

DEPARTMENT OF CIVIL ENGINEERING
COURSE SYLLABUS

Course Details					
Code				Academic Year	Semester
BAU548				1	2
Title	T	A	L	ECTS	
Underground Structures and Design	3	-	-	7	
Language	Turkish				
Level	Undergraduate		Graduate	✓	Postgraduate
Department / Program	Civil Engineering				
Forms of Teaching and Learning	Formal				
Course Type	Compulsory		Elective	✓	
Objectives	<ul style="list-style-type: none"> • Teaching basic aspects of the structural analysis and design in underground. • Demonstration of various excavation methods as well as safety and auxiliary construction measures taking into account geological, static and constructional aspects. • Geotechnical aspects of mechanical tunneling in soft ground or rock. • Tunnel construction in the pressured and swellable rock. • Consolidation of selected topics of underground construction as well as practicing the conceptual approach to complex problems. • Deepening of special mountain pressure types and in selected topics of underground construction. • Learning the conceptual approach to complex problems. 				
Content	<ul style="list-style-type: none"> • Basics and applications of numerical methods in tunnel statics. • Excavation methods (construction and operating methods) Safety and auxiliary construction measures: <ul style="list-style-type: none"> - Injections - Jet grouting - Freezing process - Drainage - Tube umbrellas - Chest anchor • Mechanical tunneling in soft ground and rock • Tunneling in squeezing rock and swelling rock • Cavern construction: arrangement, construction methods, securing. • Shaft construction in rock: construction methods, securing. • Urban tunnel construction: boundary conditions, system choice, alignment, design and construction. • Field measurements in rock and underground construction: measurement principles, planning, applications, interpretation. • Opencast tunnel: static modeling, dimensioning. 				
Prerequisites	-				
Coordinator					
Lecturer(s)	Assoc. Prof. Dr. Enver Vural YAVUZ				

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Assistant(s)			
Work Placement			
Recommended or Required Reading			
Books / Lecture Notes	<p>[1] Kolymbas, D., (2005). Tunelling and Tunnel Mechanics. Springer Verlag, Berlin. [2] British Tunnelling Society, (2011). Monitoring Underground Construction. ICE Publishing. [3] Atkinson, J., (2014). Fundamentals of Ground Engineering. CRC Press, USA. [4] Small, J., C. (2016). Geomechanics in soil, rock and environmental engineering. CRC Press. [5] Goel, R. K., Singh, B., Zhao, J. (2012). Underground infrastructures : planning, design, and Construction. Elsevier/Butterworth-Heinemann. [6] Yun, B., (2019). Underground engineering : planning, design, construction and operation of the underground space. Academic Press of Elsevier.</p>		
Other Sources	-		
Additional Course Material			
Documents	-		
Assignments	-		
Exams	-		
Course Composition			
Mathematics und Basic Sciences			%
Engineering	50		%
Engineering Design			%
Social Sciences			%
Educational Sciences			%
Natural Sciences	50		%
Health Sciences			%
Expert Knowledge			%
Assessment			
Activity	Count	Percentage (%)	
Midterm Exam	1	40	
Quiz			
Assignments	2	10	
Attendance			
Recitations			
Projects			
Final Exam	1	50	
		Total	100
ECTS Points and Work Load			
Activity	Count	Duration	Work Load (Hours)
Lectures	14	3	42

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Self-Study	14	8	112
Assignments	2	12	24
Presentation / Seminar Preparation			
Midterm Exam	1	3	3
Recitations			
Laboratory			
Projects			
Final Exam	1	3	3
Total Work Load			184
ECTS Points (Total Work Load / Hour)			7

Learning Outcomes

1	Teaching basic aspects of the structural analysis and design in underground.
2	Demonstration of various excavation methods as well as safety and auxiliary construction measures taking into account geological, static and constructional aspects.
3	Geotechnical aspects of mechanical tunneling in soft ground or rock.
4	Tunnel construction in the pressured and swellable rock.
5	Consolidation of selected topics of underground construction as well as practicing the conceptual approach to complex problems.
6	Deepening of special mountain pressure types and in selected topics of underground construction.
7	Learning the conceptual approach to complex problems.
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Weekly Content

1	Basics and applications of numerical methods in tunnel statics.
2	Basics and applications of numerical methods in tunnel statics.
3	Excavation methods (construction and operating methods) Safety and auxiliary construction measures
4	Excavation methods (construction and operating methods) Safety and auxiliary construction measures
5	Excavation methods (construction and operating methods) Safety and auxiliary construction measures
6	Excavation methods (construction and operating methods) Safety and auxiliary construction measures
7	Midterm I
8	Mechanical tunneling in soft ground and rock

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9	Tunneling in squeezing rock and swelling rock
10	Cavern construction: arrangement, construction methods, securing.
11	Cavern construction: arrangement, construction methods, securing.
12	Shaft construction in rock: construction methods, securing.
13	Urban tunnel construction: boundary conditions, system choice, alignment, design and construction.
14	Field measurements in rock and underground construction: measurement principles, planning, applications, interpretation.
15	Opencast tunnel: static modeling, dimensioning.

Contribution of Learning Outcomes to Program Objectives (1-5)

	P1	P2	P3	P4	P5	P6	P7
1							
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Contribution Level 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High

Compiled by:

Date of Compilation: