

COURSE IDENTIFICATION FORM

Course Code and Name: IM5015 / FRACTURE MECHANICS OF ENGINEERING MATERIALS

Department of : CIVIL ENGINEERING / MASTER PROGRAMME

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Autumn/Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)

Instructor

Assoc. Prof. Dr. Alper POLAT

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Course Assistant

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Groups / Classes

Course Aim

- To teach the fundamental concepts and theories explaining fracture behavior in materials.
- To analyze crack propagation in materials and learn how to calculate critical crack sizes.
- To develop the ability to apply fracture mechanics principles in designing safe and durable engineering structures.
- To distinguish between fracture mechanisms in brittle and ductile materials.
- To teach how to perform and interpret fracture analyses using experimental and numerical methods.
- To demonstrate how to apply fracture mechanics principles in material selection and design processes.
- To equip students with the skills to solve real-world engineering problems from the perspective of fracture mechanics.
- To develop the ability to recognize and analyze fracture problems across various engineering disciplines..

Course Goals

The main objective of the fracture mechanics of engineering materials course is to provide students with an understanding of the cracking and fracture behaviour of materials. This course aims to make safe and durable designs by examining the fracture processes that may occur in materials as a result of loads applied to engineering structures and ways to prevent these fractures.

Course Learning Outcomes and Proficiencies	<ul style="list-style-type: none"> Understand the fundamental principles of fracture mechanics Analyze different types of cracks and their behavior. Calculate critical crack sizes. Distinguish between different fracture types in materials. Apply fracture mechanics analysis methods. Integrate fracture mechanics into engineering design
Course Basic and Auxiliary Contexts	<ul style="list-style-type: none"> Broek, O., Elementary engineering fracture mechanics, Martinus Nijhoff Publishers, Dordrecht, 1987. Atkins, A.G. and Mai, Y.W., Elastic and Plastic Fracture; Metals, Polymers, Ceramics, Composites and Biological Materials, Ellis Horwood Limited, Chichester, 1986. Kanninen, M.F., and Popelar, C.H., Advance Fracture Mechanics, Oxford University Press, 1985, 563 pp. Bazant, Z.P., and Planas, J., Fracture and Size Effect In Concrete and Other Quasibrittle Materials, CRS Press, New York, 1998. Karihaloo, B.L., Fracture Mechanics and Structural Concrete, Longman Scientific and Technical, Essex, 1995.
Methods of Give a Lecture	Face to Face

Assessment Criteria		If Available, to Sign (x)	General Average Percentage (%) Rate
	Midterm Exam	X	50
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Exam	X	50
Semester Course Plan			

Week	Subjects
1	Theoretical strength calculations
2	Griffith criterion
3	Irwin's modification of Griffith's theory
4	Fracture mechanism and crack growth
5	Elastic crack tip stress field
6	Crack tip plastic zone, energy principle
7	Energy release rate criterion for crack growth
8	Linear elastic fracture mechanics
9	Damage criteria: Fatigue limit criterion
10	Mode I, II and III fracture
11	Superposition of stress intensity multiplier, mixed-mode crack initiation theories
12	Numerical, analytical and experimental methods for the determination of stress intensity multipliers
13	Elastic-plastic fracture mechanics, test techniques
14	Applications: Fracture of concrete, rock, ceramic and composite materials, experimental techniques