						CWS	PRS	MTE	ETE	PRE
L	**T**	**P**	**Credit**	**Area**						
3	0/1	2/0	4	DEC/GEC		15/25	25	20/25	40/50	-

ME414: Fracture Mechanics

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.

Syllabus		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., Kic 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.	**8**
Unit-6	**Fracture Safe Design Principles:** Fail-safe design. **Fractured surfaces:** Acquaintance with some common fracture surfaces of various materials, like steels, C.I, non ferrous alloys etc.	6
	Total	**42**

Reference Book:	
1	Prashant Kumar; 'Elements of Fracture Mechanics"; Tata McGraw- Hill Publishing Company Limited.
2	D. Breok; 'Elementry Fracture Mechanics"; Noordhoff International,1985
3	T.L. Anderson; 'Fracture Mechanics"; 3rd edition, Taylor & Francis, ISBN-0849316561, 2005.
4	Knott. J. F; "Fundamentals of Fracture Mechanics", John Wiley & Sons, Newyork.
5	Gdoutos. E. E; "Fracture Mechanics- An introduction"; Springer.
6	Ramesh. K; "e-Book on Engineering Fracture Mechanics"; IIT Madras

Course Outcomes

CO1	Develop basic fundamental understanding of the effects of crack like defects on the performance of Mechanical Engineering structures.
CO2	Select appropriate materials for engineering structures to ensure damage tolerance.
CO3	Employ modern numerical methods to determine critical crack sizes and fatigue crack propagation rates in engineering structures.
CO4	Classify the type of fracture and predict ductile to brittle transition.
CO5	Estimate fatigue crack growth using principles of fracture mechanics.
CO6	redict stress intensity factor, energy release rate and J-integral, computationally, as per ASTM standards.

CO-PO/PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	2	1	1	1	1	2	2	1	3
CO2	3	3	2	2	2	2	2	1	1	1	1	3	3	2	2
CO3	3	3	3	2	2	2	1	1	1	1	1	2	2	1	3
CO4	3	3	3	3	2	2	2	1	1	1	1	2	3	1	2
CO5	3	3	3	3	3	2	2	1	1	1	1	3	3	2	3
CO6	3	3	3	3	3	2	2	2	1	1	1	2	3	2	3