The course wants to introduce students to theoretical and practical aspects of the industrial robotics, with special emphasis on the manipulating robots. Students should after this course know different applications of robotic systems as well as to be able to describe mechanical robotic structures and systems. They should also be familiar with the involved mathematics and with the simple robot control systems. The main objective of the course is to provide students with the skills and the needed knowledge to use industrial robots in their future professional performance.

Learning objectives of the subject

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## 220135 - Fundamentals of Robotics

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 30h</th>
<th>40.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
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<tr>
<td></td>
<td>Hours small group: 0h</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
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<tr>
<td></td>
<td>Self study: 45h</td>
<td>60.00%</td>
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</tbody>
</table>
# 220135 - Fundamentals of Robotics

## Content

<table>
<thead>
<tr>
<th>Module 1: Introduction</th>
<th>Learning time: 7h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h 30m</td>
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</tbody>
</table>

**Description:**
1. Brief history
2. Classification of robots
3. Elements of robots: joints, links, actuators, and sensors

<table>
<thead>
<tr>
<th>Module 2: Some involved mathematics</th>
<th>Learning time: 15h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Self study: 9h</td>
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</tbody>
</table>

**Description:**
4. Position and orientation of a rigid body
5. Homogeneous transformations
6. Introduction to D-H parameters and its physical significance, Orientation of Gripper
7. Direct and inverse kinematics serial robots
8. Examples of kinematics of common serial manipulators.

<table>
<thead>
<tr>
<th>Module 3: Principles of Robot Control</th>
<th>Learning time: 12h 30m</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 5h</td>
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<tr>
<td></td>
<td>Self study: 7h 30m</td>
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</tbody>
</table>

**Description:**
10. Calculation of a link velocity and acceleration.
11. Calculation of reactions forces.
12. Trajectory-following control.
### Module 4: Robot Programming

**Description:**
- 13. Robot programming methods
- 14. Robot programming languages
- 15. Requirements of a programming robots system

The robot as a multitasking system:
- Flow Control
- Task Control

**Related activities:**
To program a robot in order to robotize a proposed industrial task included in an automated production system.

**Learning time:**
- Theory classes: 14h
- Self study: 21h

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### Module 5: System integration and robotic applications

**Description:**
- 16. Robot system integration.
- 17. Robotic applications.

**Learning time:**
- Theory classes: 2h
- Self study: 3h

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### Qualification system

- Final Exam (written and individual): 45%
- Lab work (in groups): 30%
- Deliverable exercises: 25%
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Bibliography

Basic:


Complementary:
