## STONY BROOK UNIVERSITY (SUNY) DEPARTMENT OF MECHANICAL ENGINEERING

# Vibration and Control

COURSE TITLE:	MEC532 Vibration and Control, Spring 2025	
PREREQUISITES:	Permission of instructor	
LECTURE:	Mon 15:30 – 18:20; Room: Frey Hall 305	
INSTRUCTOR:	Dr. Imin Kao, Professor	
	Email: imin.kao@stonybrook.edu	
OFFICE:	LE-167; Phone (631) 632-8308	
OFFICE HOURS:	Mon 11:00-13:00, Wed 14:00-16:00 & other time by appointment	
COURSE OBJEC- TIVES:	Fundamentals of vibrations and control of vibrations of structures and dynamic systems.	
	Topics include one-DOF systems and responses, frequency response, multi-DOF systems and responses, relevant classical control theory, modern state-space feedback control theory,	
	application of control methodology in systems with dynamics and vibration, eigenvalue	
	problems and modal analysis, vibration analysis of various continuous systems.	
Техтвоок:	• Materials from the manuscript of my book in "Mechanical Vibration and Control" to be	
	published by the Springers Publishing Company; materials from the book will be distributed	
	as course handouts	
References:	L. Meirovitch, "Fundamentals of Vibrations," Waveland Press, 2010 (ISBN 978-1-57766-	
	091-2) S. Craham Kally, "Machanical Vibrations," Schoum's Outlines, 1006	
	S. Granam Kelly, Mechanical Vibrations, Schaum's Outlines, 1996	
	D. J. Inman, Vibration with Control, wiley, 2000 P. C. Dorf and P. H. Pishon, "Modern Control Systems," 13th ed. Dearcon, 2017 (ISPN).	
	K. C. Dori and K. H. Bisnop, Modern Control Systems, 15th ed., Pearson, 2017 (ISBN: 0781202152074, 1202152074)	
	9/012921529/4, 12921529/4) I. Meirovitch "Principles and Techniques of Vibrations" Prentice-Hall 1007	
	L. Menovicii, Frincipies and rechniques of vibrations, Frence-Han, 1997	
EXAMINATIONS:	Two midterm exams (in-class and/or take-home)	
	• All exams are scheduled in class, unless otherwise specified	
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	• <u>NO</u> make-up exams unless arranged prior to the exams	
Grading:	Your semester letter grade is based on your performance on the following subjects, including	
	exams and homework assignments:	
	Homework: Weekly assignments, 25 pts	
	Midterms: Two midterm exams, 20 pts each	
	Final: One final exam, 35 pts	
TOPICS:	(on the next page)	

**Topics** of MEC532 course include the following:

- Introduction of mechanical vibration and control
- Ordinary and partial differential equations of motion for vibration analysis
- Free, forced, damped vibration and analysis for one-DOF and multi-DOF discrete systems
- Responses: transient and steady-state responses; frequency response
- Algebraic eigenvalue problems and modal analysis for conservative systems
- Vibration analysis of nonconservative discrete systems using the linear system theory
- Vibration analysis of unconstrained discrete systems
- Modern control theory (or state-space control theory): Control law (controller) and estimator design
- Combining and comparing the analyses of vibration and control
- Vibration analysis of continuous systems and approximate solution
- Use of software (MATLAB and Wolfram/Mathematica) for the analysis of vibration and control

#### **Course Learning Objectives** of MEC532

- 1. Analysis of vibration of mechanical systems
- 2. Modern control using the linear system theory

Holidays (no classes held):	March 17-23, 2025 (Spring recess)
	May 12, 2025 (Reading Day)
Classes to be held:	1/27/25, 2/3/25, 2/10/25, 2/17/25, 2/24/25, 3/3/25, 3/10/25, 3/17/25,
	3/24/25, 3/31/25, 4/7/25, 4/14/25, 4/21/25, 4/28/25, 5/5/25
First Day of Classes:	Monday, January 27, 2025
Last Day of Classes:	Saturday, May 10, 2025
Reading Day:	Monday, May 12, 2025
Final Examinations:	May 13-21, 2025
Commencement:	Friday, May 23, 2025

Important calendar days for the Spring 2025 semester (Jan 27–May 21, 2025):

### Brightspace

Brightspace, a digital learning management system (LMS), is used for this course. All course materials and communication will be posted on Brightspace. Information can be found in Brightspace Page.

**Important Copyright Notice:** The materials in this course available online through Brightspace or video recording through Echo360 are for the exclusive use of registered students currently enrolled in this course, and may not be retained or further distributed. In addition to legal sanctions, violation of these copyright prohibitions may result in University disciplinary action.

#### Various University Policies and Statements

**Student Accessibility Support Center Statement:** If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Academic Integrity Statement: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website.

**Critical Incident Management:** Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

**Regarding Student Absences:** In the event of a short-term absence from class, students are encouraged to communicate immediately and work directly with instructors. However, if a student is struggling with an extended absence due a hospitalization, family illness or death, they are encouraged to reach out to the Student Support Team.