Department of Mechanical Engineering **Spring Semester 2020**
University of California, Berkeley **J. Casey**

ME 170: Engineering Mechanics III

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.

(b) Phase portraits. Liapunov stability of equilibrium points. Determinism, predictability, chaotic behaviour.

(**c)** Frenet-Serret formulas.

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

(e) Balance of linear and angular momenta for constrained systems. Work-energy relations.

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%

Revision: 19 Dec 2019