COURSE CATALOG

Course Code: CE 404				Course Name: Theory of Plasticity			
Semester	T + P + L	Credits	ECTS	Language of Instruction	Course Type	Instruction Methods	Prequisite(s)
6-7-8	3 + 0 + 0	3	6	English	Elective(D2)	Lecture	CE201, CE202, CE204

Course Objectives	This course is designed for students in engineering who want to explore the important constitutive behavior of materials through a rigorous study of classical theory on plasticity. Course will begin by reviewing the classical continuum mechanics concepts of stress and strain and examining the elastic behavior that is well known. It will be proceed to discuss the plastic behavior commonly seen in materials. The rest of class will be focused on the mathematical formulation of elasto-plastic constitutive relationship, including yield criteria, isotropic and kinematic hardening, flow rule. Finally practical engineering limit analysis will be discussed several examples will be given.
Topics Covered	Stress-strain relations. Yield criteria and the general behaviour of materials beyond proportional limit. Approximate theories on the theory of plastic flow. Bending, torsion, plane strain and plane stress. Plasticity for materials with isotropic hardening. Kinematic hardening and time dependence. Theories based on crystal slip. Variational theorems. Plastic design.
Learning Outcomes of the Course	After completing this course students should gain: 1. describe the elastic and plastic behavior from stress-strain curves for materials; [1,2] 2- recognize typical plastic yield criteria established in constitutive modeling; [1,2] 3- understand the physical interpretation of material constants in mathematical formulation of constitutive relationship; [1,2,7] 4-solve analytically the simple boundary value problems with elasto-plastic properties; [1,2,12] 5- develop constitutive models based on experimental results on material behavior. [1,2,5] *[Note that the numbers in between the brackets address the bullet numbers in the program outcomes list.]*
ISCED Category of the Course	52 Engineering
Textbook	D.J. Han., Plasticity for Structure Engineers. W.F. Chen and Springer-,1988.
Recommended Sources	1- J. Chakrabarty, Theory of Plasticity, Elsevier Butterworth-Heinemann, 2006. 2- J.Lubliner, Plasticity Theory, Pearson, 2006. 3- S. Huang, Continuum Theory of Plasticity. John Wiley and Sons,1995. 4- L.M. Kachanov, Fundamentals of the Theory of Plasticity (Dover Civil and Mechanical Engineering), 2006. 5- 5- R. Hill, The Mathematical Theory of Plasticity (Oxford Classic Texts in the Physical Sciences)], 2004.

WEEKLY SCHEDULE

Week	Theoretical Topic	Applied / Laboratory Topics
1	Review of mechanics of solids. Stress-strain relations.	
2	Introduction to plasticity theories, comparison.	
3	Yield criteria and the general behaviour of materials beyond proportional limit.	
4	Approximate theories on the theory of plastic flow.	
5	Bending.	
6	Torsion.	
7	Plane strain and plane stress.	
8	Plasticity for materials with isotropic hardening.	
9	Kinematic hardening and time dependence.	
10	Theories based on crystal slip.	
11	Introduction to plastic design.	
12	Variational theorems.	
13	Several engineering problems.	
14	Application to engineering problems.	

COURSE ASSESSMENT POLICY

	Activities	Number	Contribution (%)
Studies throughout the term	Quiz	-	-
	Term Homework/ Project	2	30
	Reports	-	-
	Graduation Thesis/ Project	-	-
	Seminar	-	-
	Homework	3	30
	Presentations	-	-
	Midterm Exams	-	-
	Project		
	Laboratory	-	-
	Other (attendance)	-	-
FINAL EXAM		1	40
Total			100

CONTRIBUTION OF THE COURSE TO CIVIL ENGINEERING PROGRAM OUTCOMES

	Program Outcomes	1	2	3
1	The ability to apply knowledge of mathematics, science, and engineering			X
2	The ability to identify, formulate, and solve engineering problems			X
3	The ability to design a system or component to meet desired needs with realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability and sustainability		X	
4	The ability to analyze and interpret data			X
5	The ability to design and conduct experiments and apply experimental results to improve processes		X	
6	The ability to convey technical material through oral presentations and written papers/reports			X
7	The ability to function within multidisciplinary teams			X
8	The understanding of professional and ethical responsibilities			X
9	The understanding of the impact of engineering on society		X	
10	The understanding of the necessity to engage in life-long learning			X
11	The understanding of management and leadership principles and techniques		X	
12	The appreciation of the role of research in civil engineering problems			X
13	A knowledge of contemporary issues in civil engineering			X
14	The ability to use modern engineering techniques, skills, and tools		X	
15	The ability to understand and explain basic concepts in management, business, and leadership	X		
16	A commitment to quality, punctuality and continuous improvement		X	

Contribution Level: 1 low, 2 medium, 3 high

ECTS-WORKLOAD TABLE

ACTIVITIES	Number	Duration (Hour)	Workload(Hour)
Lecture Time	14	3	42
Final Exam (Including Preparation Time)	1	12	12
Quiz			
Term Homework / Project	2	13	26
Reports			
Graduation Thesis/Project	-	-	-
Seminar			
Study Time Outside the Class	14	2	28
Homework	3	8	24
Presentations	-	-	-
Midterm Exams (Including Preparation Time)	-	-	20
Project	-	-	-
Laboratory	-	-	-
Total Workload			152
ECTS Credits of the Course (Total Workload / 25)			6

Last update on 19.01.2014	Coordinator / PREPARED BY Esin Inan	APPROVED BY Esin İnan