AE 6230 – Fall 2026 Syllabus

Structural Dynamics - 3 Credit Hours

Instructor: Dr. Cristina Riso - **Email:** criso@gatech.edu

General Information

Description

Dynamic response of single-degree-of-freedom systems, Lagrange's equations; modal decoupling; vibration of Euler-Bernoulli and Timoshenko beams, membranes and plates.

Pre- &/or Co-Requisites

AE 3140 and AE 3530

Course Objectives and Learning Outcomes

Course Objectives
This course aims to introduce students to the fundamentals of structural dynamics:

1. Solving for the dynamic responses of single-degree-of-freedom (SDOF) systems
2. Deriving the governing equations for multi-degree-of-freedom (MDOF) systems
3. Solving for the dynamic responses of MDOF systems using modal decoupling
4. Deriving the governing equations and boundary conditions for continuous structures
5. Solving for the dynamic responses of continuous structures using the modal approach

The course provides students with the background to perform structural dynamics analysis and research.

Learning Outcomes
Upon successfully completing this course, students will be able to

1. Formulate and solve structural dynamics problems for
   a. SDOF systems
   b. MDOF systems
   c. Continuous systems (strings, beams, membranes, plates)
2. Master the assumptions and limitations in the models and solution methods used
3. Critically discuss and interpret their results

Course Materials

Note: Course materials may vary with each offering. The example below is typical but subject to change.

Textbook

No textbook is required but students are encouraged to consult one or multiple of the following textbooks:

1. Meirovitch, *Fundamental of Vibrations*, Waveland Press Inc., 2010
2. Inman, *Engineering Vibrations*, Pearson, 2013
3. Meirovitch, *Principles and Techniques of Vibrations*, Prentice Hall, 1997
4. Friedmann, Lesieutre, and Huang, *Structural Dynamics*, Cambridge, 2023

Course Notes

Lectures are delivered using slides, which will be posted in Canvas.

Grading Policy and Weighting

Note: Graded components of a course may vary. The example below is typical but subject to change.

Description of Graded Components and Weighting

The graded components consist of

1. Homework assignments (40%)
2. Midterm exam (30%)
3. Final exam (30%)

Each graded component will be attributed a score from 0 to 100, which will be used to compute the weighted average and letter grade based on the grading scale below. The instructor may provide optional extra-credit opportunities as specified in Canvas. There will be no additional individualized extra-credit work.

Grading Scale

Final grades will be assigned as a letter grade based on the weighted average of the scores for each graded component defined above according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69% F 0-59%

Attendance Policy

Attendance is not mandatory. All students are responsible for studying the topics covered on a weekly basis, whether they attend lectures or watch recorded lectures, and to stay current with information provided via class announcements, Canvas, or Piazza.

Additional Criteria for Successful Completion of the Course

Students who succeed in the course tend to ask questions often, devote effort to solving and learning from homework assignments, interact with the instructor, and study the material in small increments.

Academic Honesty Statement

Students are expected to follow the Georgia Tech Academic Honor Code.

Artificial Intelligence Policy

Students may use artificial intelligence (AI) tools that are approved by Georgia Tech, provided they comply with the guidelines posted in Canvas and any assignment- or exam-specific instructions. Use of AI tools that are not approved by Georgia Tech, including those pending review, is not allowed. If a proposed use of an approved AI tool is not addressed by the provided guidelines, students must obtain written instructor approval by email before using the tool for that purpose. Students must disclose any use of AI tools in the preparation of submitted work in accordance with disclosure guidelines posted in Canvas. Students remain responsible for the accuracy, originality, and appropriateness of all work they submit, regardless of whether AI tools were used. Failure to follow this policy will be considered a violation of the course academic integrity policy.

Acceptable Student Conduct

Students are expected to be respectful of the instructor and classmates. Students are allowed to join lectures late or leave early for other commitments if they do not disturb. In-class use of note-taking devices (such as laptops and tablets) is allowed. However, students should not use those devices to perform tasks unrelated to the course. Students should generally refrain from using their cell phones in class.

Services Offered Through the Office of Disability Services

Students requiring disability accommodation should contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/ to discuss learning needs and obtain an accommodation letter. They are also encouraged to email the instructor to discuss their needs.

Topics Covered

Note: The exact topics covered in a course may vary. The example below is typical but subject to change.

1. Introduction to structural dynamics
2. Single-degree-of-freedom systems
    a. Governing equations
    b. Free response
    c. Forced response
    d. Damping models
    e. Laplace and Fourier transforms
3. Multi-degree-of-freedom systems
    a. Governing equations
        i. Newton's approach
        ii. Lagrange's approach
    b. Synchronous solution
    c. Eigenvalue problems
        i. Eigenvalues and eigenvectors
        ii. Rigid-body modes
    d. Free response
    e. Forced response
4. Continuous systems
    a. Hamilton's principle
    b. Governing equations and boundary conditions for one-dimensional structures
        i. String vibrations
        ii. Axial and torsional vibrations
        iii. Euler-Bernoulli beam vibrations
    c. Differential eigenvalue problems
    d. Free response
    e. Forced response
    f. Approximate methods
        i. Rayleigh-Ritz and Galerkin methods
        ii. Finite element method (high-level overview)
    g. Advanced boundary conditions
    h. Timoshenko beams (high-level overview)
    i. Membranes and plates (high-level overview)
5. Additional topics (depending on time)