



## 58-Course Specification of Hydraulic Structures

I. Course Identification and General Information:					
1	Course Title:	<i>Hydraulic Structures</i>			
2	Course Code & Number:	CE 404			
3	Credit hours:	C.H			Credit Hours
		Th.	Tu.	Pr.	Tr.
		2	2		
4	Study level/ semester at which this course is offered:	5 <sup>th</sup> level / 1 <sup>st</sup> semester			
5	Pre –requisite (if any):	Fluid mechanics- Hydraulic- Irrigation Eng. – Hydrology			
6	Co –requisite (if any):	-----			
8	Program (s) in which the course is offered:	Civil <i>Engineering</i>			
9	Language of teaching the course:	English+ Arabic			
10	Location of teaching the course:	Classes and Lecture room			
11	Prepared By:	Dr. Zamzam Mubarak & Dr. Sharafaddin A. A. Saleh			
12	Date of Approval	Partially in 2014			

Prepared by Head of Department  
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## II. Course Description:

This course aims to apply knowledge and skills into the students in the principles and basics of design water structures for the purpose of irrigation-Network including the irrigation channels types and design methods, Design of dams and weirs, Environment Assessment for hydraulic structures (EIA) and dams-Environmental Impact, Protection works for dams, and road drainage planning and design (culvert and side channels design)

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a.1	Recognize applying mathematics and science for Hydraulics structures subject areas.	A <sub>1</sub>
a.2	Recognize the principles of design techniques related to Hydraulics structures subject.	A <sub>3</sub>
a.3	Show the role of the professional engineer in society, including safety, environmental issues, cultural heritage and traditional practices related to Hydraulics structures subject	A <sub>4</sub>
b.1	Identify the Hydraulics structures problems, and the design of dams and canal for irrigation project.	B <sub>1</sub>
b.2	Choose appropriate mathematical and computer-based methods for analyzing Hydraulics structures problems, and Solve and discuss the different types of problems	B <sub>2</sub>
b.3	Demonstrate proficiency in the evaluation and integration of information and processes in Hydraulics structures subject works.	B <sub>3</sub>
b.4	Consider the economic, social, and environmental issues as well as management in design of Hydraulics structures elements	B <sub>4</sub>
c.1	Design a Hydraulics structures systems, component, and process meeting codes, standards	C <sub>2</sub>
c.2	Investigate desired needs to solve Hydraulics structures subject problems in design of canals, dams, weirs, and road drainage structures	C <sub>2</sub>
c.3	Apply engineering techniques, modern tools, and software packages related to Hydraulics structures design and practical works.	C <sub>3</sub>
d.1	Communicate effectively using written, oral and graphical skills to clarify Hydraulics structures design works	D <sub>1</sub>

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<b>d. 2</b>	Work independently and in a team with realization of the importance of leadership of Hydraulics structures subject group work.	<b>D3</b>
<b>d. 3</b>	Ethical responsibility in conducting work	<b>D4</b>

<b>(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>a1.</b> Recognize the principles of design techniques related to Hydraulics structures subject.	Lecture Multimedia Presentations Tutorial, student's participation, Reading,	Assignment-students Presentations Written homework and short exam (quizzes)
<b>a2.</b> Explain the principles of design techniques related to Hydraulics structures subject.	Lecture Multimedia Presentations Tutorial, student's participation, Reading, and assessment	Assignment- students Presentations- Written homework and short exam (quizzes)
<b>a3.</b> Show the role of the professional engineer in society, including safety, environmental issues, cultural heritage and traditional practices related to Hydraulics structures subject	Lecture Multimedia Presentations Tutorial Reading Individual projects	Problem set- Written exam- Written assignment- individual and group assignment project- Written short exam (quizzes)

<b>(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>b1.</b> Identify the Hydraulics structures problems, and the design of dams and canal for irrigation project.	Lecture Tutorial & Reading Individual project for small group	Problem set – Assignment Participation and project Written exam

