PHYC54-2014: Mechanics from Oscillation to Chaos

Course Instructor:

Dr. Salam Tawfiq Office: SW-632 Tel: 416-287-7243

Course Meeting Times

Lectures: 2 sessions / week, 1 hour / session

Tutorial: 1 sessions / week, 1 hour / session

Office hours: Wednesday 13.30-14.30 or by appointment

Textbook and References

John Taylor, Classical Mechanics, University Science Books (2005).

References

S. Thornton and J. Marion, Classical Dynamics of Particles and Systems, (Holt Rinehart & Winston).

Goldstein, Poole & Safko, Classical Mechanics - 3rd ed.

Course Objectives

Be able to construct idealized (particle and waves) dynamical models and predict model response to applied forces using Newtonian mechanics.

Specific Learning Objectives:

- Understand the basic principles of 2D rigid body motion
- Understand central force motion
- Formulate the equations of motion of 3D rigid bodies
- Understand linear theory of harmonic oscillators
- Understand Basic concepts of Chaos and Chaotic systems.

Measurable Outcomes

- Select and use an appropriate coordinate system to describe particle motion
- Describe particle motion using intermediate reference frames, which can be in relative motion (including rotation) with respect to each other
- Identify and exploit situations in which integrated forms of the equations of motion, yielding conservation of momentum and/or energy, can be used
- Utilize 2-body orbital mechanics to analyze space trajectories
- Model and analyze simple problems involving vibration with and without damping
- Explore, model and analyze simple problems involving Chaotic system

Academic Expectations: Collaboration

Adhering to high standards of academic integrity is an important part of your undergraduate experience. The standards are obvious when it comes to exams. Collaboration, such as working with others to conceptualize a problem, define approaches to the solution, or debug code, is often a gray area, and faculty in different courses may have different approaches to this issue.

In this course, discussion is allowed as long as it is identified. Plagiarism, such as copying someone else's solution or COMPUTER code, is not allowed. The write-ups must always be your own. Modifying someone else's Assignment or code to make it your "own" is unacceptable. In case of doubt, consult the course instructor.

If you choose to collaborate with other students on the homework problems, indicate their names and the nature of your joint work. Ensure that your collaborator does the same on his/her assignment. A useful discussion of these issues may be found at http://ctl.utsc.utoronto.ca/home/integrity.

Assignments

- There will be 5 to 6 problem and some may require computer "Mathematica" code.
- There will be a midterm Test held as decided by the Registrar.
- There will be two quizzes held in Tutorial.
- Attendance and Participation is mandatory.
- There will be a comprehensive final exam during finals week.

Problem Set Policy

Some problem set will typically contain a Mathematica problem. Programming with Mathematica is not an end in itself but a means to investigate more complex phenomena using visual, analytic and numerical methods. The Mathematica code itself is not an adequate solution to the problem; you must interpret your results and answer the questions posed. You should approach the problem with the goal to understand and explain the physical phenomena investigated and the behavior of the system for variations of the parameters.

Submission Checklist

1. Write up the problem and submit the answers in complete form.
    a. For an answer to be complete, you must explain the method you used to find the solution including the equations needed and explain the setup from the code.
    b. You also must include the solutions that the code generated with the appropriate comments about what these solutions indicate about the question posed.
2. If it is a Mathematica problem, submit the code that generates the answer and the due date is the same of the Assignment. It is your responsibility to make sure it has be gone through.
3. Each homework problem must be on a separate sheet of paper. If you need more than one sheet you should staple them together.
4. Turn paper copies in before class starts on the due date. No late work will be graded. If it is submitted the same day after the lecture, a penalty of 50% will be applied.
5. When collaborating, be sure to write the names of those you discuss with on the top of your homework.
    a. Collaboration is not sharing code files or copying someone's answers.
    b. Collaboration is asking questions to help clarify your own difficulties with the problem set.

Grading

ACTIVITIES	PERCENTAGES
Problem sets	15%
Quizzes	10%
Attendance & Participation	5%
Midterm tests	20%
Final exam	50%

Attendance is mandatory for both tutorials and lectures. Missing FOUR (lectures and/or tutorials), the student will be assigned a zero. The 5% is for both attendance and participation, which is very important.

The tentative calendar below provides information about the Topics covered in this course. This schedule follows the textbook "Classical Mechanics" by John R Taylor. However, you may use other books that cover the same topics.

CHAPTER #	TOPICS	
Chapter-1	Newton's Laws of motion	Week-1
Chapter-2	Projectile and Charged particles	Week-2
Chapter-3	Momentum and Angular momentum	Week-3
Chapter-4	Energy	Week-4
Chapter-5	Oscillation	Week-5 & 6
Chapter-6	Calculus of Variation	Week-7
Chapter-7	Lagrange Equation	Week-8
Chapter-8	Coupled Oscillators and Normal modes	Week-9
Chapter-12	Nonlinear motion and Chaos	Week-10 & 11

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Access*ability* Services at UTSC as early as possible in the term. They will determine reasonable accommodations for this course.

GOOD LUCK