University of Isfahan

Course outline
Environmental Engineering
Graduate Program

Department of Civil Engineering
Faculty of Civil Engineering and Transportation
University of Isfahan

September 2024

1. Definition and goal

Environmental Engineering is a recently developed graduate program aims on training skilled experts and environmental analysts. It emphasizes designing and operating treatment facilities (e.g. potable and reused water, domestic and industrial wastewater, urban and hazardous solid waste, agricultural drainage, etc.) with their conveyance systems. Having innovative, integrated and inclusive approach toward environmental management systems for sustainable production and resource allocation is another purpose of this program.

2. Duration of Program and the structure

The average duration of Master and PhD program are 2 and 4 years, respectively. Every semester lasts 16 complete weeks of education. Each theoretical course takes 16 hours, each laboratory course might take 32 or 48 hours, and each workshop takes 48 hours each semester.

3. Credits

The total number of credits in Master and PhD program is 32 and 36, respectively as described in Tables 1-2. The titles of all core and elective courses are listed in Table 3.

Table 1. Course credits of Environmental Engineering graduate program (Master)

No.	Type of courses	Credits
1	Core courses	11
2	Seminar	1
3	Research Method	1
5	Elective courses	15
6	Thesis	6
Total		32

Table 2. Course credits of Environmental Engineering graduate program (PhD)

No.	Type of courses	Credits
1	Core courses	9
2	Elective courses	9
3	Thesis	18
Total		36

Table 3. Core and elective courses of Environmental Engineering graduate program

Course No.	Course Title	Credits	Hours per week		Pre-requisites
			Theoretical	Practical	
CN:3016047	Fundamentals of advection-diffusion and pollution modeling	3	3	-	-
CN:3016048	Engineering principles of water and wastewater treatment	3	3	-	-
CN:3016539	Principles of solid waste and air pollution management	3	3	-	-
CN:3016055	Sustainable development and environmental management	3	3	-	-
CN:3016540	Water resource systems analysis and management	3	3	-	-
CN:3016473	Basics of research methodology	1	1	-	-
CN:3016472	Seminar	1	1	-	-
CN:3016541	Water treatment plant design	3	3	-	-
CN:3016542	Wastewater treatment plant design	3	3	-	-
CN:3016543	Advanced water and wastewater treatment	3	3	-	-
CN:3016072	Design of water distribution networks and sewer systems	3	3	-	-
CN:3016082	Water recycling and wastewater reuse	3	3	-	-
CN:3016447	Water quality management	3	3	-	-
CN:3016064	Surface water flow and pollution modeling	3	3	-	-
CN:3016214	River engineering	3	3	-	-
CN:3016059	Marine environmental engineering	3	3	-	-
CN:3016443	Urban water management	3	3	-	-
CN:3016062	Air flow and pollution modeling	3	3	-	-
CN:3016061	Solid waste engineering, management, processing and recycling	3	3	-	-
CN:3016544	Industrial and hazardous waste management	3	3	-	-
CN:3012153	Transportation and environment	3	3	-	-
CN:3016230	Environmental geotechnics	3	3	-	-
CN:3016545	Environmental risk assessment	3	3	-	-
CN:3016058	Environmental knowledge, planning and management	3	3	-	-
CN:3016546	Environmental policy and economics	3	3	-	-

Course No.	Course Title	Credits	Hours per week		Pre-requisites
			Theoretical	Practical	
CN:3016547	Principles of environmental governance	3	3	-	-
CN:3016442	Global warming and climate change	3	3	-	-
CN:3016548	RS and GIS applications in environmental engineering	3	3	-	-
CN:3016545	Environmental impact assessment of civil projects	3	3	-	-
CN:3016549	Operating and practice of environmental facilities	3	3	-	-
CN:3016550	Environmental technologies	3	3	-	-
CN:3016551	Special topics in environmental engineering	3	3	-	-
CN:3016075	Design principles of sustainable development	3	3	-	-
CN:3016552	Environmental chemistry and laboratory	3	2	1	-
CN:3016056	Numerical methods in environmental engineering	3	3	-	-
CN:3016395	Soft computation	3	3	-	-
CN:3016474	Advanced statistics	3	3	-	-

- It is mandatory to pass 11 credits (3 courses, seminar, basics of research methodology) from core courses during Master program.
- It is mandatory to pass 9 credits (3 courses) from core courses during PhD program.

