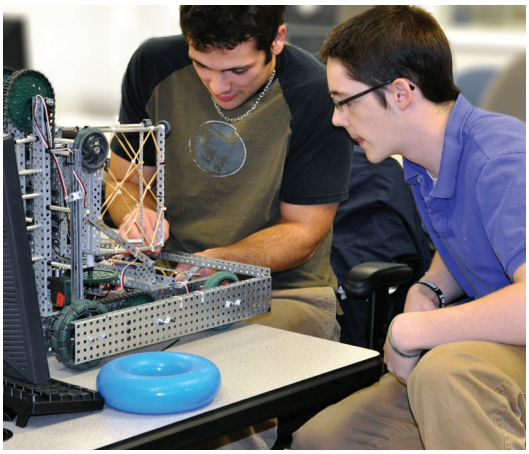
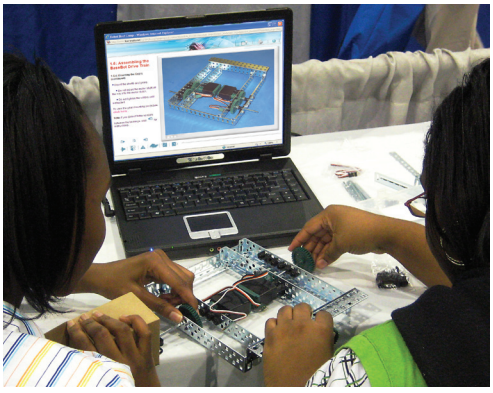
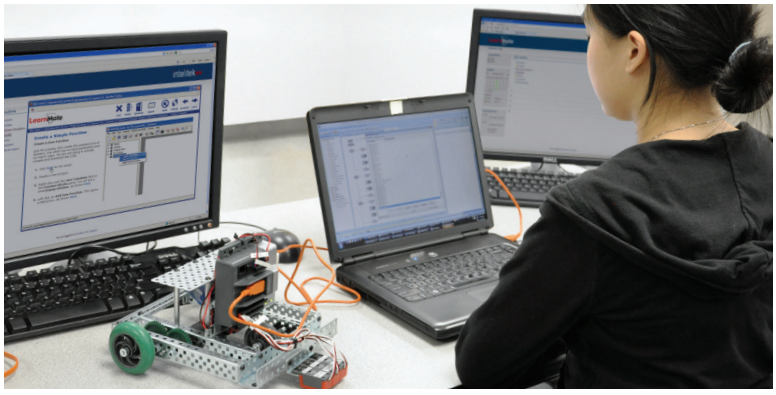
Robotics Engineering Curriculum



Engineering Program®





The Superior Robotics Program

Chosen by the leaders in competitive robotics

VEX ROBOTICS COMPETITION

SkillsUSA®

TEEA

BEST

intelitek®

www.intelitek.com

STEM Education
with a robotics emphasis

Robotics Engineering Curriculum (REC) provides a comprehensive study of engineering concepts including

- physics
- programming
- mechanical systems
- electrical and electronics systems
- relevant activities and capstone projects in each semester

These core concepts are delivered with a robotics emphasis through relevant activities and projects using the award winning **Vex Robotics hardware** and **easyC® robotic programming software**. By using robotics as a vehicle to convey the principles of engineering, REC generates excitement and enthusiasm for the engineering field!

"REC was the most sustained fun, entertainment and education in my 42 years of teaching! Kids came to class early and on their lunches just to get started!"

Roger Wills
Robotics Teacher & Coach

Robotics Engineering Curriculum (REC)

Robotics Engineering Curriculum:
Everything you need to begin a successful program **aligned to national STEM standards** - just add students!

