Career and Technical Education
CTE Course Blueprint

Technology Education

Robotics Engineering II

Concord, North Carolina

Winter 2012
Fall 2015

CTE Course Blueprint

For additional information about this blueprint, contact the Division of Career and Technical Education, North Carolina Department of Public Instruction, 6361 Mail Service Center, Raleigh, North Carolina 27699-6361.

Reference: Anderson, Lorin W. (Ed.), Krathwohl, David R. (Ed.), et al., *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives,* Addison Wesley Longman, Inc., New York, 2001.

Interpretation of Columns on the NCDPI Adapted CTE Course Blueprint

No.	1	2	3	4
Heading	Essential Std #	Unit Titles, Essential Standards, and Indicators	Course Weight	RBT Designation
Column information	Unique course identifier and essential standard number.	Statements of unit titles, essential standards per unit, and specific indicators per essential standard. If applicable, includes % for each indicator.	Shows the relative importance of each unit and essential standard. Course weight is used to help determine the percentage of total class time to be spent on each essential standard.	Classification of outcome behavior in essential standards and indicators in Dimensions according to the Revised Bloom's Taxonomy. **Cognitive Process Dimension:** 1 Remember 2 Understand 3 Apply 4 Analyze 5 Evaluate 6 Create **Knowledge Dimension:** A Factual Knowledge B Conceptual Knowledge C Procedural Knowledge

Career and Technical Education conducts all activities and procedures without regard to race, color, creed, national origin, gender, or disability. The responsibility to adhere to safety standards and best professional practices is the duty of the practitioners, teachers, students, and/or others who apply the contents of this document.

Career and Technical Student Organizations (CTSO) are an integral part of this curriculum. CTSOs are strategies used to teach course content, develop leadership, citizenship, responsibility, and proficiencies related to workplace needs.

Adapted CTE Course Blueprint for
Robotics Engineering II
(Recommended hours of instruction: 135 or 180 minimum)

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
A	**INTRODUCTION TO ELECTRONICS**	**15%**	
X101.00	**Analyze and apply concepts of Electronics**	**10%**	**A4**
	1.01 Summarize Personal Safety and Classroom Safety procedures 1.02 Identify and understand basic electronic components 1.03 Demonstrate how to draw and work with schematics 1.04 Assemble a basic circuit using a breadboard 1.05 Demonstrate how to use a digital multimeter to measure current, voltage and resistance 1.06 Explain Ohm's Law 1.07 Understand how electronic components and circuitry are used in feedback control systems 1.08 Understand how hardware interfaces with software to provide feedback		
X102.00	**Project: Create Blinking LEDs**	**5%**	**B6**
B	**MECHANICAL PROPERTIES**	**19%**	
X103.00	**Analyze and apply concepts of Chains and Sprockets**	**3%**	**A4**
	3.01 Explain how and when to effectively use chain and sprocket 3.02 Explain the advantages and limitations of various robotic drive trains		
X104.00	**Use Software to program and control robot**	**11%**	**C3**
	4.01 Use programming software to create more complex robotic programs 4.02 Use programming software to write multiple autonomous programs; select most appropriate program to be used for freeze tag competition 4.03 Evaluate performance of robot in freeze tag competition to determine ability of student to program and control robot		
X105.00	**Project: Freeze Tag Competition**	**5%**	**C6**
C	**ADVANCED C PROGRAMMING**	**24%**	
X106.00	**Understanding PID (Proportional, Integral and Derivative)**	**8%**	**C2**
	6.01 Explain the theory behind PID 6.02 Demonstrate the use of the proportional (P) control algorithm 6.03 Demonstrate the use of the Integral (I) control algorithm 6.04 Demonstrate the use of the differential (D) control algorithm		
X107.00	**Understanding advanced programming techniques**	**6%**	**C2**
	7.01 Explain digital filtering and processing sensor data 7.02 Explain arrays and matrices and their use in processing sensor data 7.03 Explain the need for randomness and how to generate random data 7.04 Discuss programming and robotics in a real world application		
X108.00	**Project: Build a robot from Design Brief**	**10%**	**B6**
	8.01 Design, build and program a vacuuming robot		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
D	**INDUSTRIAL ROBOTIC ARMS**	**15%**	
X109.00	**Analyze and explain the different types of robotic arms and their uses**	**10%**	**A4**
	9.01 Explain the uses of industrial robots found in manufacturing environments 9.02 Explain how to construct and simulate the operation of a servo 9.03 Explain how a three axis robotic arm works 9.04 Create a fully functional three axis robotic arm 9.05 Explain how robots use homing to determine their position 9.06 Describe a robot's work envelope 9.07 Describe the various coordinate systems commonly used in industrial robots 9.08 Explain and describe the concepts of Computer Integrated Manufacturing (CIM) 9.09 Discuss the components of a CIM cell and how the robots communicate with each other to accomplish a task 9.10 Create and program robotics to work together to complete a common task using the three axis robotic arm		
X110.00	**Project: Pass the Work piece**	**5%**	**B6**
E	**ADVANCED MECHANICS**	**12%**	
X111.00	**Analyze and apply concepts of Mechanical Systems**	**12%**	**A3**
	11.01 Describe various advanced mechanical systems 11.02 Describe how a simple chain and sprocket driven lift system works 11.03 Discuss how gear train systems work and the difference 11.04 Explain how a rack and pinion gear system works 11.05 Describe how a differential gear system works 11.06 Create and build two sets of rack and pinion lifts 11.07 Analyze performance of rack and pinion lifts 11.08 Describe how roller and conveyor systems work 11.09 Explain how combining different systems can improve performance of robot		
F	**FINAL PROJECT: BUCKET BATTLE**	**15%**	
X112.00	**Design and build a robot to compete in Bucket Battle**	**15%**	**B6**
	12.01 Design and program a robot to operate autonomously, as well as under operator control 12.02 Design and program a robot with a fully functional locomotive system 12.03 Design and program a fully functional collection system 12.04 Design and program a fully functional delivery system		