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<b>b2.</b> Choose appropriate mathematical and computer-based methods for analyzing Hydraulics structures problems, and Solve and discuss the different types of problems	Lecture Tutorial & Reading Individual project for small group	Problem set – Assignment Participation and project - Written exam
<b>b3.</b> Demonstrate proficiency in the evaluation and integration of information and processes in Hydraulics structures subject works	Lecture Tutorial & Reading Individual project for small group	Problem set – Assignment Participation and project - Written exam
<b>b4.</b> Consider the economic, social, and environmental issues as well as management in design of Hydraulics structures elements	Lecture Tutorial & Reading Individual project for small group	Problem set – Assignment Participation and project - Written exam

**C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>c1.</b> Design a Hydraulics structures systems, component, and process meeting codes, standards	Lecture Tutorial & Reading Individual project for small group	Problem set – Assignment Participation and project - Written exam
<b>c2.</b> Investigate desired needs to solve Hydraulics structures subject problems in design of canals, dams, weirs, and road drainage structures.	Lecture Tutorial & Reading Individual project for small group	Problem set – Assignment Participation and project - Written exam
<b>C3.</b> Apply engineering techniques, modern tools, and software packages related to Hydraulics structures design and practical works.	Lecture Tutorial & Reading Individual project for small group	Problem set – Assignment Participation and project - Written exam

**(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:**

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Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>d1.</b> Communicate effectively using written, oral and graphical skills to clarify Hydraulics structures design works, and develop creative thinking by defining their own methodologies for problem solution.	Lectures for small group Tutorials & Reading Interactive class Discussion Exercises and homework Problem set – assignment and students' presentation	Assignment, Student presentation, Participation- Individual and group assignment project
<b>d2.</b> Work independently and in a team with realization of the importance of leadership of Hydraulics structures subject group work.)	Lectures for small group Tutorials & Reading Interactive class Discussion Exercises and homework Problem set – assignment and students' presentation	Assignment, Student presentation, Participation- Individual and group assignment project
<b>d3.</b> <b>Commit to ethical</b> responsibility in conducting work	Lectures for small group Tutorials & Reading Interactive class Discussion Exercises and homework Problem set – assignment and students' presentation	Assignment, Student presentation, Participation- Individual and group assignment project

IV. Course Content:					
A – Theoretical Aspect:					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Introduction for hydraulics structures and the principles and basics of design water structures for the purpose of irrigation	a1, a3 ,b2, b3	The type hydraulics structures, economic, and the research and investigation for the selection of the appropriate location for the structures and the project execution.	1	2

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<b>IV. Course Content:</b>					
<b>A – Theoretical Aspect:</b>					
<b>Order</b>	<b>Units/Topics List</b>	<b>Learning Outcomes</b>	<b>Sub Topics List</b>	<b>Number of Weeks</b>	<b>contact hours</b>
<b>2</b>	Introducing Network of irrigation channels and their type	a1, a2,b1, b2, b3	Introducing the type and function of main, lateral, tertiary, sub-tertiary, farm and field canals.	1	2
<b>3</b>	Design of irrigation channel section	a1,a2,b1, b2,b3,b4, c1, c2, d1,d2	Kenndy and lacy theories, and design scour canals, non - scour canals and regime canals	3	6
<b>4</b>	Design dams' weirs	a1, a2,b1, b2, b3,b4, c1, c2, d1,d2	Design approach canal, weir body, stilling basin, down- stream canal, And hydraulic jump	1	2
<b>5</b>	Type of dams	a1, a2, b1, b2, b3, b4	Introducing type and function of dams	1	2
<b>6</b>	Design of dams (gravity and earth dams)	a1, a2, ,b1, b2, b3, b4, c2, c3, d1, d2	Design the body of the dam., spillway, canal intakes	3	6
<b>7</b>	Environmental Impact Assessment for hydraulic structures (EIA)	a1, a2, b1, b2, b3, d1, d2	Identify the Environmental Impact Assessment	1	2
<b>8</b>	Protection works of dams with main canal	a1, ,a2, b1, b2, b3, b4, c1, c2, d1,d2	Up -stream, downstream scouring, piping, seepage and uplift protection works	1	2
<b>9</b>	Road drainage (longitudinal canals, and culverts)	a1, ,a2,b1, b2, b3, b4, c1, c2, d1, d2	Introducing road drainage and design of culverts	2	4
<b>Number of Weeks /and Units Per Semester</b>				<b>14</b>	<b>28</b>