FUNDAMENTALS OF ADVECTION-DIFFUSION AND POLLUTION MODELING

BASIC INFORMATION

Place in Curriculum and semester: Core, S2
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

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TEACHERS:

Person in charge: Dr. Shervin Jamshidi
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37932426
Homepage: https://engold.ui.ac.ir/~sh.jamshidi
Email Address: sh.jamshidi@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	-

COURSE OBJECTIVES

The course is aimed on the numerical and mathematical basics of the advection, diffusion, and dispersion of pollutants with their related equations (mainly in water and air medium) for modeling and calculation.

REQUIRED STUDENT RESOURCES

Textbooks and references:

- Chapra S.C. (2008). Surface Water Quality Modelling, Waveland Press Inc.
- De Visscher A. (2014). Air Dispersion Modeling, Foundations and Applications, Wiley.
- Chapra S.C., Canale R.P. (2015). Numerical methods for engineers (7^{th} edition), McGraw-Hill.

Web links:

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Computer Software:

QUAL2Kw

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Definitions and principles, pollution cycles and interrelations
2	Principles of pollution loading, flux and transportation (in fluids: water, air)
3	Reactors (CSTR, PFR, MFR) and related kinetic equations
4	Principles of advection, diffusion, dispersion and transportation
5	Mass balance equations (steady state) and solutions in CSTR
6	Mass balance equations (unsteady state) and solutions in CSTR
7	Mass balance equations (steady state) and solutions in PFR and MFR
8	Mass balance equations (unsteady state) and solutions in PFR and MFR
9	Mid-term and problem solving

Week	Topic
10	Numerical analysis (Euler, Runge-kutta, etc.) and control volume
11	Feed forward and feedback systems
12	A case study in river quality modeling (Drunkard model)
13	A case study in air quality modeling (Gaussian model)
14	Pollution export coefficients, point and diffuse pollution sources
15	Initial conditions, calibration methods and equations
16	Working with the software (group project)

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignments	20% of final grade
Project	20% of final grade
Mid-Term Exam	25% of final grade
Final Exam	35% of final grade
	100%

ATTENDANCE STATEMENT

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STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible.

APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

Last update: September 2024

ENGINEERING PRINCIPLES OF WATER AND WASTEWATER TREATMENT

BASIC INFORMATION

Place in Curriculum and semester: Core, S1
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Dr. Ali Dehnavi
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37934226
Homepage: http://eng.ui.ac.ir/~a.dehnavi
Email Address: a.dehnavi@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	-

COURSE OBJECTIVES

The course is aimed on the basics, introduction and application of conventional physical, chemical and biological processes and treatment units in both water and wastewater treatment plants.

REQUIRED STUDENT RESOURCES

Textbooks and references:

- Metcalf and Eddy (2014). Wastewater engineering, treatment and resource recovery (5th edition), McGraw-Hill.
- Qasim S.R., Zhu G. (2018). Wastewater treatment and reuse, theory and design examples, Volume 1, CRC press.

Web links:

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Computer Software:

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COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Definitions and principles of water and wastewater pollutants
2	Introduction of water and environmental quality standards (indicators, limits, applications)
3	An introduction to water treatment plants (WTP) and desalination systems
4	Primary water treatment processes (Screening, coagulation-flocculation, sedimentation)
5	Main water treatment processes (e.g. Filtration) and membrane systems
6	Post treatment processes (e.g. disinfection, scaling) and safety enhancement
7	WTP operation, equipments and control systems, layout optimization
8	An introduction to domestic and industrial wastewater treatment plants (WWTP)

Week	Topic
9	Primary wastewater treatment processes (Screening, grit removal, sedimentation)
10	Secondary wastewater treatment processes (Activated sludge, MBR, SBR, UASB)
11	Natural-based Secondary treatment processes (WSPs, constructed wetlands, lagoons)
12	Tertiary treatment processes (nutrients, toxics and heavy metals removal)
13	An introduction to sludge, its specifications and mass balance
14	Sludge processing and treatment units (thickening, dewatering, digestion, stabilization)
15	WWTP operation and challenges, equipments and control systems, energy consumption
16	Recycling and reuse of treated wastewater and processed sludge

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignments	25% of final grade
Mid-Term Exam	25% of final grade
Final Exam	50% of final grade
	100%

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SYLLABI ON WEB PAGES

Last update: September 2024

PRINCIPLES OF SOLID WASTE AND AIR POLLUTION MANAGEMENT

BASIC INFORMATION

Place in Curriculum and semester: Core, S2
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Dr. Ali Dehnavi & Dr. Shervin Jamshidi
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37934226
Homepage: http://eng.ui.ac.ir/~a.dehnavi
Email Address: a.dehnavi@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	-

COURSE OBJECTIVES

The course is aimed on the basics of solid waste management and air pollution reduction. This course also intends to introduce an attitude with typical methods / systems for managing these pollutions.