REC 1 includes:

The following items (one of each) are supplied for two students and one instructor except as noted:

- Vex Kit with Cortex controller includes
  - Robot, Metal, Gears, wheels, Cortex microcontroller and transmitter
  - 9.6V Battery, 7.2V Battery with smart chargers
  - Robotic programming cable
  - Ultrasonic Range Finder Kit
  - Line Follower Kit
- Protractor
- Stop Watch (tenths of second)
- 3 Ring Binder - 1" (one per student, one per instructor)
- Composition Book (one per student, one per instructor)
- Electrical Tape - 3/4" wide (black)
- Masking Tape - 1" wide
- Tape Measure
- Spring Scale - 4.5 lbs x 0.1lb
- 5lb Weights (quantity 3)

The following items (one of each) are supplied per REC program purchased:

- LearnMate® REC 1 Content - Lab License for 10, 20 or 30 Computers
- Lab license of to easyC® v4 for Cortex, 10, 20 or 30 seats
- String - (construction grading line)
- Dry Erase Marker - Black (1 dozen)
- Dry Erase Marker - Blue (1 dozen)
- Elastic Band - #16 (450/bag)
- Precision Scale - 10 lbs x 0.1oz
- 8-32 x 1" BHCS (Box of 100)

REC 2 includes:

The following items (one of each) are supplied for two students and one instructor except as noted:

- Advanced Gear Kit
- High Strength Sprocket and Chain Kit
- Worm Gearbox Bracket
- Rack Gearbox Bracket
- Bevel Gearbox Bracket
- Potentiometer Kit (2)
- Linear Slide kit
- Continuous Rotation Motor
- Vex Y Cable
- Vex PWM Cables
- Vex Water Wheels
- Digital Multimeter
- Wire Cutter
- Pliers
- Storage Box
- Breadboard
- Resistors
- Springs
- Photo resistors
- Capacitors
- LM555 Timer
- LED's
- Transistors
- Toggle Switches
- 9 volt battery

The following items (one of each) are supplied per REC program purchased:

- LearnMate® REC 2 Content - Lab License for 10, 20 or 30 Computers
- Lab license of to easyC® v4 for Cortex, 10, 20 or 30 seats
- REC 2 Project Kit

REC 1 Packages include all the above items for two students.

Additional Class Hardware Add-on Packages *are available for REC 1 and 2 in 2, 20 and 30 student packages. Add-on packages include supplies of everything used in REC 1, less the precision scale, weights, software, and content.*

Service Packs *are available for REC 1 and 2 in 10, 20 and 30-student packages. Service Packs keep your class running from semester to semester by replenishing commonly used supplies and consumables.*

All REC packages are designed for **two students per robot**, allowing all students to have a complete hands-on experience while building teamwork and communication skills. Each package also includes a set for the instructor and a comprehensive teacher's guide with tips from engineers, college faculty, fellow teachers, and robotic team mentors.

intelitek also offers specialized training for teachers to help make their classroom successful. Basic to advanced Professional Development courses are available annually.

Engineering byDesign™

Robotics PathwayExtension!

"ITEEA chose intelitek as its partner for the EbD Robotics PathwayExtension because of their experience and expertise in robotics engineering. No other organization in the educational field can compare."

Kendall Starkweather
Executive Director,
International Technology Engineering Education Association (ITEEA)

ITEEA

Robust Hardware

Featuring the VEX Cortex Controller:

