

Ministry of Science Research and Technology



DANESHPAJOOHAN PISHRO
Higher Education Institute

2022

Master of Science in Civil Engineering-Environment



DANESHPAJOOHAN PISHRO HIGHER EDUCATION INSTITUTE

- **COURSE CHART**
- **SYLLABUS**
- **SEMESTER CHART**

Civil Engineering- Environment Courses

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034011	Basics of Water and Wastewater Treatment	3	3	0	----	----
3034012	Basics of Solid Waste Engineering and Management	3	3	0	----	----
3034013	Fundamentals of Advection and Diffusion Pollution Modeling	3	3	0	----	----
3034014	Sustainable Development and Environmental Management	3	3	0	----	----
3034015	Seminar and Research Methods	2	2	0	----	----
3034016	Thesis	6	0	6	Passing at least 3 semesters	----
Total Credits		20				

Elective Courses

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034021	Advanced Water and Wastewater	3	3	0	----	----
3034022	Design of Water and Wastewater Treatment	3	3	0	----	----
3034023	Wastewater Recycling and Reuse	3	3	0	----	----
3034024	Environmental Laboratory	1	0	1	----	----
3034025	Solid Waste Management, Processing and Recycling	3	3	0	----	----
3034026	Waste Containment and Recycling Technology	2	2	0	----	----
Total Credits		15	Students are required to pass 12 credits from the elective courses.			
Total Credits (All Courses)		35				

Basics of Water and Wastewater Treatment

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034011	Basics of Water and Wastewater Treatment	3	3	0	-----	----

Some of the topics of the course include:

Water:

- An overview of physical, chemical and biological processes for water treatment
- Water quality
- Aeration
- Settling
- Anaerobic wastewater treatment reactors
- Tertiary Treatment: (Disinfection, removing phosphorus and azote, removing floating materials and parasite eggs, removing materials that cannot be decomposed biologically)
- Unwanted sludge treatment: Calculating the amount of unwanted sludge, concentration, digestion, dewatering and its disposal)
- Water Treatment Plants Units (Treatment plant units, selecting the right treatment plant process based on water quality)

Wastewater

- An overview of physical, chemical and biological processes for wastewater treatment
- Characteristics of municipal wastewater and how to distinguish it from industrial wastewater
- Physical Treatment
- Biological Treatment
- Taste and odor control
- Filtration
- Disinfection

Basics of Solid Waste Engineering and Management

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034012	Basics of Solid Waste Engineering and Management	3	3	0	-----	----

Some of the topics of the course include:

- Introduction to solid waste management (history and the path of changes, sanitary effects, rules, economy, accountable and support elements)
- Production basics, classification, bonding and characteristics (physical, chemical, biological) of waste
- Municipal and industrial hazardous waste

- Solid waste parameters (moisture, apparent and real density of the particles, thermal value, chemical bonding, mechanical properties, compressibility, biological decomposition and...)
- Defining modern solid waste management (Waste reduction, production, source separation and storing, collection, transportation, processing, disposal and post-disposal monitoring)
- Recirculation and reuse
- Aerobic composting (Features of compost, production methods, processes, effective parameters, leachate treatment and management, machinery and equipment, calculating the dimensions of the area needed for composting, calculating the amount of air needed)
- Anaerobic composting (Variety, explaining the process, calculating the amount of emission, calculating the dimensions of the reactor)
- Combustion and energy recovery (Combustion process, combustibles, bottom ash disposal and...)
- Incineration (Atmosphere pollutants control, calculating the thermal energy and the air needed for incineration)
- Sanitary landfill (Necessities and problems originating from landfilling, methods, choosing the right place, details about the waste buried, waste interaction, soil)
- Directing waste in the soil (rules governing flow, electrical directing, electro kinetic phenomena, electro-osmosis theory)
- Waste advection in a saturated environment (advection through concentration gradient, advection through hydraulic gradient, general equation for pollution advection in soil, advection parameters estimation, adsorption isotherms, modeling systems of pollution advection in soil)
- Sanitary landfill (composite liner, landfill covering, geosynthetics applications, post-landfill monitoring, leachate and gas collection and management, calculating the quantity and quality of leachate and gas)