REQUIRED STUDENT RESOURCES

Textbooks and references:

- Tchobanoglous G., Kreith F. (2002). Handbook of Solid Waste Management (2nd edition), McGraw-Hill.
- Nemerow N.L., Agardy F.J., Salvato J.A. (2009). Environmental Engineering (6th edition), Wiley.

Web links:

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Computer Software:

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COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	An introduction to solid waste management
2	Definitions, history of solid waste management, guidelines and regulations
3	Solid waste quantity and quality (classification, production rate and effective parameters)
4	An introduction to hazardous waste (Specifications and sources)
5	Waste management system (Collection, transportation, processing, composting, landfills)
6	Waste processing technologies (digestion, incineration, pyrolysis, RDF)
7	Novel approaches in solid waste management (3Rs: reduction, reuse, recycling)
8	Economic and social aspects of waste management (green and sustainable systems)
9	An introduction to air pollution

Week	Topic
10	Definitions, pollutants, guidelines and standards
11	Impacts of air pollution (human and ecosystem)
12	Air pollution and related phenomena (Dust storms, acid rain, ozone layer depletion)
13	Greenhouse gases, global warming and climate change
14	Meteorology, impacts of ambient parameters on air pollution (wind, heat, inversion)
15	Principles of air pollution advection – diffusion and modeling (Gaussian model)
16	Scenarios and conditions in modeling air pollution (trapped, large buildings, diffuse sources)

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignments	20% of final grade
Mid-Term Exam	30% of final grade
Final Exam	50% of final grade
	100%

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SYLLABI ON WEB PAGES

Last update: September 2024

SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT

BASIC INFORMATION

Place in Curriculum and semester: Core, S1
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Dr. Shervin Jamshidi
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37932426
Homepage: https://engold.ui.ac.ir/~sh.jamshidi
Email Address: sh.jamshidi@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 hr

COURSE OBJECTIVES

The course is aimed on introducing sustainable development with the basics of integrated approaches for environmental management. The latter focuses on system thinking about environmental challenges in accordance with "think globally-act locally".

REQUIRED STUDENT RESOURCES

Textbooks and references:

- Masten S.J., Davis M.L. (2020). Principles of Environmental Engineering and Science (4th edition), McGraw-Hill.
- Meadows D.H. (2009). Thinking in Systems, a primer, Earthscan.
- Theodore M.K., Theodore L. (2021). Introduction to Environmental Management (2nd edition), CRC Press.

Web links:

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Computer Software:

Vensim PLE

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	What is environmental management?
2	A review and discussion on local environmental challenges
3	A review and discussion on global and regional environmental challenges
4	What are the environmental systems? (different parts, cycles, feedbacks)
5	The role of materials and energy cycles and the critical ecosystems (e.g. wetlands, oceans)
6	What is inclusive and integrated perspective?
7	Sustainable development (definitions and goals, 2030 Agenda)

Week	Topic
8	Innovative and integrated solutions and approaches based on SDGs
9	App 1) Environmental literacy, social participation and environmental justice
10	App 2) IWRM, Water-Energy-Food-ecosystem nexus thinking, agroforestry
11	App 3) Environmental accounting and monitoring (EA, EIA, SEA, LCA)
12	App 4) Carbon and water footprints, sustainability indicators
13	App 5) Carbon offset programs, water quality markets and other fiscal policies
14	Conceptual modeling and frameworks (e.g. DPSIR)
15	Principles of system dynamics (causal loops: reinforcing and balancing)
16	Simulation an environmental system by Vensim PLE (project)

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignments	30% of final grade
Projects	40% of final grade
Final Exam	30% of final grade
	100%

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SYLLABI ON WEB PAGES

Last update: September 2024

ENVIRONMENTAL IMPACT ASSESMENT

BASIC INFORMATION

Place in Curriculum and semester: Elective, S3
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES: -

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TEACHERS:

Person in charge: Dr. Ali Dehnavi
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37934226
Homepage: http://eng.ui.ac.ir/~a.dehnavi
Email Address: a.dehnavi@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

List the objectives, goals, aims, and/or outcomes for the course.

