

University of Isfahan

# Course outline Construction Engineering and Management Graduate Program

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

September 2024

### 1. Definition and goal

The Master's degree program is one of the higher educational courses. This program includes a combination of core and elective courses. When defining terms related to civil engineering, it is essential to consider that facilitating development and improvement in any field necessitates the use of advisory hours. The objective of establishing this program is to train specialists in the execution management and control of civil engineering projects.

In construction engineering, relevant topics related to the design and implementation will be presented, which in turn will examine the scientific credibility and value of projects. The significant gap between the theoretical and practical realms of construction engineering has made this field a serious challenge, requiring attention and research. Construction management encompasses all aspects related to the management of construction projects.

The challenges presented must be addressed under appropriate scientific principles and standards, which can be implemented in various projects, focusing on practical project models. Therefore, there is a particular emphasis in this area. This aspect is essential for the continuous development of this field worldwide. In this context, construction management and its related topics, including budgeting and the management of construction projects, can facilitate meaningful collaborations in the field of construction and associated technologies, as well as in managing issues in the construction process.

### 2. Duration of Program and the structure

The duration of the Master and PhD programs in Construction Engineering and Management is in accordance with the latest regulations and based on the educational guidelines for the Master and PhD programs approved by the Supreme Council for Planning of the Ministry of Science, Research, and Technology. The total number of credits for the Master program is 30 credits, while for the PhD program it is 36 credits, as outlined in Table 1.

No.	Course Type	Master	PhD
1	Core (Based on Table 2)	9	0
2	Elective (Based on Tables 2 and 3)	15	18
3	Research Method	1	0
4	Thesis or Dissertation	5	18
	Total	30	36

Table 1: Number of Course and Research Credits

### 3. Credits

Master's students in Construction Engineering and Management are required to successfully complete 10 credits of Core courses, as listed in Table 2. Their elective courses are selected based on Table 3.

For PhD students, no Core courses are required. All the credits needed for graduation are chosen based on Tables 2 and 3, upon the recommendation of their academic advisor. A PhD student cannot select elective courses from those they have already completed during their Master program.

For students entering the Master program in Construction Engineering and Management from non-civil engineering disciplines, it is mandatory to take a number of remedial courses (up to 12 credits) as determined by the department.

For students entering the PhD program in Construction Engineering and Management from disciplines other than Construction Engineering and Management, it is mandatory to take a number of remedial courses (up to 6 credits) as determined by the department, based on Tables 2 and 3.

Course No.	Course Title	Credits	Hours per week		Pre-
Course No.			Theory	Practical	requisites
3016506	Contract Regulations and Management	3	3	0	-
3016507	Project Planning and Control	3	3	0	-
3016508	Construction Methods	3	3	0	-
3016473	Research Method	1	1	0	-
	TOTAL			0	-

Table 2: Core Courses for the Master's Program in Construction Engineering and Management

Table 3: Elective Cour	rses for the Graduate	Program in Constru	ction Engineering ar	nd Management

	Course Title	Credits	Hours per week		Pre-
Course No.			Theory	Practical	requisites
3016509	Project Management Knowledge	3	3	0	-
3016478	Advanced Concrete Technology	3	3	0	-
3016510	Financial and Accountancy Management	3	3	0	-
3016395	Soft Computation	3	3	0	-
3016526	Advanced Construction Materials	3	3	0	-

Note: A student may select up to two elective courses from related civil engineering subjects offered in other graduate programs, with the approval of the department's Graduate Studies Council.

### **CONTRACT REGULATIONS AND MANAGEMENT**

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

**COURSE PREREQUISITES:** 

#### **COURSE CO-REQUISITES:**

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#### **TEACHERS:**

Person in charge: Dr. Hossein Amoushahi
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/~h.amoushahi/
Email Address: <u>h.amoushahi@eng.ui.ac.ir</u>

#### WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

#### **COURSE OBJECTIVES**

The purpose of this course is to familiarize students in the field of Construction Engineering and Management with the national technical and executive system, contract management, and contracting issues in civil projects in the country. During this course, students will gain knowledge on the following topics:

