University of Isfahan

Course outline

Water Resources Engineering and Management Graduate Program

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

September 2024

1. Definition and goal

Water Resources Engineering and Management graduate program is one of the higher education programs that its goal is training skilled experts for design and management of water resources issues.

2. Duration of Program and the structure

The average duration of this program is 2 years. 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 this program is 32 and 36 credits (for MS and PhD programs, respectively) that is described in Table 1 and Table 2. The titles of the aforementioned courses are as listed in Table 1 to 5.

Table 1. Course credits of Water Resources Engineering and Management graduate program (MS Program)

No.	Type of courses	Credits
1	Core courses (Type 1)	6
2	Seminar	1
3	Research Method	1
4	Core courses (Type 2)	Min 6, and Max 12
5	Elective courses	Min 6, and Max 12
6	Thesis	6
Total		32

Table 2. Course credits of Water Resources Engineering and Management graduate program (PhD Program)

No.	Type of courses	Credits
1	Core courses	0
2	Elective courses	15
3	Thesis	21
Total		36

Table 3. Core courses (Type 1) for Water Resources Engineering and Management graduate program (MS Program)

Course No.	Course Title	Credits	Hours per week			Prerequisites/ Co-requisites
			Theoretical	Practical	Guided learning	
CN:3016328	ADVANCED HYDROLOGY	3	3			Hydrology (BS of Civil Engineering)
CN:3016330	WATER RESOURCE SYSTEM ANALYSIS-I	3	3			
Total		6	6			

Table 4. Core courses (Type 2) for Water Resources Engineering and Management graduate program (MS Program)

Course No.	Course Title	Credits	Hours per week			Prerequisites/ Co-requisites
			Theoretical	Practical	Guided learning	
CN:3016327	ADVANCED OPEN CHANNEL HYDRAULICS	3	3			
CN:3016385	HYDROINFORMATICS	3	3			
CN:3016389	ADVANCED GROUNDWATER	3	3			
CN:3016447	WATER QUALITY MANAGEMENT	3	3			
Total		12	12			

- Minimum of 2 credits and maximum of 4 should be passed from this table.

Table 5. Selected elective courses for Water Resources Engineering and Management graduate program (MS and PhD Programs)

Course No.	Course Title	Credits	Hours per week			Prerequisites/ Co-requisites
			Theoretical	Practical	Guided learning	
CN:301652	ECONOMICS OF WATER RESOURCES PROJECTS	3	3	-	-	-
CN:3016431	ENVIRONMENTAL IMPACT ASSESMENT	3	3	-	-	-
CN:3016446	FLOOD and DROUGHT MANAGEMENT	3	3	-	-	-
CN:3016443	URBAN WATER MANAGEMENT	3	3	-	-	-
CN:3016476	WATER RESOURCE SYSTEM ANALYSIS-II	3	3	-	-	-

ADVANCED GROUNDWATER

BASIC INFORMATION

Place in Curriculum and semester: Core, S2

Number of credits: 3

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Dr. Mahmoud Hashemi

Office location: Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran

Phone Number: +98 (31) 37935086

Homepage: http://eng.ui.ac.ir/~m.hashemi

Email Address: m.hashemi@eng.ui.ac.ir

WEEKLY HOURS

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

COURSE OBJECTIVES

The course is aimed to make student familiar with the types of aquifers, basic concepts of groundwater flow, groundwater hydraulics in steady and unsteady conditions near the wells, analysis, modelling, attenuation and remediation of groundwater pollution.

