

# PHYSICS 311 – OSCILLATIONS AND WAVES

## Semester 2018

Autumn

### LECTURES

Tue. & Thu. 11:00 – 11:50 a.m., CHCB 231

### INSTRUCTOR

Eijiro ('Ebo') Uchimoto

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Office Hours: Mon. 10 – 11 a.m., Tue. 2 – 3 p.m., Wed. 3 – 4 p.m., Thu. 1 – 2 p.m.,  
Fri. 11 a.m. – 12 noon (and by appointment)

### SCOPE

- Development of physical intuition and mathematical skills necessary for analyzing a wide range of periodic phenomena
- Detailed studies of oscillations and waves in preparation for advanced study in physics

### OUTCOME

- Will have acquired thorough and coherent understanding of periodic phenomena for a wide range of physical situations
- Will have acquired basic mathematical skills of solving ordinary and partial differential equations for oscillations and waves
- Will have acquired solid physical and mathematical foundations for advanced study in classical mechanics, electrodynamics, quantum mechanics, and optics

### NUMBER OF CREDITS

2 credits

### PREREQUISITES

Fundamentals of Physics (with Calculus) I and II or College Physics I and II

### PRE/COREQUISITE

Multivariable Calculus (Calculus III)

### TEXTBOOK

None. My personal manuscripts will be posted on Moodle.

### HOMEWORK

Reading assignments and problem sets to be posted on Moodle.

### EXAMS

Three midterm exams (Thu. 9/20, Tue. 10/23, Thu. 11/29)

Final exam (10:10 a.m. – 12:10 p.m. on Fri. 12/14)

## COURSE GUIDELINES AND POLICIES

### Student Conduct Code

The Student Conduct Code at the University of Montana embodies and promotes honesty, integrity, accountability, rights, and responsibilities associated with constructive citizenship in our academic community. This Code describes expected standards of behavior for all students, including academic conduct and general conduct, and it outlines students' rights, responsibilities, and the campus processes for adjudicating alleged violations. [Full student conduct code.](http://www.umt.edu/vpsa/policies/student_conduct.php)  
[http://www.umt.edu/vpsa/policies/student\\_conduct.php](http://www.umt.edu/vpsa/policies/student_conduct.php)

### Course Withdrawal

Students may use Cyberbear to drop courses through the first 15 instructional days of the semester. Beginning the 16<sup>th</sup> instructional day of the semester through the 45<sup>th</sup> instructional day, students use paper forms to drop, add and make changes of section, grading option or credit. PHSX 311 may not be taken as credit/no-credit.

### Disability Modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and [Disability Services for Students](#). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

### Grading Policy

Your grade will be based on the following:

|                |                |
|----------------|----------------|
| Problem sets:  | 25%            |
| Midterm exams: | 45% (15% each) |
| Final exam:    | 30%            |

Typical cutoffs for the final course grade:

|       |     |
|-------|-----|
| A-/B+ | 83% |
| B-/C+ | 72% |
| C-/D+ | 58% |
| D-/F  | 45% |

## TENTATIVE COURSE OUTLINE

| <b>Date</b>                           | <b>Topics</b>  |
|---------------------------------------|--|
| <b>Week 1: Aug 28, 30</b>             | Introduction<br>Simple harmonic motion (SHM)<br>Addition of sinusoidal functions                   |
| <b>Week 2: Sept 4, 6</b>              | Complex numbers<br>Linear ordinary equations (ODE's) with constant coefficients                    |
| <b>Week 3: Sept 11, 13</b>            | Pendulums<br>Damped oscillators  |
| <b>Week 4: Sept 18</b>                | More on damped oscillators   |
| <b>Sept 20</b>                        | <b>Exam #1</b>   |
| <b>Week 5: Sept 25, 27</b>            | Oscillatory circuits<br>Forced oscillators   |
| <b>Week 6: Oct 2, 4</b>               | Non-homogeneous linear ODE's<br>More on forced oscillators   |
| <b>Week 7: Oct 9, 11</b>              | Spring combinations<br>Coupled oscillators   |
| <b>Week 8: Oct 16, 18</b>             | More on coupled oscillators<br>Partial differentiation   |
| <b>Week 9: Oct 23</b>                 | <b>Exam #2</b>   |
| <b>Oct 25</b>                         | Transvers waves on a taut string<br>Wave equation  |
| <b>Week 10: Oct 30, Nov 1</b>         | Superposition principle, interference<br>Standing waves  |
| <b>Week 11: Nov 8</b>                 | Energy and momentum transport associated with wave propagation<br>(Nov 6 – No class, Election Day) |
| <b>Week 12: Nov 13, 15</b>            | Electromagnetic waves<br>Phase and group velocities  |
| <b>Week 13: Nov 20</b>                | Fourier series<br>THANKSGIVING BREAK (Nov. 22 – 24)  |
| <b>Week 14: Nov 27</b>                | More on Fourier series   |
| <b>Nov 29</b>                         | <b>Exam #3</b>   |
| <b>Week 15: Dec 4</b><br><b>Dec 6</b> | Fourier transform<br>Review  |
| <b>Week 16: Dec 14</b>                | <b>FINAL EXAM</b>  |