Kingdom of Saudi Arabia Ministry of Higher Education **Qassim University** College of Engineering		المملكة العربية السعودية وزارة التعليم العالي **جامعة القصيم** **كليه الهندسه**

Fracture Mechanics

College: College of Engineering

Department: Mechanical

First: Course Definition

1- Course Code: ME 639

2- Units: 3 Credit Hours

3 – Semester : 2nd

4 -Prerequisite : ME 351 Mechanics of Materials, ME 250 Materials Engineering

5- Co-requisite

6- Location (if not on main Campus):

Second: Course Objectives

(i) Explain the importance of flaw analysis in structural design and safety assessments.
(ii) Teach the derivation of stress fields near the crack in linear and non linear materials.
(iii) Explain how these stress/ strain fields relate to the fracture criteria and understanding of their limitations.
(iv) Illustrate how major fracture criteria are applied in design and assessments.

Third: Course Specifications

1- Topics to be covered

Subject	No of Weeks	Units
Crack tip solutions	1	3
displacements of fracture surfaces,	1	3
Stress and strain fields and path-independent integrals	1	3
Basic tensor algebra,	1	3

Concepts of dissipated energy,	1	3
stiffness reduction and compliance methods, ,	1	3
Materials testing test specimens for fracture mechanical testing	1	3
Limits of linear fracture mechanics	1	3
stress intensity factors and fracture toughness,	1	3
Fatigue	1	3
Paris' law and stress corrosion laws.	1	3
Non-linear fracture mechanical concepts and fracture resistance curves.	1	3
Special Topics in Fracture Mechanics	1	3
Mini Project Presentations	1	3
Final Exam	1	3

2- Course components (Total hrs in the Semester)

Lecture	Exercise or lab	Other
45	**-----**	**----**

3- Intended Learning Outcomes of the Course (ILO's)

a. *Knowledge*

i) Description of the knowledge to be acquired:

Understanding of Fracture as a failure criteria
Understanding of Failure theories related to Fracture
Understanding of Stress Intensity Factors for different types of loading

ii) Teaching strategies to be used to develop that knowledge

Lectures
Home Assignments
Discussions in the Class
Case study
Mini project (Design)

iii) Methods of assessment of knowledge acquired

Quizzes: to assess understanding of fundamentals of fracture mechanics.
Discussion Groups: to assess interactive and communication abilities**.**
Midterm Exams: to assess understanding of mechanical design procedure, problem solving and analytical and design capabilities.
Final Exam: to assess **understanding** of different aspects of fracture mechanics, design capabilities, analytical skills and ability to solve logical problems.
Mini project: to assess **practical hands-on**, report writing, ability to deal with suppliers, and design of systems.

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

(a) Ability to analyze, design and assess a mechanical part from fracture mechanics point of view
-
-

ii) Teaching strategies to be used to develop these cognitive skills

- Lectures
- Assignments, at home
- Case study
- Mini project (Design), Supervised

-

iii) Methods of assessment of students cognitive skills

Quizzes: to assess understanding of fundamentals of fracture mechanics.
Discussion Groups: to assess interactive and communication abilities**.**
Midterm Exams: to assess understanding of mechanical design procedure, problem solving and analytical and design capabilities.
Final Exam: to assess **understanding** of different aspects of fracture mechanics, design capabilities, analytical skills and ability to solve logical problems.
Mini project: to assess **practical hands-on**, report writing, ability to deal with suppliers, and design of systems.

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- Team work
- Ideas development and sharing with others

ii) Teaching strategies to be used to develop these skills

- Assignments, at home
- Case study
- Mini project (Design), Supervised

iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

- *Case Study*
- *Mini Project*
- *Mini Project Presentations*
-

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

-
- Use of Commercial Software, e.g. MATLAB and ANSYS to do Fracture Mechanics Problems
-
-

ii) Teaching strategies to be used to develop these skills

- Lectures
- Assignments, at home
- Case study
- Mini project (Design), Supervised

iii) Methods of assessment of students numerical and communication skills

- **Quizes:** to assess understanding of fundamentals of fracture mechanics.

Discussion Groups: to assess interactive and communication abilities**.**

Mini project: to assess **practical hands-on**, report writing, ability to deal with suppliers, and design of systems-

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

-
-

-
-
-

ii) Teaching strategies to be used to develop these skills-

-
-
-
-
-

iii) Methods of assessment of student's psychomotor skills

-
-
-
-

4- Student Assessment Schedule

Assessment	Assessment task (test, group project, examination etc.)	Weight of
1	Quizzes	10 %
2	General Performance/ Attendance	2 %
3	Mid Term Exam1	15 %
5	Mid Term Exam2	15 %
6	Mini Project, Home Assignment	8 %
7	Final Exam	50 %

5- Student Support

Extra office hours available to the student to discuss course material and mini project with the instructor.

6- Learning Resources

i) Essential Books (References)

1. T. L. Anderson, *Fracture Mechanics: Fundamentals and Application* 3rd Ed. 2004-
2. Hertzberg, Deformation and Fracture Mechanics, John Wiley. 2004

ii) Course Notes

-
-

iii) Recommended Books

- *Salford, R.J., Principles of Fracture Mechanics*, *Prentice Hall* 2002
-
-

iv) Electronic Books & Web Sites:

-
-

v) Periodicals

-
- International Journal of Fracture Mechanics
-
-
-

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- End of semester teaching evaluations through survey forms
- End of semester course evaluations through survey forms
-

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

-

iii) Processes for Improvement of Teaching

-
-

iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange

and remarking of a sample of assignments with a faculty member in another institution)

-

-

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

The course evaluations done by the instructor are reviewed every semester by a subject committee. The improvements are debated, summarized and put up to the Department Council Meeting. After further debate and discussion the suggestions for modification of the course are sent forth to the college council. After approval from the college council the suggestions can be incorporated in the course.