Intro to Robotics V2 Lesson Breakdown

This document provides a high level overview of the concepts covered in each lesson.

Unit 1

Lesson 1: Welcome to Intro to Robotics!

- Overview of the class
- Safety Introduction
- Exploring what's in the kit

Lesson 2: Mechanical Basics

- Overview of the mechanical parts in the kit
- First Build: Mechanical Ball Launcher

Lesson 3: Simple Machines

- Defining simple machines
    - Breaking down the 6 common simple machines (screw, lever, inclined plane, wedge, pulley, and wheel & axle)
- Brainstorming how simple machines are used in robotics
- Exploring building simple machines using the kit of parts

Lesson 4: Exploring Actuators and Testbeds

- What is an actuator?
    - What is a motor?
    - What is a servo?
    - Introducing the actuators in the kit
- What is a testbed?
    - Build a basic testbed
    - Wiring the testbed

Lesson 5: Getting Started with the Control System

- Setting up the Control Hub
- Setting up the Driver Hub
- Connecting the Control Hub to the Driver Hub
- Configuration Process

Lesson 6: Intro to Blocks Programming

- Navigating Blocks
- Programming Motors
    - Setting power and direction
    - Controlling a motor with a gamepad
    - Using telemetry with a motor
- Programming Servos
    - Setting a servo position
    - Resetting a servo during initialization
    - Using If/Else Statements
    - Controlling a servo with a gamepad
    - Using telemetry with a servo

Lesson 7: Review and Quiz

- Key Terminology Quiz
- Programming Basics Application Quiz

Unit 2

Lesson 8: The Engineering Design Process

- What is the engineering design process?
- Defining each step:
    - Identify the Problem
    - Ideate
    - Plan
    - Create
    - Test & Evaluate
    - Improve
    - Share
- Practicing going through the steps with an example prompt

Lesson 9: All About Gears

- What are gears?
- Exploring the anatomy of gears
- What are gear trains?
- Gear Ratios
- Gear Spacing
- Building a gear train

Lesson 10: Gear Physics

- What is speed?
- What is torque?
- Exploring how gear ratios change speed and torque
    - Observing Gears in Motion Lab
- What are idler gears?

Lesson 11: The Lift Challenge Introduction

- What is compound gearing?
- Calculating gear ratio with compound gearing
- Assembling the lift base
- Creating a pulley for the lift
- Programming the motor for the lift
- What happens when you stall a motor?
- Using the Engineering Design Process to design the lift

Lesson 12: Picking a Gear Ratio

- What is the free speed and stall torque of a motor?
- Calculating the speed with a gear ratio
- Calculating the torque with a gear ratio
- How to decide the gear ratio needed for the lift challenge
- What is force?
- What is weight?
- What is efficiency?
- Calculating the torque needed to move a pulley
- Using the needed pulley torque to calculate the needed gear ratio
- Adding a safety factor when calculating torque

Lesson 13: Planetary Gearboxes

- What is a gearbox?
- Exploring the UltraPlanetary Gearbox
- What is planetary gearing?
    - Parts of a planetary gear system
- Determining gear ratio with gearboxes
- Discussing the differences between a gearbox and gear train

Lesson 14: Lift Challenge Testing and Quiz

- Testing the final lift designs and gear ratio
- Unit 2 Key Terms and Engineering Design Process Quiz

Unit 3

Lesson 15: Exploring Gamepad Inputs and Programming Review

- What are the different types of gamepad inputs?
    - Boolean
    - Float
- How do the different types appear in code and translate to the robot?
- Review of programming using the DUO Control System

Lesson 16: What is a Drivetrain?