Students are expected to learn:

- ✓ General and basic concepts: history, types of porous media (unconsolidated, jointed, karst), types of aquifers (unconfined, confined, leaky, perched) and their characteristics, history of exploiting groundwater with emphasis on Iranian qanat system
- ✓ Introduction on the modelling: continuum approach in porous media, hydrologic cycle, groundwater budget equation, groundwater data and how to measure, record and report it
- ✓ Concepts of groundwater flow: concepts of porosity, hydraulic conductivity, storage, permeability, heterogeneity and anisotropy in aquifers
- ✓ General groundwater flow: Darcy law and its application in one-dimensional groundwater flow problems, Dupuit-Forchheimer assumptions and their application in unconfined aquifer flow
- ✓ Analysis of groundwater flow: General groundwater equation in unconfined and confined aquifers, application of groundwater flow equation in steady one-dimensional groundwater flow problems, application of groundwater flow equation in unsteady one-dimensional groundwater flow problems, potential theory and flow nets, two-dimensional steady groundwater flow
- ✓ Hydraulics of groundwater flow in unconfined aquifer well: hydraulics of groundwater steady flow in aquifer well, hydraulics of groundwater unsteady flow in aquifer well, pumping-out test, flow near boundaries, image well method
- ✓ Hydraulics of groundwater flow in confined aquifer well: hydraulics of groundwater steady flow in aquifer well, hydraulics of groundwater unsteady flow in aquifer well, Theis equation, Cooper-Jacob method, recovery method, hydraulics of groundwater unsteady flow in leaky aquifer well, multiple well systems, partially penetrating wells

- ✓ Groundwater pollution: natural quality of groundwater, salinity of groundwater and its sources, physical, chemical and biological characteristics of groundwater, municipal, industrial and agricultural irrigation sources of groundwater pollution, solved and dissolved pollutants of groundwater, light non-aqueous phase liquids LNAPLs and non-aqueous phase liquids DNAPLs, methods for attenuation and remediation of groundwater pollution
- ✓ Analysis of groundwater pollution: advection-dispersion equation, groundwater pollutants, analytical solution for advection-dispersion equation
- ✓ Remediation of groundwater pollution: monitoring quality and quantity of groundwater, methods for remediation of aquifers with emphasis on conventional pump and treatment method
- ✓ Saline water intrusion: types of water salinity problems in aquifers, island and coastal aquifers, Ghyben-Herzberg relation for estimation of fresh-saline waters interface, effect of well in form of fresh-saline waters interface (Strack relation), upconing of fresh-saline waters interface due to well pompage, equation of fresh-saline waters interface in oceanic island aquifers, control of saline water intrusion
- ✓ Numerical modelling of groundwater flow: various numerical models for solution of flow and solute transport equations, finite-difference method for solution of flow in steady and unsteady conditions, finite-difference method for solution of solute transport equation, introduction on MODFLOW and MT3DMS softwares, their related packages and applications

REQUIRED STUDENT RESOURCES

Textbooks:

1. Todd, D.K., Mays, L.W., Groundwater Hydrology, John Wiley & Sons, Inc. 2005. London, 273 p.

References:

1. Charbeneau, R.J., Groundwater Hydraulics and Pollutant Transport, Prentice-Hall, 2006.
2. Fetter, C.W., Applied Hydrogeology, Prentice-Hall, 2001.
3. Bedient, P.B., Rifai, H.S., Newell, C.J., Ground water contamination: transport and remediation, Prentice Hall 1994/1999.
4. Bear, J., Hydraulics of Groundwater, McGraw-Hill, New York, 1979.

Web links for Required Computer Softwares:

MODFLOW 6 v.6.2.2: USGS Modular Hydrologic Model

https://www.usgs.gov/software/modflow-6-usgs-modular-hydrologic-model

MT3D-USGS: Groundwater Solute Transport Simulator for MODFLOW

https://www.usgs.gov/software/mt3d-usgs-groundwater-solute-transport-simulator-modflow

The Groundwater Toolbox: A Graphical and Mapping Interface for Analysis of Hydrologic Data

https://www.usgs.gov/software/groundwater-toolbox-graphical-and-mapping-interface-analysis-hydrologic-data