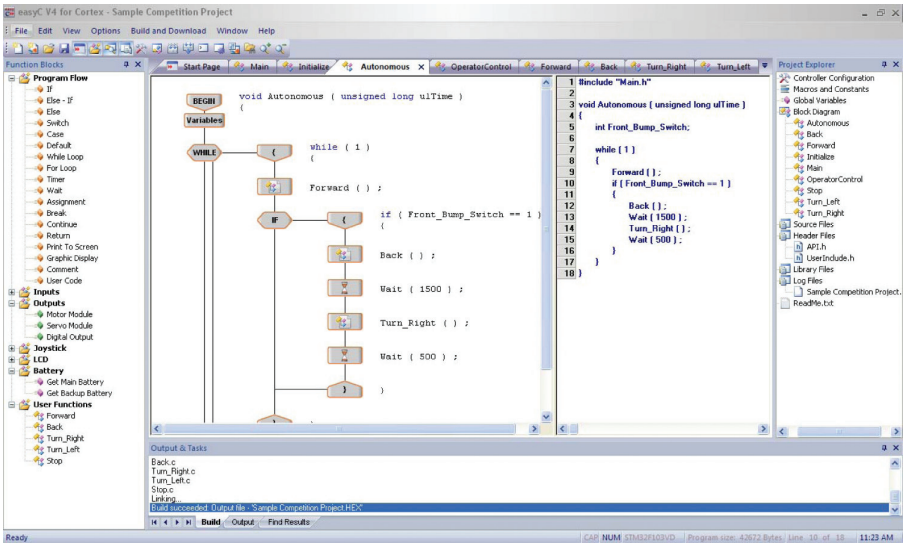
VEX ROBOTICS DESIGN SYSTEM

The VEX Cortex Microcontroller coordinates the flow of all information and power on the robot. It has built in bi-directional communication for wireless driving, debugging and downloading using the state of the art VEXnet 802.11 wireless link. The Microcontroller is the brain of every VEX robot.

- Built-in VEXnet Technology: Wireless driving, wireless debugging, and wireless downloading
- Motor Ports: (8) standard 3-wire Motor or Smart ports. (2) 2-wire Motor ports.
- I2C Smart Sensor Port: Will connect to multiple new smart sensors in the future.
- UART Fast Serial Ports: Connects to the VEX LCD Display (19,200 baud) and will have future support to 1.125 Mbaud
- Digital/Analog Input Ports: (8) high-res Analog Inputs, (12) fast Digital I/Os that can all be used as interrupts.
- Battery Ports: Connect 7.2V power sources, such as the Battery Holder or the VEX 7.2V Robot Battery. Also connect a 9V Backup Battery to protect against communication losses.
- Programmable with easyC v4 for Cortex

Robotic Programming Software

easyC V4 Cortex



- 10 Motor Ports (127 to -127 convention)
- 12 digital I/O with interrupt capabilities
- Graphical Display window for real time debugging and feedback
- On-Line Window can be used to manually test motors and sensors
- Label motor and I/O ports in the new configuration window for easy programming.
- Terminal window for simple feedback
- Configurable VEXnet or Crystal competition projects
- Simulate a VEXnet WiFi competition match with the Competition Switch Simulator
- Add or Create custom libraries, header files, source files
- Customizable tabbed user interface
- Math function block to define advanced math functions
- Full Text Editor for advanced, customized programming
- Program a holonomic robot with one block of code
- Download to the robot over WiFi or directly via USB
- Windows 7 ready – takes advantage of Vista & Windows 7 Aero feature

"easyC is hands down the best programming package I have ever had students work with.

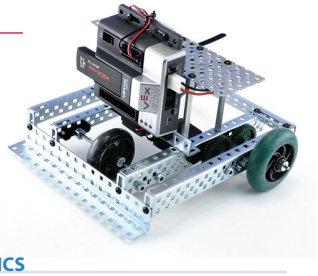
Students with no experience can be programming robots within a class period."

David Kelly
Science and Robotics Teacher

Engaging E-Learning Curriculum

Robotics Engineering Curriculum 1

In REC 1, students build and program the BaseBot, then use it to conduct experiments demonstrating physics and mechanical properties, adding sensors and mechanisms. REC 1 concludes with a capstone project featuring competitive instructional strategies.



