

**Course:** Ag Automation and Robotics

**Instructor:** Carolyn Wright

Unit	Time Frame	Learning Target (s) / Objective (s)	Standard (s)
Introduction to Engineering/ Engineering Design Process	Sept.	Identify and Explain each step in the engineering design process, Working in groups students will apply the engineering design process to a challenge in order to develop a solution	
Introduction to Robotics, Robotic Systems & Subsystems, VEX Parts	Sept.	Identify and Describe the different robotic subsystems, Identify examples of different types of modern robots, Incorporate different subsystems to build a robot	
The GAME Begins	Sept./Oct.	Students will follow the engineering design process to design a robot that can play the described game head to head during VEX competitions.	
Intro to Programming, VEX Code, VEX Code Pro	October	Demonstrate proper use of the coding software; Explain the difference between coding for the driver controlled portion of the competition and the autonomous period.	
Create, Test, Improve	Nov./Dec.	Students will explore steps 4 and 5 of the EDP to test and modify their robot for competition.	

Object Manipulation	January	Identify and Describe the different types/categories of robot manipulators, Apply the categories and types of manipulators to real world examples, Create an object manipulator for their competition robot	
Speed, Power, Torque, and Motors; Gear Ratios	January	Explain the physical principles of speed, power, and torque, Apply these principles to DC motors, Apply these concepts on mechanical systems to calculate key details of the design	
Drivetrain Design	January	Identify different types of robot drive train systems, Explain the differences between the different drive train systems, Apply these principles and those of the previous units to design a powertrain for their robot's drive system	
Lift Design	Feb/March	Explore different types of lift systems used on competition robots, Design a lift system for their robots	

Systems Integration, Testing & Iteration	Jan/Feb	Integrate the previously created subsystems into their finished robot, Compete in final competition against classmates	
Arduino	March/April	Students will be able to write and upload code to an Arduino, Build a circuit on a breadboard, Debug (troubleshoot) a circuit, Use Arduino functions for digital and analog input and output.	
Agricultural Automation and Robotics	April/May	Describe the use of automation and robotics in the field of agriculture; Explain the pros and cons of automation and robotics used in the Ag industry	

Vocabulary	Assessments	Program Materials / Resources
Engineering, methodical process, classical mechanics, structural design, manufacturing, design, design team, quantitative, EDP, Constraints	In Class Activities and Discussions, Design Challenge, Engineering Notebook Reflection Questions	iPads, Paper, Pencils
Robotics, Robots, Body/Frame, Control System, Manipulators, Drivetrain, Central Processing Unit (CPU), Structure, Motion, Power, Sensors, Logic, Control	In Class Activities and Discussions, 2022-23 Robot Tear Down/Dissection, Engineering Notebook Reflection Questions	iPads, VEX Materials, VEX 2022-23 Robots
Strategic Design, Objectives, Specifications, Analysis, Cost-benefit, Speed, Power, Agility, Center of Gravity	Introduce VEX Competition Game, The Game-Scavenger Hunt, EDP Packet-Research & Sketch, Hero Robot Build, Engineering Notebook Reflection Questions	iPads, Paper, Pencil, VEX Materials, Competition Challenge, EDP Packet, Scavenger Hunt Packet, Hero Bot Build Plans
Autonomous, Driver Controlled, Coding	Sphero Bot Obstacle Course, VEX Code-Driver Controlled, VEX Code-Autonomous, VEX Code Pro Tutorial	iPad, Sphero Bots, Coding Challenges, Computer, VEX Code Software
	Test Hero Bot, Hero Bot Performance Analysis, Modify Hero Bot for Competition, First Competition @ Belfast	iPads, Paper, Pencil, VEX Materials, Computer, VEX Code Software, Engineer Design Notebook

Manipulators, Accumulators, Force, Plow, Scoops, Traction, Friction, Claw, Normal Force, Actuation, Magazine, Conveyor, Conveyance, Compression, Elasticity, Orientation,	In Class Activities and Discussions, Competition Object Manipulator Analysis, Research Improvements and Make Modifications, Engineering Notebook Reflection Questions	iPads, Paper, Pencil, VEX Materials
Speed, Power, Torque, DC, Methodical, Mechanics, Rotational Speed, Acceleration, Force, Work, Newton, Watt, Voltage, Load, Current, Stall Torque, Free Speed, Stall Current, Free Current	In Class Activities and Discussions, Gear Ratio Calculation, Create a specified Gear Ratio, Engineering Notebook Reflection Questions	iPads, Wkst, Pencils, Calculator, VEX Materials
Friction (Static vs Kinetic), Traction, Drivetrain, Subsystem, Magnitude, Coefficient of Friction, Normal Force, Drive Wheel, Turning Point, Turning Scrub, Zero Radius Turn, Chassis, "Car Style", Skid Steer, Swerve Drive, Crab Drive, Omni-directional	Drivetrain Design Types Pros & Cons, Modify Drivetrain as necessary for competition, Engineering Notebook Reflection Questions	iPads, Paper, Pencil, Wksts, VEX Materials
Object manipulators, Lift mechanisms, Degrees of Freedom, Lever, Rotating Joint, Shock Load, Mechanical Advantage, Iteration, Elevator, Actuation, Rack and Pinion, Linkages (driven vs fixed), Orientation, Passive Assistance, Pnuematics, Hydraulics	In Class Activities and Discussions, EDP Packet for lift design options for their robot, Build lift for their robot, Engineering Notebook Reflection Questions, Hydraulics, Pneumatics	iPad, Paper, Pencil, EDP Packet, VEX Materials

System Integration, Control, Pneumatics, Drivetrain, Testing, Iteration	In Class Activities and Discussion, Finalize Robot Build- make any final modification, Engineering Notebook Reflection Questions, Second Competition @ Franklinville, Overall robot build/competition reflection	iPad, VEX Materials, Computer, Engineering Design Notebooks
Microcontroller, Prototyping	Arduino Coding Challenges	iPad, Arduino Kits, Arduino Tutorial Videos, Arduino Coding Challenges
Robotic Milkers, Robotic Feed Pushers, Robotic Alley Scrappers, Drones, GPS Tractors, Precision Agriculture, Precision Planting Equipment	Field Trip- Robotic Dairy Farm or Ag Robotics Manufacturing Company	