PEST++, a Software Suite for Parameter Estimation, Uncertainty Analysis, Management Optimization and Sensitivity Analysis

https://pesthomepage.org/

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	General and basic concepts: history, types of porous media (unconsolidated, jointed, karst), types of aquifers (unconfined, confined, leaky, perched) and their characteristics, history of exploiting groundwater with emphasis on Iranian qanat system

Week	Topic
2	Introduction on the modelling: continuum approach in porous media, hydrologic cycle, groundwater budget equation, groundwater data and how to measure, record and report it
3	Concepts of groundwater flow: concepts of porosity, hydraulic conductivity, storage, permeability, heterogeneity and anisotropy in aquifers
4	General groundwater flow: Darcy law and its application in one-dimensional groundwater flow problems, Dupuit-Forchheimer assumptions and their application in unconfined aquifer flow
5	Analysis of groundwater flow: General groundwater equation in unconfined and confined aquifers, application of groundwater flow equation in steady one-dimensional groundwater flow problems, application of groundwater flow equation in unsteady one-dimensional groundwater flow problems, potential theory and flow nets, two-dimensional steady groundwater flow
6	Hydraulics of groundwater flow in unconfined aquifer well: hydraulics of groundwater steady flow in aquifer well, hydraulics of groundwater unsteady flow in aquifer well, pumping-out test, flow near boundaries, image well method
7	Hydraulics of groundwater flow in confined aquifer well: hydraulics of groundwater steady flow in aquifer well, hydraulics of groundwater unsteady flow in aquifer well,
8	Hydraulics of groundwater flow in confined aquifer well: Theis equation, Cooper-Jacob method, recovery method, hydraulics of groundwater unsteady flow in leaky aquifer well, multiple well systems, partially penetrating wells
9	Groundwater pollution: natural quality of groundwater, salinity of groundwater and its sources, physical, chemical and biological characteristics of groundwater, municipal, industrial and agricultural irrigation sources of groundwater pollution,
10	Groundwater pollution: solved and dissolved pollutants of groundwater, light non-aqueous phase liquids LNAPLs and non-aqueous phase liquids DNAPLs, methods for attenuation and remediation of groundwater pollution
11	Analysis of groundwater pollution: advection-dispersion equation, groundwater pollutants, analytical solution for advection-dispersion equation
12	Remediation of groundwater pollution: monitoring quality and quantity of groundwater, methods for remediation of aquifers with emphasis on conventional pump and treatment method
13	Saline water intrusion: types of water salinity problems in aquifers, island and coastal aquifers, Ghyben-Herzberg relation for estimation of fresh-saline waters interface, effect of well in form of fresh-saline waters interface (Strack relation)
14	Saline water intrusion: upconing of fresh-saline waters interface due to well pompage, equation of fresh-saline waters interface in oceanic island aquifers, control of saline water intrusion
15	Numerical modelling of groundwater flow: various numerical models for solution of flow and solute transport equations, finite-difference method for solution of flow in steady and unsteady conditions
16	Numerical modelling of groundwater flow: finite-difference method for solution of solute transport equation, introduction on MODFLOW and MT3DMS softwares, their related packages and applications

EVALUATION PROCEDURES AND GRADING CRITERIA

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

100%

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024.

ADVANCED HYDROLOGY

Basic Information
Course prefix and semester: Core, S1
Number of credits: 3

Course prerequisites:
-
Course co-requisites:
-
Teachers:
Person in charge: Dr. Mohammadali Alijanian
Office location: Department of Civil Engineering and Transportation
Phone Number: +98 (31) 3793 5317
Email Address: m.alijanian@eng.ui.ac.ir

Weekly hours

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

Course Objectives
Students are expected to:
- ✓ become familiar with the hydrological equations and factors.
- ✓ become familiar with the statistical hydrology and calculations
- ✓ become familiar with the engineering approaches on evaluating runoffs

Required Student Resources
Textbooks and References:
- ✓ Eslamian S. (2014), Handbook of engineering hydrology: Environmental hydrology and water management.
- ✓ Karamouz M. (2013), Hydrology and Hydroclimatology: Principles and applications.
- ✓ Ven Chow (1988), Applied Hydrology.