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<b>B – Tutorial Aspect:</b>				
<b>Order</b>	<b>Tasks/ Experiments</b>	<b>Number of Weeks</b>	<b>contact hours</b>	<b>Learning Outcomes</b>
<b>1</b>	Design of irrigation channel section	<b>2</b>	<b>4</b>	a1, a3,b1,b2, b3, b4, c1, c2, d1,d2
<b>2</b>	Design of weirs and settle basin	<b>2</b>	<b>4</b>	a1, a3,b1,b2, b3, b4, c1, c2, d1,d2
<b>3</b>	Design of dams (gravity and earth dams)	<b>4</b>	<b>8</b>	a1, a3,b1,b2, b3, b4, c1, c2, d1,d2
<b>4</b>	Protection works of dams with main canal	<b>1</b>	<b>2</b>	a1, a3,b1,b2, b3, b4, c1, c2, d1,d2
<b>5</b>	Design of road cross drainage (culvert)	<b>2</b>	<b>4</b>	a1, a3,b1,b2, b3, b4, c1, c2, d1,d2
<b>6</b>	Environmental Impact Assessment for hydraulic structures (EIA)	<b>1</b>	<b>2</b>	a1, a2, b3, b4, d1, d2
<b>6</b>	Small project	<b>2</b>	<b>4</b>	a1, a2, a3, b1, b2, b3, b4, c1, c2, d1, d2, d3
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>	

<b>V. Teaching strategies of the course:</b>
Lecture, Tutorial, student's participation, Reading, and assessment, Presentations, Multimedia Presentations, Reading and discussion, Field visit, and small Individual project Lectures for small group, Tutorials & Reading, Interactive class Discussion, Exercises and assignment and student's presentation.

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<b>VI. Assignments:</b>				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Design of irrigation channel section	a1, a2,a3, b1,b2, b3, b4, c1, c2, d1,d2	3	2.4
2	Design of weirs and settle basin	a1, a2,b1, b2, b3, b4, c1, c2, d1,d2	2	1.2
3	Design of dams (gravity and earth dams)	a1, a2, ,b1, b2, b3, b4, c1, c2, d1,d2	4	3
4	Protection works of dams with main canal	a1, ,a2,b1, b2, b3, b4, c1, c2, d1,d2	1	1.2
5	Design of road cross drainage (culvert)	a1, ,a2,b1, b2, b3, b4, c1, c2, d1, d2	2	1.8
6	Environmental Impact Assessment for hydraulic structures (EIA)	a1, a2, d1, d2	1	1.2
7	Small project	a1, a2,a3,c1,c2, b1, b2, b3, b4, d1,d2	2	1.2

<b>VII. Schedule of Assessment Tasks for Students During the Semester:</b>					
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Written assignment and quizzes	2 - 11	12	8%	a1,a2,a3,b1,b2,b3,b4, c1, c2, d1,d2, d4
2	Mid-term exam.	7 <sup>th</sup>	22.5	15%	a1,a2,a3,b1,b2,b3,b4, c1, c2, d1,d2, d4
3	Practical Exam, reports	12 <sup>th</sup>	10.5	7%	a1,a2,a3,b1,b2,b3,b4, c1, c2, d1,d2, d4
4	Final-exam.	15 <sup>th</sup>	105	70%	a1,a2,a3,b1,b2,b3,b4, c1, c2, d1,d2, d4
5	<b>Sum</b>		<b>150</b>	<b>100%</b>	

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## VIII. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

### 1- Required Textbook(s) (maximum two ).

1. الصندوق الاجتماعي للتنمية، "دليل تصميم السدود الصغيرة" (كتاب تطبيقي). صادر من الادارة العامة – وحدة المياه والبيئة - الصندوق الاجتماعي للتنمية 2007
2. P. Novak, A.I.B. Moffat, C. Nalluri, and R. Narayanam, (2007) "Hydraulic Structures, Fourth Edition", London and New York 2007.
3. وزارة الشؤون البلدية والقروية " دليل تصميم العبارات 2013" المملكة العربية السعودية 2013
4. Dr. Sharafadden and Dr. Taha 2006 "Lecture notes of hydraulic structures". College of Engineering – Sana'a University 2006.

