1 The Continuum Viewpoint and the Equation of Motion

1.1 On the molecular origin of fluid behavior and its analytical difficulties.

1.2 Rheological properties of materials; elastic solids, Newtonian fluids and viscosity, non-Newtonian fluids, viscoelastic fluids. The defining attribute of a "fluid."

1.3 The continuum viewpoint and the concept of properties as fields; Eulerian vs Lagrangian methods of description. The importance of reference frame in the Eulerian description; steady and unsteady flows.

1.4 Acceleration of a fluid particle expressed in terms of the (Eulerian) velocity field: the material (or substantial, or total) time derivative. The rate of change of with time of a fluid property seen by an observer moving through a continuum at an arbitrary velocity.

1.5 Material particles, material volumes, and control volumes. The physical laws that govern the behavior of continua, expressed in terms of material volumes. (Much more to follow in §3 and §4).

1.6 Forces acting on a continuum: body forces and surface forces.

1.7 Pascal's principles and the concept of pressure in a static (or otherwise shear-free) fluid.

1.8 Net surface force on a fluid particle in a pressure field.

1.9 Thermal equation of state for fluids of constant composition (the equilibrium density-pressure-temperature relation).

1.10 The equation of motion of a fluid in differential form.

Read: Fay Chapt. 1 Chapt. 2, pp 39-44 Chapt. 3, pp 89-97 Chapt. 4, pp 128-132
Or Kundu & Cohen Chapt. 1.1–1.6, Chapt. 2 (review)
Chap. 4.1, 4.5–4.7

Problems: Handout: special Problem 1.01 on sounding rocket.