Classical mechanics II: Mechanics of material points

Chapter 1: Kinematics of material points *(3 hours)*

1. Reminders of the universality of time in Newtonian kinematics, definitions of velocity and acceleration and expressions of their Cartesian coordinates.
2. Expressions of velocity and acceleration in cylindrical coordinates. Calculation of the radius of curvature of the path.

Chapter 2: Composition of movements (*3 hours*)

1. Application to any movements
2. Laws of composition of accelerations and velocities
3. Consider a special case: composition of translation and uniform rectilinear translation.

Chapter 3: Dynamics of material points (*3 hours*)

1. Reminder of Newton's laws
2. Galilean relativity
3. Basic law in non-Galilean reference frames

Chapter 4: Angular momentum (*3 hours*)

1. Angular momentum of a point particle and of a system of particles.
2. Angular momentum of a rotating rigid object.
3. Moment of force (torque) and angular momentum.
4. Angular momentum conservation

Chapter 5: Kinetics of a system of material points (*3 hours*)

1. Mass, center of mass, moment of inertial with respect to an axis; Kinetic energy.
2. Center of mass frame
3. Motion of a system of particles
4. Koenig theorems
5. Calculation of the moments of inertial

Chapter 6: Rotational motion (*3 hours*)

1. Angular displacement, velocity and acceleration
2. Angular and linear quantities
3. Rotational kinetic energy
4. Work, energy and power in rotational motion
5. Combined translational and rotational motion

Chapter 7: Dynamics and energetics of a system of material points (*3 hours*)

1. System of forces, internal forces, external forces
2. Sum and moment of a system of forces
3. Theorem of momentum and theorem of angular momentum
4. Power and work of a system of force relative to a reference frame
5. Theorems of kinetic energy and mechanical energy. Virial theorem

Chapter 8: Two-body problem (*3 hours*)

1. Utilization of the center-of-mass frame. Concept of fictitious particle. Equation of motion
2. For a potential energy associated with a conservative central force
3. Potential energy effecive and qualitative discussion
4. Kepler problem