LEGO SPIKE Robotics: SPIKE Prime (Grades 6–12)

This is one of five courses in my ECA proposal for OWIS. The overview document has the full menu, my background and the payment arrangement. Format: ten 1-hour lessons.

1 Overview

Students work in pairs to design, build and program a robot that solves missions on a competition-style field. SPIKE Prime is LEGO's robotics kit for secondary school, with motors and distance, force and colour sensors. Students start with word blocks and move on to Python, a programming language used widely in industry and universities.

For students: build a robot that thinks for itself, then teach it in real code.

2 Objectives

- Design and improve a robot to meet a goal, testing changes one at a time (thinking skills).
- Use sensors and feedback so a robot can react to what it measures, and explain why it behaves as it does (thinking and research skills).
- Move from block programming to Python, writing reusable functions (thinking skills).
- Plan a mission strategy as a team and present the robot and its design choices (social and communication skills).

3 Scheme of work

This ten-lesson outline is tentative. The order and pace of lessons will be adjusted to the students' ages, experience and interests.

Lesson	Focus	Students build or do	ATL skill
1	Meet SPIKE Prime	Connect the hub, motors and sensors; first program in word blocks	Self-management: caring for equipment
2	A precise driving base	Build a base; calculate distance from wheel circumference	Thinking: applying mathematics
3	Sensors	Use the distance, force and colour sensors to stop, turn and react	Research: collecting data
4	Following a line	Program line following and tune it for speed and accuracy	Thinking: improving by testing
5	Moving to Python	Rewrite earlier programs in Python	Thinking: transferring a skill
6	Functions	Write reusable routines such as "turn 90 degrees" and "drive to line"	Thinking: breaking problems into parts
7	Attachments and strategy	Design an arm or tool; plan which missions to attempt	Social: planning as a team
8	Reliability	Run the same mission ten times; find and fix what varies	Self-management: perseverance
9	Timed runs	Full timed runs on the field, as in a competition	Self-management: working under time pressure
10	Showcase and presentation	Run the robot on the field for families; present its design, what failed and how it was fixed	Communication: presenting technical ideas

4 Lesson structure (60 minutes)

Minutes	Stage	What happens
5	Warm-up and kits out	Kits handed out and checked; recap of last week
10	New idea	One new idea or technique, demonstrated on a robot
35	Build and test	Pairs build, program, test and improve
10	Share and pack up	Quick demonstrations and what each pair learned; pack-up

5 Mixed grades: levels A, B and C

- **Level A:** build and program from the guided example, in word blocks.
- **Level B:** adapt the example to a new mission, starting to use Python.
- **Level C:** design an original robot and write the whole program in Python.

Older or more experienced students are encouraged to take Level C and to help explain ideas to their partner.

6 Potential competitions

Two competitions accept SPIKE Prime robots, for students who want to take their robot further:

- **National Robotics Competition** (Science Centre Singapore): the Upper Primary category (ages 10–12) and the Secondary category (ages 13–17). Teams have two or three members and a coach. Registration usually closes in early July and the competition runs in August. It includes a presentation to judges as well as robot runs.
- **World Robot Olympiad Singapore:** age categories are set each season, and SPIKE Prime is an accepted kit.

7 Requirements

- **Kits:** school SPIKE Prime kits, one per pair of students.
- **Devices:** student Mac laptops with the SPIKE app installed.
- **Room:** the STEM Room (L4), with space to lay out a mission field.

8 Expected outcomes

By the end of the course, each pair will have built a reliable robot, programmed it in word blocks or Python depending on their level, and presented its design. Students should be able to explain how sensor readings change what the robot does, and how they tested and improved it. The course is a foundation for later robotics or programming.