Web links:
-
Computer Software:
-
Course Schedule/Outline/Calendar of Events

Week	Topic	Reading /Assignment
1	Hydrological cycles	-
2	Watershed specifications	-
3	Hydrometry and monitoring network	-
4	Precipitation (intensity, frequency)	HW1
5	Losses (infiltration, interception and impoundments)	HW2
6	Evaporation and Evapotranspiration	HW3
7	Hydrograph and runoff estimation (SCS method)	HW4
8	Mid-term	-
9	Unit hydrograph and synthetic unit hydrograph	HW5
10	Intense unit hydrographs (IUHs)	HW6

Week	Topic	Reading /Assignment
11	Flood routing and Muskingum method	HW7
12	Statistical hydrology	-
13	Statistical hydrology/2	HW8
14	Hydrological design criteria (PMP, PMF)	-
15	Drought and time series	-
16	Final Exam	-

EVALUATION PROCEDURES AND GRADING CRITERIA

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

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024.

ADVANCED OPEN CHANNEL HYDRAULICS

BASIC INFORMATION
Place in Curriculum and semester: Core, S2
Number of credits: 2

COURSE PREREQUISITES:
Fluid Mechanics, Open Channel Hydraulics

COURSE CO-REQUISITES:
-

TEACHERS:
Person in charge: Dr. Ahmad Shanehsazzadeh
Office location: Building no. 2, Faculty of Civil Engineering and Transportation, University of Isfahan, Azadi Sq., 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
Flow in open channel is part of fluid mechanics and the knowledge is applied in many civil engineering practices including design of hydraulic structures, river engineering, culverts, coastal and ocean engineering,

By the end of the course students are expected to:
- ✓ Understand the definition, physics and behavior of flow in open channels
- ✓ Apply the fluid mechanics basic laws in the open channels
- ✓ Solve the problems of steady and unsteady flows in open channels
- ✓ Calculate the water surface profile of gradually varied flow and flood routing
- ✓ Get familiar with the physics of various phenomena in open channels and the method of solutions
- ✓ Know the principles of numerical modeling the open channel flow and work with the related software.

REQUIRED STUDENT RESOURCES
Textbooks and References:
1. Open Channel Flow, Henderson.
2. Open Channel Hydraulics, Ven Te Chow
3. Open-Channel Hydraulics, Richard H. French

Web links:
-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Introduction
2	Review the concepts, definitions and basic principles
3	Application of fluid mechanics principles in open channel flow

Week	Topic
4	Application of Specific energy and specific force
5	Steady flow- uniform and gradually varied flow
6	Spatially varied flow-inflow
7	Spatially varied flow-outflow
8	Unsteady flow- introduction
9	Unsteady flow- Saint Venant equations
10	Computation of Saint Venant equations
11	Rapidly unsteady flow, surges and waves
12	Rapidly unsteady flow-dam break
13	Sediment transport- modes of transport
14	Estimate of sediment rate
15	Student research presentations: water hummer, transitions, scouring, spillways, stilling basins, wave theories
16	Open channel flow software (HEC-RAS)- student project

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	10% of final grade
Project	25% of final grade
Mid-Term Exam	15% of final grade
Final Exam	50% of final grade
	100%

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024.

ECONOMICS OF WATER RESOURCES PROJECTS

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

COURSE PREREQUISITES:
-
COURSE CO-REQUISITES:
-
TEACHERS:
Person in charge: Dr. Hamed Yazdian
Office location: Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 3793 5326
Email Address: h.yazdian@eng.ui.ac.ir

WEEKLY HOURS

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

COURSE OBJECTIVES
The purpose of this course is to acquaint students with the basic concepts of water resources economics, as well as economic evaluation of projects and water valuation in different sectors of consumption.