- 1. National technical and executive system, as well as relevant laws and regulations
- 2. Development planning, annual budgeting, and performance status of national civil projects
- 3. General principles and structure of contracts
- 4. Project delivery systems and payment methods
- 5. Consultancy services, scope of services, fees, selection and assignment procedures, insurance,
- agreements, contractual conditions, classification, and qualification verification

6. Contracting practices, bid proposal evaluation, work assignment procedures, insurance, agreements, contractual conditions, classification, qualification verification, basic price lists, and contract adjustment indices

7. Engineering and building control systems, national building codes, and engineering regulations

### **REQUIRED STUDENT RESOURCES**

#### Textbooks and references:

1. Planning and Budget Organization, National Technical and Executive System, http://tec.mporg.ir

2. Ministry of Roads and Urban Development, Building and Housing Office of National Building Regulations, http://www.inbr.ir

3. Public Budgeting in Iran, Alireza Farzib, Center for Public Management Education Press

4. Civil Code of Iran

5. The Role of Value Engineering in Project Management, Mohammad Saeed Jabal Ameli, Management and Planning Organization Press

6. Development of a Fuzzy Model for Selecting Suitable Project Delivery Systems, Ali Mostafavi, Master's Thesis, University of Tehran, 2008.

7. Dorsey, R. W. (2017), Project delivery systems for building construction, Associated General Contractors of America.

8. FIDIC-International Federation of Consulting Engineers (Fédération International Des Ingénieurs-Conseils). www.fidic.org

9. UNIDROIT- International Institute for the Unification of Privat Law (Institut International Pour L'Unification du Droit Prive), www.unidroit.org

#### Web links:

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#### **Computer Software:**

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#### COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Торіс
1	National technical and executive system; development planning and civil project performance; budgeting.
2	National technical and executive system; development planning and civil project performance; budgeting.
3	National technical and executive system; development planning and civil project performance; budgeting.
4	General principles of contracts; contract structures; project delivery systems and payment methods.
5	General principles of contracts; contract structures; project delivery systems and payment methods.
6	General principles of contracts; contract structures; project delivery systems and payment methods.
7	Scope of services and consultancy fees; agreements and contractual conditions in consultancy services.
8	Scope of services and consultancy fees; agreements and contractual conditions in consultancy services.
9	Scope of services and consultancy fees; agreements and contractual conditions in consultancy services.
10	Agreements and contractual conditions for contracting services, including three-party contracts and
	design-build contracts.
11	Agreements and contractual conditions for contracting services, including three-party contracts and
	design-build contracts.
12	Agreements and contractual conditions for contracting services, including three-party contracts and
	design-build contracts.
13	Work assignment methods for contractors and consultants; contractor and consultant classification and
	qualification verification; insurance in contractor and consultant contracts; basic price lists and contract
	adjustment indices.
14	Work assignment methods for contractors and consultants; contractor and consultant classification and
	qualification verification; insurance in contractor and consultant contracts; basic price lists and contract
	adjustment indices.
15	Work assignment methods for contractors and consultants; contractor and consultant classification and
	qualification verification; insurance in contractor and consultant contracts; basic price lists and contract
	adjustment indices.
16	National building codes and the Engineering and Building Control Law.

#### **EVALUATION PROCEDURES AND GRADING CRITERIA**

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

#### ATTENDANCE STATEMENT

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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

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#### SYLLABI ON WEB PAGES

### **PROJECT PLANNING AND CONTROL**

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

#### **COURSE PREREQUISITES:**

#### **COURSE CO-REQUISITES:**

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#### **TEACHERS:**

Person in charge: Dr. Mehran Zeynalian
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: https://engold.ui.ac.ir/~m.zeynalian/
Email Address: <u>m.zeynalian@eng.ui.ac.ir</u>

#### WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

#### **COURSE OBJECTIVES**

The purpose of this course is to familiarize students in the field of Construction Engineering and Management with the processes involved in developing, scheduling, and controlling project timelines, as well as the practical applications of these processes. Another key objective of the course is to introduce students to processes related to project cost estimation, budgeting, and cost control. Throughout this course, students will gain a foundational understanding of the following:

- 1. Processes for defining the sequence of activities, resource leveling, duration estimation, and using network calculation algorithms to create the project's baseline schedule.
- 2. Processes for estimating project activity costs, aggregating costs over the project timeline to establish a cost baseline.
- 3. Processes for monitoring and controlling project progress to update and manage changes to the project's schedule and cost baselines.

