# Robotics

## SYLLABUS

### I. IDENTIFICATION

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| **Program:** Electrical Engineering | | |
| **Course:** Robotics | | |
| **Class hours:** 72 hours (4 local credits) | **Academic year:** 2023/2 | **Phase:** Optative Class |
| **Professor:** Douglas Wildgrube Bertol | | |
| **Contact:** douglas.bertol@udesc.br | | |

### II. SUMMARY

Introduction to Robotics. Robotics and Industrial Automation. Mathematic Basis. Modeling and Kinematic Control of Robot Manipulators. Programming and Industrial Applications of Robot Manipulators. Notions of Mobile Robotics.

### III. DIDACTIC PROGRAM

The class will cover, but is not restricted to, the following topics:

- Introduction to robotics: history, social impact, the definition of robots; examples of industrial robot applications;
- Spatial descriptions and transformations: position, orientation, and reference systems; mappings between reference systems; translational, rotational, and transformation operators; arithmetic of transformations;
- Kinematics of manipulators: direct kinematics (simple chain mechanisms, Denavit-Hartenberg notation, and parameters, obtaining transformations between links, and calculation of direct kinematics); Inverse kinematics (existence and multiplicity of solutions, solution methods: algebraic and numerical);
- Kinematic control: generation of trajectories in joint space; generation of trajectories in Cartesian space;
- Notions of mobile robots: types and examples of mobile robots; mobile robot applications; actuators and sensors; odometry and navigation;
- Laboratory: constructive aspects of manipulator robots (robot components, robot morphology, and workspace); simulation of manipulator robot; operation of industrial robot manipulators; programming industrial manipulators.

### IV. LEARNING METHODOLOGY

The classes will be developed through lectures, computer simulations, and laboratory practices. Industrial robots from the Manufacturing Automation Laboratory will be used in laboratory practices.

### V. ASSESSMENT SYSTEM

The assessment will consist of quizzes, seminars, and group presentations throughout the semester.

### IV. BIBLIOGRAPHY

CRAIG, John J. Introduction to Robotics: Mechanics and Control. Pearson, 2017.

NIKU, Saeed B. Introduction to Robotics: Analysis, Control, Applications. Willey, 2020.

SPONG, M. W.; HUTCHINSON, S.; VIDYASAGAR, M. Robot Modeling, and Control, Wiley, 2020.

ODREY, Nicholas, et al. Industrial Robotics -Technology, Programming, and Applications. McGraw Hill Education, 2017.

SIEGWART, Roland.; NOURBAKHSH, Illah R. Introduction to autonomous mobile robots. Massachusetts: MIT Press, 2011.

EVERETT, H. R. Sensors for mobile robots: theory and application. Massachusetts: A. K. Peters, 1995.