REQUIRED STUDENT RESOURCES
Textbooks and References:
1- Soltani G. (2018), Economics of Water Resources.
2- Ostrom, E.(2005).Understanding Institutional Diversity. Princton University Press, UK.
3- Instructions for Economic Studies of Water Resources Development Projects - Journal 285 of the Management and Planning Organization of Iran.
4- Griffin, R.C. (2005), Water Resource Economics: The Analysis of Scarcity, Policies, and Projects (MIT Press)

Web links:
-
Computer Software:
COMFAR
COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1,2	Familiarity with the concepts of water resources economics
3,4	Fundamentals of Engineering Economy
5	Application of engineering economy in water resources projects
6	Justification of water resources projects
7,8	Basics of water valuation
9	Valuation of domestic water
10	Agricultural water valuation
11	Industrial water valuation
12,13	Calculate the cost of water
14	Indicators of economic evaluation of water resources development projects

Week	Topic
15	Unconventional water sources
16	The concept of virtual water

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	50% of final grade
Final Exam	50% of final grade
	100%

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

Any students with disabilities or other special needs, which 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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct has occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024.

ENVIRONMENTAL IMPACT ASSESMENT

BASIC INFORMATION

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

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES: -

-

TEACHERS:

Person in charge: Dr. Ali Dehnavi
Office location: 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

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

Textbooks:

In English:

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

In Persian:

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

References in Persian:

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

7. 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

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

Syllabi on Web Pages

Last update: September 2024.

FLOOD and DROUGHT MANAGEMENT

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

Course prerequisites:
-
Course co-requisites:
-
Teachers:
Person in charge: Dr. Ramtin Moeini and Dr. Mohammadali Alijanian
Office location: Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 3793 5293 and +98(31)37935317
Email Address: r.moeini@eng.ui.ac.ir and m.alijanian@eng.ui.ac.ir

Weekly hours

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

Course Objectives
Familiarities with the concepts, principles, and governing laws on flood and drought are expected. Furthermore, identifying different methods of flood and drought controlling and managing will be considered in this course.

Required Student Resources
Textbooks and References:
1- Duivendijk, J.V. (2005). Manual on Planning of Structural Approaches to Flood Management, International Commission on Irrigation and Drainage (ICID) .
2- Mishra, A., Singh, V., (2011). Drought Modeling- A review, Journal of Hydrology, 403, 157–175.
3- Wilhite, D., (1993). Drought Assessment, Management, and Planning: Theory and Case Studies, Springer.

Web links:
-
Computer Software:
MTLAB, R, MINITAB, EASYFIT, HECs
Course Schedule/Outline/Calendar of Events

Week	Topic	Reading /Assignment
1	Introduction of the course; its application, generalities, and principles of flood management (presented by Dr. Moeini)	-
2	Types of floods, flood damages, flood management approaches (presented by Dr. Moeini)	HW 1
3	Hydrology and hydraulics of floodplain, precipitation model, runoff, flood trend finding, flood flood histogram (presented by Dr. Moeini)	HW 2
4	Reservoir operation management in flood conditions (presented by Dr. Moeini)	HW 3
5	Structural methods of flood control (reservoir, pit, sealing wall) - (Presented by Dr. Moeini)	HW 4

Week	Topic	Reading /Assignment
6	Non-structural methods of flood control (flood warning system) - (Presented by Dr. Moeini)	HW 5
7	Crisis Management, Student Seminars - (Presented by Dr. Moeini)	-
8	Definitions of Drought, Types of Droughts, Importance of Drought Survey - Causes and Effects - (Presented by Dr. Alijanian)	-
9	Drought Characteristics - Drought Parameters and Indices, Univariate and Multivariate Indices (Presented by Dr. Alijanian)	HW6
10	Spatial analysis and zoning of drought - Models of regional drought analysis - Temporal analysis of drought (Presented by Dr. Alijanian)	HW7
11	Risk analysis and uncertainty (basics and definitions of risk, hydrological and economic uncertainties) - (Presented by Dr. Alijanian)	HW8
12	Probability Drought Analysis (Return and Frequency Analysis Period, Intensity-Area-Frequency Models) - (Presented by Dr. Alijanian)	HW9
13-14	Probabilistic Drought Analysis (Copula Multivariate Drought Analysis) - (Presented by Dr. Alijanian)	HW10
15-16	Drought Forecasting	HW11