REC Unit 1: Introduction to Robotics

- 1.1 (Core): Introduction to Robotics
- 1.2 (Core): Engineering Notebook
- 1.3 (Activity): Engineering Notebook
- 1.4 (Core): Safety
- 1.5 (Core): The VEX Robot
- 1.6 (Activity): Vex Components
- 1.7 (Core): Fasteners
- 1.8 (Activity): Chassis Construction
- 1.9 (Core): Drive Train
- 1.10 (Activity): Drive Train Construction
- 1.11 (Core): Robot Controller
- 1.12 (Activity): Wiring the Vex Controller and Battery
- 1.13 (Core): Wireless Control
- 1.14 (Activity): Using Wireless Control
- 1.15 (Core): Dual Joystick Control (Tank)
- 1.16 (Activity): Tank Control
- 1.17 (Core): Single Joystick Control (Arcade)
- 1.18 (Activity): Arcade Control Operation
- 1.19 (Core): Robot Systems Design
- 1.20 (Activity): Adding Components to the BaseBot
- 1.21 (Project): Motion Path Challenge

REC Unit 2: Introduction to Vex Programming

- 2.1 (Core): Basic Motor Control
- 2.2 (Activity): Draw a Line
- 2.3 (Core): Pseudocode and Turns
- 2.4 (Activity): Make a Square
- 2.5 (Core): Variables, Constants and Comments
- 2.6 (Activity): Apply Constants, Variables, and Comments
- 2.7 (Core): Tools in easyC
- 2.8 (Activity): Using easyC Tools
- 2.9 (Core): Dead Reckoning and User Functions
- 2.10 (Activity): Follow a Complex Path
- 2.11 (Core): Conditional Statements
- 2.12 (Activity): Modifying the GoForward Function
- 2.13 (Core): Loops
- 2.14 (Activity): Make Multiple Squares
- 2.15 (Core): Simplified Symbols, Logical Operators, and Integer Math
- 2.16 (Project): Fine Motor Control

REC Unit 3: Physics and Robotics

- 3.1 (Core): Motors and Motor Speed
- 3.2 (Activity): Angular Velocity
- 3.3 (Core): DC Motors: Types and Uses
- 3.4 (Core): Gears and Gear Trains
- 3.5 (Activity): Gear Trains
- 3.6 (Core): Fundamentals of Linear Motion
- 3.7 (Activity): Linear Motion
- 3.8 (Core): Rotational Dynamics
- 3.9 (Activity): Linear and Angular Velocity
- 3.10 (Core): Newton's Laws
- 3.11 (Activity): Weight
- 3.12 (Core): Friction and Traction
- 3.13 (Activity): Coefficients of Friction
- 3.14 (Core): Torque
- 3.15 (Activity): Test Motor Torque
- 3.16 (Core): Gear Ratios and Torque
- 3.17 (Activity): Hill Climb
- 3.18 (Core): Power
- 3.19 (Project): Tractor Pull

REC Unit 4: Sensors

- 4.1 (Core): Introduction to Sensors
- 4.2 (Activity): Open-Loop vs. Closed-Loop Navigation
- 4.3 (Core): Open-Loop vs. Closed-Loop Systems
- 4.4 (Core): Introduction to Vex Kit Sensors
- 4.5 (Activity): Bumper Car
- 4.6 (Core): Ultrasonic Sensors
- 4.7 (Activity): Ultrasonic Rangefinder
- 4.8 (Core): Following Lines
- 4.9 (Activity): The Line-Following Sensor
- 4.12 (Activity): Line Following
- 4.13 (Unit Project): Bumper Books

REC Unit 5: Arms and End Effectors

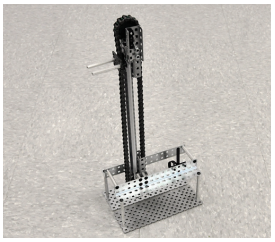
- 5.1 (Core): Introduction to Robotic Arms, Degrees of Freedom
- 5.2 (Activity): Robotic Arm Construction
- 5.3 (Core): Mass, Weight, Center of Weight and Torque
- 5.4 (Activity): Center of Weight of BaseBot
- 5.5 (Core): Relationship of Torque, Gear Ratio and Weight of Payload
- 5.6 (Activity): Stall Torque
- 5.7 (Core): Remote Control; Limit Switches
- 5.8 (Activity): Windshield Wiper
- 5.9 (Core): End Effectors
- 5.10 (Activity): End Effector