### **REQUIRED STUDENT RESOURCES**

#### Textbooks and references:

- 1. Uher, T. E. (2003). Programming and Scheduling Techniques, University of New South Wales Press Ltd (UNSW Press Ltd), Sydney.
- Hendrickson, C. (2003). Project Management for Construction, the online textbook, Version 2,1 prepared Summer, [An earlier edition is published in bound form by Prentice Hall (1949, ISBN: -17-VP) with co-author Tung Au.). http://www.ce.cmu.edu/pmbook/
- 3. T- Project Management Institute (PMI). (TT). Practice Standard for Work Breakdown Structures, 2nd Ed., Pennsylvania, USA.
- 4. Burke, R. (2001). PROJECT MANAGEMENT, Planning and Control Techniques, 3 Ed., John Wiley & Sons, Ltd, West Sussex, England.
- 5. Project Management Institute (PMi). (2011). Practice Standard for Earned Value Management, 2nd Ed. Pennsylvania, USA.

- 6. Halpin, D. W, and Senior B. A. (2011). Construction Management, 4th Ed., John Wiley & Sons, Inc., N USA.
- 7. Y- Project Management Institute (PMI). (TV), Project Management Body of Knowledge, 6th Ed., PMI, Pennsylvania.
- 8. A Project Management Institute (PMI). (T-11). Practice Standard for Scheduling, 2nd Ed., Pennsylvania,
- 9. USA.
- 10. Kerzner, H. (T4). Project Management, A Systems Approach to Planning, Scheduling, and Controlling, 1. Ed., John Wiley & Sons, Inc, New Jersey, USA

#### Web links:

#### **Computer Software:**

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#### COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Торіс
1	Basic concepts
2	Work Breakdown Structure (WBS)
3	Activity definition
4	Activity sequencing
5	Duration estimation for activities
6	Network analysis (Critical Path Method)
7	Network analysis (PERT)
8	Network analysis (Monte Carlo simulation)
9	Network analysis (Critical Path): links and windows
10	Network analysis (Critical Path): calculation algorithms
11	Resource-constrained scheduling
12	Line of Balance method
13	Cost estimation and project budgeting
14	Project cash flow
15	Earned Value Method: measuring earned value
16	Earned Value Method: evaluating project performance

#### **EVALUATION PROCEDURES AND GRADING CRITERIA**

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

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#### SYLLABI ON WEB PAGES

### **CONSTRUCTION METHODS**

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

**COURSE PREREQUISITES:** 

#### **COURSE CO-REQUISITES:**

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#### **TEACHERS:**

Person in charge Dr. Mehran Zeynalian
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: https://engold.ui.ac.ir/~m.zeynalian/
Email Address: <u>m.zeynalian@eng.ui.ac.ir</u>

#### WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

#### **COURSE OBJECTIVES**

The purpose of this course is to acquaint students with various construction execution methods for civil engineering structures.

#### **REQUIRED STUDENT RESOURCES**

#### **Textbooks and references:**

1. Abouk Simaan, Hague Stephen, An introduction To Construction Simulation Dung Simphony, Epstein, Erika, Implementing Successful Building Information Modeling Artech House, T-IT T-Gransberg DD. Popescu, CM. and Ryan, R, 1-7, Construction equipment management for engineers, estimators, and owners. CRC Press

- 2. Kense, Kark M, Building information Modeling Routledge, T 11
- 3. Nunnally-idunnally, S.W., 1994. Construction methods and management (Vol. 1). Prentice Hall.
- 4. Managing construction equipment. Pearson College Dhion.
- 5. Robert, 1, Purifoy, P., Clifford, J. Schenayder, E and Shapira, A, T-11, Trd Edition. Construction Planning Equipment and Methods. International Edition
- 6. Spence, Will
- 7. Perkins. Construction Methods, Materials, and Techniques Deimar Pub, 1-1.

