LTG 2021 PROGRAM : VIRTUAL ROBOTICS PROGRAMMING
LESSON PLANS

I. Overview

Students will learn about the basics of coding and robotics. The course is powered by an online robotics learning environment, which provides online simulation, a visual code editor, embedded content, class management and more. Students will learn concepts of programming commands, delays, repeat loop, and the basics of robotics navigation using mathematics and logic.

These basic concepts are presented through gamified missions in virtual locations. If there is extra time or students finish early during each lesson, they will be doing the self-paced Amazon Cyber Challenge and augmenting their own final projects.

Virtual Locations

Adventures Peak, Frozen Island, Lost City, Crystal Crater, Candy Town and Milky Way

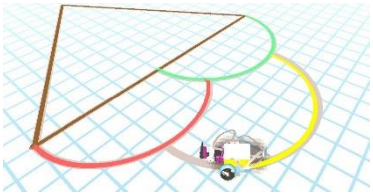
Amazon Cyber Challenge

Brings real-world industry to the classroom. This virtual learning experience student learn the basics of computer science while uncovering the miraculous ways goods are delivered at Amazon.

Final Project

Each student will design a drawing, and code their own robot to produce a drawing. The requirements of the final project is as follows:

- Minimum of 5 different programming blocks.
- Minimum of 3 explorer tools
- Engineering idea that inspired your creation.



A recording will be done for each student demonstrating the robot, explaining the code/program, and sharing the engineering idea that inspired the design.

Lesson#	Name	Topics Learned
1	Adventure Peak	First steps in the CoderZ learning environment. Basic navigation: driving and turning using Drive and Turn blocks.
2	Frozen Island	Basic arithmetic practice: addition, subtraction, division.
3	The Lost City	How to use the Explore Mode feature to measure distances, the Wait block, and Repeat Loops.
4	Crystal Crater	Basic geometry practice: angles and parallel lines. Practicing Repeat Loops.
5	Candy Town	More geometry: the concept of radius in a circle. Practicing Repeat Loops.
6	Sketch It!	Practice pack - drawing using all the skills learned up to this pack: driving distance, angles, radii, etc.
7	The Milky Way	Using the Explore Mode feature to measure angles and radii. Planning the optimal route to complete a mission as quickly and efficiently as possible, given a time limit.
8	Final Project	For the final projects, each student will design a drawing, and code their own robot to produce a drawing.
9	Final Project Presentation	Students will demonstrate their creations. A recording will be done for each student demonstrating the robot, explaining the code/program, and sharing about the design.

II. Lesson 1 : Adventure Peak

A. Learning Goals

- Login to the virtual environment, and get to know the platform.
- Have a basic comprehension of robot movement and action.
- Understand the concepts of driving backward and forward for set distances and performing right-angle/90-degree screw turns.
- Learn to analyze the robot's environment and plan a route to reach the target.
- Learn how to use Explore Mode to explore the scene before coding.

B. Activities

Step	Description	Timing
1	Students sign up to CoderZ and create accounts.	5 minutes
2	Demonstrate how to select the first pack and launch the first mission. Demonstrate how to drag blocks from the menus on the left side, run a simulation, and restart a simulation when necessary.	10 minutes
3	Students complete missions: 1-5 of Adventure Peak Pack.	20 minutes
4	Explain the benefit of mapping out the robot's course using Explore Mode.	10 minutes
5	Students complete missions: 6-7 of Adventure Peak Pack.	20 minutes
6	Complete Class Conclusion Questions and discussion.	10 minutes

III. Lesson 2: Frozen Island

A. Learning Goals

- Become more comfortable using Explore Mode to view the scene from above.
- Analyze the robot's environment and plan a route to reach the target.
- Practice addition, subtraction and division.

B. Activities

Step	Description	Timing
1	Reflection on last session.	5 minutes
2	Demonstrate how to observe the various distances drawn on the floor using Explore Mode. Explain that this time these are not the exact distances; rather, the students will have to perform basic arithmetic calculations to find the necessary drive distances (addition, subtraction, division).	10 minutes
3	Students complete missions 1-4 in Frozen Island pack.	20 minutes
4	Go over mission 5 of Frozen Island pack with the students. Remind them to use Explore Mode and explain about Pseudocode.	5 minutes
5	Let students complete missions 5-6 in Frozen Island pack.	20 minutes
6	Complete Class Conclusion Questions and discussion.	10 minutes

IV. Lesson 3: The Lost City

A. Learning Goals

- Use Explore Mode to discover the distances needed to drive.
- Learn the concept of Delay/Wait.
- Get to know the new Wait For and Repeat blocks.
- Practice writing pseudocode
- Understand the need for loops and how to code with them.
- Practice problem-solving.

B. Activities

Step	Description	Timing
1	Reflection on last session.	5 minutes
2	Demonstrate how to use the Distance Measuring tool in Explore Mode, to measure the distances they need to drive. Explain the need to wait until the completer pieces or ramps move into place, and introduce the Wait block.	10 minutes
3	Students complete missions 1-4 in The Lost City pack.	15 minutes
4	Explain the concept of Repeat Loops and show the students how to drag them from the menu.	5 minutes
5	Let students complete missions 5-7 in The Lost City pack.	15 minutes
6	Explain that not all buttons do good things — some buttons will hinder the robot rather than aid it. In such cases, we will have to drive around the 'bad' buttons.	5 minutes
7	Let students complete missions 8-9 in The Lost City pack.	15 minutes
8	Complete Class Conclusion Questions and discussion.	5 minutes

V. Lesson 4: Crystal Crater

A. Learning Goals

- Have a basic understanding of geometry, angles, parallels, vertical angles, adjacent angles etc.
- Get to know the angle parameter of the Turn block.
- Practice using Explore Mode to discover angles drawn on the road.
- Practice mapping the robot's environment and problem-solving.

