UNIVERSITY OF PUERTO RICO
RIO PIEDRAS CAMPUS
COLLEGE OF NATURAL SCIENCES
DEPARTMENT OF PHYSICS
UNDERGRADUATE PROGRAM

Title: Intermediate Mechanics II

Code: PHYS 4052

Number of Credits: 3

Prerequisites: PHYS 4051

Co-requisite: PHYS 4032 (Mathematical Physics II)

Description

This is the second part of the Classical Mechanics course for Physics majors. The topics include: (i) Systems of particles; (ii) Kinematics and dynamics of rigid bodies; (iii)The moment of inertia tensor, Euler angles and Euler's equation for a rigid body, the symmetrical top; (iv) Coupled oscillations: the general problem of coupled oscillations, normal coordinates and modes, the vibrating string; (v) Introduction to Hamilton's principle, and to Lagrangian and Hamiltonian dynamics.

Objectives

After completing this course the student will know the fundamental axioms of classical mechanics and will be able to apply these to actual physical problems. The student will have mastered and practiced the application of simple mathematical techniques to solve problems of Classical Mechanics and Relativistic Mechanics

Course Content

Topic	Assigned time (hours)
1. Introduction.	3
2. Calculus of variation.	
3. Calculus of variation.	3
4. The Lagrangian function and equation, Hamiltonian principle and Hamiltonian Dynamics.	3
5. The Lagrangian function and equation, Hamiltonian principle and Hamiltonian Dynamics.	3
6. Dynamics of a system of particles, center of mass, total momentum and total angular momentum of system.	3
7. Dynamics of a system of particles, center of mass, total momentum and total angular momentum of system.	3
8. Dynamics of rigid bodies, moment of inertia, Euler's equations.	3

9. Dynamics of rigid bodies, moment of inertia, Euler's equations.	3
10. Accelerated coordinate systems, motion on surface of the rotating earth.	3
11. Accelerated coordinate systems, motion on surface of the rotating earth.	3
12. Introduction to special relativity, Galileo invariance, Lorentz transformations.	3
13. Introduction to special relativity, Galileo invariance, Lorentz transformations.	3
14. Waves in continuous systems, vibrating string, the wave equation.	3
15. Waves in continuous systems, vibrating string, the wave equation.	3
Total hours	45 contact hours

Instructional Strategy

The main instructional tool in this class is lecturing. The emphasis in this course is to introduce and train the student in solving mechanics problems using elementary mathematical methods, which are mainly based on solving differential equations arising from Newton's Laws. As such, pure theoretical derivations are kept to a minimum and are only used to introduce the basic concepts. Most of the lecturing time is thus dedicated to the demonstration of solving mechanical problems. Weekly homework assignments allow the student to practice problem solving techniques discussed in class and to develop a deeper understanding of the material. Solutions of homework problems are subsequently discussed in class, where a student usually presents his/her solution.

Minimum Require Facilities

Traditional lecture room to accommodate around ten students.

Student Evaluation

Since the emphasis of this course is on problem solving techniques, the grades are mainly based on four exams where the student will work on problems similar to the ones encountered in class and in the homework problems, as well as on the performance in homework assignments.

Grading System

The overall score is determined by calculating the percentage of points obtained by the student. Grades are then assigned according to the standard curve: 100-90% = A, 89-80% = B, 79-70% = C, 69-60% = D, 59-0% = F.

Bibliography

The content of this course is similar and on the level of the standard texts:

1. Classical Mechanics by Barger & Olsson, 1995, McGraw-Hill
2. Classical Dynamics by Marion & Thornton, 1995, Saunders College Publishing

3. Classical Dynamics: A Contemporary Approach by J.V. Jose and E.J. Saletan, 1998, Cambridge University Press

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