Web links:

#### **Computer Software:**

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Week	Торіс
1	Design and planning for site layout and workshop setup
	Layout and planning for machinery, including cranes and other equipment on-site
2	Use of simulation and optimization models to enhance project construction
3	Procurement, storage, and utilization of construction materials to improve project efficiency

Week	Торіс
4	Design of various formwork types (metal, wooden, slip forms, and tunnel forms)
5	Execution of concrete structures (e.g., buildings, bridges, dams, tunnels)
6	Concrete pouring under special climatic and environmental conditions, including hot and
	cold weather and coastal areas
7	Execution of steel structures (e.g., buildings, bridges, connections)
8	Construction of lightweight (LSF), wooden, masonry, and industrial structures (e.g., space
	frames, warehouses, pipe racks)
9	Execution of prefabricated and modular structures
10	Special mix designs and concrete pouring methods, including self-compacting concrete,
	fiber-reinforced concrete, mass concrete, lightweight concrete, and shotcrete
11	Quality control on-site (inspection and quality control for concrete, steel, and welding
	materials)
12	Preliminary and comprehensive structural evaluations, including strength tests like core
	sampling, ultrasonic tests, rebar corrosion potential, chloride profile, carbonation, and
	statistical analysis of semi-destructive and non-destructive strength tests
13	Use of Building Information Modeling (BIM) to enhance project construction
14	Lean planning methods to improve project construction efficiency
15	Use of image analysis, Radio Frequency Identification (RFID), and Geographic Information
	Systems (GIS) to improve construction methods
16	Health, Safety, and Environment (HSE), sustainable construction methods, and construction
	evaluation models

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

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#### SYLLABI ON WEB PAGES

### **RESEARCH METHOD**

**BASIC INFORMATION Place in Curriculum and semester:** Core, S1 **Number of credits:** 1

COURSE PREREQUISITES:

COURSE CO-REQUISITES:

TEACHERS:

Person in charge: Dr. Maryam Daei Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran Phone Number: +98 (31) 37935310 Homepage: https://engold.ui.ac.ir/~m.daei/ Email Address: m.daei@eng.ui.ac.ir

#### WEEKLY HOURS

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

#### COURSE OBJECTIVES

The objective of this course is to familiarize students with the principles of research, research methods, and the presentation of scientific and engineering findings. Students will also provide specific information as part of class participation.

#### **REQUIRED STUDENT RESOURCES**

#### **Textbooks and References:**

- 1. Fadaei Nia, Ali (2016), "General Research Methods," Tehran University Press.
- 2. Thiel D.V. (2011), Research Methods for Engineers, Cambridge University Press.
- 3. Kothari, C.R. (2004), Research methodology: Methods and techniques, Third Edition, New Age International (P) Ltd.

#### Web links:

#### **Computer Software:**

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Week	Торіс
1	Principles of Research (Definitions, Understanding and Insight, the Need for Methodologies)
2	Principles of Research (Definitions, Understanding and Insight, the Need for Methodologies)
3	Principles of Research (Definitions, Understanding and Insight, the Need for Methodologies)
4	Types of Research (Qualitative and Quantitative, Descriptive, Correlational, and Applied)
5	Types of Research (Qualitative and Quantitative, Descriptive, Correlational, and Applied)
6	Types of Research (Qualitative and Quantitative, Descriptive, Correlational, and Applied)
7	Stages of Research (Research Models, Method Selection, Tool Selection, Report Writing)
8	Stages of Research (Research Models, Method Selection, Tool Selection, Report Writing)
9	Stages of Research (Research Models, Method Selection, Tool Selection, Report Writing)

Week	Торіс
10	Understanding and Utilizing Information: Fundamental Research
11	Understanding and Utilizing Information: Fundamental Research
12	Understanding and Utilizing Information: Fundamental Research
13	Understanding and Utilizing Information: Fundamental Research
14	Books and Information Resources
15	Books and Information Resources
16	Books and Information Resources

Assignments	40% of final grade
Project	30% of final grade
Final Exam	<u>30% of final grade</u>
	100%

#### ATTENDANCE STATEMENT

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#### SYLLABI ON WEB PAGES

### **PROJECT MANAGEMENT KNOWLEDGE**

**BASIC INFORMATION Place in Curriculum and semester:** Elective, S2 **Number of credits**: 3

**COURSE PREREQUISITES:** 

**COURSE CO-REQUISITES:** 

#### **TEACHERS:**

Person in charge: Dr. Mehran Zeynalian
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: https://engold.ui.ac.ir/~m.zeynalian/
Email Address: <u>m.zeynalian@eng.ui.ac.ir</u>

