

## **MECH 4720 Introduction to Precision Engineering (Fall 23-24)**

### **Course Description:**

Principles of precision design, precision machining, and precision measurement; mathematical definitions and theoretical studies of tolerances for one-, two-, and three-dimensional precision assemblies; applications and industrial practices.

**Textbook:** Hong-Chao Zhang,  
Advanced Tolerancing Techniques,  
John Wiley and Sons, Inc., 1997.

### **Grading Policy:**

Home work (30%)  
Study Paper (70%)

### **Supplementary Texts:**

Hiromu Nakazawa, Principles of Precision Engineering,  
Oxford University Press, 1994.

Alexander H. Slocum, Precision Machine Design,  
Prentice Hall, 1992.

George Tlusty, Manufacturing Processes and Equipment,  
Prentice Hall, 2000.

**Laboratory Work:** None

### **Lecture Content:**

1. Introduction (0.5 weeks)
2. Tolerance Analysis and Synthesis (7 weeks)  
Introduction  
Linear tolerance analysis  
Non-linear tolerance analysis  
Tolerance synthesis  
Concurrent tolerancing  
Three-dimensional tolerance analysis  
Tolerance optimization
3. Precision Design (3.5 weeks)  
Total design  
Zero play  
Abbe's principle  
Principle of compliance  
Minimization of heat deformation

Smooth motion  
Principle of kinematic design  
Error correction  
Filter effect  
Reduction principle

4. Precision Machining (3 weeks)
  - Upper limit principle
  - Forced vibration and chatter reduction
  - Element technology
  - Principle of machining units
  - Copying principle
  - Evolution
  - Anisotropic principle
  - Multistage principle