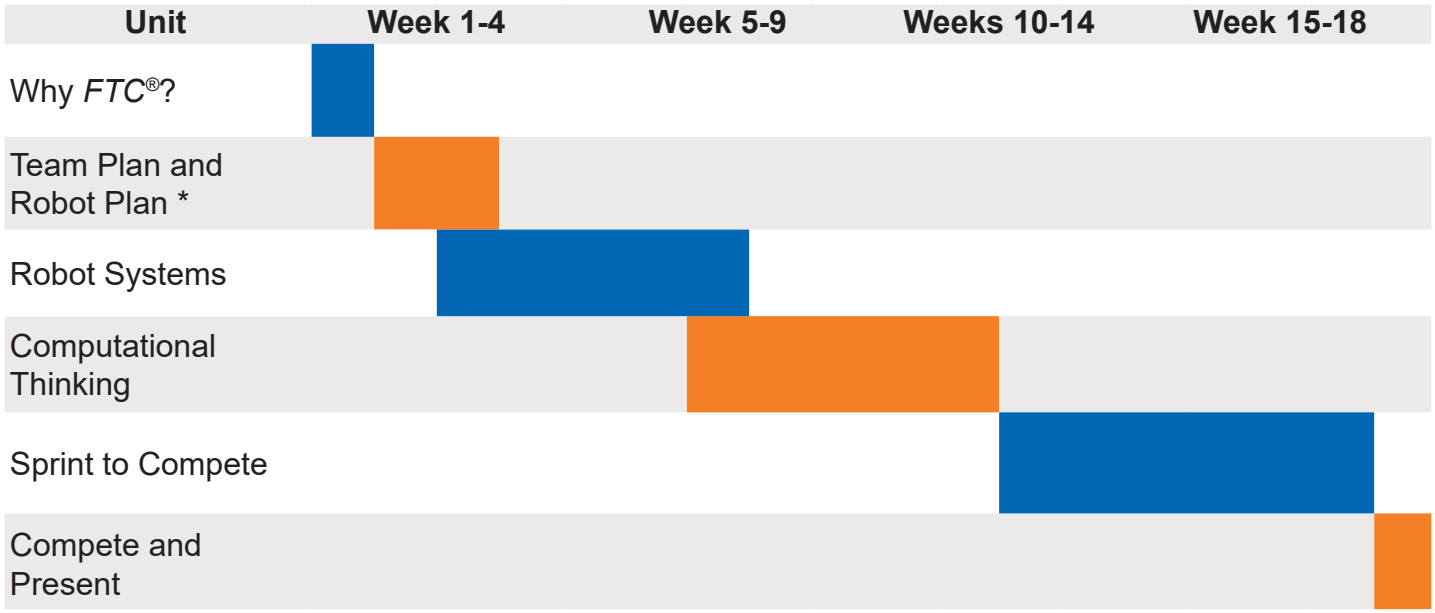
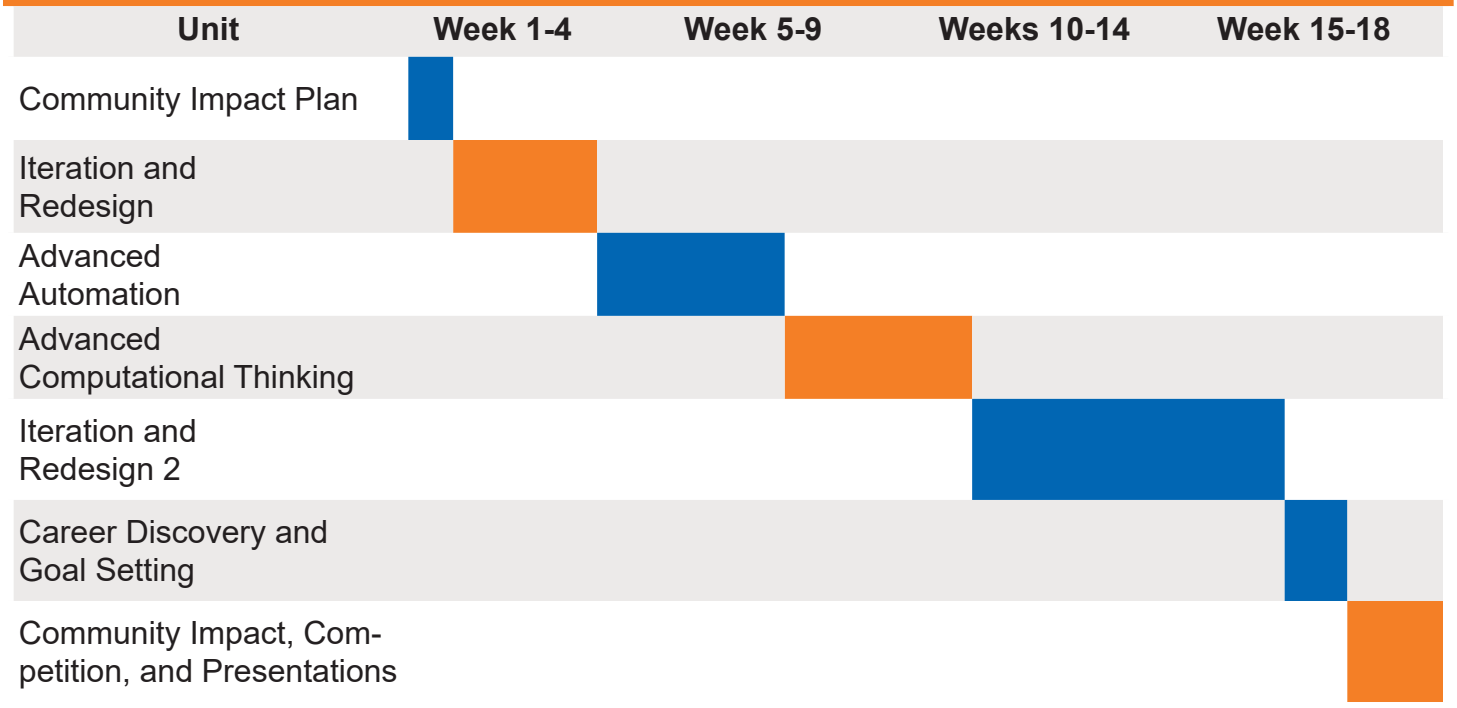
FIRST TECH CHALLENGE