EVALUATION PROCEDURES AND GRADING CRITERIA

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

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

Any students with disabilities or other special needs, which 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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct has occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024.

HYDROINFORMATICS

BASIC INFORMATION
Course prefix and semester: Core, S1
Number of credits: 3

COURSE PREREQUISITES:
-
COURSE CO-REQUISITES:
-
TEACHERS:
Person in charge: Dr. Mohammadali Alijanian
Office location: Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 3793 5317
Email Address: m.alijanian@eng.ui.ac.ir

WEEKLY HOURS

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

COURSE OBJECTIVES
Students are introduced to different methods of data mining, working with databases, machine learning, artificial intelligence, and soft computing, and utilizing them in water resources studies.

REQUIRED STUDENT RESOURCES
Textbooks and References:
1- Larose, D. T., Larose, C., D., (2014), Discovering Knowledge in Data: An Introduction to Data Mining, Wiley.
2- Dean, J., (2014), Big Data, Data Mining, and Machine Learning, Wiley
3- Kumar, P., Alameda, J., Bajcsy, P., Folk, M., Markus, M., (2006), Hydroinformatics: Data Integrative Approaches in Computation, Analysis, and Modeling, CRC Press.
4- Goubesville, P., Cunge, J., A., Caignaert, G., (2014), Advances in Hydroinformatics, SIMHYDRO, Springer.

Web links:
-
Computer Software:
MTLAB, R, MINITAB, EASYFIT
COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic	Reading /Assignment
1	Introduction to Hydroinformatics	-
2	Data preprocessing	HW 1
3	Soft Computing- Supervised Classification- knn method	HW 2
4-6	Soft Computing- Supervised Classification- PCA method	HW 3
7	Soft Computing- Unsupervised Classification- k-means clustering	HW 4
8-10	Soft Computing- ANN-GA	HW 5
11-12	Fuzzy Logic	HW6
13-14	Hydrologic Models	HW7
15-16	Geostatistics	HW8

EVALUATION PROCEDURES AND GRADING CRITERIA

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

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

Any students with disabilities or other special needs, which 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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct has occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024.

SEMINAR AND RESEARCH METHODS

BASIC INFORMATION
Course prefix and semester: Core, S1
Number of credits: 2

COURSE PREREQUISITES:
-
COURSE CO-REQUISITES:
-
TEACHERS:
Person in charge: Dr. Mohammadali Alijanian
Office location: Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran
Phone Number: +98 (31) 3793 5317
Email Address: m.alijanian@eng.ui.ac.ir

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES
Students are expected to:
- ✓ become familiar with the scientific searching and indexing.
- ✓ become familiar with the methods of presentation and scientific speech.
- ✓ become familiar with the principles of writing research proposals and thesis.

REQUIRED STUDENT RESOURCES
Textbooks and References:
www.clarivate.com
www.scimagojr.com

Web links:
-
Computer Software:
-
COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic	Reading /Assignment
1	Definitions	-
2	Introducing research steps	HW1
3	Types of publications and research outcomes	-
4	Types of references and indexing	-
5	Indices for evaluation of research	-
6	Keys to searching and literature review	-
7	Keys to develop an introduction	HW2
8	Types of material and methods (in Engineering)	HW3
9	Keys to prepare scientific results	HW4
10	Keys to develop discussion, abstract or conclusions	HW5
11	Keys to prepare a presentation	HW6