### 2- Essential References.

- 1- الصندوق الاجتماعي للتنمية، "دليل تصميم السدود الصغيرة" (كتاب تطبيقي). صادر من الادارة العامة – وحدة المياه والبيئة - الصندوق الاجتماعي للتنمية 2007
- 2- ميخائيل جورج وكيل 1992، "المنشآت المائية (1. المنشآت المائية، 2. السدود)" ز جامعة حلب- كلية الهندسة المدنية- مديرية الكتب والمطبوعات- الجمهورية السورية (1991-1992)
- 3- احمد الهاييتي 2007، " تصميم وسلامة السدود الترابية – محاضرات". كلية الهندسة - جامعة الانبار- الجمهورية العراقية (2007)
- 4- Munson,B. R., Young, D. F and Okiishi, T. H. (1990), "Fundamentals of Fluid Mechanics", John Wiley & Sons, New York, 3rd ed. 1998.
- 5- P. Novak, A.I.B. Moffat, C. Nalluri, and R. Narayanam, (2007) "Hydraulic Structures, Fourth Edition", London and New York 2007.
- 6- وزارة الشؤون البلدية والقروية " دليل تصميم العبارات 2013" المملكة العربية السعودية 2013
- 7- Jerome M. Norman and others "Hydraulic Design of Highway Culverts (HDS5), 1985. Jerome M. Norman and Associates, Norfolk Va 23503, 1985.
- 8- Dr. Sharafadden and Dr. Taha 2006 "Lecture notes of hydraulic structures". College of Engineering – Sana'a University 2006.

### 3- Electronic Materials and Web Sites etc.

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<b>IX. Course Policies:</b>	
<b>1</b>	<b>Class Attendance:</b> The students should have more than 75 % of attendance according to rules and regulations of the faculty.
<b>2</b>	<b>Tardy:</b> The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.
<b>3</b>	<b>Exam Attendance/Punctuality:</b> The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for mid-term exam and final exam.
<b>4</b>	<b>Assignments &amp; Projects:</b> The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
<b>5</b>	<b>Cheating:</b> If any cheating occurred during the examination, the student is not allowed to continue and he has to face the examination committee for investigation and punishment according to the faculty rules
<b>6</b>	<b>Plagiarism:</b> The student will be terminated from the Faculty, if one student attend the exam on another behalf according to the policy, rules and regulations of the university.
<b>7</b>	<b>Other policies:</b> - All the teaching materials should be kept out the examination hall. - The mobile phone is not allowed. - There should be a respect between the student and his teacher.

<b>Reviewed By</b>	<b><u>Vice Dean for Academic Affairs and Post Graduate Studies</u></b> <b><u>Dr. Tarek A. Barakat</u></b> <b><u>Dr. Mohammad Algorafi</u></b>
	<b><u>Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa</u></b> <b><u>Dr. Ahmed mujahed</u></b> <b><u>Dr. Munaser Alsubri</u></b>

## **Template for Course Plan (Hydraulic Structures)**

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I- Information about Faculty Member Responsible for the Course:						
Name of Faculty Member	Dr. Sharafaddin A. Saleh Dr. Zamzam Mubarak		Office Hours			
Location & Telephone No.	Civil Eng. Department 777665575 774229900		SAT	SUN	MON	TUE
E-mail	Sharaf1960s@gmail.com Zamzam_mubarak@yahoo.com					8-10 Am
						10-12 Am

II- Course Identification and General Information:					
1-	Course Title:	Hydraulic Structures			
2-	Course Number & Code:	CE 404			
3-	Credit hours:	C.H			
		Th.	Tu.	Pr.	Tr.
		2	2		
4-	Study level/year at which this course is offered:	5 <sup>th</sup> level / 1 <sup>st</sup> semester			
5-	Pre –requisite (if any):	Fluid Mechanics, Hydraulic, Irrigation Eng. And Hydrology			
6-	Co –requisite (if any):	.....			
7-	Program (s) in which the course is offered	Civil Engineering			
8-	Language of teaching the course:	English+ Arabic			
9-	System of Study:	Attending class (Regular)			
10-	Mode of delivery:	Lecture			
11-	Location of teaching the course:	Class			

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### III- Course Description:

