

黄河水利职业技术学院

**Yellow River Conservancy Technical Institute**

水利水电建筑工程高水平专业群

**High-Level Specialty Group of Water Conservancy and  
Hydropower Construction Engineering**

《水电站》

*Hydropower Plants*

课 程 标 准

Curriculum Standard

(2020 版)

(2020 Version)

水利工程学院

**School of Water Conservancy Engineering**

二〇二〇年十二月

**December, 2020**



# 《水电站》课程标准

## Curriculum Standard for *Hydropower Plants*

### 1 课程概述

#### 1 Course Overview

##### 1.1 课程名称

##### 1.1 Course Title

课程名称：《水电站》

Course title: *Hydropower Plants*

##### 1.2 学时与适用对象

##### 1.2 Credit Hours and Target Audience

课程总计 44 学时，其中理论学时 40，实践学时 4。本标准适用于水利水电建筑工程高水平专业群。

The total number of credit hours for the course is 44, including 40 hours for theory classes and 4 hours for practical classes. This standard applies to the high-level specialty group of Water Conservancy and Hydropower Construction Engineering.

##### 1.3 课程定位

##### 1.3 Course Description

《水电站》课程是水利水电建筑工程专业的一门职业岗位能力课程。其任务是教会学生具有水电站建筑物的设计能力；绘制与识读水电站枢纽及厂房各层图的技能，培养学生运用所学的理论知识去解决实际工程问题的能力。在学习和实训过程中引入了《水电站进水口设计规范》（DLT-5398-2007）、《水利水电工程施工组织设计规范》（SL 303—2004）等行业技术规范和标准的课程。

The course *Hydropower Plants* is an occupational position capability course of the specialty of Water Conservancy and Hydropower Construction Engineering. The task is to teach students to nurture the abilities to design hydropower plants structures, the skills to draw and read the drawings of each level of the hydropower plant hubs and plant houses, and the capabilities to apply the theoretical knowledge learned to solve practical engineering problems. The course of industry technical codes and standards such as *Design Code for Water Intakes of Hydropower plants* (DLT-5398-2007) and *Design Code for the Construction Organization of Water Conservancy and Hydropower*

*Projects (SL 303-2004) are introduced in the learning and practical training process.*

本课程的预修课程为《水利工程制图》、《水工混凝土结构》、《水力分析与计算》、《水工建筑物》等课程，主修完本课程后，学生可进行中小型水电站建筑物的设计、施工等方面的工作。

The prerequisite courses for this course are *Cartography of Water Conservancy Engineering, Hydraulic Concrete Structure, Hydraulic Analysis and Calculation and Hydraulic Structures*, etc. After majoring in this course, students can work on the design and construction of small and medium-sized hydropower plant structures.

## 2 课程目标

### 2 Curriculum Goals

#### 2.1 总体目标

#### 2.1 Overall Objective

依据水利水电建筑工程专业群人才培养方案，本课程的总体目标是要教会学生水电站的类型、水轮机类型与构造、水轮机能量损失及汽蚀、调速设备等基础知识，中小型水电站进水、引水建筑物、压力水管、厂房的布置及※设计方法，\*水电站厂房施工相关的职业能力。课程中融入水利兴国、水利富民、责任担当、创新思维等元素，培养学生精益求精的大国工匠精神。

According to the talent training program for the specialty group of water conservancy and hydropower construction engineering, the overall goal of this course is to teach students basic knowledge such as the types of hydropower plants, the types and structures of hydraulic turbines, the energy loss and cavitation of hydraulic turbines, and speed control equipment, to impart the layout and design methods of water intakes, diversion structures, pressure water pipes, plant houses of small and medium-sized hydropower plants, as well as to cultivate professional capabilities related to the construction of hydropower plants. The curriculum incorporates elements of reinvigorating the country through water conservancy, enriching the people through water conservancy, assuming responsibility and innovative thinking, so as to prepare the students for the craftsman's spirit which strives for excellence.

