

AE 425: Fracture mechanics										
L	T	P	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/-	20/25	40/50	-

Objective: To familiarize the students with basics of Griffith's energy balance approach, the shape of the plastic zone for plane stress and plane strain cases, Stress intensity factors and plane strain fracture toughness. To impart in-depth knowledge of elastic plastic fracture mechanics and fatigue crack propagation and applications of fracture mechanics.

AE 425: Fracture mechanics		Contact Hours
Unit-1	Introduction: Introduction and overview Inter-disciplinary approaches in fracture mechanics, modes of deformation and failure, Griffith theory.	6
Unit-2	Linear Elastic Fracture Mechanics: Stress concentration in the vicinity of notches and cracks, concept of stress intensity factor (SIF), Stress intensity factor for different types of cracks and geometry. Irwin's stress intensity approach, fracture toughness.	6
Unit-3	General Yielding Fracture Mechanics: Crack tip plastic zones and its evaluation, Wall's crack opening displacement. Barenblatt and Dugdale's models.	8
Unit-4	Evaluation of Fracture Mechanics Parameters: Plane strain fracture toughness testing i.e., K _{IC} Concepts of crack tip opening displacements (CTOD)	8
Unit-5	J-Integral and fatigue crack: J integral and its evaluation, application of J-integral. Mechanics of fatigue crack propagation.	6
Unit-6	Fatigue crack propagation and applications of fracture mechanics: Crack nucleation and growth and the stress intensity factor. Factors affecting crack propagation, fatigue life prediction, Paris law, statistical analysis, variable amplitude service loading, means to provide fail-safety, required information for fracture mechanics approach, mixed mode (combined) loading and design criteria. Fracture of composite materials.	8
Total		42

Reference Books:	
1	Prashant Kumar; 'Elements of Fracture Mechanics'; Publisher- Tata McGraw- Hill Publishing Company Limited (ISBN 0070656967)
2	Knott.J.F; "Fundamentals of Fracture Mechanics", Publisher-John Wiley & Sons, Newyork (ISBN 0408705299)
3	Gdoutos.E.E; "Fracture Mechanics- An introduction"; Publisher-Springer (ISBN 9401581584)
4	Ramesh.K; "e-Book on Engineering Fracture Mechanics"; IIT Madras (ISBN: 978- 81-904235-0-2)
5	T. L. Anderson , "Fracture Mechanics: Fundamentals and Applications", Publisher CRC Press (ISBN 0849342600)
6.	P. Kumar, "Elements of Fracture Mechanics", Publisher- Wheeler Publishing

Course Outcomes

CO1	To understand the sources of crack, interpret and use the concepts of fracture mechanics with stress concentration.
CO2	To discuss the concepts of shape of the plastic zone for plane stress and plane strain cases in formulating and solving design problems.
CO3	To explain the assumptions underlying several numerical and experimental methods of determination of fracture toughness and be able to the concepts of crack resistance, J-integral tearing modulus and stability.
CO4	To analyze the Crack-tip opening displacement its application and experimental determination with understanding of Parameters affecting the critical CTOD and use of J integral.
CO5	To interpret, analyses the concepts of fracture mechanics in fatigue crack propagation.
CO6	To apply of the concept of fracture mechanics for practical application.

CO-PO/PSOMatrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2