《水力学》课程教学大纲

课程编号：2920010　　适用专业：给水排水专业

计划学时：74 学时　　计划学分：5 学分

一、本课程的性质和任务

《水力学》是给排水工程专业一门重要的专业基础课，其任务是以水为研究对象，用实验和理论分析的方法，来研究液体平衡和机械运动规律以及如何运用这些规律来解决工程实际问题，并为专业课的学习打下良好的基础。

二、本课程的基本要求

水力学课程的主要任务是使学生掌握液体运动的一般规律和有关的基本概念、基本理论，学会必要的分析计算方法和一定的实验操作技术，为学习专业课程，从事专业技术工作，进行科学研究打下必要的坚实基础。

三、课程的特点

1．对基本概念、基本定律与基本分析方法的要求并重。

2．对基本理论的掌握与常见工程水力计算能力的要求并重。

3．实验课程是重要的学习与实践环节。

四、课程内容

（一）、绪论

1．水力学及其任务

2．作用于液体上的力

3．液体的主要物理性质

（二）、水静力学

1.静止液体中压强的特性

2.液体平衡微分方程

3.重力作用下静止液体中压强的分布规律

4.液柱式测压计

5.液体的相对平衡

6.液体作用在平面壁上的总压力

7．液体作用在曲面壁上的总压力

（三）、水动力学基础

1． 液体运动的描述方法

2． 欧拉法的基本概念

3．连续性方程

4． 液体运动的微分方程

5． 伯努利方程

6．动量方程

（四）、*相似原理与量纲分析

1．相似原理

2．模型试验

3．量纲分析

（五）、水头损失

1．水头损失的分类

2．雷诺实验与流态

3．沿程水头损失与切应力的关系

4．圆管中的层流运动

5．液体的紊流运动

6.局部水头损失

（六）、有压管路

1．短管的水力计算

2．长管的水力计算

3．管网水力计算基础

4．有压管流中的水击

（七）、明渠流动

1．明渠流动概述

2．明渠均匀流

3．无压圆管均匀流

4．明渠非均匀流基本概念

5．水跃与水跌

6.棱柱形渠道非均匀渐变流水面曲线的分析

7.明渠非均匀渐变流水面曲线的计算

（八）、 孔口、管嘴出流与堰流

1．孔口出流

2．管嘴出流

3．堰流

（九）、渗流

1．概述

2．渗流的达西定律

3．地下水的渐变渗流

4．井和井群

四、使用大纲说明

1、学时分配表

课程内容	学　时　数				备　注
	总学时	讲授	实验	上机	
绪论	4	4			
水静力学	8	8			
水动力学基础	10	10			
*相似原理和量纲分析					选学
水头损失	8	8			
有压管路	8	8			
明渠流动	8	8			
孔口、管嘴出流和堰流	8	8			
渗流	6	6			
实验			14		7 个实验

2. 教学方法提示

课堂讲授为主。

3. 考核方式

成绩采用综合评定：考试占 80%，平时占 20% 。

4　*号表示选学内容。

五、课程教材及主要参考书

教材

《水力学》第一版，张维佳主编，中国建筑工业出版社 2008 年。

参考书

《流体力学》第二版，刘鹤年主编，中国建筑工业出版社 2004 年。

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The Syllabus of *Hydraulics*

Course Code: 2920010

Major: Water Supply and Sewerage Engineering

Periods: 74 Credits: 5

1. Curriculum Property and Curriculum Objectives

Hydraulics is an important basic course of Water Supply and Sewerage Engineering. In this course, Water is the study objective, and the experimental and theoretical methods are utilized to study the liquid balance and the laws of mechanical motion, besides, how to use these laws to solve the practical engineering problems is also an important objective of this course.

2. Basic Requirements

Students must master the general principles of fluent motion and the relative basic concepts, basic theories, and know the necessary analysis and calculation methods. After learning this course, a good foundation should be built for learning the other professional courses, engaging in the professional and technical works and scientific research.