注：对较高层次目标在课程目标中用“\*”号标出，对最高层次目标在课程目标中用“※”号标出。为满足不同专业及不同基础学生的学习需求，本课程设置了三个层级的知识和技能要求，基本层级是专科生必须达到的最低要求，“\*”“※”分别表示较高、最高层级要求，专业群中的专业或学生可根据专业岗位能力要求及学生基础和目标确定实际授课中的知识点和技能点。

**Note: Higher-level objectives are marked with "\*" in the course objectives, and the highest-level objectives are marked with "※" in the course objectives. To meet the learning needs of students of different majors and different foundations, this course sets three levels of**



knowledge and skill requirements, the basic level is the minimum requirement that junior college students must meet, “\*” “※” indicate higher and highest level requirements respectively, majors or students in specialty group can determine the knowledge and skill points in actual lectures according to the requirements of professional job competencies and students' foundations and goals.

## 2.2 分项目标

### 2.2 Specific Objectives

#### (1) 知识目标

##### (1) Knowledge objectives

①掌握和会使用相关学术词语;

① Mastering and using relevant academic terms;

②掌握水电站进水、引水、输水、平水等建筑物的类型、作用、组成、构造、结构、布置

② Mastering the types, role, composition, construction, structure and layout of the structures of hydropower plants such as water intakes, water diversion, water conveyance and water stabilization

及尺寸拟定方法;

as well as dimensioning methods;

③掌握水电站主机组、辅助设备的布置方法;

③ Mastering the arrangement method of the major units and auxiliary equipment of hydropower plants;

※④掌握水电站主厂房尺寸确定方法;

※④ Mastering the dimensioning methods of the main plant houses of hydropower plants;

⑤了解水电站厂房的细部结构;

⑤ Grasping the detailed structure of hydropower plants;

⑥掌握水电站厂区的组成及布置方法;

⑥ Mastering the composition and arrangement methods of hydropower plants;

\*⑦掌握水电站厂房施工流程图及一般施工方法;

\*⑦ Mastering the flow chart and general construction methods for the construction of hydropower plants;

\*⑧掌握厂房施工质量的标准。

\*⑧ Mastering the standards of the construction quality of plant houses.

#### (2) 技能目标

## **(2) Skill objectives**

- ①会查阅技术规范及相关标准;
- ① Being able to consult and apply technical specifications and relevant standards;
- ②会设计水电站建筑物;
- ② Being able to design structures of hydropower plants;
- ③会识读与绘制水电站建筑物设计图;
- ③ Being able to read and draw design drawings for structures of hydropower plants;
- ④会编制水电站厂房施工流程图;
- ④ Being able to design flow charts for the construction of plant houses of hydropower plants;
- ⑤会监控厂房施工质量。
- ⑤ Being able to monitor the construction quality of plant houses.

## **(3) 思政目标**

### **(3) Behavioral objectives**

- ①能刻苦学习、吃苦耐劳
- ① Being able to study hard and bear hardships
- ②能科学严谨、诚实协作
- ② Being able to collaborate honestly with scientific and rigorous attitudes.
- ③能积极创新
- ③ Being able to actively innovate
- ④能领悟都江堰等水利工程中的水利职业精神，理解水利造福人民
- ④ Being able to perceive the professionalism of water conservancy in water conservancy projects such as Dujiangyan Irrigation System and understand how water conservancy benefits people

## 3 教学设计

### 3 Syllabus Design

本课程打破传统的知识传授为主要特征的课程模式，变革为以工作任务为中心，以能力养成为目的组织课程内容和教学。根据与企业一线专家的多次关于学生实际就业岗位需要的实际能力分析，依据实际工作过程和工作任务剖析筛选课程知识要点，立足于实际技能的培养和学生的可持续发展，开发和设计学习项目。为教会学生水电站建筑物设计及厂房施工工作，以“项目导向，任务驱动”的原则设置相关知识点和实训环节，以实际水电站设计和施工为背景开发为水电站进引建筑物布置、



压力水管布设、平水建筑布设、厂区布置、厂房布置设计和水电站厂房施工六个学习项目，而基于工作过程又把六个学习项目分化为实际电站建筑物设计背景资料、进水建筑物布置、引水建筑物布置、压力水管布置、调节保证计算、调压室布设、水电站厂区布置、立式机组地面厂房设备布置设计、水电站厂房施工流程、厂房施工质量控制等 11 个工作任务（子项目），并根据完成工作任务所需的知识、能力、素质选取教学内容，把行业、企业标准和技术规范融入课程内容和课程评价体系，通过讲课与实训的穿插进行，以完成每个任务促进学生的相应技能的形成。

