet piling, and others.	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			4 weeks
15	**3.4.3 Design pile construction on soft ground** - Technology selection; - Detail dimensions design of piles;				4 weeks

	- Stability check;				
16	**3.4.4 SPECIAL SUBJECT** **3.4.4.1 Volume of the headwork calculation and the estimated cost** (with applying BIM design) **3.4.4.2 Construction technology – encouraged** - Construction duration and proper sheet piling technology; - Stability check; **3.4.3 Other content – encouraged** - Economical calculation - Environmental impact assessment	* Lecturer: - Lecturing - Query - Use practical images and problems - Conveying experiences and study methodology. - Work assignment. * Student: - Answer queries - Problem solving - Question the course (if necessary) Implement of the work			5 weeks
	Total	45	28	15	2

(1) Detailed content for heading 2 of every chapter.

(2) Preparation work for students and teaching and learining activities

10. Learning outcomes:

No.	Learning outcomes of the course	Learning outcomes of corresponding education program (3)
1	Knowledge: - Practical and theoretical knowledge in structural designing, the design principles and calculation - Master the fundamentals relating to geotechnical engineering, hydrology, structural engineering, material engineering, construction management…	2,3,4,5

	- General knowledge on maintenance, operation and repairing structures	
2	Skills: - Capability to recognize many hydraulic structure types, structure design and calculation - Capability to propose and solve hydraulic structure problem (seepage calculation, loads and impacts, stability and strength). - Team work skills in data collection and structure design - Utilize modern software (CAD, MS office…)	7,8,10,11,12,13
3	Independent and responsible capability (if any):	14,16
4	Individual ethics for profession, society (if any): - Be moral, be conscience, be disciplinary, be responsible for works, community and society . - Master and implement the State and Party's policy - High responsibility in working and group work - Seriously implement the copy rights laws and intelectual possesion - Having acquisitiveness, striving to study and upgrade the degree, creativeness in specialisation.	14,15,16

(3) Learning outcomes of Corresponding Education Program was proposed by Head of specialisation.

11. Contacts

A. Address: Room 412 – Building A1, Thuy loi University

B. Head of division: *(responsible for answering the queries from students and related partners)*

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Hà Nội, Dated July, 26th 2021

DEAN **DEAN** **HEAD OF DIVISION**

(In charge of training specialisation) *(In charge of course)*