Students are expected to:

- ✓ Understand the various dimensions of the environment, environmental challenges and the need for environmental assessment as a management tool
- ✓ Be aware of the legislation, regulations and requirements of environmental assessment.
- ✓ Learning the effects and environmental consequences of civil and construction projects on the
- ✓ environment.
- ✓ Familiarize with the methods of projects environmental assessment

REQUIRED STUDENT RESOURCES

List books, lab manuals, technology, supplies, calculators, and any other materials required or recommended for the student to complete the course requirements.

Textbooks:
In English:

- Anji Reddy Mareddy, "Environmental Impact Assessment: Theory and Practice", 1st Edition, Butterworth-Heinemann publisher, 2017.
- John Glasson, Riki Therivi and Andrew Chadwick, "Introduction to Environmental Impact Assessment (Natural and Built Environment Series), 4th Edition, Routledge publisher, 2012.

In Persian:

- Masoud Monavariri, "Environmental Impact Assessment", 2nd Edition, Mitra publisher, 2008.
- Mahmoud Shariat and Masoud Monavariri, "Introduction to environmental impact assessment", published by DOE, 1997.

References in Persian:

- DOE, Human's Environmental Laws, Regulation Criteria and Standards, Department of Environment (DOE), 2012.
- PBO, Guide to Strategic Environmental Assessment for Civil Projects, Criterion No. 690, Planning and Budget Organization (PBO), 2015.
- DOE, Environmental Impact Assessment of Civil Projects, Department of Environment (DOE), Deputy of Education and Research, 2008.

Web links:

http://research.wrm.ir
http://waterstandard.wrm.ir

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Provide students with a tentative projected outline of significant events that occur throughout the semester, including assignments, projects, examinations, field trips, guest speakers, etc. *For example:*

Week	Topic
1	Introduction to the lesson and its general presentation
2	General and the need for environmental protection (with emphasis on water resources as a case study)
3	Development and sustainable development
4	Systems thinking approach for development (with emphasis on water resources as a case study)
5	Introduction to Ecosystems
6	Water Quality indicators
7	Air and Soil quality indicators
8	Acquaintance to important strategies of water resources development projects: problems and solutions (by emphasizing important aspects in EIA)
9	
10	Environmental Economics and Environmental Auditing
11	Presenting the generals of EIA, history in the world and Iran
12	Sections of the EIA report
13	Presentation of EIA methods
14	
15	Presenting student projects
16	Presenting student projects

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	10% of final grade
Project	25% of final grade
Final Exam	65% of final grade
	100%

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

Last update: September 2024

URBAN WATER MANAGEMENT

BASIC INFORMATION

Place in Curriculum and semester: Elective, S3
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Dr. Ramtin Moeini
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37935293
Email Address: r.moeini@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

Students are expected to:

- ✓ become familiar with the design of water distribution network and related software.
- ✓ become familiar with the methodology of urban water management

REQUIRED STUDENT RESOURCES

Textbooks and References:

- Cantor A.F (2018). Water Distribution System Monitoring: A Practical Approach for Evaluating Drinking Water Quality (2nd edition), CRC press.
- Trifunovic N. (2020). Introduction to urban water distribution, Volume 1: Theory (2nd edition), CRC press.

Web links:

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Computer Software:

EPANET, WaterCAD, WaterGEMS

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Presenting the syllables and policy regarding class absence, fundamental concepts, generalities and principles of urban water management and planning
2	Investigation of water supply, transmission and distribution system
3	Became familiar with components of urban water supply and distribution systems (pipe, valve, pump, tank, reservoir)
4	A review of fluid mechanics concepts and generalities (continuity, momentum and energy equations)
5	Presenting different calculation methods for pressure flow
6	Simulation of urban water system (design period, population, consumption, peak coefficients, design discharge, velocity and pressure limitations)
7	The principles of designing and formulating branching and looped networks and solving methods