This course breaks the traditional curriculum model characterized by imparting knowledge and is arranged by focusing on tasks for the purpose of ability development. According to the analysis jointly conducted by the front-line experts of enterprises of students' practical ability required by their actual employment, as per the actual working process and tasks, the key points of course knowledge are analyzed and selected. For the sake of the cultivation of students' practical skills to realize sustainable development, the study projects are developed and designed. In order to teach students the design of hydropower plant structures and construction of plant house, relevant knowledge points and practical training are set based on the principle of "project-orientation, task-stimulation". Based on the design and construction of practical hydropower plants, six study projects are developed, i.e. layout of water intake and diversion structures of hydropower plant, layout of penstock, layout of water stabilization structures, layout of plant area, layout design of plant house and construction of plant house. On the basis of working process, the six study projects are further divided into 11 working tasks (sub-projects), i.e. background data of practical hydropower plants structures design, layout of water intake structures, layout of water diversion structures, layout of penstock, regulation guarantee calculation, layout of surge chamber, layout of hydropower plants, layout design of vertical unit in ground plant, structural dimension proposing and drawing, construction process of hydropower plants, quality control of construction. Teaching content is selected according to the knowledge, ability and quality for complete the tasks. Moreover, the industry standards, enterprise standards and technical specifications are integrated into the curriculum content and curriculum evaluation system, and each task is combined with lectures to promote the formation of students' corresponding skills.

课程采用项目化教学，按项目分别采用任务驱动、项目导向等教学模式。教学设计见表 1。

Task-driven and project-oriented teaching modes are adopted in the course according to the project. See Table 1 for Syllabus Design.

表 1 《水电站》课程教学设计

Table 1 Syllabus Design of *Hydropower Plants* Course

学习项目编号 Learning Program NO.	学习项目名称 Learning Program Name	学习型工作任务 Learning Tasks	学时 Credit Hours	
项目一 Program I	第一次课 First class	课程介绍 Syllabus introduction	2	12
	背景资料分析 Background data analysis	1-1 背景资料分析 1-1 Background data analysis	2	
	进引水建筑物布置 Layout of water intake and diversion structures	1-2 进水建筑物布置 1-2 Layout of water intake structures	4	
		1-3 引水建筑物布置 1-3 Layout of water diversion structures	4	
项目二 Program II	压力水管布置 Layout of penstock	2-1 压力水管布置 2-1 Layout of penstock	4	8
		2-2 调节保证计算 2-2 Regulation guarantee calculation	4	
项目三 Program III	平水建筑物布置 Layout of water stabilization structures	3-1 调压室布置 3-1 Layout of surge chamber	4	4
项目四 Program IV	厂区布置 Layout of plant area	4-1 厂区布置 4-1 Layout of plant area	4	4
项目五 Program V	厂房布置设计 Layout design of plant house	5-1 厂房设备布置 5-1 Layout of plant house equipment	4	8
		5-2 构造、尺寸拟定及绘图 5-2 Construction, structural dimension proposing and drawing	4	
项目六 Program VI	水电站厂房施工 Construction of plant house of hydropower plant	6-1 绘制水电站厂房施工流程图 6-1 Drawing the construction flow chart of plant house of hydropower plant	4	8
		6-2 厂房施工质量控制 6-2 Quality control of plant house construction	4	
总计 Total			44	

## 4 教学内容与要求

## 4 Teaching Contents and Requirements

表2 《水电站》教学内容与要求

Table 2 Teaching Contents and Requirements of Hydropower Plants

序号 S/N	教学内容 (工作任务) Teaching Contents (Tasks)	知识内容与要求 Knowledge and Requirements	技能内容与要求 Skills and Requirements	思政元素 Ideological Elements	参考课时 Reference Teaching Hours
1	第一次课、背景资料分析 First class, background data analysis	(1) 掌握水电站设计背景资料分析方法。 (1) Mastering the analysis method of background data of hydropower plant design.	(1) 能熟练选择水轮机的类型; (1) Being able to skillfully select the type of hydraulic turbines; (2) 能熟练选配水轮发电机及调速器; (2) Being able to skillfully select the hydro-generator and speed controller;	爱国主义 Patriotism 民族自豪感 National pride	4