Fundamentals of Advection and Diffusion and Pollution Modeling

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034013	Fundamentals of Advection and Diffusion and Pollution Modeling	3	3	0	-----	----

Some of the topics of the course include:

- Advection and diffusion phenomena in the environment
- Advection-Diffusion in water
- Advection-Diffusion in soil and groundwater
- Advection-Diffusion in air
- Operations causing advection-diffusion
- Mass balance and flow equations
- Advection-Diffusion Equations
- Analytical one-dimensional solution to advection-diffusion equation
- Introduction to numerical methods
- Solving one - dimensional advection equations, diffusion equations and advection-diffusion equations and crossing between the three

- Important points of two-dimensional and three - dimensional numerical solution to advection-diffusion equation
- Advection-Diffusion modeling in surface water
- Advection-Diffusion modeling in soil and groundwater
- Advection-Diffusion modeling in air

Sustainable Development and Environmental Management

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034014	Sustainable Development and Environmental Management	3	3	0	-----	----

Some of the topics of the course include:

- The importance of Environment Engineering among all civil engineering branches
- Sustainable development, definition history and indicators
- Framework of editing the sustainable development indicators (PSR, DPSIR)
- Rules, standards and important contracts in environment protection field
- Preparing land: basics, tools and methods
- Environmental management of surface and underground water and pollution control
- Environmental management of sea water and pollution control
- Environmental management of soil and treatment methods for contaminated soil
- Environmental management of municipal and industrial solid waste and hazardous waste materials
- Environmental management of air pollution, indicators, pollution resource and control
- Environmental management of noise pollution, indicators, pollution resource and control
- Classic and modern simulation models and existing tools
- Single-goal and multi-goal optimization models and existing tools
- Applications of systematic view in planning and different environmental system management
- Evaluation, decimal and environmental auditing

Seminar and Research Method

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034015	Seminar and Research Method	2	2	0	-----	----

The goal of the course is to introduce students to principles and basics of research, research methods, oral and written presentation of scientific findings. In this course students will attend the class and will be introduced to research goals and methods and information gathering methods. Students will be required to present the information they would have gathered in the class. Students must collect information and overview technical literature in the civil engineering-environment field. Students have to practically exercise the use of information gathering and written presentation. Every single student should give a short scientific lecture and they will be evaluated by the teacher and the rest of the students.

Basics of Water and Wastewater Treatment

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034021	Advanced Water and Wastewater	3	3	0	----	----

Some of the topics of the course include:

- Water systems and distribution networks
- Calculating the demand and consumption includes: short, medium and long term consumption, the true identity of demand and consumption, change in demand and consumption in different seasons of time, effective factors in water consumption
- Introduction to network analysis methods (Introducing new solutions for hydraulic equations like Gradient Method, introducing Pressure Dependent Analysis.
- Introducing water without wages
- Effective qualitative parameters, modeling, water qualitative parameters, methods and models
- Calibration of different variations of hydraulic analysis of water networks and different calibration methods
- Water networks exploitation management: (Linear and non-linear planning, dynamic planning, integer planning) and new research methods like (Genetic Algorithm, ant colony, banned research, and heat simulation and ...) Their applications in water distribution systems and networks in design and final utilization stages.
- Monitoring the hydraulic and qualitative parameters by SCADA systems
- Water network exploitation management [Demand management - disaster management, management of maintenance, repair and improvement of pipes and water system units, pressure management]
- Water networks modeling
- Applications of GIS in modeling
- Introduction to systems like ANN, Fuzzy and Neuro-fuzzy systems
- Introduction to sewerage network hydraulics and different methods of equation solving
- Defining network variations in domestic and surface sewerage systems and introducing modeling methods
- Final explanations about domestic and surface sewerage systems and networks

Design of Water and Wastewater Treatment

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034022	Design of Water and Wastewater Treatment	3	3	0	----	----

The main goal of the course is to introduce students to the design of water and wastewater treatment. This course explores the basics for design of different treatment plant units, regulations and standards. It will also discuss the indicators for the right plant structure, cost estimation and economical analysis for the correct design of treatment.

