Canvas Course Curriculum

# Computer Science

C/C++ Programming

Introduction to Computers

• Basic hardware and software concepts.

• The different types of programming languages.

• C/C++ Integrated Development Environment (IDE).

• Demonstration ( Installation (PC, Mac, online compiler).

• Test driving a C++ application.

• Writing a simple program in C++.

The Structure of C/C++ Program

• main(), #include, using namespace std.

• Output and Input: cout, cin.

• numeric data, character data, string data.

• data types: int, float, double, char.

• arithmetic operators: +, -,\*, /, %

• Memory Concepts.

• Demonstration.

• Lab exercise.

Decision Making: Equality and Relational Operators

• Relational operators: >, <, >=, <=

• Equality operators: ==, !=

• Lab exercise

• Programming project.

Control Statement in C/C++

• Algorithms

• Logical operators: &&, ||

• Decision/Selection constructs: if, if...else statements.

• Repetition: while statement, sentinel-controlled repetition.

• An introduction to counter controlled repetition, the increment and

decrement operators.

• Lab exercise.

• Programming project.

Control Statements

• The essentials of counter-controlled Repetition.

• The for repetition statement.

• Examples using the for statement.

• do...while repetition statement.

• switch multiple selection statement.

• Lab exercise.

• Programming project.

Functions in C/C++

• Software reusability.

• Math Library functions.

• User-defined functions.

• Function Definitions.

• Demonstration.

• Lab exercise.

• Programming project.

Functions in C/C++

• Lab exercise

• Graphics library demonstration.

• Using a graphics library.

• Drawing on the computer.

• Student programming project.

Graphics Programming

Student programming project.

# SolidWorks Surface Modeling

1) Surface modeling introduction using SolidWorks

2) Creating classic surface model shapes using SolidWorks.

3) SolidWorks Aircraft Surface Model SolidWorks Part 1: Sketching

4) Part 2: Lofting the Fuselage.

5) Part 3: Creating the Canopy

6) Part 4: Creating the wings and stabilizers

7) Part 5: Creating the Air Intake

8) Part 6: Surface Trimming, Mirroring, and Conversion to Solid

9) Part 7: Creating a Base and Mounting Points.

10) Part 8: Splitting The Model For Printing

11) Part 9: 3D Printing Your Model

12) Part 10: Post Processing Your 3D Print

# Introduction to Robotics

## Class Topics

| **Class #** | **Hours** | **Topics** |
| --- | --- | --- |
| 1 | 1.5 | Introduce engineering and engineering design process, Robotics and applications |
| 2 | 1.5 | Build the Drivetrain of the VEX Clawbot Robot |
| 3 | 1.5 | Write simple programs to drive DC motors: Robots go forward/backward, turn left/ right at different speeds. |
| 4 | 1.5 | Introduce relational and logic operators and programming structure: Running motors in an infinite loop |
| 5 | 1.5 | Program bump sensor and optical shaft encoders: Robots go straight and travel the required distance. |
| 6 | 1.5 | Program bump sensor and optical shaft encoders: Robots go straight and travel the required distance. Part II |
| 7 | 1.5 | Introduce the robotic arm and claw, potentiometer and limit switch:  Building a robotic arm on the chassis and program the arm/claw to grasp an object and move it to another location. |
| 8 | 1.5 | Programming the robot to perform a simple autonomous task of moving an object from one location to another utilizing sensors. |

| **Week #** | **Hours** | **Projects and Tasks** |
| --- | --- | --- |
| 1 | 3 | 1. Introducing the VEX Easy C programming environment. 2. Building the VEX Clawbot Drivetrain |
| 2 | 3 | 1. Programming Simple movement commands. 2. Using simple conditional loops and logic operations to control robot movement |
| 3 | 3 | 1. Using the bump sensor and optical shaft encoders to control the robot movements and create accurate movements. |
| 4 | 3 | 1. Attaching the robot arm and claw to the VEX Clawbot Robot. 2. Programming the robot to actuate the robot arm and claw. 3. Combining drivetrain commands with robot arm and claw. |