			(3) 能合理分析电站设计背景资料。 (3) Being able to reasonably analyze the background data of hydropower plant design.		
2	进水建筑物布置 Layout of water intake structures	(1) 掌握进水建筑的形式及组成; (1) Mastering the form and composition of water intake structures; (2) 掌握进水建筑物的布置方法; (2) Mastering the layout method of water intake structures; (3) 掌握进水建筑物的尺寸拟定方法; (3) Mastering structural dimension proposing of water intake structures; (4) 掌握进水建筑物设备类型、布置及尺寸确定方法。 (4) Mastering the equipment type, layout and dimension determination method of water intake structures.	(1) 能熟练布置水电站进水建筑物; (1) Being able to skillfully lay out the water intake structures of hydropower plant; (2) 会写背景资料分析报告; (2) Being able to write analysis report of background data; (3) 会读识水电站进水建筑物工程图; (3) Being able to identify the engineering drawing of water intake structures of hydropower plant; (4) 会书写工程设计报告。 (4) Being able to write engineering design report.	鼓励学生积极努力、不惧困难、练真本领 Encouraging students to work hard, face difficulties bravely and practice skills steadfastly	4
3	引水建筑物布置 Layout of water diversion structures	(1) 掌握引水建筑物的类型及断面形式; (1) Mastering the type and section form of water diversion structures; (2) 掌握引水建筑物的尺寸拟定方法; (2) Mastering the structural dimension proposing method of water diversion structures; (3) 掌握引水建筑物路线选择原则及方法; (3) Mastering the principles and methods of selecting route of water diversion structures; (4) 掌握压力前池的作用、组成及类型; (4) Mastering the	(1) 能熟练布置水电站引水建筑物; (1) Being able to skillfully lay out the water diversion structures of hydropower plant; (2) 会写背景资料分析报告; (2) Being able to write analysis report of background data; (3) 会读识水电站引水建筑物工程图; (3) Being able to identify the engineering drawing of water diversion structures of hydropower plant; (4) 会书写工程设计报告。 (4) Being able to write engineering design report.	学习逆天穿黄工程增强中国自信 Learning the incredible engineering project crossing Yellow River to enhance China's self-confidence	4



		function, composition and type of fore bay; (5) 掌握压力前池布置及尺寸拟定; (5) Mastering the layout and dimension proposing of the fore bay; (6) 掌握压力前池设备布设方法。 (6) Mastering the layout method of fore bay.			
4	压力水管布设 Layout of penstock	(1) 掌握压力水管的作用、类型和适用条件; (1) Mastering the function, type and applicable conditions of penstock; (2) 掌握压力水管管径及管壁厚度确定方法; (2) Mastering the determination method of diameter and thickness of penstock; (3) 掌握压力水管的管线选择及布置方法; (3) Mastering the pipeline selection and layout method of penstock; (4) 掌握压力水管构造、附件作用; (4) Mastering the penstock structure and function of accessories; (5) 掌握压力水管敷设方式、支承结构。 (5) Mastering the laying method and supporting structure of penstock.	(1) 会确定压力水管类型、路线、供水方式; (1) Being able to determine the type, route and water supply mode of penstock; (2) 会确定压力水管经济管径; (2) Being able to determine the economic pipe diameter of penstock; (3) 会压力水管的布置设计及管路附件设置; (3) Being able to design penstock layout and set pipeline accessories; (4) 会确定压力水管敷设方式、支承结构。 (4) Being able to determine the laying mode and supporting structure of penstock.	增强学生责任心、吃苦耐劳精神 Enhancing students' sense of responsibility and hard-working spirit	4
5	调节保证计算 Regulation guarantee calculation	(1) 掌握调节保证计算的概念; (1) Mastering the concept of regulation guarantee calculation; (2) 掌握水击类型及简单管水击计算方法; (2) Mastering the type of water hammer and the calculation method of water hammer	(1) 会计算简单管水击压力、调保计算; (1) Being able to calculate simple pipe water hammer pressure, adjustment and maintenance; (2) 会撰写压力水管布设报告。 (2) Being able to write penstock layout report.	增强学生“四个自信” Enhancing "four self-confidences" in students	4



