THOMPSON RIVERS UNIVERSITY

Course Outline

PHYS 3200 – 01
Advanced Mechanics (3,0,0)
Winter 2020

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Office Hours: TBA or by appointment

Calendar Description

This course offers an extension to the concepts studied in PHYS 2200: Mechanics. Topics include Newtonian mechanics, oscillations, central forces, motion in noninertial frames, Hamilton's principle and Lagrange's equations, systems of particles, and dynamics of rigid bodies.

Education Objectives/Outcomes

On completion of the course students will be expected to:

- derive equations of motion using methods of Lagrangian and Hamiltonian mechanics;
- solve differential equations to obtain the motion of mechanical systems;
- use Lagrange multipliers to analyze constrained systems, including finding the equations of motion and determining constraint forces;
- identify conserved quantities and use these to solve or simplify equations of motion;
- analyze motion in noninertial reference frames, accounting in particular for the centrifugal and Coriolis forces;
- analyze the motion of rigid bodies, including evaluation of the moment of inertia tensor and determining the principle moments and axes;
- determine the normal frequencies and modes of oscillations about equilibria.

Prerequisites

PHYS 2200 (Mechanics), MATH 2110 (Calculus 3), MATH 2120 (Linear Algebra 1), MATH 2240 (Differential Equations 1) and MATH 3170 (Calculus 4).

Texts/Materials

J. R. Taylor, *Classical Mechanics*, University Science Books, 2005.

Student Evaluation

Assignments (×5) 20%
3-star report and presentation 20%
Midterm exam 25%
Final exam 35%

In the event a student misses an exam, a mark of zero will be given unless the student contacts the instructor prior to the exam, informing the instructor of the particular situation. Students are responsible for checking the final examination schedule which shall be posted each semester by the Registrar, and for advising the Registrar of any conflicts within the schedule. Attendance at a scheduled final examination is mandatory, and the responsibility is on the student to seek remedy for a missed final exam.

Students who require special accommodation due to a disability are encouraged to contact Accessibility Services.

Special Course Activities

Students will be assigned one of the problems identified with three stars (★★★) in the text *Classical Mechanics*. Each student will submit a typeset solution of their problem, and will give a 10 minute in-class presentation.

Attendance Regulations

A registered student who does not attend the first two events (e.g., lectures/labs/etc.) of the course and who has not made prior arrangements acceptable to the instructor may, at the discretion of the instructor, be considered to have withdrawn from the course and have his/her course registration deleted. A registered student is expected to attend a minimum of 90% of lectures and seminars for which he/she is enrolled. In the case of deficient attendance without cause, a student may, on recommendation of the instructor to the instructors Dean or Chairperson, be withdrawn from a course. Admission to a lecture or seminar may be refused by the instructor for lateness, class misconduct, or failure to complete required work.

Academic Integrity Policy

TRU students are required to comply with the standards of academic integrity set out in Student Academic Integrity policy (ED 5-0), available at TRU website. Cheating, academic misconduct, fabrication, and plagiarism could result in failure of a course or even suspension from TRU.

Prior Learning Assessment and Recognition/Challenges

Students may receive credit for Prior Learning Assessment and Recognition (PLAR) by writing a challenge examination designed by a qualified specialist approved by the Department of Mathematics and Statistics. More information can be obtained from the Office of the Registrar.

Course Topics

1. Review of Newton's Laws
2. Projectiles with air resistance
3. Momentum, angular momentum and energy
4. Oscillations
5. Lagrangian mechanics
6. Noninertial frames
7. Rotation of rigid bodies
8. Hamiltonian mechanics
9. Special topics in chaos theory or continuum mechanics