CONTENT AREA(S): Design & Technology　　　　**GRADE LEVEL(S):** 9-12

COURSE: Advanced Robotics　　　　**TIME FRAME:** Full Year

I. Course Overview

This course will bring the FIRST Technology Challenge (FTC) to life inside the classroom. Students will design and build robotic devices that will compete at local and state competitions. The use of CADD software, computer programming, and construction materials such as Tetrix, will be used to help students explore various design options to create custom robots to complete in a variety of tasks and obstacles. Students will participate during class time and designated hours outside of class to prepare to compete in highly competitive contests against other high school teams.

II. Units of Study

Unit 1: Introduction to Robotics and Programming
Unit 2: Behaviors
Unit 3: Technical Writing
Unit 4: Decision Making
Unit 5: Mechanisms
Unit 6: FTC Competition

III. Essential Questions *(The open-ended, provocative questions that help frame inquiry)*

Unit 1: INTRODUCTION TO ROBOTICS AND PROGRAMMING
- What is robotics?
- What is Java (programming language) and how is it useful in robotics and everyday life?
- Is programming precise?

Unit 2: BEHAVIORS
- Why is it important to be able to do specific movements?
- How can sensors affect programming and movements for a robot?
- How do you break a problem into steps to accomplish the programming goal?

Unit 3: TECHNICAL WRITING
- How can technical writing be utilized to successfully document a project?
- Why is it important for engineers to document their work in a specific way?
- Technical writing does not only consist of writing, what are other important ways information is conveyed in technical writing?

Unit 4: DECISION MAKING
- How does "decision making" programming advance a robots ability to make advanced decisions?
- How do loops and switches advance a robots ability to complete specified tasks?
- How do if statements, variables, and constants improve your programming ability?

Revision Date: 6/2018

Unit 5: MECHANISMS
- How can simple machines and complex machines be used to tackle obstacles?
- What are the differences between simple and complex machines?
- How can simple and complex machines be used to complete the assigned task?

Unit 6: FTC COMPETITION
- What does it mean to represent your school with "Gracious Professionalism (large component of the FTC competition)?"
- How does the team compete and cooperate with alliances at tournaments?
- How does the FTC competition help develop strategic, problem solving, organizational, and team building skills?

IV. Learning Objectives

NJSLS-Technology (Standard 8.2)	
8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
8.2.12.C.4	Explain and identify interdependent systems and their functions.
8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).
NJSLS-21st Century (Standard 9)	
9.3.MN-HSE.1	Demonstrate the safe use of manufacturing equipment.
9.3.MN-PPD.3	Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
9.3.ST.1	Apply engineering skills in a project that requires project management, process control and quality assurance.
9.3.ST.3	Describe and follow safety, health and environmental standards related to science,

Revision Date: 6/2018

	technology, engineering and mathematics (STEM) workplaces.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.2	Display and communicate STEM information.
9.3.ST-ET.4	Apply the elements of the design process.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
CRP2.	Apply appropriate academic and technical skills.
CRP4.	Communicate clearly and effectively and with reason
CRP6.	Demonstrate creativity and innovation.
CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11.	Use technology to enhance productivity

V. Instructional Materials

- Computers
- FTC Robotics Components

VI. Key Performance and Benchmark Tasks

Unit 1: INTRODUCTION TO ROBOTICS AND PROGRAMMING
- Presentations on different forms of robotics that have an impact on our society
- Analyze the difference between telling someone to do something and breaking it into each individual step.
- Create an "original program" to have someone complete a task
- Utilize MIT App Inventor to create first program

Unit 2: BEHAVIORS
- Create "flow maps" to better break down the large problems into smaller pieces
- Understand how to create continuous and controlled movement
- Manipulate and create machines to solve problems

Unit 3: TECHNICAL WRITING
- Create professional documentation adhering to the FTC Standards
- Utilize information regarding technical writing to create a professional design portfolio
- Utilize CADD software to create professional drawings to supplement their professional portfolio

Revision Date: 6/2018

Unit 4: DECISION MAKING
- Understand what conditional execution is
- Understand the flow of a loop
- Create programs that can make decisions based on switches and condition statements
- Utilize variables and constants to create more complex programming

Unit 5: MECHANISMS
- Research and explore various components and brainstorm multiple solutions to the assigned design problem
- Manipulate and create machines to solve problems

Unit 6: FTC COMPETITION
- Collaborate and assist other teams in successful alliances during the competition setting
- Students will be able to define and present themselves with "Gracious Professionalism" in the competition atmosphere
- Create a comprehensive design portfolio detailing each step of the design process, problem solving, and team building strategies throughout the projects.