		<p>of simple pipe;          (3) 熟悉调节保证计算的目的及任务。          (3) Being familiar with the purpose and task of regulation guarantee calculation.</p>			
6	<p>平水建筑物——调压室布设          Layout of water stabilization structures-Surge Chamber</p>	<p>(1) 掌握调压室的作用;          (1) Mastering the function of surge chamber;          (2) 掌握调压室应满足的基本要求;          (2) Mastering the basic requirements of surge chamber;          (3) 掌握调压室的设置条件;          (3) Mastering the setting conditions of surge chamber;          (4) 掌握调压室的类型;          (4) Mastering the type of surge chamber;          ※(5) 掌握调压室的最小断面确定方法;          ※(5) Mastering the method of determining the minimum section of surge chamber;          (6) 掌握调压室布设方法。          (6) Mastering the layout method of surge chamber.</p>	<p>(1) 能熟练选择调压室的类型;          (1) Being able to skillfully select the type of surge chamber;          ※(2) 会确定水电站调压室的最小断面尺寸;          ※(2) Being able to determine the minimum section size of surge chamber of hydropower plant;          (3) 能合理布置调压室;          (3) Being able to reasonably arrange the surge chamber;          (4) 会撰写阶段报告。          (4) Being able to write a phase report.</p>	<p>激发科技报国的家国情怀          Inspiring the patriotism that science and technology are to serve the country</p>	4
7	<p>厂区布置          Layout of plant area</p>	<p>(1) 掌握水电站厂房组成、类型;          (1) Mastering the composition and type of plant house of hydropower plant;          (2) 掌握厂房五大系统内涵;          (2) Mastering the connotation of the five systems of the plant house;          (3) 掌握水电站厂区组成和各组成作用;          (3) Mastering the composition of hydropower plants and the role of each</p>	<p>(1) 能认知厂区、厂房组成;          (1) Being able to recognize the composition of the hydropower plant and plant house;          (2) 会布置水电站的厂区;          (2) Being able to lay out the hydropower plant;          (3) 会绘制厂区布置图;          (3) Being able to draw the hydropower plant layout;          (4) 会撰写厂区布置阶段报告。</p>	<p>培养学生科学思维方法          Cultivating students' scientific thinking</p>	4

		<p>component;</p> <p>(4) 掌握水电站厂区布置原则;</p> <p>(4) Mastering the layout principle of hydropower plant;</p> <p>(5) 掌握厂区常用布置方案的优缺点;</p> <p>(5) Mastering the advantages and disadvantages of common layout schemes of hydropower plant;</p> <p>(6) 掌握地下厂房枢纽布置及厂内布置特点、内部布置;</p> <p>(6) Mastering the layout of underground plant house hub, the characteristics and internal layout of the plant;</p> <p>(7) 掌握厂房、厂区布置方法。</p> <p>(7) Mastering the layout method of plant house and hydropower plant.</p>	<p>(4) Being able to write the stage report of hydropower plant layout.</p>		
8	<p>厂房设备布置</p> <p>Layout of plant house equipment</p>	<p>(1) 掌握水电站厂房常见结构形式;</p> <p>(1) Mastering the common structural forms of plant house of hydropower plant;</p> <p>(2) 掌握水电站主厂房结构轮廓;</p> <p>(2) Mastering the structural outline of the main plant house of hydropower plant;</p> <p>(3) 掌握水轮机及其进出水设备的布置;</p> <p>(3) Mastering the layout of hydraulic turbine and its water inlet and outlet equipment;</p> <p>(4) 掌握发电机的冷却与通风、支承结构;</p> <p>(4) Mastering the cooling, ventilation and supporting structure of generator;</p> <p>(5) 掌握厂房辅助附属设备布置方法。</p> <p>(5) Mastering the</p>	<p>(1) 能识读厂房工程图, 认知厂房结构;</p> <p>(1) Being able to read engineering drawings and structure of plant house;</p> <p>(2) 会布置水轮机及其进出水设备;</p> <p>(2) Being able to arrange the hydraulic turbines and their water inlet and outlet equipment;</p> <p>(3) 会布置发电机;</p> <p>(3) Being able to arrange the generator;</p> <p>(4) 会布置水电站辅助附属设备。</p> <p>(4) Being able to arrange the auxiliary equipment of hydropower plant.</p>	<p>激发学生为水利努力奋斗精神。</p> <p>Stimulating students' striving spirit for water conservancy.</p>	4



