Załącznik Nr 5 do Zarz. Nr 33/11/12

(faculty stamp)

COURSE DESCRIPTION

Z1-PU7	WYDANIE N1	Strona 1 z 1

1. Course title: WATER AND WASTEWATER TREATMENT FACILITIES HYDRAULICS	**2. Course code**
3. Validity of course description: 2012/2013	
4. Level of studies: BA, BSc programme	
5. Mode of studies: intramural studies	
6. Field of study: ENVIRONMENTAL ENGINEERING	(FACULTY SYMBOL)
7. Profile of studies: general	
8. Programme: Water Supply and Wastewater Discharge Systems	
9. Semester: 6 and 7	
10. Faculty teaching the course: Faculty of Energy and Environmental Engineering, Institute of Water and Wastewater Engineering	
11. Course instructor: Urszula Olsińska	
12. Course classification: subject of the specialization	
13. Course status: compulsory	
14. Language of instruction: English	
15. Pre-requisite qualifications: Fluid Mechanics	
16. Course objectives: Students should gain a basic knowledge on a behaviour of fluids during a motion (phenomena and laws governing flows of fluids). Then they should learn how to implement a theory in designing and control procedures in case of different structures met in water supply and wastewater discharge systems so that students will be able to cooperate with professionals both in the field of designing and operation of the systems being of environmental engineers interest.	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Student distinguishes pipes and pumps operated in-series and in a parallel manner, is able to draw a resultant characteristics and calculate basic parameters of any pressurized system.	test	lecture	K_W06+ K_U08+++ K_U06++
2.	Student is able to design essential elements of water supply systems, analyze and compare different design solutions.	project	project	K_U08+++ K_U09++ K_K05+
3.	Student is able to design an open channel, closed conduit operated under gravity force and relevant hydraulic structures (proportional weirs, spillways, energy dissipators...)	test	lecture	K_W06+ K_U08+++
4.	Student classifies reactors according to their construction and operation mode and defines flow patterns for different units.	test	lecture	K_W06+ K_U08+++
5.	Student defines basic parameters describing hydraulic efficiency of reactors operated under continuous steady flow conditions (**E** and **F** curves, first and second moments of residence time distribution...).	test	lecture	K_W06+ K_U08+++

6.	Student is able to calculate a theoretical and mean residence time, a variation of the mean residence time, basic descriptors of flow used in mathematical models (number of tanks-in-series and dispersion number), velocity gradient. Finally, the student discusses obtained results in terms of flow pattern in a given unit, hydraulic efficiency of the unit, and proposes a required improvements.	project	project	K_W06+ K_U08+++ K_W04+

18. Teaching modes and hours

Lecture / BA /MA Seminar / Class / Project / Laboratory

Sem 6 - 15 h., Sem 7 - 15 h

19. Syllabus description:

Semester 6 :

Review of closed conduit hydraulics (application of the continuity equation, momentum equation, energy equation, calculating head loss). Design of a simple pipe system. Solving pipe network flow problems (branched and looped systems, equivalent pipes for parallel and in series pipes). Storage in water distribution systems. Pumps in water distribution systems (pump head, combining pumps, pumping equipment). Required pressure in water distribution systems and methods of its regulation. Providing and restoring carrying capacity. Pressure surge in pipelines. Surge protection. Sizing of open channels and close conduits partially filled. Methods and equipment used in volumetric flow rate measurements in water supply systems and wastewater discharge systems. Velocity control in process equipment. Introduction to reactor hydraulics and design. Mass balance and performance equations. Theoretical detention time. Tracer studies – useful information obtainable from the pulse and step response experiments. The residence time distribution (RTD) for units operated under steady state conditions (**E** and **F** curves, mean residence time and its variation). Role of RTD, state of aggregation, and earliness of mixing in determining reactor behaviour. Flow patterns (plug flow, ideal mixing and non-ideal flow). Mathematical models describing flow patterns in process equipment (the dispersion model, the tanks-in-series model and compartment models). Methods of reactor hydraulics evaluation (stagnant regions, channelling and short-circuiting, back flow, recirculation) and hydraulic efficiency assessment.

Semester 7:

1.Multialternative design, analysis and comparison of alternative design solutions for chosen elements of a water distribution system or sewerage (e.g. pumping system, storage, reducing valve housing).
2. Case study: assessment of hydraulic efficiency of a given unit on basis of results from the pulse and step experiments.

20. Examination: semester ...no

21. Primary sources:

Levenspiel O., Chemical Reaction Engineering. 3-rd ed., John Wiley & Sons, New York, 1999.
Chadwick A., Morfett J., Hydraulics in Civil and Environmental Engineering. E. & FN SPON, London, 1993.The Norton Anthology of American Literature, 4th edition, Vol. I-II. Norton, New York, 1994.
Lencastre A., Handbook of Hydraulic Engineering. ELLIS HORWOOD LIMITED (a division of John Wiley $ Sons, New York), Chichester, 1987.

22. Secondary sources:

T. Siwiec, A. Soczewica, J. Wróbel: Wybrane przykłady i zadania z wodociągów i kanalizacji. Wyd. Prywatnej Wyższej Szkoły Ochrony Środowiska. Radom 1998.
Mielcarzewicz E. W.: Obliczanie systemów zaopatrzenia w wodę. Arkady, Warszawa, 2000.
J. Szarawara, J. Skrzypek, A. Gawdzik – Podstawy inżynierii reaktorów chemicznych. WN-T, Warszawa,1991.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	15/44
2	Classes	/
3	Laboratory	/
4	Project	15/45
5	BA/ MA Seminar	/
6	Other	1/
	Total number of hours	31/89

24. Total hours:120

25. Number of ECTS credits: 4

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 1
26. Comments:

Approved:

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(date, Instructor's signature)

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(date , the Director of the Faculty Unit signature)