Mechanics - Physics 300
Gustavus Adolphus College - Fall 2016

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Textbooks: *Classical Dynamics of Particles and Systems (5th Edition), by Marion and Thornton*
Recommended: *Mathematical Handbook of Formulas and Tables, by Murray R. Spiegel*
                 (Schaum's Outline Series)

Course Description and Objectives:

In this course we extend the development of non-relativistic classical mechanics, introduced in Classical Physics I and II, to the formal study of the dynamics of particles and systems. Topics include the application of vector calculus to the dynamics of particles, vibrating systems, rigid bodies, and central force systems, and to the development and applications of the Lagrangian and Hamiltonian formulations of mechanics. There will be an introduction to non-linear systems and chaos. The language of vector calculus and differential equations will be used throughout, with particular emphasis on the use of curvilinear (cylindrical and spherical) coordinates. In addition to providing students with a guided introduction to the subject of analytical mechanics, this course has three broader objectives:

1. to prepare students for the transition to the study of the quantum theory, the theory of vector fields, and statistical mechanics, with the least possible difficulty;
2. to impart to the student, at the crucial period in the student's career between "introductory" and "advanced" physics, some degree of sophistication in handling both the formalism of the theory and the operational techniques of problem solving; and
3. to bring together and extend the mathematical techniques introduced in previous mathematics and physics courses, and to give the student sufficient opportunities for practice so that she or he becomes reasonably proficient in their use.

Course Policy and Evaluation

1. **Class Meetings and Reading Assignments**: The class will meet five days a week for lecture, small-group problem solving, homework review and, occasionally, for exams. Attached is a weekly calendar of activities for the course. When reading assignments are made for a class session, the reading is expected to be completed **before** coming to the class.

2. **Academic Honesty**: The instructor is bound to abide by the College's Honesty Policy and therefore must report all incidents of academic dishonesty (cheating, copying, etc.) to the Dean's Office. In the spring of 2003, the College adopted an academic honesty policy and honor code system, which is printed in the Academic Bulletin and in the Gustavus Guide. All students will be required to abide by the policy and write the following honor code on every examination and graded assignment:
   "On my honor, I pledge that I have not given, received, nor tolerated others' use of unauthorized aid in completing this work."
   Not all components of this course are subject to the Honor Code. The instructor will clearly identify to which items the Code applies. But the student is responsible for requesting clarification if necessary.

3. **Reading Quizzes**: Each day that there is a reading assignment, there will be a reading quiz administered via Moodle. The quiz must be completed by each student before coming to class, and the Moodle assignment for that day will expire 10 minutes before class begins, i.e. at 8:50 AM. Reading quizzes are subject to the Honor Code. By clicking the **Submit** button, the student effectively writes the required statement and signs it.

4. **Homework**: Problems will be assigned on a weekly basis. Problems will be graded and returned to the student. Homework should be neat and orderly. Late homework will be accepted at the discretion of the instructor with some loss of points. Collaboration on homework assignments is expected to some degree. Although homework is not considered an Honor Code component, it is important that students realize the importance of individual effort in this area. The instructor believes that students who do their own homework will do better on exams and this should be reward enough. However, it appears to be necessary to discourage outright copying from other students or answer books in other ways as well. Thus, the following penalties will apply: First incident of copying – Credit for the problem(s) will be split between those involved (1/2 credit from answer book); Second incident – Zero credit for the problem(s); Third incident – Zero credit for the assignment.

5. **Group Problems**: Frequently in class, students will work together, in assigned groups of 3-4 members, to cooperatively solve problems. A group solution will be submitted, with all group members receiving the same grade. There will be no make-up for group problems missed due to absence. These activities will not be scheduled and may be used to test students' knowledge of old material or to introduce new material. Although collaborative efforts will be encouraged for solving in-class problems, assigned homework, labs, and some quizzes, they are **not allowed** for most quizzes and all exams. The instructor will make it clear which quizzes are to be group efforts and which are not to be.

6. **Attendance** : Regular attendance at all class meetings is expected. Students will be held responsible for informing themselves of all announcements/assignments made in class. Excessive absenteeism will result in some reduction of final grade.

7. **Exams :** There will be four hour exams and a two-hour final exam (see the calendar below). Students must arrange **in advance** to take an exam at other than the scheduled time, and may do so **only** for a valid health or school-related reason. (It is the responsibility of the student to inform the instructor during the first week of the semester regarding any anticipated absences due to required field trips, athletic events, musical performances, or other extra-curricular activities.) Exams missed without pre-arrangement are entered as zero credit and cannot be made up.

8. **Incompletes**: A grade of incomplete will be given only for work not completed due to circumstances beyond the control of the student.

9. **Office Hours, etc.:** My scheduled office hours are 1st and 3rd hours every day. I will also be available at other times for walk-in business and also by appointment. Don't be afraid to ask for help.

10. **Evaluation**:

Hour Exams	45%	A	94 - 100	C+	74 - 78
Final Exam	20%	A-	90 - 94	C	70 - 74
Homework	15%	B+	86 - 90	C-	66 - 70
Group Problems	10%	B	82 - 86	D+	62 – 66
Reading Quizzes	10%	B-	78 - 82	D	58 - 62
& Participation		F	< 58		

Assignment of final letter grades will also take into account the instructor's subjective evaluation of the student's attendance, initiative, class participation, preparation (particularly quantity and quality of homework), and evidence of improvement.

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Course Schedule

Week Beginning	Section	Title
September 5	Marion 1.1 - 1.7	**Matrices, Vectors, and Vector Calculus**
September 12	1.8 - 1.17 & 2.1 – 2.3	**Newtonian Mechanics-Single Particle**
September 19	2.4 - 2.8 & 3.1 – 3.3	**Oscillations**
September 26	Marion 3.4 – 3.6	**Oscillations**

September 27 & 28   *** Nobel Conference - No Classes ****

September 30   ** Exam 1 on Chapters 1 & 2 ***

October 3	Marion 3.7 – 3.10	**Oscillations**
October 10	4.1 – 4.6 & 5.1 – 5.5	**Nonlinear Oscillations and Chaos & Gravity**
October 17	Marion 6.1 – 6.6	**Some Methods in the Calculus of Variations**

October 21   ** Exam 2 on Chapters 3 - 5   ***

October 22 - 25   *** Reading Days ******

October 24	Marion 7.1 – 7.5	**Hamilton's Principle-Lagrangian and Hamiltonian Dynamics**
October 31	7.6 – 7.10 & 8.1 – 8.4	**Central Force Motion**
November 7	8.5–8.7, 8.10, & 9.1–9.5	**Dynamics of Systems of Particles**
November 14	Marion 9.6 – 9.9	**Dynamics of Systems of Particles**

November 17   ** Exam 3 on Chapters 6 - 8   ***

November 21	9.9 – 9.10	**Dynamics of Systems of Particles**

November 23 – 27   *** Thanksgiving Break ******

November 28	10.1 – 10.4 &11.1 – 11.3	**Motion in a Noninertial Reference Frame**
December 5	11.4 -11.6 & 12.1 – 12.4	**Dynamics of Rigid Bodies**
December 12	12.6 – 12.9 & Review	**Coupled Oscillations**

December 20 10:30 AM   * Final Exam – ½ on Chapters 9 - 12 & ½ Comprehensive ***