		layout method of auxiliary equipment in the plant house.			
9	<p>※构造、尺寸拟定及绘图</p> <p>※Construction, structural dimension proposing and drawing.</p>	<p>(1) 掌握水电站主要尺寸确定方法;</p> <p>(1) Mastering the determination method of main dimensions of hydropower plant;</p> <p>(2) 掌握水电站副厂房布置方法;</p> <p>(2) Mastering the layout method of auxiliary plant house of hydropower plant;</p> <p>(3) 熟悉水电站厂房的细部结构。</p> <p>(3) Being familiar with the detailed structure of plant house of hydropower plant.</p>	<p>(1) 会计算主厂房尺寸;</p> <p>(1) Being able to calculate the size of the main structures;</p> <p>(2) 会合理布置水电站副厂房;</p> <p>(2) Being able to reasonably arrange the auxiliary power house of hydropower plant;</p> <p>(3) 会撰写水电站厂房设计报告;</p> <p>(3) Being able to write design report of plant house of hydropower plant;</p> <p>(4) 会绘制主厂房三视图。</p> <p>(4) Being able to draw three-views-drawing of the main plant house.</p>	<p>增加伟大时代使命感及水利人担当精神</p> <p>Enhancing the sense of mission in the great era and the spirit of water conservancy</p>	4
10	<p>绘制水电站厂房施工流程图</p> <p>Drawing the construction flow chart of plant house of hydropower plant</p>	<p>(1) 熟悉水电站厂房的施工特点;</p> <p>(1) Being familiar with the construction characteristics of plant house of hydropower plant;</p> <p>(2) 掌握水电站厂房混凝土的分期分块;</p> <p>(2) Mastering the stage and block of concrete in plant house of hydropower plant;</p> <p>(3) 掌握水电站厂房的施工程序;</p> <p>(3) Mastering the construction procedure of plant house of hydropower plant;</p> <p>(4) 掌握水电站厂房一期混凝土施工方法;</p> <p>(4) Mastering the first-stage concrete construction method</p>	<p>(1) 会编制水电站厂房的施工流程图。</p> <p>(1) Will prepare the construction flow chart of plant house of hydropower plant.</p>	<p>增加伟大时代使命感及水利人担当精神</p> <p>Enhancing the sense of mission in the great era and the spirit of water conservancy</p>	4

		of plant house of hydropower plant; (5) 掌握水电站厂房二期混凝土施工方法。 (5) Mastering the second-stage concrete construction method of plant house of hydropower plant.			
11	*厂房施工质量控制 * Quality control of plant house construction	(1)掌握厂房混凝土施工注意事项; (1) Mastering the precautions of concrete construction in plant house; (2) 掌握厂房混凝土施工技术要求。 (2) Mastering the technical requirements of concrete construction in the workshop.	(1) 会写出厂房施工质量标准。 (1) Being able to write the construction quality standards of plant house.	学习大国工匠的水利工作者 Learning from water conservancy workers in the country	4

## 5 教学方法与手段

## 5 Teaching Methods and Means

本课程采用工学结合、理实一体、线上线下结合的“互联网+教·学·做·评”一体化教学模式。各项目教学采用的具体教学方法、手段见表3。

This course adopts a teaching mode of "Internet + teach, learn, practice and evaluation" by combining work and learning, theory and practice, as well as online and offline teachings See Table 3 for the specific teaching methods and means adopted in each project.

表3 项目教学方法与手段

Table 3 Teaching Methods and Means for Projects

序号 S/N	工作任务 Tasks	教学方法与手段 Teaching Methods and Means
1	第一次课、背景资料分析 First class, background data analysis	教学方法：案例分析、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: Case analysis, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
2	进水建筑物布置 Layout of water intake structures	教学方法：任务驱动、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: task stimulation, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.



