MECH4750 Mechanical Vibrations

Course Code: MECH4750	**Course Title:** Mechanical Vibrations
Required Course Or Elective Course: Elective	**Terms Offered (Credits):** Spring (3 credits)
Faculty In Charge: Yi Kuen Lee	**Pre/Co-Requisites:** MECH 2020 and MECH 2040

Course Structure:

Lecture: 2 day per week, 1.5 hour per lecture

Textbook/Required Material:

1. Lecture notes
2. S.S. Rao, Mechanical Vibration, 5/e, Prentice Hall, 2011.

Course Description:

Single-degree-of freedom vibration, multiple-degree-of freedom vibration, vibration in continuous media, numerical method and the applications in mechanical engineering, aerospace engineering and MEMS

Course Topics:

1. Introduction to Vibration
2. Single-degree-of-freedom vibration
3. Multiple-degree-of-freedom vibration
4. Vibration under General Forcing Conditions
5. Vibration in continuous media
6. Analytical methods in vibration
7. Damping, Effective Mass, Vibration Control
8. Vibration measurements and techniques
9. Finite Element Method
10. Applications of vibration in mechanical engineering
11. Applications of vibration in aerospace engineering
12. Applications of vibration in MEMS: micro accelerometers and micro gyroscopes

Course Objectives:	1. To equip the students with fundamental vibration theories and vibration control technologies that are commonly used in mechanical and aerospace engineering, MEMS. 2. To introduce various damping mechanisms and frequency response function in mechanical systems. 3. To provide students with the skill of identification of system vibration characteristics, the response of free vibration and forced vibration, using analytical methods and numerical methods, especially finite element method. 4. To introduce the design of various vibration control methods, such as vibration isolators abd vibration absorbers, based on specified vibration constraints and/or international standards. 5. To introduce experimental methods to determine vibration characteristics for vibration control and condition-based maintenance in mechanical and aerospace engineering.
Course Outcomes:	A. Ability to derive system equations using first principles. B. Ability to modify, in a design scenario, the system parameters to alter vibration response.

	C. Ability to determine natural frequencies and vibration shape(s). D. Ability to measure vibration characteristics and infer model parameters from the measured data. E. Ability to apply modern computational techniques (i.e. Matlab and ANSYS to vibration analysis). F. Ability to design practical vibration control systems for mechanical systems in mechanical and aerospace engineering.
Assessment Tools:	Regular homework problems 20% Mid-term, Final exams/term projects 80%