Week	Topic
	(simple iterative, linear theory, Newton-Raphson, Hardy Cross)
8	Optimization of urban water system (objective function and constraints definition, methodology of solving)
9	Water use (consumption) management and analysis of urban water system
10	Water demand management and analysis of urban water system
11	Comprehensive management of urban water (leakage and water loss determination and management)
12	Comprehensive management of urban water (burst and background losses, physical and non physical losses, authorized and unauthorized consumption, unbilled authorized consumption)
13	Comprehensive management of urban water (district metered area (DMA), FAVAD theory)
14	National and international urban water management challenges
15	Reliability and risk analysis of water supply networks
16	Primary familiarized design software such as EPANET, WaterCAD, SewrCAD, WaterGEMS, SewerGEMS

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	10% of final grade
Project	10% of final grade
Mid-Term Exam	30% of final grade
Final Exam	50% of final grade
	100%

ATTENDANCE STATEMENT

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STUDENTSWITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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SYLLABI ON WEB PAGES

Last update: September 2024

WATER QUALITY MANAGEMENT

BASIC INFORMATION

Course prefix, title and semester: Elective, S1
Number of credits: 3

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Dr. Shervin Jamshidi
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37932426
Email Address: sh.jamshidi@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 hr	-	-

COURSE OBJECTIVES

Students are expected to:

- ✓ become familiar with pollution and environmental protection policies.
- ✓ become familiar with the types of emission sources.
- ✓ become familiar with the principles of advection-diffusion of pollutants
- ✓ become familiar with the principles of surface water quality modeling
- ✓ become familiar with the advances in water quality management

REQUIRED STUDENT RESOURCES

Textbooks and References:

- Chapra S.C. (2008), Surface Water Quality Modeling, McGraw Hill.
- Eckenfelder W.W., Hansard W.N. (2004), Understanding water quality management-Technology and applications, DEStech publications
- Thomann R.V. and Mueller J.A. (1987), Principals of Surface Water Quality Modeling and Control, Pearson

Web links:

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Computer Software:

Qual2k

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Definitions
2	Water quality parameters
3	Standards of water quality monitoring/TMDLs
4	Types of water resources and modeling
5	Types of pollutants and emission sources
6	Lake and reservoir quality management (Eutrophication)

Week	Topic
7	Lake and reservoir quality management (Thermal stratification)
8	Mid-term
9	Groundwater quality management and indices
10	Kinetics and equations of river quality modeling
11	Mass balance and advection-diffusion equations
12	River quality management and modeling (QUAL2K)
13	Toxics and bio-indicators
14	Advances in water quality management
15	Water quality trading
16	Project

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	10% of final grade
Project	30% of final grade
Mid-Term Exam	20% of final grade
Final Exam	40% of final grade
	100%

ATTENDANCE STATEMENT

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STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

Last update: September 2024

WATER RESOURCE SYSTEM ANALYSIS

BASIC INFORMATION

Course prefix, title and semester: Core, S3
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

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TEACHERS:

Person in charge: Dr. Ramtin Moeini
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number:+98 (31) 37935293
Email Address: r.moeini@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

Students are expected to:

- ✓ become familiar with the methods of modeling, analysis and evaluation of various issues in the field of water resources engineering and management

REQUIRED STUDENT RESOURCES

Textbooks and References:

- Loucks D.P., van Beek E. (2017). Water Resource Systems Planning and Management, Springer.
- Arora J. (2016). Introduction to optimum Design (4th edition), Elsevier.
- Simonovic S.P. (2009). Managing Water Resources: Methods and Tools for a Systems Approach, Earthscan.

Web links:

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Computer Software:

Matlab, LINDO, LINGO, GAMS, MODSIM, WEAP, MIKE-BASIAN, HEC-ResPRM

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Presenting the syllables and policy regarding class absence, Generality (basic concepts of water resources planning, system concept and its components)
2	Generality (Systematic approach, Integrated water resources management (IWRM), index definition (such as sustainability)
3	System modeling (water resource system modeling challenges and advances, different methods of modeling, simulation and optimization methods)
4	Modeling steps, real examples of water resource management models (including surface and underground resource, qualitative and qualitative models)
5	Classical optimization (principles of optimization and optimality conditions, linear programming (LP) method,

