

**Vibrations**  
**EML4220** Class# 16028 Section# 2047  
**Class Periods:** 6 (12:50– 1:40 PM) **Location:** LIT 0101  
**Academic Term:** Spring 2026

**Instructor:**

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**Office hours:**

Zoom link <https://ufl.zoom.us/j/98862672004?pwd=eHlwOGp0anhleW1oa0xuWTFLOC8xZz09>

**Course Description**

Free and forced vibrations, single and multiple degrees of freedom systems, applications to mechanical systems.

**Course Pre-Requisites / Co-Requisites**

Prereq: EGM 3344, EGM 3401, EGM 3520 and MAP 2302 with minimum grades of C.

**Course Objectives**

This course stresses fundamental engineering science and mathematical principles required for understanding vibrations. There are two major goals:

- a) To learn the concepts needed for understanding and analysis of the dynamic behavior of vibrating systems.
- b) To develop skills for designing vibrating systems with desired properties that enhance vibration when it is wanted and reduce vibration when it is unwanted.

**Materials and Supply Fees**

List if applicable

**Relation to Program Outcomes (ABET):**

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

| Outcome                                                                                                                                                                                                                                       | Coverage* |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics                                                                                                  | Medium    |
| 2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors                   | High      |
| 3. An ability to communicate effectively with a range of audiences                                                                                                                                                                            |           |
| 4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts | Medium    |
| 5. An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives                                                               |           |
| 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions                                                                                                |           |
| 7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies                                                                                                                                             | Medium    |

**Course Schedule** (*Tentative, may be modified in time*)

|    | Wk | Date          | Topic                                                                       |
|----|----|---------------|-----------------------------------------------------------------------------|
| 1  | 1  | Jan 12        | Introduction to the course                                                  |
| 2  |    | Jan 14        | <b>Chapter 1</b> (8 lectures 3 reviews), Free Vibration step 1 & 2          |
| 3  |    | Jan 16        | Free Vibration step 3 & 4                                                   |
| 4  | 2  | Jan 21        | Energy method, compound pendulum                                            |
| 5  |    | Jan 23        | Viscous damping                                                             |
| 6  | 3  | Jan 26        | Viscous damping examples                                                    |
| 7  |    | Jan 28        | Stiffness <b>HW1 due</b>                                                    |
| 8  |    | Jan 30        | Application of vibrations to instruments and measurements                   |
| 9  | 4  | Feb 2         | Stability                                                                   |
| 10 |    | Feb 4         | Career fair no class                                                        |
| 11 |    | Feb 6         | Chapter 1 & HW 1 review <b>HW2 due</b>                                      |
| 12 | 5  | <b>Feb 9</b>  | HW 2 and Practice exam review                                               |
| 13 |    | <b>Feb 11</b> | <b>Exam 1</b>                                                               |
| 14 |    | Feb 13        | Exam1 review/ <b>Chapter 2</b> , Harmonic excitation (5 lectures 3 reviews) |
| 15 | 6  | Feb 16        | Harmonic excitation, two important phenomena                                |
| 16 |    | Feb 18        | Harmonic excitation of damped system                                        |
| 17 |    | Feb 20        | Base excitation                                                             |
| 18 | 7  | Feb 23        | Base excitation, rotating balance                                           |
| 19 |    | Feb 25        | Measurement devices/accelerometer/seismometer <b>HW3 due</b>                |
| 20 |    | Feb 27        | Review of chapter 3 and HW3                                                 |
| 21 | 8  | Mar 2         | Practice exam review                                                        |
| 22 |    | <b>Mar 4</b>  | <b>Exam 2</b>                                                               |
| 23 |    | Mar 6         | Exam2 review/ <b>Chapter 3</b> General forces (4 lectures 3 reviews)        |
| 24 | 9  | Mar 9         | Impulse and arbitrary Force                                                 |
| 25 |    | Mar 11        | Step and ramp response: derivations                                         |
| 26 |    | Mar 13        | Ramp response: applications                                                 |
| 27 | 10 | Mar 23        | Periodic forces and Fourier theory                                          |
| 28 |    | Mar 25        | Applications to Shock spectrum, Review of Chapter 3 <b>HW4 Due</b>          |
| 29 |    | Mar 27        | Reviews of HW4 and Practice exam                                            |
| 30 | 11 | <b>Mar 30</b> | <b>Exam 3</b>                                                               |
|    |    | <b>Mar 31</b> | <b>Exam 3</b>                                                               |
| 31 |    | Apr 1         | Exam 3 review / <b>Chapter 4</b> MDOF systems (5 lectures 3 reviews)        |
| 32 |    | Apr 3         | 2DOF Eigenvalues and natural frequencies                                    |
| 33 | 12 | Apr 6         | 2DOF Modal analysis                                                         |
| 34 |    | Apr 8         | More than 2DOF                                                              |
| 35 |    | Apr 10        | Rigid body motion and modal analysis/systems with viscous damping           |
| 36 | 14 | Apr 13        | Resonance, Modal analysis of forced response <b>HW5 due</b>                 |
| 37 |    | Apr 15        | Vibration Design and Review of Chapter 4                                    |
| 38 |    | Apr 17        | Review of HW5 and Practice Exam                                             |
| 39 | 15 | <b>Apr 20</b> | <b>Exam 4</b>                                                               |
| 40 |    | Apr 22        | Review of Exam 4                                                            |

### ***Important Dates (Tentative)***

Feb 11 Exam 1 8:20 - 9:30 pm, Turlington Hall

Mar 4 Exam 1 8:20 -9:30 pm, Turlington Hall

Mar 31 Exam 1 8:20-9:30 pm, Turlington Hall

Apr 20 Exam 1 8:20-10:20 pm, Turlington Hall

### ***Evaluation of Grades***

| Assignment        | Total Points | Percentage of Final Grade |
|-------------------|--------------|---------------------------|
| Homework Sets (5) | 100 each     | 20%                       |
| Participation     | 100          | 5%                        |
| Exam 1            | 100          | 20%                       |
| Exam 2            | 100          | 15%                       |
| Exam 3            | 100          | 15%                       |
| Exam 4            | 100          | 25%                       |
|                   |              | 100%                      |

- Late homework will be deducted 20% per day.

### ***Grading Policy***

The following is given as an example only.

| Percent     | Grade | Grade Points |
|-------------|-------|--------------|
| 93.4 - 100  | A     | 4.00         |
| 90.0 - 93.3 | A-    | 3.67         |
| 86.7 - 89.9 | B+    | 3.33         |
| 83.4 - 86.6 | B     | 3.00         |
| 80.0 - 83.3 | B-    | 2.67         |
| 76.7 - 79.9 | C+    | 2.33         |
| 73.4 - 76.6 | C     | 2.00         |
| 70.0 - 73.3 | C-    | 1.67         |
| 66.7 - 69.9 | D+    | 1.33         |
| 63.4 - 66.6 | D     | 1.00         |
| 60.0 - 63.3 | D-    | 0.67         |
| 0 - 59.9    | E     | 0.00         |

### ***Academic Policies & Resources***

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: <https://go.ufl.edu/syllabuspolices>. Instructor-specific guidelines for courses must accommodate these policies.

### ***Commitment to a Positive Learning Environment***

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWCoe Human Resources, 352-392-0904, [student-support-hr@eng.ufl.edu](mailto:student-support-hr@eng.ufl.edu)
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, [pld@ufl.edu](mailto:pld@ufl.edu)