Course Specifications

Program(s) on which this course is given:	Aerospace Engineering
Department offering the program:	**Department of Aerospace Engineering**
Department offering the course:	**Department of Aerospace Engineering**
Academic Level:	B.Sc.
Date	March 23 2015
Semester (based on final exam timing)	■ Fall □ Spring

A- Basic Information

1. Title:	Fracture Mechanics			**Code:**	AER 636			
2. Units/Credit hours per week:	Lectures	27	Tutorial	15	Practical	**3**	Total	45

B- Professional Information

1. Course description:	The course is intended to introduce the basic concepts and the crack damage calculation methodology as applied to structures subjected to static and dynamic load. These calculation leads to predicting the structural service life under the applied load
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	To know the historic perspective of fracture mechanics science how it started and how it was developed.
	To understand the missile mission requirements, mission analysis, space vehicle specifications, mission constraints including escape from gravity and possibly gravity field reentry corridor
	b) Intellectual Skills
	To learn the existing missile and space vehicle typical structures configurations and applied materials
	To learn the theories and methods for computing the structural design loads that arise from the engine ignition shock load, the accompanying dynamic vibration loads and the acoustic load on payload in its compartment, the aerodynamic shock wave load, and the in space inertia and thermal loads. Most missile loads are random and base excited loads
	c) Professional and Practical Skills
	To Conduct missile random and deterministic load analysis
	To Conduct the missile random and deterministic static and dynamic stress, strain, and deformation analysis. To conduct modal analysis, structural dynamic response in frequency domain and in time domain.
	d) General and Transferable Skills
	To Gain the ability to apply missile structural random load analysis and compare them to deterministic dynamic and static analysis and to compare the results.

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours
Historical Perspective, Fracture Mechanics Approach to Design, The Energy Criterion, The Stress-Intensity Approach, Time-Dependent Crack Growth and Damage Tolerance, Dimensional Analysis in Fracture Mechanics		3	
Fundamental Concepts: Linear Elastic		3	

Fracture Mechanics ,An Atomic View of Fracture, Stress Concentration Effect of Flaws , The Griffith Energy Balance , Comparison with the Critical Stress, Modified Griffith Equation , The Energy Release Rate			
Stress Analysis of Cracks, Crack-Tip Plasticity, Crack-Tip Triaxiality Plane Strain Fracture, Mixed-Mode, Fracture, Interaction of Multiple Cracks		6	3
Dynamic and Time-Dependent Fracture Crack-Tip-Opening Displacement Crack-Growth Resistance Curves		6	6
Creep Crack Growth, Fatigue Crack Propagation, Viscoelastic, Fracture Mechanics, The Fatigue Threshold, Growth of Short Cracks, Micromechanisms of Fatigue Damage Tolerance Methodology		6	6
Environmentally Assisted Cracking in Metals, Corrosion Principles, Environmental Cracking Stress Corrosion Cracking Hydrogen Embrittlement		3	3
4. Teaching and Learning Methods	Lectures (27)	Practical Training/ Laboratory (15)	Seminar/Workshop (3)
	Class Activity (4)	Case Study (1)	Projects (1)
	E-learning (2)	Assignments /Homework (5)	Other:

5. Student Assessment Methods	
• **Assessment Schedule**	**Week**
-Assessment 1;Class test	4,5,6
-Assessment 2; Project Assignment	7
-Assessment 3; Presentations	10
-Assessment 3; Midterm Exam	9
-Assessment 4; Final Exam	16
• **Weighting of Assessments**	
-Mid-Term Examination	20
-Final-term Examination	40
-Project	20
-Class Test	15
-Presentation	5
-Total	100

6. List of References

Fracture mechanics fundamentals and applications, Editor: T.L. Anderson, ISBN: 13: 978-1-4200-5821-5

7. Facilities Required for Teaching and Learning	
Computer lab	
Course Coordinator:	**Nader M. Abuelfoutouh**
Head of Department:	**Ayman H. Kassem**