Week	Topic
	Linear optimization models)
6	Graphical method, simplex method, Big-M and II-phase methods, Dual model, sensitivity analysis
7	Network models: Basis and importance of network models, Shortest path model, Maximum flow model, Minimum spanning tree model, Critical path method
8	Nonlinear optimization and nonlinear programming (NLP) method (Lagrange method, Kuhn-Tucker condition, Necessary condition, constrained optimization problem)
9	Mixed integer linear and nonlinear programming methods, binary (Zero-one) problem
10	Dynamic programming (DP) method: basis of DP method and its theory, methodology of solving classical problem, forward and backward methods
11	Dynamic Programming (DP) method: inverted and non inverted forms, traveling salesman problem (TSP), water allocation problem, reservoir operation problem
12	Water storage volume determination of dam reservoir (Dead storage, active storage, surplus (flood) storage)
13	Active storage determination (simple methods, mass curves, Ripple, sequential peak method, simulation and optimization)
14	Water resource modeling (different water resource definition, single and multi objective models, single and multi purpose models)
15	Reservoir rule curves determination (standard operation policy (SOP), simulation, optimization)
16	Primary familiarized related software such as LINGO, LINDO, GAMS, MODSIM, WEAP, MIKE-BASIAN, HEC-ResPRM

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	10% of final grade
Project	20% of final grade
Mid-Term Exam	30% of final grade
Final Exam	40% of final grade
	100%

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SYLLABI ON WEB PAGES

Last update: September 2024

PRINCIPLES OF ENVIRONMENTAL GOVERNANCE

BASIC INFORMATION

Course prefix, title and semester: Elective, S2
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

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TEACHERS:

Person in charge: Dr. Shervin Jamshidi & Dr Hamed Yazdian
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37932426
Email Address: sh.jamshidi@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

Students are expected to become familiar with:
The principles and philosophy of environmental good governance and environmental ethics

REQUIRED STUDENT RESOURCES

Textbooks and References:

- Field B.C., Field M.K. (2017). Environmental Economics, an Introduction (7th edition), McGraw-Hill.
- Stevenson H. (2018). Global Environmental Politics: Problems, Policy and Practice, Cambridge.

Web links:

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Computer Software:

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COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	A review on sustainable development and planning
2	A review on system thinking in environmental management
3	What are causal loops and feedbacks?
4	Governance: definitions and different concepts
5	Multi level governance (horizontal/ vertical)
6	Adaptive and good governance
7	Conflicts (common-pool) and resolution methods
8	Environmental regulations and the legislation frameworks
9	Power and the basics of political economics
10	Fiscal policies: Carbon offsets and permit markets
11	What are institutions?
12	Social capacity-building and local participations
13	Environmental justice (Philosophy and trends)

Week	Topic
14	Environmental ethics (based on Islamic thoughts)
15	Discussion and problem solving
16	Discussion on project

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	35% of final grade
Project	35% of final grade
Final Exam	30% of final grade
	100%

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SYLLABI ON WEB PAGES

Last update: September 2024

MARINE ENVIRONMENTAL ENGINEERING

BASIC INFORMATION

Course prefix, title and semester: Elective, S1
Number of credits: 3

COURSE PREREQUISITES:

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COURSE CO-REQUISITES:

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TEACHERS:

Person in charge: Dr. Ahmad Shanehsazzadeh
Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 37935328
Homepage: http://eng.ui.ac.ir/~a.shanehsazzadeh
Email Address: a.shanehsazzadeh@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

Students are expected to become familiar with:
The principles and philosophy of environmental good governance and environmental ethics

REQUIRED STUDENT RESOURCES

Textbooks and References:

- Weis J.S. (2015). Marine Pollution: what everyone needs to know, Oxford Press.
- Kumar S. (2021). Modern Treatment Strategies for Marine Pollution: Recent Innovations, Elsevier.
- Grace R.A. (2009). Marine Outfall Construction, ASCE Press.

Web links:

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Computer Software:

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COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Introduction and definitions
2	Marine environmental pollutants
3	Emerging pollutants (microplastics)
4	Pollution classification and sources (point – diffuse)
5	Marine pollution control methods
6	Marine pollution reduction technologies
7	Environmental impacts of marine pollution
8	Marine pollution standards and guidelines
9	Principles of pollution advection – diffusion in marine environment
10	Ambient effective parameters (e.g. tides, waves)
11	Impacts of coastal structures on pollution transport

Week	Topic
12	Principles of discharging wastewater from coastal areas
13	Estuaries (specifications and modeling highlights)
14	Case specific analysis
15	Case specific analysis (2)
16	Final project development

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	20% of final grade
Project	30% of final grade
Final Exam	50% of final grade
	100%

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