This course aims to apply knowledge and skills into students in the principles and basics of design water structures for the purpose of irrigation-Network including the irrigation channels types and design methods, Design of dams and weirs, Assessment for hydraulic structures (EIA) and dams-Environmental Impact, Protection works for dams with main, and road drainage planning and design (culvert and side channels design)

### IV- Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:
  - a.1 Recognize applying mathematics and science for Hydraulics structures subject areas. A1
  - a.2 Recognize the principles of design techniques related to Hydraulics structures subject. A3
  - a.3 Show the role of the professional engineer in society, including safety, environmental issues, cultural heritage and traditional practices related to Hydraulics structures subject A4
  - b.1 Identify the Hydraulics structures problems, and the design of dams and canal for irrigation project. B1
  - b.2 Choose appropriate mathematical and computer-based methods for analyzing Hydraulics structures problems, and Solve and discuss the different types of problems B2
  - b.3 Demonstrate proficiency in the evaluation and integration of information and processes in Hydraulics structures subject works. B3
  - b.4 Consider the economic, social, and environmental issues as well as management in design of Hydraulics structures elements B4
  - c.1 Design a Hydraulics structures systems, component, and process meeting codes, standard C2
  - c.2 **Investigate** desired needs to solve Hydraulics structures subject problems in design of canals, dams, weirs, and road drainage structures C2
  - c.3 Apply engineering techniques, modern tools, and software packages related to Hydraulics structures design and practical works. C3
  - d.1 Communicate effectively using written, oral and graphical skills to clarify Hydraulics structures design works D1
  - d.2 Work independently and in a team with realization of the importance of leadership of Hydraulics structures subject group work. D 3
  - d.3 **Commit to ethical** responsibility in conducting work D4

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V. Course Content:				
● Distribution of Semester Weekly Plan of Course Topics/Items and Activities.				
A – Theoretical Aspect:				
Order	Topics List	Sub Topics List	Week Due	Contact Hours
1	Introduction for hydraulics structures and the principles and basics of design water structures for the purpose of irrigation	The type hydraulics structures, economic, and the research and investigation for the selection of the appropriate location for the structures and the project execution.	1	2
2	Introducing network of irrigation channels and their type	Introducing the type and function of main, lateral, tertiary, sub-tertiary, farm and field canals.	2	2
3	Design of irrigation channel section	Kennedy and Lacey theories, and design scour canals, non - scour canals and regime canals	3 - 5	6
4	Design dams' weirs	Design approach canal, weir body, stilling basin, down- stream canal, And hydraulic jump	6	2
5	Type of dams	Introducing type and function of dams	7	2
6	Midterm Exam		8	
7	Design of dams (gravity and earth dams)	Design the body of the dam., spillway, canal intakes	9,10,11	6
8	Environmental Impact Assessment for hydraulic structures (EIA)	Identify the Environmental Impact Assessment	12	2
9	Protection works of dams with main canal	Up -stream, downstream scouring, piping, seepage and uplift protection works	13	2
10	Road drainage structure	Introducing road drainage and design of culverts	14,15	4
11	Final Exam		16	2
Number of Weeks /and Units Per Semester			16	32

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<b>B – Tutorial Aspect:</b>			
<b>Order</b>	<b>Topics List</b>	<b>Week Due</b>	<b>Contact Hours</b>
1	Design of irrigation channel section	3 & 5	6
2	Design of weirs and settle basin	6	4
3	Design of dams (gravity and earth dams)	8-10	6
4	Protection works of dams with main canal	12	2
5	Design of road cross drainage (culvert)	13&14	4
6	Small project	11 to 13	6
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>

<b>VI. Teaching strategies of the course:</b>
<p>Lecturing, Tutorial, student's participation, Reading, and assessment</p> <p>Presentations, Multimedia Presentations</p> <p>Reading and discussion, Field visit, and small Individual project</p> <p>Multimedia Presentations</p> <p>Lectures for small group, Tutorials &amp; Reading, Interactive class Discussion</p> <p>Exercises and assignment and student's presentation</p>

