

FACULTY OF **ENGINEERING**

DEGREE COURSE: **CIVIL AND ENVIRONMENTAL ENGINEERING**

MASTER DEGREE: **CIVIL ENGINEERING**

SUBJECT: HYDRAULICS DESIGN

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OBJECTIVES

- Understanding of fundamentals in the design of hydraulic constructions in urban and natural environments;
- Improving of the knowledge of aqueducts;
- Improving of the knowledge of sewers;
- Improving of the knowledge of fluvial construction;
- Understanding of fundamentals in maritime hydraulics and maritime constructions.

CONTENTS

The course (6 CFU) is composed of 48 lessons divided into five modules related to:

1. Aqueducts (2 CFU=16 lessons), focused on design reservoirs, water pipes, water supply networks and internal plants;
2. Sewers (2 CFU=16 lessons), focused on design white and black sewer and the importance of water quality.
3. Fluvial constructions (1 CFU=8 lessons), focused on design and verify constructions in urban context, such as aqueducts and sewers, and in natural context, such as fluvial structures.
4. Maritime hydraulics (1 CFU=8 lessons), focused on the analysis of processes related to the mechanics of wind waves and their nearshore propagation, to coastal dynamics and to wave-structure interaction in order to design coastal and harbour constructions.

For each module the specific topics are illustrated in the following:

MODULE 1 – EXECUTIVE PLAN OF AN AQUEDUCT

1. Introduction to the course
2. Theoretical recalls on aqueducts
3. Design of water pipes – part 1
4. Design of water pipes – part 2
5. Design of water pipes – part 3
6. Design of a reservoir – part 1
7. Design of a reservoir – part 2
8. Design of an urban supply network – part 1
9. Design of an urban supply network – part 2
10. Design of an urban supply network – part 3

11. Design of an urban supply network – part 4
12. Water sanitary systems – part 1
13. Water sanitary systems – part 2
14. EPANET software
15. Example of an executive plan
16. Self evaluation test on aqueducts

MODULE 2 - EXECUTIVE PLAN OF A SEWER

17. Theoretical recalls
18. Evaluation of flow rates
19. Mathematical models of urban drainage
20. Open-channels and pipes – part 1
21. Open-channels and pipes – part 2
22. Special structures – part 1
23. Special structures – part 2
24. Special structures – part 3
25. Control of outfalls
26. Types of outfalls
27. Pumping stations
28. Outfall plants – part 1
29. Outfall plants – part 2
30. SWMM software
31. Example of an executive plan
32. Self evaluation test on sewers

MODULE 3 - FLUVIAL CONSTRUCTIONS

33. Drainage basins
34. Solid transport in rivers – part 1
35. Solid transport in rivers – part 2
36. Fluvial constructions in mountain territories – part 1
37. Fluvial constructions in mountain territories – part 2
38. Fluvial constructions in valley territories
39. Fluvial constructions in plain territories
40. Self evaluation test on fluvial constructions

MODULE 4 - MARITIME HYDRAULICS

41. Tides, currents and winds
42. Wind waves
43. Regular waves
44. Irregular waves
45. Processes related to wave propagation
46. Coastal dynamics and coastal constructions
47. Harbours
- 48: Self evaluation test on Maritime Hydraulics

LEARNING OUTCOMES

At the end of the course, the student will be able to explain the topics related to hydraulic constructions in different environments through an appropriate technical language. In addition, he will also be able to describe the engineering approaches to design hydraulic constructions.

ASSESSMENT

Written exam: multiple choice and open questions

RECOMMENDED TEXTBOOKS

- Qasim, S.R., Motley, E.M., Zhu, G., WATER WORKS ENGINEERING: PLANNING, DESIGN AND OPERATION, Prentice Hall PTR, 1-844 pp.
- Mara, D., Sleigh, A., Tayler, K., PC-BASED SIMPLIFIED SEWER DESIGN, University of Leeds, 1-122 pp.
- Chow, V.T., OPEN-CHANNEL HYDRAULICS, McGraw-Hill Book Company, 1-728 pp.
- Graf, W.H., Altinakar, M.S., FLUVIAL HYDRAULICS: FLOW AND TRANSPORT PROCESSES IN CHANNELS OF SIMPLE GEOMETRY, John Wiley and Sons, 1-682 pp.
- Bras, R.L., HYDROLOGY: AN INTRODUCTION TO HYDROLOGICAL SCIENCES, Addison-Wesley Publishing Company, 1-324 pp.
- Novak, P., Moffat, A.I.B., Nalluri, C., Narayanan, HYDRAULIC STRUCTURES, Taylor and Francis Group, 1-725 pp.
- Dean, R.G., Dalrymple, R.A., WATER WAVE MECHANICS FOR ENGINEERS AND SCIENTISTS, World Scientific, 1-368 pp.
- Sawaragi, T., COASTAL ENGINEERING – WAVES, BEACHES, WAVE-STRUCTURE INTERACTIONS, Elsevier, 1-497 pp.