Alanya Alaaddin Keykubat University | Rafet Kayış Faculty of Engineering
Mechanical Engineering Department
2021-2022 Fall Semester
SYLLABUS

Code/Name	SEC 401.1 / Introduction to Fracture Mechanics
Type	Required
Credit/ECTS	5/5
Hour per Week	3 (3+0+0)
Level/Year	Undergraduate/1
Semester	Fall
Classroom	TBA
Content	Basic concepts. Failure criteria. Mechanisms of fracture. Stress intensity factor. Energy balance and stress intensity factor approach to fracture. Plane strain and plane stress fracture toughness of materials. Fatigue crack growth. Elastic-plastic fracture. Plastic zone models. J-integral. Fail-safe and safe-life design concepts. Damage tolerances. Applications on practical problems.
Prerequisites	MEC 201 Strength of Materials I, MEC 202 Strength of Materials II, MEC 305 Machine Elements I
Textbooks	***Primary*** CH Wang, Introduction to Fracture Mechanics, DSTO Aeronautical and Maritime Laboratory, 1996 ***Supplementary*** TL Anderson, Fracture Mechanics Fundamentals and Applications, Taylor & Francis, 3rd edition, 2005
Objectives	• To develop a clear understanding of principles for fracture mechanics • To provide crucial information on engineering applications
Course Outcomes	In this course you will be able to: CO1 Establish the theoretical stress distributions ahead of a crack under brittle and ductile conditions CO2 Explain the relationship between linear elastic and non-linear fracture concepts and the terms K, G, CTOD and J CO3 Distinguish between the mechanisms of fracture under brittle and ductile conditions CO4 Appreciate how to make valid fracture toughness measurements for a range of materials CO5 Apply the principles of fracture mechanics to predict the fatigue life of engineering components

Weekly Schedule of Topics

W	Topic
1	Basic concepts related with fracture
2	Energy release rate
3	Stress intensity factor
4	Stress Intensity Factor for Complex Cases
5	Inelastic Deformation at the Crack Tip
6	J-Integral
7	Crack Tip Opening Displacement
8	Test Methods
9	Test Methods (Continued)
10	Fatigue Failure and Environment-Assisted Fracture

11	Fatigue Failure and Environment-Assisted Fracture (Continued)
12	Finite Element Analysis of Cracks in Solids
13	Mixed Mode Crack Initiation and Growth
14	Crack Detection Through Non-Destructive Testing

Professional Contribution	Ability to comprehensively explain engineering principles associated with the fracture mechanics of various construction materials

Contribution to Program Outcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	2	3	1	2	2	3	0	0	2
CO2	2	1	2	3	3	4	2	1	0	0	2
CO3	3	4	2	4	4	4	2	3	0	0	2
CO4	3	3	5	5	4	4	2	1	0	0	2
CO5	4	5	2	4	4	4	2	4	0	0	2

* Contribution Level | 0: None | 1: Very Low | 2: Low | 3: Medium | 4: High | 5: Very High

Special Conditions	• Students work in groups for assignment. • The consequence of violation of the attendance rule is to receive a grade of **NA.**
Requirements	Basic knowledge of a dynamic analysis software
Evaluation	Midterm Exam 40% Final Exam 60% Total 100%
Rubric	A rubric will be announced after the exams based on the details of the answer keys.
Course Policy	1. You must attend at least 70% of the sessions including add-drop period. 2. Be in the class on time. 3. English should always be used to communicate with one another. 4. Mobile phone should be switched off and put away during the class. 5. You cannot talk to your friends during class no matter what the subject is.
Cheating & Plagiarism	• Copying or letting someone to copy your work on exams, assignments, or reports is cheating. • Cutting and pasting text, figures and tables from the web sources or any other electronic source is plagiarism. • The consequence of academic dishonesty is to receive a grade of **F** for the course.

Instructor

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Prepared by Akın Oktav on July 27, 2021