#### WEEKLY HOURS

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

#### **COURSE OBJECTIVES**

The purpose of this course is to provide students in the field of Construction Engineering and Management with knowledge of key project management knowledge areas that: 1) are widely applicable across various projects and are broadly recognized for their value and effectiveness, and 2) are generally agreed to enhance the likelihood of success in a wide range of diverse projects when applied correctly. Through this course, students will gain an understanding of the following foundations and applications:

- 1. Construction industry, project, project management, and the role of the project manager
- 2. Project phases, project lifecycle, organizational structures, and project management process groups
- 3. Project management knowledge areas and processes (inputs, tools and techniques, outputs)

#### **REQUIRED STUDENT RESOURCES**

#### Textbooks and references:

1. Project Management institute (PM). (-1) "Project Management Body of Knowledge1 Ed. PMI Pennsylvania.

2. Project Management institute (PMI) (1) Construction Extension to the PMBOK Guide, Ed., PMI. Newtown Square, Pennsylvania.

3. Hendrickson, Project Management for Construction (An earlier edition is published in bound 89, 15BN: 0-13-731266 01 with co-author Tung Au).

4. Kerzner, H. (-1. Project Management. A Systems Approach to Planning, Scheduling and Controlling Ed, Wiley, New York)

5. Project Management Institute (PMI) (T1) Practice Standard for Work Breakdown Structures, Ed PMI, Pennsylvania.

6. P Project Management Institute (PMI) IT-1) Project Manager Competency Development Framework, Ed, PML, Pennsylvania.

Web links:

#### **Computer Software:**

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#### **COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS**

Week	Торіс
1	Construction industry and structures, key definitions, project lifecycle, project stakeholders
2	Construction industry and structures, key definitions, project lifecycle, project stakeholders
3	Construction industry and structures, key definitions, project lifecycle, project stakeholders
4	Competencies and qualifications of the project manager, organizational impacts on project
	management
5	Competencies and qualifications of the project manager, organizational impacts on project
	management
6	Project management process groups and knowledge areas
7	Project management process groups and knowledge areas
8	Project initiation processes
9	Project planning processes
10	Project planning processes
11	Project execution processes
12	Project execution processes
13	Project monitoring and control processes
14	Project monitoring and control processes
15	Project closing processes
16	Project closing processes

#### **EVALUATION PROCEDURES AND GRADING CRITERIA**

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

#### **ATTENDANCE STATEMENT**

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#### SYLLABI ON WEB PAGES

### FINANCIAL AND ACCOUNTANCY MANAGEMENT

**BASIC INFORMATION Place in Curriculum and semester:** Elective, S2 **Number of credits**: 3

COURSE PREREQUISITES:

### COURSE CO-REQUISITES: -

## TEACHERS:

Person in charge: Dr. Hossein Amoushahi 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/~h.amoushahi/ Email Address: <u>h.amoushahi@eng.ui.ac.ir</u>

#### WEEKLY HOURS

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

#### **COURSE OBJECTIVES**

To introduce the fundamentals of financial management and project accounting.

#### **REQUIRED STUDENT RESOURCES**

1- FINANCIAL MANAGEMENT: ACCA - UK, ICA - GH & ACCOUNTANCY STUDENTS, Y Y, by t PREMIUM Kinn

#### Web links:

Week	Торіс
1	Financial Management:
	Introduction to financial management
2	Financial statement analysis, break-even analysis, and profitability
3	Financial forecasting
4	Investment analysis
5	Financial planning
6	Financial resources for clients and contractors
7	Cost estimation and control methods
8	Direct costs, indirect costs
9	Contingent costs
	Non-monetary factors
10	Relationship between cost-driving factors
	Cost estimation methods and control
11	Contract Accounting and Its Application in Project Management:
	Introduction and fundamentals of accounting, including definitions
12	Analysis and recording of financial events in contracting

