WATER WORKS, WATERSUPPLY

Hydrogeology Msc Program

2018/19 2nd semester

COURSE SYLLABUS

University of Miskolc
Faculty of Earth Science and Engineering
Institute of Environmental Management

Content

1. Course description, details

Course Title: Waterworks, water supply **Instructor:** Dr. Tamás Madarász PhD, associate professor Gábor Nyiri, PhD student	**Code:** MFKHT720027 **Responsible department/institute:** Institute of Environmental Management Type of course: Compulsory
Position in curriculum (which semester): 2	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 3	**Course:** full time

Course Description:
The students will be familiar with the basic elements of modern waterworks and water supply. Based on a sample network design, the students will be able to design the necessary parts of a working waterworks plant as well as pipe system of the water distribution system.
The short curriculum of the subject:
The estimation and calculation of the water demand. Water demand for the fireflow. The measurement of the water loss in the supply system. Requirements concerning the water quality. Pumps, pipes, water towers and their hydraulics. The principal assignments of this subject are the design and management calculations of a water distribution network. The class shall be guided through the protocol of designing a simple water distribution network. Minor separate assignments may be given to the class. The individual project progress shall be discussed on during the class meetings. The principle assignment submission deadline is the last course meeting. Written submissions (drawings, reports, etc) are to emphasize clarity and legibility. Competencies to evolve:
Knowledge: T1, T2, T4, T5, T8
Ability: K1, K4, K5, K6, K8, K10, K11, K13, K14, K15
Attitude: A1, A2, A3, A4, A5, A6, A7, A8, A9
Autonomy and responsibility: F1, F2, F3, F4, F5, F6

Assessment and grading:
Students will be assessed with using the following elements.

Attendance:	10 %
Mid term exam	50 %
Assignment reports	40 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Compulsory or recommended literature resources:

- HAESTAD Methods Advanced water distribution modeling and management http://systemssolution.net/cadtechno/0%20SAMPLE/SPECs%20&%20DETAILS/BOOKS%20MECHANICAL/PLUMBING/WATER%20DISTRIBUTION%20MODELING.pdf
- Avi Ostfeld: Water Supply System Analysis, ISBN 978-953-51-0889-4, InTech, 2012.
- Beckwith S., Chase D. V., Garyman W., Koelle E.,Savic D., Walski T. M.: Advanced water distribution modeling and management, Bentley Institute Press, 2007.
- R. M. Clark, S. Hakim, A. Ostfeld: Handbook of Water and Wastewater Systems Protection, e-ISBN 978-1-4614-0189-6, Springer, 2011.

- D. D. Ratnayaka, M. J. Brandt, K. M. Johnson: Twort's Water Supply, ISBN: 978-0-7506-6843-9 Elsevier, 2009
- Swamee P. K., Sharma A. K.: Design of water supply pipe networks, Wiley-Interscience, 2008.

2. Course syllabus

Waterworks, Watersupply.
Course syllabus
2018/2019. II. semester
Hydrogeology MSc

Course syllabus: Waterworks and water supply (MFKHT720027)
Instructor: Tamás Madarász PhD, lecturer
Assistants: Gábor Nyiri, PhD student; Hoang Ding Thien, PhD student
contact: hgmt@uni-miskolc.hu

Course meeting time and room
Thursday 8 am; venue: Building C/2, room 111

Educational tools
Lectures, practical experience, individual assignments, student presentations.
Contact classes appr. 65%

Assignments
The principal assignments of this subject are the design and management calculations of a water distribution network. The class shall be guided through some elements of designing a simple water distribution network components. The individual project progress shall be discussed during the class meetings. The assignment submission deadline shall be announced with each assignments. Written submissions (drawings, reports, etc) are to emphasize clarity and legibility. They are to be submitted as hard copy unless otherwise indicated. During the semester one written test is scheduled, which must be completed at a minimum level of grade 2.

Main Course literature:
- HAESTAD Methods Advanced water distribution modeling and management; http://systemssolution.net/cadtechno/0%20SAMPLE/SPECs%20&%20DETAILS/BOOKS%20MECHANICAL/PLUMBING/WATER%20DISTRIBUTION%20MODELING.pdf
- Course notes, presentations, handouts

Grading
Grades will be based on assignments, test and participation performance. Participation comprises attendance and attitude in class. Oral exam - only when requested by instructor or student.
Overall weighting will be as follows:

ACTIVITIES	PERCENTAGES
Assignment reports	40%
Written tests/exams	50% (both tests must meet minimum criteria)
Participation — attendance, attitude	10%

Course schedule plan:

Date	planned topic	Materials and Assignment
February 14	Introduction of course material, syllabus	Water demand, source, technology, price, Homework assignment 1
February 21	Student presentation on homework assignment	
February 28	Introduction to water distribution network; physical principles (G. Nyiri)	Course material Chapter 2.
March 7	Water consumption, water demand (G. Nyiri)	Course material Chapter 4.
March 14	Drinking water network components 1. pipes, reservoirs, valves, hydrants	Course material Chapter 3 Homework assignment 3
March 21	Seminar on reservoir design	Homework assignment 2.
March 28	MidTerm test	
April 4	Drinking water network components 2. meters and pumps - principles, types, pump selection	Course material Chapter 3+ Homework assignment 3
April 11	Network operation characteristics	
April 18	Seminar on pipe network	Homework assignment 4
April 25	Methods reducing NRW; Leakage detection (Thien.H)	Lecture slides + handout material
May 2	Leakage detection – field work (Thien H. Zs. Fekete)	Field work notes by students
May 9	Water quality and treatment technologies (G. Nyiri)	Lecture slides
May 16	Final test	

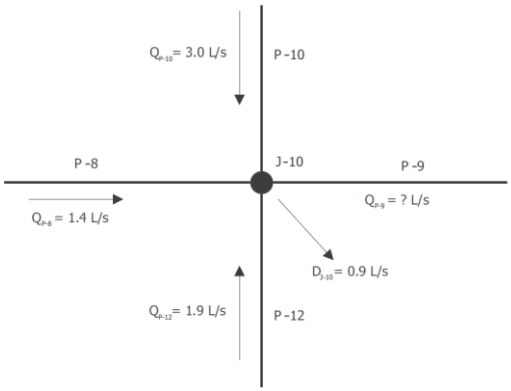
Water works and water supply
Midterm Examination

Name:……

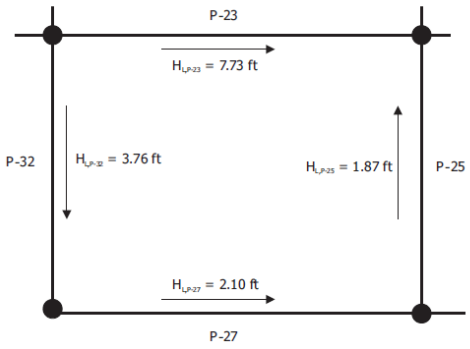
Country:……...

Open book, open notes test!
Duration: 60 minutes

1, Find the magnitude and direction of flow through pipe P-9! (5 points)



2, Does the conservation of energy around the loop apply? Why or why not? (5 points)



3, The water need of the settlement is 2200 m3/day met from a groundwater source of 200m depth using wells. Each wells' nominal capacity is Q=180l/min, they are installed at a distance of 400m, β=0,6.

3,a Calculate the number of minimum Operating well hours (N_{min}) per day, that is needed to meet the water demand of the settlement (8 points)

3,b Calculate the minimum number of wells that need to be installed to meet the water demand of the settlement if the wells can run 24hours a day. (4 points)

4, The table shows the design parameter of an elevated tank (same network as in task 2).

4,a Give the hourly peak consumption of the network in m3/h (6 points)

4,b Calculate the minimum volume of the elevated storage (in m3) using the table below (fill all the grey cells!) (16 points)

4,c What action you can have to further decrease the volume of the storage, list a few options (you can not change the daily water demand!). (6 points)

Time	**Q_{in} (%)**	**Q_{out} (%)**			
0-1	0	0			
1-2	0	0			
2-3	0	0			
3-4	1	0			
4-5	3	1			

5-6	6	5			
6-7	8	8			
7-8	8	14			
8-9	8	6			
9-10	6	4			
110-11	4	5			
11-12	5	6			
12-13	4	3			
13-14	4	4			
14-15	3	5			
15-16	4	4			
16-17	6	4			
17-18	7	5			
18-19	8	12			
19-20	6	8			
20-21	4	3			
21-22	3	2			
22-23	2	1			
23-24	0	0			

Individual Assignment for the semester

Homework assignment
Waterworks, waternetworks
March, 1 2018

1, Create a typical daily water demand distribution table for „your settlement", based on the parameters provided in the table below.
Q_d=maximum daily water demand
Q_{hmax}= hourly maximum water demand

	Q_{hmax}= 21%	Q_{hmax}= 19%	Q_{hmax}= 17%	Q_{hmax}= 15%
Q_d= 1500m^3/day	A1	B1	C1	D1
Q_d= 1700m^3/day	A2	B2	C2	D2
Q_d= 1800m^3/day	A3	B3	C3	D3

1,a Prepare the hourly water demand distribution table in % of daily water demand
1,b Using excel create the graphics of the above table in a combined diagram showing the hourly water demand with columns, the cumulated daily water demand with line diagram.

2, The water need of the settlement is met from a groundwater source of 200m depth using wells. The wells nominal capacity is Q=300l/min, they are installed at a distance of 200m, β=0,8.