TEACHING THE CROSSROADS CURRICULUM
Scope and Sequence Yearlong

Semester 1



Semester 2



***Scope and sequence can be reduced to fit a semester or trimester upon request.**

FIRST TECH CHALLENGE

TEACHING THE CROSSROADS CURRICULUM
Student Outcomes by Unit

Overview of Units

Unit		Student Outcome
Why FTC	1-1 Why FIRST 1-2 FTC Robots 1-3 Decompose A Robot	Students will discover and apply *FIRST* Core Values and *Gracious Professionalism* while learning about an *FIRST* Tech Challenge robot and experimenting with build activities.
Team Plan and Robot Plan	2-1 Project Management 2-2 Safety Plan 2-3 Engineering Design Process 2-4 Game Plan 2-5 Robot Plan	Students will learn about project management, safety, and the engineering design process and will use these elements to develop a team plan and robot plan. Students will develop design strategy around a qualifying competition or class mini-game.
Robot Systems	3-1 Chassis Design 3-2 Electrical Theory 3-3 Pairing and Configuration 3-4 Building Manipulators	Students will learn about chassis, electrical, and manipulator design and how to apply basic theory to their robot design. The theory includes fundamental physics concepts of speed, torque, gear ratios, and moments.
Computational Thinking	4-1 Algorithms 4-2 Decomposition and Flow 4-3 Data Types 4-4 Autonomous	Students will understand the basics of computational thinking including decomposition, pseudocode, data types, and developing algorithms through flow control using loops and conditionals.
Sprint to Compete	5-1 Understanding Problems 5-2 Sprint for Events 5-3 Competition and Presentations	Students will learn about project management sprints and how to use them to improve efficiency in the iteration and design process. They will work through sprints to improve their robot design and prepare materials for competition and presentations. Mini-game competitions can be used in the classroom. Students will utilize a class competition and presentation to key industry professionals as an end-of-semester product.
Community Impact Plan	6-1 Community Impact Plan	Students will use *FIRST* Core Values to develop a plan for a product that will make an impact on their community.
Iteration and Redesign	7-1 Design and Simplicity 7-2 Loads and Forces 7-3 Ownership and Aesthetics 7-4 Mini-Comp	Students will improve robot performance and design through applying knowledge of principles of functionality, loads, and forces and increasing ownership and aesthetics of their robot. They will gain feedback through a class mini-competition.
Advanced Automation	8-1 Mechanical Advantage 8-2 Pulley and Chain Systems 8-3 Compartmentalization and Feedback	Students will learn about how to improve designs and robot efficiency through mechanical advantage, using pulley and chain systems, and compartmentalizing systems on the robot.
Advanced Computational Thinking	9-1 Cumulative Error 9-2 Compartmentalizing Code 9-3 Abstraction and Augmented Reality 9-4 Object Oriented Programming	Students will learn how to improve algorithms through reducing cumulative error, compartmentalizing code, and developing robot states. They explore augmented reality and its application in a robotics game. Students will get an introduction to abstraction and a transition to text-based Java programming.
Iteration and Improvements	10-1 Iteration and Improvements	Students will continue to use project management sprints to identify areas where improvements need to be made using their design criteria.
Career Discovery and Goal Setting	11-1 Skill Identification 11-2 Resumes, Portfolio, and Digital badges 11-3 Class Pack to Qualifying Teams 11-4 Community Impact and Presentations	Students will identify skills learned through the course and careers associated with the skills. They will discover career pathways and how they can apply skills to the pathway. They will learn how to use contributions they have made to their team to develop a learning journey and portfolio for use in the workforce.