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VII. Assignments:				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Design of irrigation channel section	a1, a2,a3, b1,b2, b3, b4, c1, c2, d1,d2	3	2.4
2	Design of weirs and settle basin	a1, a2,a3, b1,b2, b3, b4, c1, c2, d1,d2	2	1.2
3	Design of dams (gravity and earth dams)	a1, a2,a3, b1,b2, b3, b4, c1, c2, d1,d2	4	3
4	Protection works of dams with main canal	a1, a2,a3, b1,b2, b3, b4, c1, c2, d1,d2	1	1.2
5	Design of road cross drainage (culvert)	a1, a2,a3, b1,b2, b3, b4, c1, c2, d1,d2	2	1.8
6	Environmental Impact Assessment for hydraulic structures (EIA)	a1, a2, b1, b2, d1, d2	2	1.2
7	Small project	a1, a2,a3, b1,b2, b3, b4, c1, c2, d1,d2, d4	2	1.2

VIII. Schedule of Assessment Tasks for Students During the Semester:				
Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Assessment Method	Week Due	Mark	Proportion of Final Assessment
2	Written assignment and quizzes	2 - 11	12	8%
3	Mid-term exam.	7 <sup>th</sup>	22.5	15%
4	Practical Exam, reports	12 <sup>th</sup>	10.5	7%
5	Final-exam.	15 <sup>th</sup>	105	70%
6	Sum		150	100

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## IX. Learning Resources:

• Written in the following order: (Author – Year of publication – Title – Edition – Place of publication – Publisher).

### 1- Required Textbook(s) (maximum two ).

1. دليل تصميم السدود الصغيرة (كتاب تطبيقي) صادر من الصندوق الاجتماعي للتنمية 2007
2. وكالة الشؤون الفنية - وزارة الشؤون البلدية والقروية 213، " دليل تصميم العبارات MA100CM 2013". المملكة العربية السعودية 2013
3. P. Novak, A.I.B. Moffat, C. Nalluri, and R. Narayanam, (2007) "Hydraulic Structures, Fourth Edition", London and New York 2007.
4. Dr. Sharafadden and Dr. Taha 2006 "lecture notes of hydraulic structures". College of Engineering – Sana'a University 2006.

### 1- Essential References.

1. الصندوق الاجتماعي للتنمية، "دليل تصميم السدود الصغيرة" (كتاب تطبيقي). صادر من الادارة العامة – وحدة المياه والبيئة - الصندوق الاجتماعي للتنمية 2007
2. ميخائيل جورج وكيل 1992، "المنشآت المائية (1). المنشآت المائية، 2. السدود" ز جامعة حلب- كلية الهندسة المدنية- مديرية الكتب والمطبوعات- الجمهورية السورية (1991-1992)
3. احمد الهايتي 2007، " تصميم وسلامة السدود الترابية – محاضرات". كلية الهندسة - جامعة الانبار- الجمهورية العراقية (2007, 1990), Munson, B. R., Young, D. F and Okiishi, T. H. (1990), 2007 "Fundamentals of Fluid Mechanics", John Wiley & Sons, New York, 3rd ed. 1998.
4. P. Novak, A.I.B. Moffat, C. Nalluri, and R. Narayanam, (2007) "Hydraulic Structures, Fourth Edition", London and New York 2007.
5. وزارة الشؤون البلدية والقروية " دليل تصميم العبارات 2013" المملكة العربية السعودية 2013
6. Jerome M. Norman and others "Hydraulic Design of Highway Culverts (HDS5), 1985. Jerome M. Norman and Associates, Norfolk Va 23503, 1985.
7. Dr. Sharafadden and Dr. Taha 2006 "Lecture notes of hydraulic structures". College of Engineering – Sana'a University 2006.

### 3- Electronic Materials and Web Sites etc.

## X. Course Policies:

Unless otherwise stated, the normal course administration policies and rules of the Faculty of ----- apply. For the policy, see: -----

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1	<b>Class Attendance:</b> The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2	<b>Tardy:</b> The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.
3	<b>Exam Attendance/Punctuality:</b> The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for mid-term exam and final exam.
4	<b>Assignments &amp; Projects:</b> The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5	<b>Cheating:</b> If any cheating occurred during the examination, the student is not allowed to continue and he has to face the examination committee for investigation and punishment according to the faculty rules
6	<b>Plagiarism:</b> The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7	<b>Other policies:</b> - All the teaching materials should be kept out the examination hall. - The mobile phone is not allowed. - There should be a respect between the student and his teacher.

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