Some of the topics of the course:

- Physical, chemical and biological processes of water and wastewater treatment overview
- Water and wastewater treatment units
- How to select the right treatment method based on water quality and raw sewage
- Design of aeration units
- Design of activated sludge systems
- Design of lagoons
- Design of trickling filters
- Other biological wastewater treatment methods
- Sludge digester
- Design of adsorption and ion exchange units
- Cost estimation for the design of water and wastewater treatment

Wastewater Recycling and Reuse

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034023	Wastewater Recycling and Reuse	3	3	0	-----	-----

Some of the topics of the course:

- Identifying water resources with the consideration of issues of using fresh water, water usage and...
- History, the state of usable options, the necessity and benefits of wastewater reusing in Iran and the whole world
- Laws and standards concerning the wastewater reuse
- The sanitary effects and sides to the reuse of wastewater
- Identifying the wastewater pollution by focusing on their origin
- Reusing wastewater in industry
- Reusing wastewater in agriculture
- Reusing wastewater in supplying groundwater and conservation in case of a future drought
- Reusing wastewater in raising fish and for entertainment applications
- Planning and managing wastewater recycling systems
- Wastewater treatment processes considering the treated wastewater usage
- Waste disposal in the ground

Environmental Laboratory

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034024	Environmental Laboratory	1	0	1	-----	---

This course introduces students to important environmental parameters, organic and inorganic parameters measuring devices and methods in different environments.

Some of the topics of the course:

- Indicating water and wastewater permanent and temporary hardness
- PH alkalinity test
- Jar test
- Chlorine level test
- Dissolved oxygen measuring test
- Nitrate and Nitrite test
- BOD test and COD test
- Phosphate measuring test
- Detergent measuring test
- Measuring CO and CO₂ in the air
- Measuring Physical characteristics of water and wastewater including
- Noise measuring test

Solid Waste Management, Processing and Recycling

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
3034025	Solid Waste Management, Processing and Recycling	3	3	0	—	—

Some of the topics of the course:

- Introduction to solid waste management (history and the path of changes, sanitary effects, rules, economy, accountable and support elements)
- Production basics, classification, bonding and characteristics (physical, chemical, biological) of waste
- Solid waste parameters (moisture, apparent and real density of the particles, thermal value, chemical bonding, mechanical properties, compressibility, biological decomposition and...)
- Defining modern solid waste management (Waste reduction, production, source separation and storing, collection, transportation, processing, disposal and post-disposal monitoring)
- Recirculation and reuse
- Aerobic composting (Features of compost, production methods, processes, effective parameters, leachate treatment and management, machinery and equipment, calculating the dimensions of the area needed for composting, calculating the amount of air needed)
- Anaerobic composting (Variety, explaining the process, calculating the amount of emission, calculating the dimensions of the reactor)
- Combustion and energy recovery (Combustion process, combustibles, bottom ash disposal and...)
- Incineration (Atmosphere pollutants control, calculating the thermal energy and the air needed for incineration)
- Hazardous waste management (Household hazardous waste, hospital hazardous waste, industrial hazardous waste)
- Geotechnical basics and waste advection in a saturated environment (Directing waste in the soil, rules governing flow, electrical directing, electrokinetic phenomena, electro-osmosis)

theory, advection through concentration gradient, advection through hydraulic gradient, general equation for pollution advection in soil, advection parameters estimation, adsorption isotherms, modeling systems of pollution advection in soil)

- Sanitary landfill (Necessities and problems originating from landfilling, methods, choosing the right place, details about the waste buried, waste interaction, soil, composite liner, landfill covering, geosynthetics applications, post-landfill monitoring, leachate and gas collection and management, calculating the quantity and quality of leachate and gas)