Modifying Scope and Sequence to Fit Your Needs

- The curriculum is designed to fit many career and technical education programs as an intro to engineering design course, but it can be modified and implemented at many different levels. Each unit has a broad overview of concepts with many points where a more in-depth dive can be taken to cover specific standards, or they can be taught on a more fundamental level and brushed over to fit your needs. The following table lists minimum and maximum time limits for each unit and identifies their priority for students to be able to complete the semester and end-of-course activities.

Crossroads Curriculum Class Pack Semester 1		
Semester 1 Recommended Topic Instructional Time	***Minimum and Maximum Minutes***	***Priority of Completion for Semester Mini-Game***
Unit 1-1 Why *FIRST*?	60	High
Unit 1-2 FTC Robots	30	High
Unit 1-3 Decompose a Robot?	60-240	High
Unit 2-1 Project Management	30-120	High
Unit 2-2 Safety Plan *	60-240	Medium-Low
Unit 2-3 Engineering Design Process	120-240	High
Unit 2-4 Game Plan **	120-300	High
Unit 2-5 Robot Plan	240-300	High
Unit 3-1 Chassis Design	120-300	High
Unit 3-2 Electrical Theory	60-180	High
Unit 3-3 Pairing and Configuration	180-300	High
Unit 3-4 Building Manipulators	180-300	High
Unit 4-1 Algorithms	60-120	High
Unit 4-2 Decomposition and Flow	60-120	High
Unit 4-3 Data Types	300-420	Medium-High
Unit 4-4 Autonomous	300-420	Medium-High
Unit 5-1 Understanding Problems	300-600	Low
Unit 5-2 Sprint for Events	180-300	High
Unit 5-3 Competition and Presentation	300	High
Semester 1 Total	**40-75 Hours**	

*** Safety Plan depth depends on the access to tools and other resources students will be using. It should be covered in depth if students will be using tools.**
**** If you progress through the curriculum before the game or mini-game is released, have students follow the basic bot build guide and go back to creating a game plan.**

Modifying Scope and Sequence to Fit Your Needs

- The second semester focuses on improving robot skills through continued iterations and skill development. The culminating event for the second semester is a community event with a scrimmage and presentations of community project. There also is a final engineering portfolio in the Careers unit. This is their final event and it may be completed before or after the community presentation.

Crossroads Curriculum Class Semester 2		
Semester 1 Recommended Topic Instructional Time	***Minimum and Maximum Minutes***	***Priority of Completion for Community Event***
Unit 6-1 Community Impact Plan	300	High
Unit 7-1 Design and Functionality	60-180	High
Unit 7-2 Loads and Forces	180-300	Low
Unit 7-3 Ownership and Aesthetics	180-300	High
Unit 7-4 Mini-Comp	60	High
Unit 8-1 Mechanical Advantage	240-360	High
Unit 8-2 Pulley and Chain Systems	240-360	Low
Unit 8-3 Compartmentalization and Feedback	240-260	Medium
Unit 9-1 Cumulative Error	60-120	Medium
Unit 9-2 Compartmentalizing Code	120-300	High
Unit 9-3 Abstraction and Augmented Reality	300-600	Low
Unit 9-4 Object-Oriented Programming	60-300	Low
Unit 10-1 Iteration and Redesign 2	300-900	High
Unit 11-1 Skill Identification **	60	**Medium- High**
Unit 11-2 Resumes, Portfolio, and Digital Badges**	300-400	**Medium- High**
Unit 11-3 From Class Pack to Qualifying Teams**	120	**Low**
Unit 11-4 Community Impact and Presentations	300	**High**
Semester 2 Total Instructional Contact Hours	**50-100 Hours**	

****You will want to plan your community event and then determine whether to do the Careers unit before or after. The unit has a final assessment in the form of a portfolio, which could be used as the semester exam.**