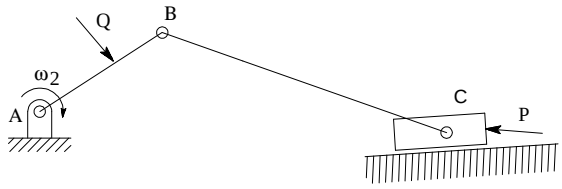
Erasmus Mundus

Mechanical background TEST Guide

The exam will be composed of four questions.

Question 1. The student choses one of the following exercises and then explains how to solve it (at least one method of solution will be required)

Exercise 1.A.



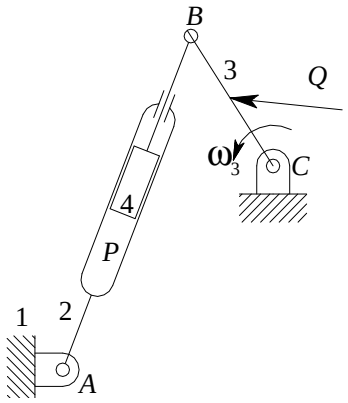
Given the (constant) angular velocity of the crank, evaluate the velocity and the acceleration of point C.

Given the load Q evaluate the moving force P for which the mechanism is statically balanced. Evaluate also the internal reactions R, neglecting friction and weights.

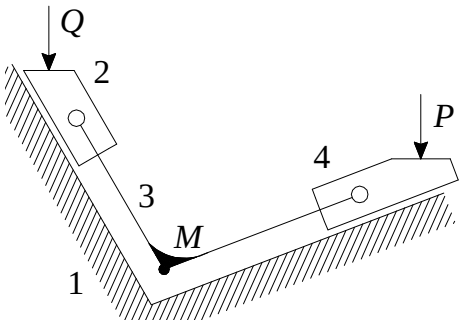
Exercise 1.B.

Given the (constant) angular velocity of the crank 3, evaluate the angular velocity and the angular acceleration of the cylinder 2.

Given the load Q evaluate the actuating force P (exerted by the linear actuator 2 to the slider 4) for which the mechanism is statically balanced. Evaluate also the internal reactions R, neglecting friction and weights.



Exercise 1.C.



Given the (constant) velocity of the slider 2, evaluate the velocity and acceleration of point M attached to link 3.

Given the load Q evaluate the actuating force P for which the mechanism is statically balanced. Evaluate also the internal reactions R, neglecting friction and weights.

Question 2. The professor choses one of the following themes and the student discusses the subjects.

Question 2.A. Inertial properties of bodies in the space. Mass moment of inertia, parallel axis theorem.

Question 2.B. Elements of Continuous Mechanics. Properties of the materials: Hooke's Law, tensile stress, relative strain, Young's modulus (tensile, elastic modulus) . Stress strain curve for Ductile and Fragile materials

Question 2.C. Lubrication. One-dimensional Reynolds Theory of hydrodynamic lubrication. Raileigh step and linearly variable height profiles: Kingsbury-Michell axial bearings

Question 2.A. Power, Work, Energy and Efficiency. The basic definitions of energy, work and power. The efficiency of the mechanical systems.

Question 3. The student choses one of the following themes and discusses the subjects.

Question 3.A. Mechanical Vibrations. Damped and not damped free oscillator. Forced vibrations with damping. Vibrations of systems with more than 1 DOF

Question 3.B. Friction and Wear. The basic wear mechanisms and the classification of wear phenomena. Hertz formulae. Wear prediction models

Question 4. The student choses one of the following themes and discusses the subjects.

Question 4.A. The basic equations of the Dynamic of the rigid body, inertial forces and moments. Application of the **free body method** to the dynamic balance of mechanisms. **Inverse** problem.

Question 4.B. The basic equations of the Dynamic of the rigid body, inertial forces and moments. Application of the **principle of the virtual works** to the dynamic balance of mechanisms. **Inverse** problem.

Question 4.C. Dynamic Analysis and Simulation of Multi-Body systems MBS. Redundant Lagrangian coordiantes: (absolute angles , natural coordinates, Reference Point Cartesian Coordinates). Dynamic simulation of planar MBS by means of the Lagrange multipliers method. **Direct** dynamic problem.