2,a Calculate the number of minimum Operating well hours (N_{min}) per day, that is needed to meet the water demand of the settlement
2,b Calculate the minimum number of wells that need to be installed to meet the water demand of the settlement if the wells can run (a) 24hours a day, if they can (b) run only two shifts 16 hours a day

Reporting deadline: March 8, 2018
Reporting format: Edited and Printed document (table, graphs, calculation) and files archived for further use

Tamás Madarász
course instructor

Homework assignment 2 – Elevated tank design
Waterworks, water networks
March 8, 2018

Design the volume of a system's elevated tank, using the following data and considerations. The goal is to follow the pattern of consumption as close as possible in order to minimize the volume of the elevated tank

Conditions:

- The number of network pumps may vary between 2-4;
- Network pumps can operate for 16 consecutive hours (2 shifts);
- Total volume of tanks (elevated+ underground) should be less than 50% of Q_d daily water demand.
- Tasks 1 and 2 must be repeated to target the best (minimum) storage volume.

1, Establish the network pumps daily operating plan for several cases as described bellow

1,a Create the planning table as bellow for 2, 3 and 4 network pumps
1,b Calculate the rate of 1 pump working hour (%) for each case
1,c Create the graph combined with task 2.

Trial No:	
No of network pumps:	

Time	**No. of operating pumps**	**No. of pump working hours**	**Rate of daily Q_d (%)**
0-1	0	0	
1-2	1	1	
…			
23-24			
		∑=	

2, Establish the design table as bellow

Time	**Q_{in} (%)**	**Q_{out} (%)**	**$\sum Q_{in}$ (%)**	**$\sum Q_{out}$ (%)**	**$\sum(Q_{in}-Q_{out})$**
0-1					
1-2					
…					
23-24					
					min=
	∑=	∑=			max=

2,a Calculate the design volume of the elevated storage (as % of Q_d) for every trial using the table (trials should aim to test the options of 2, 3 and 4 network pumps, and also the iteration efforts to minimize the storage capacity)
2,b Crerate the graphs for graphical solution, based on the classroom instructions ($\sum Q_{in}$ (%); $\sum Q_{out}$ (%); Pump working hours (%)
2,b Archive the design table versions and also the respective graphs

3, Chose and fix the design storage volume and the respective table. Select the type of elevated tanks from the available standard volumes.

Reporting deadline: March 21

Reporting format: Edited and Printed document (table, graphs, calculation) and files archived for further use

Tamás Madarász
course instructor

Homework assignment 4 – Underground tank design
Waterworks, water networks
April 5, 2018

Design the volume of a system's underground tank, using the following data and considerations. The goal is to minimize the volume of the underground tank and thus the volume of total stored water of the system. ($V_{elevated}$ + $V_{underground}$ <0,5*Q_d).

Conditions:

- Please refer to Assignment 1, Task 2 (minimum Number of Wells ($N_{w\,min}$; Well operating hours);
- Well pumps can run 24h/day, but each well pump can be switched on/off only once/day!
- Tasks 1 and 2 must be repeated to target the best (minimum) storage volume.

1, Establish the well pumps daily operating plan for several cases as described bellow

1,a Create the planning table as bellow for the cases of $N_{w\,min}$, $N_{w\,min}$ +1 well

1,b Calculate the rate of 1 pump working hour (%) for each case and try to get the best fit to minimize the storage volume

1,c Create the graph combined with task 2.

Trial No:			
No of well pumps:			
Time	**No. of well pumps**	**No. of well pump working hours**	**Rate of daily Q_d (%)**
0-1	0	0	
1-2	1	1	
…			
23-24			
		∑=	

2, Establish the design table as bellow

Time	**Q_{in} (%)**	**Q_{out} (%)**	**∑Q_{in} (%)**	**∑Q_{out} (%)**	**∑(Q_{in}-Q_{out})**
0-1					
1-2					
…					
23-24					
					min=
	∑=	∑=			max=

2,a Calculate the design volume of the underground storage (as % of Q_d) for every trial using the table (trials should aim to test the options of for various number of wells and also the iteration efforts to minimize the storage capacity). Be aware that for the Q_{out} column you should use the respective data of finalized Elevated tank design table!

2,b Crerate the graphs for graphical solution, based on the classroom instructions (∑Q_{in} (%); ∑Q_{out} (%); Well operating hours (%))

2,b Archive the design table versions and also the respective graphs

3, Chose and fix the design storage volume and the respective table. Select the type of underground tanks from the available standard volumes.

Reporting deadline: April 12, 2018

Reporting format: Edited and Printed document (table, graphs, calculation) and files archived for further use

Tamás Madarász
course instructor

ANNEX 1. Water distribution network layout

Consumption	Node
Q/20	2, 5, 7, 8, 10, 11
Q/10	1, 3, 6, 9
3Q/20	4, 12