B. Activities

Step	Description	Timing
1	Reflection on last session.	5 minutes
2	Demonstrate that in this pack, the distances and the turn angles are drawn on the floor. Demonstrate how to expand the Turn block to include an angle parameter.	15 minutes
3	Explain the following angles: Acute – less than 90 degrees. Obtuse – more than 90 degrees but less than 180 degrees.	10 minutes
4	Students complete missions 1-4 in Crystal Crater pack. Overlapping – one (bigger) angle contains the second (smaller) angle inside it. Make sure the students understand when they need to add angles and when to subtract.	5 minutes
5	Students complete missions 5-8 in Crystal Crater pack.	15 minutes
6	Explain the concept of parallel lines and transversals, and the angles the 3 lines create together: vertical angles, corresponding angles.	5 minutes
7	Let students complete missions 8-11 in Crystal Crater pack.	15 minutes
8	Complete Class Conclusion Questions and discussion.	5 minutes

VI. Lesson 5: Candy Town

A. Learning Goals

- Define what a radius, diameter and circumference are.
- Comprehend what a smooth turn is, how the robot performs it, and what it is useful for.
- Know how to expand the Turn Block to enable smooth turns based on radius and angle.
- Create even more complex programs and practice loops.
- Practice problem solving, pseudo-code, and efficient programming.

B. Activities

Step	Description	Timing
1	Reflection on Crystal Crater.	5 minutes
2	Explain the following features of a circle: Circumference – the distance once around a circle. Diameter – a line that goes straight across a circle, through its center. It is twice the circle's radius. Radius – the distance from the center of a circle to any point on its circumference. It is half of the circle's diameter. Demonstrate how to expand the Turn block to include a radius parameter and remind the students to use Explore Mode to see data drawn on the floor.	10 minutes
3	Students complete missions 1-4 in Candy Town pack.	20 minutes
4	Explain that in some cases, the students will have to discover the radius of a circle (or part of a circle) using the Distance Measuring tool in Explore Mode.	10 minutes
5	Students complete missions 5-10 in Candy Town pack.	20 minutes
6	Complete Class Conclusion Questions and discussion.	10 minutes

VII. Lesson 6: Sketch It!

A. Learning Goals

- Learn to use the Trail blocks.
- Refine their planning and pseudo-code writing.
- Practice all the skills they have learned up until now: driving forward and backward, angles, screw and smooth turns.

B. Activities

Step	Description	Timing
1	Reflection on Candy Town.	5 minutes
2	Explain that this is a practice pack. The students must use all the knowledge and skills they have acquired throughout the course, but also can have fun. Go over all the blocks and tools the students have learned in the first 5 lessons. Explain that in the first mission they are to write the initials of their name. Advise them to practice with pen and paper before they code, and to break down each letter into parts and translate them into blocks.	15 minutes
3	Students complete mission 1 in Sketch It pack.	15 minutes
4	In the second mission, the objective is to draw an ice-cream cone with ice-cream scoops on top of it. Naturally the students can draw as many scoops and even toppings as they like – encourage them to be creative!	10 minutes
5	Students complete mission 2 in Sketch It pack.	5 minutes
6	In the third mission, the objective is to draw a mandala. Show the students a few examples of mandalas and encourage them to draw something colorful and symmetrical. Remind them to work with 360-degrees variations.	15 minutes
7	Students complete mission 3 in Sketch It pack	10 minutes

VIII. Lesson 7: The Milky Way

A. Learning Goals

- Refine their planning and pseudo-code writing.
- Practice all the skills they have learned up until now: driving forward and backward, angles, screw and smooth turns.
- Practice using Explore Mode and its various features.
- Create an efficient code in which the robot completes the course in the quickest time possible.

B. Activities

Step	Description	Timing
1	Reflection on Sketch It.	5 minutes
2	Explain that this is the final pack, and it will be the most challenging. Demonstrate that there is nothing drawn on the floors: no drive distances, no angles, no radii. The students will have to find out all the data on their own.	10 minutes
3	Students complete missions 1-3 in Milky Way pack.	25 minutes
4	Explain that in the next few missions there is a time limit. The students must find the most efficient route through the scene with the quickest drive time.	5 minutes
5	Students complete missions 4-6 in Milky Way pack.	30 minutes

IX. Lesson 8 : Final Project Creation

A. Learning Goals

- Demonstrate an understanding of the basic concepts of coding and robotics.
- Demonstrate creativity
- Demonstrate problem solving

B. Activities

Step	Description	Timing
1	Review the programming blocks learnt	5 minutes
2	Review the following Explore tools	5 minutes
3	Review the definition of engineering	5 minutes
4	Discuss requirements for final project.	10 minutes
5	Student work on their final projects	50 minutes

X. Lesson 9 : Final Project Presentation

A. Learning Goals

- Demonstrate an understanding of the basic concepts of coding and robotics.
- Demonstrate creativity
- Demonstrate problem solving

B. Activities

Step	Description	Timing
1	Student demonstrate their final projects. Recording these demonstrations	75 minutes