- What is a drivetrain?
- What is the difference between a differential and omnidirectional drivetrain?
- Building the Classbot Drivetrain

Lesson 17: Rubble Robots Activity Introduction

- Introduction to the Unit 3 challenge of building a robot to help clear “debris” from a construction site
- Using the Engineering Design Process to begin designing a solution to the challenge
- What is a mechanism?
- How to program continuous rotation servos

Lesson 18: Programming a Drivetrain

- What happens when motors are mirrored on a drivetrain?
- How does the inputs from a gamepad's joysticks translate to movements of the robot?
- How does motor power change a robot's movements?
- Programming two styles of drivetrain: Tank Drive and Arcade Style Drive
    - How to change to Split Arcade Drive

Lesson 19: Optimizing Programs with Variables

- What is a variable?
- How are variables used to optimize a program?
- How does the robot translate variables?
- Using variables to optimize the drivetrain code

Lesson 20: Rubble Robots Test Day

- Testing the final Rubble Robot designs on the challenge area

Unit 4

Lesson 21: Thinking Like a Robot

- Writing detailed instructions
- What's the difference between writing directions for a classmate and writing directions for a robot?
- What is pseudocode?

Lesson 22: Autonomous Robots

- What are autonomous robots?
- Programming a robot to move autonomously
- Using “sleep” as part of a program
- Optimizing a program using loops

Lesson 23: Robot Lunch Rush Activity Introduction

- Introduction to the Unit 4 challenge of programming a robot to navigate a space autonomously to stop at “tables” before returning to the starting area
- Planning the autonomous program using pseudocode

Lesson 24: What is a Sensor?

- Defining three categories of sensors: digital, analog, and I2C
- How does a robot interact with sensors?
- Where are sensors used in everyday life?

Lesson 25: Touch Sensors

- What is a touch sensor?
- Programming a touch sensor
- Exploring using multiple loops and adding exit conditions

Lesson 26: Robot Lunch Rush Test Day

- Testing the final Robot Lunch Rush programs in the challenge area

Unit 5

Lesson 27: Extending the Robot's Reach

- Adding the arm, claw, and touch sensor limit switch to the Classbot
- Programming the robot arm
- Observing differences in how the robot arm moves based on direction and position along the driving gear

Lesson 28: Limit Switches

- What are limit switches?
- Using a touch sensor as a limit switch
- Programming the servo claw

Lesson 29: ElapsedTime and Optimizing Code with Functions

- What is ElapsedTime?
- Programming the robot to drive using ElapsedTime
- What is a function?
    - Optimizing the classbotDriving code with functions

Lesson 30: What is an Encoder?

- What is an encoder?
- Using encoders to control the Classbot's arm position
- Introduction to the Warehouse Workers Relay activity
    - Loading Station 1

Lesson 31: Encoders in Motion

- Using encoders with the drivetrain
- Warehouse Workers Relay Activity
    - Loading Station 2

Lesson 32: What is an IMU?

- What is an IMU?
    - Exploring the 6-axis IMU in the Control Hub
- Collecting data from the IMU
- Driving the robot using an IMU
- Warehouse Workers Relay Activity
    - Loading Stations 3-4

Unit 6

Lesson 33: Operation: Supply Survey Introduction

- Introduction to the Operation: Supply Survey Activity that serves as the final project for the course

Lesson 34: What is a Color Sensor?

- What is a color sensor?
- What makes up a color when using the HSV color model?
- Programming the color sensor to provide various information, including hue, saturation, and a reported color using the collected information

Lesson 35: History of Robotics

- How long have robots existed and what counts as a robot?
- Discussing the origin of the word “robot”
- Exploring the evolution of modern robots in various field of application

Lesson 36: Evolving Technologies

- Why does technology change and evolve?
- What is prototyping and what role does it play in developing technologies?
- How does technology change after being released to a larger audience?

Lesson 37: Robotic Connections

- Brainstorming how different disciplines or subject areas appear in robotics
- What are the connections between robotics and:
    - Math
    - Science
    - Technology/Engineering
    - Language Arts
    - History/Social Studies
    - Art

Lesson 38: Careers in Robotics and Beyond

- Exploring careers within robotics
- Discussing the wider span of who may work on robotics projects or for robotics companies
- Discussing the role of expertise in various fields play into robotics projects

Lesson 39: Operation: Supply Survey Test Day

- Final test day for the robots!