SIPP Program Canvas Course

# Introduction to Drones

## Class Topics

| **Class #** | **Hours** | **Topics** |
| --- | --- | --- |
| 1 | 1.5 | Introduction to drones and drone technology. Introduction to drone design and building process. |
| 2 | 1.5 | Introduction to basic drone components and electronics. Introduction to drone design for additive manufacturing. |
| 3 | 1.5 | Introduction to DJI Tello EDU Drone. Introduction to the Drone Programming environment. Introduction to remote drone piloting. |
| 4 | 1.5 | Programming basic movements with the DJI Tello Drone. |
| 5 | 1.5 | Incorporation of conditional loops and logic operators in drone autonomous programming. |
| 6 | 1.5 | Programming Tello drone with mission pad to complete mission tasks. |
| 7 | 1.5 | Programming Tello drone with mission pad to complete mission tasks. Part II |
| 8 | 1.5 | Programming Tello drone with mission pad to complete mission tasks. Part II |

| **Week #** | **Hours** | **Projects and Tasks** |
| --- | --- | --- |
| 1-2 | 3 | 1. Understanding remote control of drone using a remote control 2. Understanding basic drone movements and programming basic movement commands |
| 3 | 3 | 1. Programming drone autonomous movements to follow specific path plans to achieve tasks. |
| 4 | 3 | 1. Programming drones to follow mission pads placed at specific locations to complete a mission task. |

# SEL + Survey Course Integration

**SEL Topics Embedded into Survey Course:**

| **Topic** | **Learning Outcome/Benchmark** |
| --- | --- |
| **Self-Awareness** | |
| Growth mindset | Utilizes a growth mindset & self-efficacy strategies to work through setbacks when writing a simple program in C++, creating models in SolidWorks, writing simple programs to drive DC motors, etc. |
| Self-confidence | Gain self-confidence when achieving small wins (e.g. writing a simple program, creating classic surface model shapes in solidworks, etc.) |
| Strengths & growth areas | Identifies one’s strengths & growth areas within each survey course module topic |
| Transitions | Prepare for and recognize change of topics (transitions) throughout survey course |
| **Self-Management** | |
| Energy regulation, support needs, sensory needs | Maintains awareness and management of energy regulation, support needs, and sensory needs & preferences when in survey course classroom |
| Self-advocacy | Self-advocates for one’s needs in survey course classroom |
| Executive Function | Uses individualized executive function strengths and weaknesses to guide executive functioning support during survey course  Organizational systems for planning & executing survey coursework |
| Tracks own learning progress | Evaluates & tracks progress of own learning within each module of survey course |
| Adaptability & Initiative | Shows adaptability, initiative, and self-motivation to complete projects and achieve badges |
| Goal-directed behavior | Sets & works towards learning goals defined by instructors and self in survey course |
| Rules & routines | Understands & follows the rules and routines of survey course class time set by each instructor |
| Self-management plan | Makes changes to individual self-management plan as needed to achieve survey course badges |
| **Social Awareness** | |
| Perspective-taking | Uses perspective-taking while working with others in survey course projects |
| Demands & opportunities of situations | Recognizes the demands & opportunities for growth and learning within a survey course project |
| Being with others vs. taking a break | Identifies when oneself is able to be with others and when a break is needed during survey course class time |
| **Relationship Skills** | |
| Information communication | Communicates information & asks for help from appropriate survey course module instructor and/or peer when needed |
| Feedback | Gives & receives feedback (feedback loop) to and from survey course instructors and peers |
| Positive relationships | Develops positive relationship with survey course instructor & peers |
| Teamwork and collaboration | Uses teamwork & collaborative problem-solving when working with others on survey course projects |
| Multiple communication methods | Uses multiple communication methods when communicating information learned with survey course instructor & peers - oral presentation, visual communication, written communication |
| **Responsible Decision-Making** | |
| Curiosity, open-mindedness, and creativity | Demonstrates curiosity, open-mindedness, and creativity during survey course |
| Problem Solving and Critical Thinking | Problem-solving and critical thinking skills used across all survey course module projects   * Identifies problems * Uses pattern-recognition to problem solve * Uses systems thinking * Uses algorithmic thinking * Makes reasoned judgment after observing, collecting data, analyzing data, and uses this evidence to support decision |
| Load of responsibilities vs. current capacity | Increasing and decreasing your “load of responsibilities” with your current capacity & communicating this with your survey course module instructor |

# 

**Excerpt from grant on student assessment:**

**Student Assessment**

Spectrum Innovates Pathway Program is a credit bearing certificate program. Student achievement is evaluated by performance assessments that determine competency.