Week	Topic	Reading /Assignment
12	Reviewing process and keys to prepare responses	-
13	Seminar by students	-
14	Seminar by students	-
15	Seminar by students	-
16	Presenting proposals	-

EVALUATION PROCEDURES AND GRADING CRITERIA

Assignment	30 of final grade
Seminar	40% of final grade
Research proposal	30% of final grade
	100%

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024

URBAN WATER MANAGEMENT

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

COURSE PREREQUISITES:
-
COURSE CO-REQUISITES:
-
TEACHERS:
Person in charge: Dr. Ramtin Moeini
Office location: 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:
1. A. K. Sharma, Design of Water Supply Pipe Networks, Wiley-Interscience, 2008.
2. B. S.N. Raju, Water supply and wastewater engineering, New Dehli Publisher: Tata McGraw-Hill, 2000.
3. B.E. Larock, R.W. Jeppson and G.Z. Watters, Hydraulics of pipeline systems- CRC Press, 1999.
4. D.D. Baumann, J.J. Boland, W.M. Hanemann, Urban water Demand management and planning, McGraw-Hill, NewYork, 1997.
5. A. Chiplunkar, K. Seetharam, C.K. Tan, K.Y. Lee, Good practice in urban water management, National university of Singapore, 2012.
6. H.H.G. Saveniye, Vander Zaag, Demand Management and water as an economic good, IHE Netherlands, 2001.
7. D.V. walski, D. Chose, D. Savis, W.M., Greyman, S. Beckwith, E. Koelle, Advance water distribution modeling and management, Heasted Methods, 2000.

Web links:
-
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)

Week	Topic
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 (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

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTSWITH 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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024

WATER QUALITY MANAGEMENT

BASIC INFORMATION

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

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Dr. Shervin Jamshidi
Office location: 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	-	-	-

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:

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

Web links:

-

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)
7	Lake and reservoir quality management (Thermal stratification)

Week	Topic
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	Final Exam

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

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024

WATER RESOURCE SYSTEM ANALYSIS-I

BASIC INFORMATION
Course prefix and semester: Core, S1
Number of credits: 3

COURSE PREREQUISITES:
-
COURSE CO-REQUISITES:
-
TEACHERS:
Person in charge: Dr. Ramtin Moeini
Office location: 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:
1. D. P. Loucks, J.R. Stedinger, D.A. Haith, Water resource systems planning and analysis, Englewood Cliffs, N.J. : Prentice-Hall, First edition, 1981.
2. W. Hall, J. Darcup, Water resource system engineering, McGraw-Hill, NewYork, 1970.
3. L.W. Mays, Y.K. Tung, Hydro systems engineering and management, McGraw-Hill, NewYork, 1972.
4. C. Revelle, Optimizing reservoir resources: including a new model for reservoir reliability, John Wiley & Sons, NewYork, 1st edition, 1999.
5. J. Arora, Introduction to optimum Design, McGraw-Hill, 2004.
6. G. Hadley, Linear programming, Addison Wesley publishing company Inc., 1994.
7. N. Buros, Scientific allocation of water resources: water resources development and utilization-a rational approach, American Elsevier Publishing Company, 52 Vanderbilt Avenue, New York, 1971.
8. Dreyfus S.E., Averill, M.L., The art and theory of dynamic programming, Academic Press, 1977.
9. A.O. Esogbue, Dynamic programming for optimal water resources systems analysis, Prentice Hall Advanced Reference Series: Engineering, Englewood Cliffs, N.J. : Prentice-Hall, 1989.
10. C. Revelle, Optimizing reservoir resource: Including a New Model for Reservoir Reliability, John Wiley & Sons, INC. NewYork etc., 1999.

Web links:
-
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, 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%

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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.

