**AE 7773: Advanced Fracture Mechanics**

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| Credit Hours: | 3-0-3 |
| Prerequisites: | AE 7772 or CEE 7772 or CHE 7772 or ME 7772 or MSE 7772 |
| Catalog Description: | Nonlinear fracture mechanics including elastic-plastic, time-dependent fracture, advanced test methods, J-integral theory, and extensions. Crosslisted with ME, CEE, CHE, and MSE 7773. |
| Textbooks: | Melvin F. Kanninen and Carl H. Popelar, *Advanced Fracture Mechanics*, First Edition, Oxford University Press, 1985. Ashok Saxena, *Nonlinear Fracture Mechanics for Engineers*; First Edition, CRC Press, 1998. |
| References: | M.Kanninen and C.Poplar, "Advanced Fracture Mechanics", Oxford University Press  T.L.Anderson, "Fracture Mechanics-Fundamentals and Applications", CRC Press Current Literature in Fracture Mechanics |
| Goals: | To provide an in-depth treatment of advanced topics in fracture mechanics including fracture and crack growth under elastic-plastic, time-dependent and dynamic conditions.The course emphasizes the fundamental underpinings of nonlinear fracture mechanics and its use in material evaluation and life prediction methodology for components. Micro-mechanics of fracture and crack growth processes are also covered. Upon completion of the course, the students should be able to read and follow current research papers in fracture mechanics. |
| Topics: | * Limitations of LEFM * Fundamentals of Plasticity, Slip-line Fields and Limit-loads * Analysis of Cracks under Elastic-Plastic Loading * Methods of Estimating J-integral * Crack Growth Resistance Curves * Instability Theory * Dynamic Fracture * Micromechanics of Ductile Fracture and Constraint Effects * Fracture in the Transition Region * Fatigue Crack Growth Under Large-scale Plasticity * Analysis of Cracks in Creeping Bodies * Creep Crack Growth * Creep-fatigue Crack Growth * Fracture in Visco-elastic Materials * Case Studies   + Creep Fracture in Components   + Integrity of Nuclear Steam Pipes   + Failure of Turbine Casings   + Failure of Turbine Rotors   + Integrity of Jet Engine Disks   + Probabilistic Fracture Mechanics |
| Grading scheme: | |  | | --- | | Two Exams | |