13	Financial reporting and types, including preparation of balance sheets
14	Revenue and expense recognition and classification
15	Understanding profit and loss, and preparing income statements
	Preparing financial statements, familiarity with audit reports
16	Internal auditing controls

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

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#### SYLLABI ON WEB PAGES

### ADVANCED CONCRETE TECHNOLOGY

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

COURSE PREREQUISITES:

COURSE CO-REQUISITES:

TEACHERS:

Person in charge: Dr. Hossein Tajmir Riahi Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran Phone Number: +98 (31) 37935307 Homepage: https://engold.ui.ac.ir/~tajmir/ Email Address: tajmir@eng.ui.ac.ir

#### WEEKLY HOURS

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

#### COURSE OBJECTIVES

To provide an in-depth understanding of the properties of concrete and its constituent materials, proper methods of production and application, as well as advanced and mass concrete types. Special Focus:

1- Targeted at PhD students

2- Empowering students in concrete design

#### **REQUIRED STUDENT RESOURCES**

#### **Textbooks and References:**

- 1- J. Newman and B. S. Choo, "Advanced Concrete Technology Set", Butterworth-Heinemann; 2003.
- 2- Z. Li, "Advanced Concrete Technology", Wiley; 2011.

3- M. El-Reedy, "Advanced Materials and Techniques for Reinforced Concrete Structures", CRC Press; 2009.

Web links:

#### **Computer Software:**

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Week	Торіс
1	Cement Hydration: Hydration process, cement compound chemistry, effects of cement compounds on strength and heat, properties of hydration products, gel characteristics, microscopic structure of hydration compounds,
	hydration models
2	Hydration process, cement compound chemistry, effects of cement compounds on strength and heat, properties of hydration products, gel characteristics, microscopic structure of hydration compounds, hydration models

Week	Торіс
3	Concrete Strength:
	Compressive and tensile strength, impact of various factors on strength, strength equations,
	relationships between compressive and tensile strength, porosity-strength relationships, fatigue
	strength, and impact resistance
4	Time-Dependent Deformations:
	Static and dynamic elastic moduli, correlations between strength and modulus of elasticity
5	Shrinkage and Creep:
	Factors affecting concrete shrinkage, shrinkage calculations from various standards, shrinkage
	measurement, factors influencing creep, creep calculations from standards, and creep measurement
	techniques
6	Factors affecting concrete shrinkage, shrinkage calculations from various standards, shrinkage
	measurement, factors influencing creep, creep calculations from standards, and creep measurement
7	Concrete Mix Design:
/	Key factors in mix design, relationships between characteristic and target strengths, mix design
	stages weight- and volume-based methods air-entrained concrete specialty concrete designs
	durability-based design
8	Key factors in mix design, relationships between characteristic and target strengths, mix design
-	stages, weight- and volume-based methods, air-entrained concrete, specialty concrete designs,
	durability-based design
9	Fresh Concrete:
	Rheology of concrete, comparison of different workability testing methods, two-point workability
	testing
10	Additives and Pozzolans in Concrete:
	Types of additives and admixtures, their impact on concrete properties, mechanisms of action, use of
	pozzolans, and their role in durability
11	Durability and Permeability:
10	Factors affecting concrete permeability, permeability measurement
12	Concrete Evaluation in Structures.
	sampling concrete accentance criteria statistical analysis of test results
13	New Types of Concrete:
10	Polymer concrete, fiber-reinforced (steel and polymer) concrete, sulfur concrete, roller-compacted
	concrete, ferrocement, lightweight and heavyweight concrete, ultra-high-strength concrete, plastic
	concrete, and self-leveling concrete
14	Polymer concrete, fiber-reinforced (steel and polymer) concrete, sulfur concrete, roller-compacted
	concrete, ferrocement, lightweight and heavyweight concrete, ultra-high-strength concrete, plastic
	concrete, and self-leveling concrete
15	Mass Concrete:
	Thermal issues, cooling systems, pre- and post-cooling methods, and related calculations
16	Thermal issues, cooling systems, pre- and post-cooling methods, and related calculations

Assignments	20% of final grade
Project	30% of final grade
Final Exam 50% of final grad	
	100%
	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

### **SOFT COMPUTATION**

**BASIC INFORMATION Place in Curriculum and semester:** Elective, S2 **Number of credits**: 3

COURSE PREREQUISITES:

COURSE CO-REQUISITES:

TEACHERS:

Person in charge: Dr. Maryam Daei Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran Phone Number: +98 (31) 37935310 Homepage: https://engold.ui.ac.ir/~m.daei/ Email Address: m.daei@eng.ui.ac.ir

#### WEEKLY HOURS

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

#### COURSE OBJECTIVES

To familiarize students with the concepts of soft computation and its underlying methods.

