

## **Certificate: Structural Analysis and Design**

The certificate course will provide students with knowledge in advanced structural analysis for design of engineering components. The topics include fracture and fatigue considerations in design. Finite element methods will be introduced, and students will have access to general purpose finite element programs to solve structural design problems. (12 credit hours)

### **ME 510      Finite Element Methods 3 credits**

Overview and applications of FE theory in linear static and dynamic systems. Review of matrices, strain and stress tensors. Along with variations and energy principles in FEA and applications in linear stress analysis: 1D, 2D and 3D. Transient solutions; modal analysis and modeling concepts are also covered.

### **ME 512      Structural Analysis 3 credits**

Principles of structural theory, matrix and finite element methods of analysis are discussed in addition to dynamics of structures.

### **ME 514      Advanced Stress Analysis 3 credits**

This course covers stresses and deformations in mechanical and structural elements and systems: theory, analysis and applications. Topics selected from among the following in applied elasticity and advanced mechanics of materials: stress and strain transformation; plane theory of elasticity and stress functions; energy methods; thick-walled cylinders and spinning disks; torsion of non-circular and hollow sections; unsymmetric bending and shear center; curved beams; beams on elastic foundations; plates and shells; elastic stability.

### **ME 558      Fracture and Fatigue Considerations in Design 3 credits**

A comprehensive review of fracture and fatigue processing in engineering material with emphasis on mechanics instead of mechanics of failure. Design methodology based on fracture toughness and fatigue crack propagation is presented. Laboratory test methods and data interpretations are also presented.