MECH 4720 Introduction to Precision Engineering

Course Code: MECH 4720	**Course Title:** Introduction to Precision Engineering
Required Course Or Elective Course: Elective	**Terms Offered (Credits):** Fall/Spring
Faculty In Charge: Yongsheng Gao	**Pre/Co-Requisites:** (MATH 1014 OR MATH 1020 OR MATH 1024) AND (COMP 1002 OR COMP 1021 OR COMP 1022P OR COMP 1022Q)

Course Structure: 2 days per week, 3 hours

Textbook/Required Material:

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

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.

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.

Course Topics:

1. Introduction (0.5 weeks)

2. Tolerance Analysis and Synthesis (7 weeks)
3. Introduction
4. Linear tolerance analysis
5. Non-linear tolerance analysis
6. Tolerance synthesis
7. Concurrent tolerancing
8. Three-dimensional tolerance analysis
9. Tolerance optimization

10. Precision Design (3.5 weeks)
11. Total design
12. Zero play
13. Abbe's principle
14. Principle of compliance
15. Minimization of heat deformation
16. Smooth motion
17. Principle of kinematic design
18. Error correction
19. Filter effect
20. Reduction principle

21. Precision Machining (3 weeks) 22. Upper limit principle 23. Forced vibration and chatter reduction 24. Element technology 25. Principle of machining units 26. Copying principle 27. Evolution 28. Anisotropic principle 29. Multistage principle	
Course Objectives:	1. To equip students with fundamental theories and technologies for precision design. 2. To introduce students benefits of precision engineering. 3. To provide students extensive training in development and use of linear and nonlinear tolerance models. 4. To introduce students concept of sensitivity analysis for precision design analysis. 5. To introduce students precision design and precision machining principles.
Course Outcomes:	1. Ability to use basic knowledge in mechanisms and mathematical tool to model to design products with quality. 2. Ability to conduct tolerance allocation and analysis for precision machine design and assessment. 3. Ability to conduct sensibility analysis for precision design optimization. 4. Awareness of the needs and benefits of precision engineering 5. Awareness of the technical and social problems in the manufacturing industries in the Pearl river delta and the need for industrial transformation.
Assessment Tools:	Precision design analysis study paper