3. Curriculum features

3.1Basic concepts, laws and analysis methods should be mastered.

3.2Calculating common engineering hydraulic problems with the basic laws should be mastered.

3.3 Experimentsare an important part for study and practice.

4. Curriculum contents

4.1 Introduction

- 4.1.1 Hydraulics and Its tasks
- 4.1.2 Force acting on liquid
- 4.1.3 Main physical properties of liquid

4.2 Hydrostatics

- 4.2.1 Features of pressure in static liquid
- 4.2.2 Differential equation for liquid equilibrium
- 4.2.3 The distribution of pressure in static liquid under the action of gravity
- 4.2.4 Liquid column manometer
- 4.2.5 The relative equilibrium of liquid
- 4.2.6 The total pressure of a plane under the action of liquid
- 4.2.7 The total pressure of a curved wall under the action of liquid

4.3 Foundations of hydrodynamics

- 4.3.1 Description method of liquid motion
- 4.3.2 The basic concept of the Eulerian method
- 4.3.3 Continuity equation
- 4.3.4 Differential equation of liquid motion
- 4.3.5 Bernoulli equation
- 4.3.6 Momentum equation

4.4 Similarity principle and Dimensional analysis

- 4.4.1 Similarity principle
- 4.4.2 Model experiment
- 4.4.3 Dimensional analysis

4.5 Head loss

4.5.1 Classification of head loss

4.5.2 Reynolds experiment and flow model

4.5.3 Relationship between frictional head loss and sheering stress

4.5.4 The laminar flow in tube

4.5.5 The turbulent of the liquid

4.5.6 Local head loss

4.6 Pressurized pipe system

4.6.1 Hydraulic calculation of short pipe

4.6.2 Hydraulic calculation of long pipe

4.6.3 The foundation of hydraulic calculation of pipe network

4.6.4 Water hammer in the Pressurized pipe system

4.7 Open-channel flow

4.7.1 Overview of the open-channel flow

4.7.2 Uniform flow in open-channel

4.7.3 Uniform flow in non-pressure pipe

4.7.4 Basic concepts of non-uniform flow in open-channel

4.7.5 Hydraulic jump and Hydraulic drop

4.7.6 Analysis of water surface profile of mildly-varying flow in prism-shaped channel

4.7.7 Calculation of water surface profile of non-uniform mildly-varying flow in open channel

4.8 Orifice discharge, nozzle discharge and weir flow

4.8.1 Orifice discharge

4.8.2 Nozzle discharge

4.8.3 Weir flow

4.9 Seepage flow

4.9.1 Overview

4.9.2 Darcy′s law of seepage flow

4.9.3 Mildly-varying seepage flow of ground water

4.9.4 Well and gang of wells

5. Instruction of the syllabus

5.1 Allocation of periods

Contents	Total periods				Remarks
	Periods	Lecturing periods	Experiments periods	Computer periods	
Introduction	4	4			
Hydrostatics	8	8			
Foundations of hydrodynamics	10	10			
* Similarity principle and Dimensional analysis					Elective
Head loss	8	8			
Pressurized pipe system	8	8			
Open-channel flow	8	8			

Orifice discharge, nozzle discharge and weir flow	8	8			
Seepage flow	6	6			
Experiments			14		7

5.2 Teaching method

Mainly depending on the lecturing.

5.3 Evaluation

At the end of this course, students will be evaluated on their classroom participation and the final examination. The formula is: Class participation (20%) + Final test (80%) = Course result (100%).

5.4The contents marked by '*' represents the selectable contents which can be learned by students themselves.

6. Textbook and reference

Textbook: *Hydraulics*(1st ed.), Zhang Weijia, China architecture and building press, 2008.

Reference: Hydromechanics (2nd ed.), Liu Henian, China architecture and building press, 2008.

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