<u>APPROVED ACADEMIC HONESTY STATEMENT</u>

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

<u>SYLLABI ON WEB PAGES</u>

Last update: September 2024

WATER RESOURCE SYSTEM ANALYSIS-II

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

COURSE PREREQUISITES:
Water resource system analysis-I
COURSE CO-REQUISITES:
-
TEACHERS:
Person in charge: Dr. Ramtin Moeini
Office location: 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 especially hydropower generation problems and swarm intelligent methods

REQUIRED STUDENT RESOURCES
Textbooks and References:
1. D.P. Loucks, E. van Beek, Water Resource Systems Planning and Management, Springer International Publishing, 2017
2. D. P. Loucks, J.R. Stedinger, D.A. Haith, Water resource systems planning and analysis, Englewood Cliffs, N.J. : Prentice-Hall, 1981
3. W.A. Hall, J.A. Darcup, J.A. Water resource system engineering, McGraw-Hill, NewYork, 1970.
4. L.W. Mays, Y.K. Tung, Hydro systems engineering and management, McGraw-Hill, NewYork, 2002
5. C. Revelle, Optimizing reservoir resources: Including a New Model for Reservoir Reliability, John Wiley & Sons, NewYork, 1999.
6. K.L. Du, M.N.S., Swamy, Neural Networks and Statistical Learning, Springer Science & Business Media, 2013.
7. D. Simon, Evolutionary Optimization Algorithms, John Wiley & Sons, NewYork, 2013.
8. J. Arora, Introduction to optimum Design, 4th Edition, Elsevier Science, 2017.
9. A.O. Esogbue, Dynamic programming for optimal water resources systems analysis, Prentice Hall, 1989.
10. J. Figueria, S. Greco, M. Ehrgott, M., Multiple Criteria Decision analysis, state of the art surveys, international series in operation research & management science, Frederick S. Hillier, Series Editor, Stanford University, 2016.
11. L.H. Tsoukalas, R.E. Uhrig, Fuzzy and neural approaches in engineering, 1st edition, John Wiley & Sons, NewYork, 1997.
12. G. J. Klir, Folger, T.A. Fuzzy sets, uncertainty and information, 1st edition, Prentice-Hall, Inc. Upper Saddle River, NJ, USA, 1988.
13. J. Figueria, S. Greco, M. Ehrgott, Multiple Criteria Decision analysis, state of the art surveys, International series in operation research & management science, Frederick S. Hillier, Series Editor, Stanford University, 2016.

Web links:

-

Computer Software:

Matlab, GAMS, MODSIM, WEAP

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Presenting the syllables and policy regarding class absence, Generality (basic concepts of water resources planning)
2	Introduction to different methods of simulation and optimization
3	Introduction to artificial neural networks (ANN)
4	Bayesian network, application of artificial neural networks for modeling water engineering problems (including reservoir rule curve determination)
5	Introduction to genetic algorithm (GA)
6	Introduction to ant colony optimization algorithm
7	Generalities and introduction of other meta-heuristic algorithms (including particle swarm optimization (PSO) algorithm, simulated annealing, etc.), application of meta-heuristic algorithms in solving water resources problems (including reservoirs operation problem)
8	Introduction to deterministic modeling in water resources systems, Introduction to dam reservoir, different parts, objectives and structure
9	Reservoir design methods (simple methods, mass curve, consecutive peaks, simulation and optimization), determination of dead capacity in the reservoir, methods of calculation and determination of flood control capacity
10	Introduction to hydropower systems, modeling, design and operation of hydropower systems
11	Stochastic modeling in water resources, stochastic dynamic programming (SDP)
12	Introduction to Fuzzy Logic
13	Multi-criteria decision making methods (AHP, ELECTRE, TOPSIS)
14	Introduction to multi-purpose multi-reservoir system
15	Reservoir rule curves determination (standard operation policy (SOP), simulation, optimization)
16	Primary familiarized related software such as GAMS, MODSIM, WEAP

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%

ATTENDANCE STATEMENT

The course instructor clearly informs students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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

The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Last update: September 2024