

ME 170: Engineering Mechanics III

Tu Th 12:30-2:00, 3108 Etcheverry Hall
jimcasey@berkeley.edu

Office Hours: MWF 3:15-4:15, 6125 Etcheverry Hall

Syllabus

1. Introduction

Concepts and principles of classical mechanics. Newton's laws for particles and Euler's laws for general bodies. Scalars, vectors, and tensors. Examples of rotation tensors and inertia tensors.

2. Dynamics of particles

(a) Inertial and non-inertial frames of reference. Some basic dynamics problems. Phase portraits. Liapunov stability of equilibrium points. Determinism, predictability, chaotic behaviour.

(b) Coordinate transformations. Frenet-Serret formulas.

(c) Central forces. Kepler's laws. Orbital problems. Ballistic missiles. Theory of apses. Siacci's theorems.

(d) Balance of linear and angular momenta for constrained systems. Work-energy relations. The 2-body problem. The N-body problem. Interplanetary travel.

3. Dynamics of rigid bodies. The rotation tensor. Euler angles. Euler parameters. The angular velocity tensor and vector. The inertia tensor and its properties. Euler's differential equations. Spinning tops. Gyrodynamics. Poinsot's method.

Bibliography

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Grading Scheme (Approximate)

Homework = 35%, Midterm Exam = 15%, Final Exam = 50%

Final Exam: Thursday, 10 May, 3:00-6:00

Revision: 19 Jan 2018