3	引水建筑物布置 Layout of water diversion structures	教学方法：任务驱动、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: task stimulation, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
4	压力水管布设 Layout of penstock	教学方法：任务驱动、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: task stimulation, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
5	调节保证计算 Regulation guarantee calculation	教学方法：项目导向、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: project orientation, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
6	平水建筑物——调压室布设 Layout of water stabilization structures-Surge Chamber	教学方法：任务驱动、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: task stimulation, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
7	厂区布置 Layout of plant area	教学方法：案例分析、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: Case analysis, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: Engineering pictures, animation, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
8	厂房设备布置 Layout of plant house equipment	教学方法：案例分析、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: Case analysis, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
9	※构造、尺寸拟定及绘图 ※Construction, structural dimension proposing and drawing.	教学方法：案例分析、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: Case analysis, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.

10	绘制水电站厂房施工流程图 Drawing the construction flow chart of plant house of hydropower plant	教学方法：任务驱动、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: task stimulation, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.
11	*厂房施工质量控制 * Quality control of plant house construction	教学方法：任务驱动、多媒体演示、边讲边练边评、思政教育等。 Teaching methods: task stimulation, multimedia demonstration, teach+practice+evaluation, ideological and political education, etc. 教学手段：工程图片、视频、动画等。信息化采用精品在线开放课程、慕课堂等数字化学习平台。 Teaching means: engineering pictures, videos, animations, etc. Informatization: Digital learning platforms such as high-quality online open courses and MOOC courses.

## 6 考核与评价

### 6 Examination and Evaluation

《水电站》课程推行“过程考核+结果考核”教学评价模式。课程成绩由过程考核成绩和过关考核成绩两部分组成，各占总成绩的50%。

A "process assessment+result assessment" teaching evaluation method is adopted in the course of *Hydropower Plants*. Course scores are composed of scores of process examination and scores of pass examination, each accounting for 50% of the total scores.

“过程考核”是对学生平时课程学习过程中课堂表现、思政素养及知识技能掌握程度的考核，借助在线课程、慕课堂等数字化平台实施，考核内容包括课堂考勤、随堂测验、单元测验、平时作业（包括线上和线下）、资源学习、课堂表现等方面，确定过程考核成绩；

"Process examination" is to assess students' classroom performance, ideological and political literacy and knowledge and skills in the normal course learning process by online courses, classroom and other digital platforms. The examination contents include attendance, in-class test, unit test, online and offline homework, resource learning, classroom performance, etc., and then determine the results of process examination;

过程成绩=云课堂成绩 30%+慕课堂成绩 40%+课堂表现、思政素养 25%+书写作业 5%

Process score = cloud classroom score (30%)+ MOOC classroom score (40%)+ classroom performance, ideological and political caliber (25%)+ writing homework (5%)

\*过程成绩=云课堂成绩 35%+慕课堂成绩 35%+课堂表现、思政素养 20%+书写作业 10%

\* Process score = cloud classroom score 35%+ MOOC classroom score 35%+ classroom performance, ideological and political literacy 20%+ writing homework 10%

※过程成绩=云课堂成绩 40%+慕课堂成绩 30%+课堂表现、思政素养 20%+书写作业 10%

※ Process score = cloud classroom score (40%)+ MOOC classroom score (30%) + classroom performance, ideological and political caliber (20%) + writing homework (10%)

“结果考核”借助先进的网络信息技术和资源开发技术，开发《水电站》课程在线考试平台，实现在线自主测试、多功能随机组卷、自主预约考试、智能监考、系统自动阅卷等功能。

"Result examination": With advanced network information technology and resource development technology, develop the online examination platform for *Hydropower Plants* course which has functions of online self-test, random test-paper handout with multi-function,



self-appointment for examination, intelligent invigilation, system automatic reviewing, etc.

课程成绩=过程成绩（50~60）%+结果考核（50~40）%

Course score = process score (50~60)%+ result examination (50~40)%

注：“\*”“※”分别表示较高、最高层级要求。

Note: "\*" and "※" respectively represent the higher- and highest-level requirements.