#### **REQUIRED STUDENT RESOURCES**

#### **Textbooks and References:**

 Soft Computing Based Optimization and Decision Models: To Commemorate the 10th Birthday of Professor José Luis "Curro" Verdegay (Studies in Fuzziness and Soft Computing) 2017, by David A. Pelta and Carlos Cruz Corona.

Web links:

#### **Computer Software:**

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Week	Торіс
1	An introduction to the concept of soft computation and its definitions
2	An introduction to the concept of machine learning and its underlying methods
3	An introduction to soft computing techniques including GA, PSO, and other methods
4	An introduction to soft computing techniques including GA, PSO, and other methods
5	Genetic Algorithm (GA)
6	Genetic Algorithm (GA)
7	Fuzzy Interface Algorithms and their Applications
8	Fuzzy Interface Algorithms and their Applications
9	Fuzzy Systems
10	Fuzzy Systems
11	Artificial Neural Networks (ANN), Stages, Features, and Applications
12	Artificial Neural Networks (ANN), Training and Evaluation of Neural Networks
13	Artificial Neural Networks (ANN), Types of Neural Networks, such as MLP and GRNN
14	Hybrid Systems, Evolutionary Algorithms

Week	Торіс
15	Hybrid Systems, ANFIS Systems and Fuzzy Controllers
16	Hybrid Systems, ANFIS Systems and Fuzzy Controllers

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

#### ATTENDANCE STATEMENT

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#### STUDENT SWITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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#### SYLLABI ON WEB PAGES

### **ADVANCED CONSTRUCTION MATERIALS**

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

**COURSE PREREQUISITES:** 

COURSE CO-REQUISITES:

TEACHERS:

Person in charge: Dr. Hossein Tajmir Riahi Office location: Department of Civil Engineering, Faculty of Civil Engineering and Transportation, University of Isfahan, Hezar-Jerib av., Isfahan, Iran Phone Number: +98 (31) 37935307 Homepage: https://engold.ui.ac.ir/~tajmir/ Email Address: \_tajmir@eng.ui.ac.ir

#### WEEKLY HOURS

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

#### COURSE OBJECTIVES

The aim of this course is to introduce students to modern construction materials.

#### **REQUIRED STUDENT RESOURCES**

#### **Textbooks and References:**

1. Advanced Building Construction and Materials Handbook, 2017, by Ph.D. Dr. Tanjina Nur.

Web links:

#### **Computer Software:**

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Week	Торіс
1	Properties and Applications of Various Modern Materials, including Lightweight Concrete, Profiles, and
	Sisals
2	Properties and Applications of Various Modern Materials, including Lightweight Concrete, Profiles, and
	Sisals
3	Properties of Sustainable Materials and their Applications in Construction Projects
4	Types of Fibers: Effects on Properties
5	Types of Fibers: Effects on Properties
6	Nanomaterials: Fundamental and Modified Characteristics
7	Complementary Techniques, including Green Roofs and Geo-synthetics
8	Polymer Materials: Including Adhesives and Barriers (derived from reinforced concrete)
9	Examination of the Application of New Materials in Industrial and Residential Structures
10	Material and Resource Disruptions in Response to Climatic and Environmental Conditions
11	Material and Resource Disruptions in Response to Climatic and Environmental Conditions
12	Production of Materials Based on Sustainable Development
13	Production of Materials Based on Sustainable Development

Week	Торіс
14	Review of Various Materials and New Methods in Lightweight Proposed Structures
15	Quality Control Management in the Production of Materials in Workshops and Relevant Quality Control
	Processes
16	Quality Control Management in the Production of Materials in Workshops and Relevant Quality Control
	Processes

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

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#### SYLLABI ON WEB PAGES