# Mechatronics Lab

**Mechanical Engineering – Tel Aviv University**  
**Arduino Uno & Alvik Platform**

## Course Objectives

* Understand embedded systems fundamentals.
* Program sensors, actuators, and wireless communication.
* Design simple electronics and 3D-printed adaptations.
* Develop and compete with an autonomous robot.

## Labs Sessions Overview

### Lab 1 – Introduction to Embedded Systems

* What is an embedded system?
* Arduino Uno & Alvik platform overview.
* First programs: Blink LED on Uno, Alvik MicroPython basics.

### Lab 2 – Sensors and Actuators

* Sensors: distance, color, IMU, line-following.
* Actuators: LEDs, motors, servos.
* Hands-on exercises with Alvik and Sidekick Kit components.

### Lab 3 – 3D Design for 3D Printing

* FDM-oriented CAD modelling in SOLIDWORKS.
* Design & print a servo-driven Alvik loader prototype.
* Verify fit, clearance and centre-of-mass; plan rapid re-iterations

### Lab 4 – Introduction to Electrical Design

* Decode & draw schematics using SparkFun examples.
* Capture a circuit in KiCad/EasyEDA and preview the PCB flow.
* Apply safe wiring: logic-level matching, power rails and breadboard discipline

### Lab 5 – Advanced Embedded Systems: Wi-Fi Networking

* MicroPython networking stack.
* Setting up Wi-Fi control and data logging.
* Teleoperation and remote monitoring.

### Labs 6–10 – Sumo Competition Preparation

* Motion control and PID tuning.
* Sensor integration for autonomous behavior.
* Custom 3D-printed parts and additional actuators.
* Teleoperation practice, logging, and strategy.
* Final Sumo robot competition and project presentations.

## Deliverables

* Lab reports with diagrams and reflections.
* Mini project (schematic, block diagram, 3D design).
* Final robot demonstration and presentation.

## Resources

* [Arduino Uno Docs](https://docs.arduino.cc/hardware/uno-rev3)
* [Sidekick Kit Tutorials](https://wiki.seeedstudio.com/Sidekick_Basic_Kit_for_Arduino_V2/)
* [Alvik Documentation](https://docs.arduino.cc/hardware/alvik/)
* [MicroPython Examples](https://github.com/arduino/arduino-alvik-mpy/tree/main/examples)