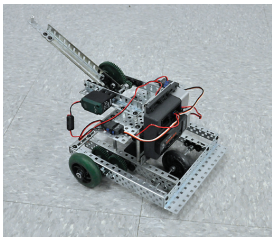
REC Unit 6: Project

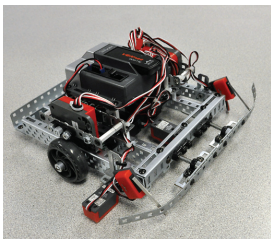
- 6.1: (Project): Ultrasonic Trainyard Challenge

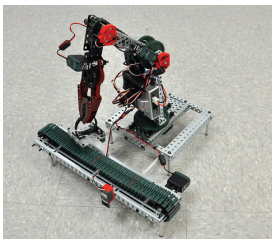
Robotics Engineering Curriculum 2

In REC 2, students continue with deeper engineering topics, building more advanced robots including those shown below.









REC Unit 7: Introduction to Electronics

- 7.1 (Core): Fundamentals of Electricity
- 7.2 (Core): Components and Schematics
- 7.3 (Activity): Schematics and Breadboards
- 7.4 (Core): Ohm's Law and Making Measurements
- 7.5 (Activity): Using a Multimeter and Ohm's Law
- 7.6 (Core): Circuits
- 7.7 (Activity): Series and Parallel Circuits
- 7.8 (Core): Feedback
- 7.9 (Activity): Blinking LED
- 7.10 (Core): Working With easyC® and Sensors
- 7.11 (Activity): Integrating Hardware and Software
- 7.12: Final Project

REC Unit 8: Mechanical Properties

- 8.1 (Core): Safety and Best Practices
- 8.2 (Core): Chain and Sprockets
- 8.3 (Activity): Testing Chain and Sprockets
- 8.4 (Core): Locomotion Systems
- 8.5 (Activity): Building the Tumblebot
- 8.6 (Core): My Robot Features
- 8.7 (Activity): Program the Tumblebot Drivetrain
- 8.8 (Core): Using the easyC® C-Editor
- 8.9 (Activity): Writing an Arcade Function
- 8.10 (Core): Advanced easyC® Functions
- 8.11 (Activity): Introduction to Freeze Tag
- 8.12 (Core): Adding Autonomous Control
- 8.13 (Project): Freeze Tag

REC Unit 9: Advanced C Programming

- 9.1 (Core): Proportional Control
- 9.2 (Activity): Using Proportional Control
- 9.3 (Core): Derivative Control
- 9.4 (Activity): Using Derivative Control
- 9.5 (Core): PID Control
- 9.6 (Activity): Integral Control
- 9.7 (Core): Data Filtering
- 9.8 (Activity): Data Filtering and Graceful Degradation
- 9.9 (Core): Behavioral Robotics
- 9.10 (Activity): Build a Vacuuming Robot
- 9.11 (Core): Organizing Behaviors
- 9.12 (Activity): Writing a Roombot Behavior
- 9.13 (Core): Random Turns
- 9.14 (Activity): Generating Random Numbers
- 9.15 (Project): Roombot Field Navigator

REC Unit 10: Industrial Robotic Arms

- 10.1 (Core): Industrial Robots
- 10.2 (Activity): Building a Turret
- 10.3 (Core): Potentiometers
- 10.4 (Activity): Installing the Potentiometer
- 10.5 (Core): Robotic Movement
- 10.6 (Activity): Completing the Arm
- 10.7 (Core): Robotic Integration
- 10.8 (Project): Pass the Workpiece

REC Unit 11: Advanced Mechanics

- 11.1 (Core): Lift Systems
- 11.2 (Activity): Building a Lift Mechanism
- 11.3 (Core): Advanced Gear Systems
- 11.4 (Activity): Rack and Pinion Test Stand

REC Unit 12: Project

- 12.1 (Project): Bucket Battle

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444 East Industrial Park Dr. • Manchester, NH 03109
Phone: 800-221-2763 • info@intelitek.com
www.intelitek.com