Sultan Qaboos University
College of Engineering

COURSE OUTLINE

Course Code and Title:	CIVL 4146 Hydraulics
Instructor:	Dr. Ahmad Sana
Section	10/11
Lecture Time	Mon. 8:00-9:50 (Sec. 10), Wed. 8:00-9:50 (Sec. 11)
Place	CMT/A11
Office Hours	Sun. to Wed. 10:00-12:50
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1. Catalog Course Description

This intermediate course aims to teach the design principles for engineering water works such as pipelines, open channels and turbomachinery. Lectures are supplemented by class tutorials and computer laboratory work.

2. Required Background:

Prerequisites by course: CIVL 4046, MATH 4174

Prerequisites by topic:

Fundamentals of algebra and arithmetic, basic principles of physics, principles of basic engineering mechanics and basic principles of fluid mechanics.

Post-requisites: None

Equivalent Courses: None

3. Textbook & Suplemental Materials:

Textbook:

Fundamentals of Hydraulic Engineering Systems by N. H. C. Hwang and R. J. Houghtalen, 4th Ed., Prentice-Hall.

Supplemental Materials:

1. Engineering Fluid Mechanics by Crowe, Elger and Roberson, 7th Ed., John Wiley, 1997.
2. Handouts

Lecture Notes: Can be downloaded from http://ahmadsana.tripod.com

4. Course Objectives (to be linked to program outcomes):

The objectives of this course are to give the student a fundamental knowledge of:

1. Calculating friction (major) loss and minor losses in pipelines and their measurements in the laboratory
2. Designing pump-pipeline systems
3. Using Solver in MS-Excel, EPANET and WaterCAD to analyze pipe networks
4. Calculating water hammer pressure due to rapid and slow valve closures.
5. Calculating and measuring water level rise in surge tanks due to water hammer
6. Differentiating between types of pumps
7. Using velocity diagrams, pump curves and similarity principles
8. Analyzing and designing of open channels
9. Calculating water surface profiles in open channels
10. Designing open channels

5. Course Outcomes:

Upon the successful completion of this course, students are expected to develop the following skills/understanding (letters in parentheses denote the program outcomes):

1. Ability to calculate major and minor losses in pipelines **[a]**
2. Ability to use laboratory equipment to measure major and minor losses in pipelines **[k]**
3. Ability to analyze and design pipe networks manually and with the help of computer. **[a,c,e,k]**
4. Ability to calculate water hammer pressure in pipelines due to rapid and slow valve closure. **[a,c]**
5. Ability to calculate and measure water level in surge tanks due to water hammer. **[a,c,e,k]**
6. Differentiate among various types of pumps and apply pump curves and similarity principles for pumps. **[a,e]**
7. Determine the pump properties experimentally when they are connected in series and parallel **[a,c,k]**
8. Ability to calculate discharge carrying capacity of open channels **[a, e]**
9. Ability to calculate water surface profiles in open channels manually and with the help of computer **[a, e, k]**
10. Ability to design lined open channels **[a, c]**

6. Course Contents:

The following topics will be covered in this course:

No.	Topic
1.	Water flow in pipes: Pipe flow, Reynolds number, forces in pipe flow, Bernoulli's equation and its applications, friction loss, minor losses.
2.	Pipelines and pipe networks: Pipelines connecting two reservoirs, Siphons, pipelines with pumps, branching pipe systems, pipe networks, water hammer and surge tanks, Using Solver in MS-Excel, EPANET and

WaterCAD to analyze pipe networks.

3. Water Pumps: Centrifugal pumps, Propeller pumps, Mixed flow pumps, Selection of a pump, Pumps in parallel or in series, Cavitation, Specific speed and pump similarity.
4. Water flow in open channels: Classification of open channel flow, uniform flow, energy principles, gradually varied flow and classifications, computation of water surface profiles, Design of lined open channels.

7. Instructional Methods:

Lectures presentation, Tutorial problems, Laboratory experiments

8. Course Assessment:

The degree of student achievement in this course will be assessed as follows:

1. Design Projects [15%]
2. Quizzes [15%]
3. Laboratory Reports [10%]
4. Mid-Term Examination [20%]
5. Final examination [40%]

9. Student Responsibilities

The student is referred to the Undergraduate University Regulations for more details on the following topics:

- Group work: Students are encouraged to work together on homework problems, but all the work submitted must be the student's own work.
- Attendance: In accordance with the University Regulations, it is the student's responsibility to be punctual and to attend all classes.
- Academic misconduct: academic misconduct is defined as the use of any dishonest or deceitful means to gain academic advantage or benefit.

10. Professional Contribution:

This is a core course that has the goal of developing the understanding and skills in the subject of hydraulics for use in Civil Engineering applications. It is a three-credit hours course on Engineering Topics.

11. Useful Sites:

The following links may be useful:

Check your learning style from this website:
http://www.personal.psu.edu/bxb11/LSI/LSI.htm

A nice introduction to fluid mechanics and hydraulics:

http://www.youtube.com/watch?v=lfXDJKKPGfY&feature=related

A number of videos about fluid mechanics and hydraulics:
http://web.mit.edu/hml/ncfmf.html

A very useful website for online calculations for open channels
http://ponce.tv/online_channel_hydraulics.php

12. Weekly Teaching Schedule:

Week	Date	Material to be Covered	Design Project	Quiz	Test
1.	23/09/13				
	25/09/13				
2.	30/09/13				
	02/10/13	Course outline and Introduction			
3.	07/10/13	Water flow in pipes: Bernoulli's equation			
	09/10/13	Friction loss calculations	1		
4.	14/10/13	Friction loss calculations			
	16/10/13	Minor losses in pipes			
5.	21/10/13	Minor losses in pipes		**1**	
	23/10/13	Pipelines and pipe networks			
6.	28/10/13	Pipelines connecting two reservoirs			
	30/10/13	Siphons, pipelines with pumps			
7.	04/11/13	Branching pipe systems, pipe networks			
	06/11/13	Water hammer and surge tanks			
8.	11/11/13	Using EPANET to analyze pipe networks.	2		
	13/11/13	Types of water Pumps		**2**	
9.	18/11/13	Propeller pumps, Mixed flow pumps			
	20/11/13	Velocity diagrams for centifugal pumps			
10.	25/11/13	**Mid-Term Examination**			**1**
	27/11/13	Pump-pipeline systems			
11.	02/12/13	Pumps in parallel or in series			
	04/12/13	Cavitation			
12.	09/12/13	Specific speed and pump similarity			
	11/12/13	Water flow in open channels			
13.	16/12/13	Uniform flow, energy principles	3	**3**	
	18/12/13	Uniform flow, energy principles			
14.	23/12/13	Gradually varied flow and classifications			
	25/12/13	Gradually varied flow and classifications			
15.	30/12/13	Computation of water surface profiles			
	01/01/14	Computation of water surface profiles			
16.	06/01/14	Design of lined open channels			
	08/01/14	Design of lined open channels		**4**	
		Final Examination **18/01/2014, SAT. 08:00-11:00**			**2**

Note: Schedule is subject to change. Any changes will be announced during the semester.