## 7 说明与建议

## 7 Explanation and Suggestion

### 7.1 教材选编建议

#### 7.1 Suggestions on Textbook Selection

- |     |  |                                    |                                      |
|-----|--|------------------------------------|--------------------------------------|
| (1) | 《水电站》  | 雷恒、周志琦                             | 黄河水利出版社                              |
| (1) | <i>Hydropower Plants</i>   | Lei Heng, Zhou Zhiqi               | Yellow River Water Conservancy Press |
| (2) | 《水电站建筑物设计与施工》讲义  | 陶永霞等主编                             |                                      |
| (2) | Handout on Design and Construction of Hydropower Plants Structures | Tao Yongxia, et al, general editor |                                      |
| (3) | 《水电站》  | 袁俊森主编                              | 黄河水利出版社                              |
| (3) | <i>Hydropower Plants</i>   | Yuan Junsen, general editor        | Yellow River Water Conservancy Press |

### 7.2 课程资源开发与利用

#### 7.2 Development and Utilization of Course Resources

学习资料资源：实训指导书、题库，包括《水电站厂房设计规范》（SL266-2014）、《小型水电站施工技术规范》（SL172-2012）等规范；

Learning resources: training instructor and question bank, including *Design Code for Hydropower House* (SL266-2014) and *Technical Code for Construction of Small-sized Hydropower Station* (SL172-2012);

信息化教学资源：多媒体课件、多媒体素材、动画及网络课程。

Informatization teaching resources: Multimedia courseware, multimedia materials, animation and online courses.

信息化教学平台：《水工混凝土结构》河南省精品在线开放课程、智慧职教云课堂等。

Information-based teaching platform: Henan province high-quality online open course *Hydraulic Concrete Structure*, ICVE classroom, etc.

### 7.3 教学必需的保障条件及建议

#### 7.3 Necessary Guarantee Conditions and Suggestions for Teaching

(1) 软硬件条件

(1) Software and hardware conditions



校内实训基地有混流式水轮机结构实训场、轴流式水轮机结构实训场、抽水蓄能电站厂房（水电站虚拟仿真中心）、水电厂运行仿真实训室、调速器及辅助设备实训室、水轮发电机组安装与检修实训室、水电厂电力系统微机保护实训室，主要配套的教学设备有实验仪器、多媒体机房与教室。

On-campus training bases include francis hydraulic turbine structure training field, axial flow turbine structure training field, pumped storage plant house structures (virtual simulation center of hydropower plants), plant house operation simulation training room, speed controller and auxiliary equipment training room, hydro-generator installation and maintenance training room, and plant house power system microcomputer protection training room. The main supporting teaching equipment includes experimental instruments, multimedia computer room and classroom.

本课程具备的网络课程如下：

The online courses of this course are as follows:

《水电站》在线开放课程：

Online open course *Hydropower Plants*;

<http://www.icourse163.org/course/YRCTI-1207106809?tid=1461500472>

高等职业教育水利水电建筑工程专业教学资源库：

水电站- 智慧职教

Resource database for Water Conservancy and Hydropower Construction Engineering of higher vocational education;

*Hydropower Plants-ICVE*

[https://www.icve.com.cn/portal\\_new/courseinfo/courseinfo.html?courseid=r2reabkkmabftcbsn1kdlw](https://www.icve.com.cn/portal_new/courseinfo/courseinfo.html?courseid=r2reabkkmabftcbsn1kdlw)

《水电站建筑物施工》国家精品资源共享课：

National high-quality resource sharing course *Hydropower Plants Structures Construction*;

[http://www.icourses.cn/sCourse/course\\_6141.html](http://www.icourses.cn/sCourse/course_6141.html)

(2) 师资条件

(2) Teachers' condition

教学团队要求具有职业道德，热爱学生，严谨认真，具有丰富的教学经验及企业经历的“双师”结构教师；教师要具备信息化教学能力；具备熟练的工具书使用能力；具备独立完成中小型水电站设计能力。

The faculty is made up of teachers who have excellent work ethics, love students, work carefully, and have abundant teaching experience and enterprise experience; Teachers should master information-based teaching, use reference books easily and could independently design the small and medium-sized hydropower plants.