Outcomes are assessed throughout the program’s implementation using novel and existing instruments for formative, ongoing and summative purposes. These instruments combined with observational assessments denote the achievement of benchmarks and provide real time feedback. Student engagement in this feedback loop ensures understanding and retention of the concepts and skills needed to achieve the desired competency. A virtual badge is awarded for each competency that is achieved. Requirements for competencies and their representative badges (Yowell, 2018) are developed in concert with industry’s emerging needs and Vaughn’s competency requirements for degree programs. Students must acquire the requisite badges that represent an array of essential and highly valued skills and concepts in order to receive a credit-bearing certificate upon completion of the program.

# Competency-Based Assessment Tool

# SAMPLE: SIPP Summer Curriculum

| **Competency** | **Benchmarks** | **Evidence**  *Portfolio, Project-Based, Evaluation, Summative, Formative, Observation* | **Rating**  0-*Not Yet Demonstrated*  *1 - Emerging*  *2 - Competent*  *3 -Highly Competent* | **Narrative Feedback for Student**  *Faculty, Mentor, Peer, Self* |
| --- | --- | --- | --- | --- |
| *Fluency using CAD software to develop working prototypes of assigned projects* | *Develop CAD models of moderate complexity using a variety of sketch and modeling tools in novel ways*  *Develop assemblies and sub-assembly using to defined tolerance*  *Develop engineering drawings to workplace standard*  *Refine model, integrating feedback from multiple sources.* | *Student Work from Week 1 Project* |  |  |
| *Demonstrate ability to program microcontrollers to interact with the physical world* | *Attain fundamental concepts of programming: syntax,, language, conditional statements, variables,*    *Develop strategies for Debugging and troubleshooting* | *Series of projects completed using*  *CPX*  *and*  *Arduino* |  | *Checklist /rubric* |
| *Demonstrate ability to build working prototypes in conjunction with physical computing devices* | *Devise plans*  *Use tools and materials for construction*  *Test*  *Iterate on design / troubleshoot* | *Series of projects completed using*  *CPX*  *and*  *Arduino* |  |  |
| *Consistently demonstrating a growth mindset during assigned projects and activities* | *Embrace challenges*  *Persist through setbacks*  *View failures as opportunity for growth*  *Maintain effort & strong work ethic*  *Learn when to ask for help*  *Take inspiration from the setbacks of others* | *Week 1: end of week check-in, reflection*  *Continually evaluated at end of week check-ins* |  | *Checklist/rubric* |
| *Successfully communicates and collaborates with others* | *-Communicates needs, wants, information, negotiates, resolves conflict, and asks for help when needed*  *-Understands giving and receiving feedback and constructive criticism*  *-Develops positive relationships with supportive peers and adults*  *-Participates in group/team activities using teamwork and* [*collaborative problem-solving*](https://www.mediate.com/articles/BernsteinS1.cfm) | *Week 6: end of week check-in*  *Continually evaluated during any group/team activities* |  |  |

# 

# Competency-Based Assessment Tool

# Intro to Programming

| **Competency** | **Benchmarks** | **Evidence**  *Portfolio, Project-Based, Evaluation, Summative, Formative, Observation* | **Rating**  0-*Not Yet Demonstrated*  *1 - Emerging*  *2 - Competent*  *3 -Highly Competent* | **Narrative Feedback for Student**  *Faculty, Mentor, Peer, Self* |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

# Competency-Based Assessment Tool

# Intro to SolidWorks

| **Competency** | **Benchmarks** | **Evidence**  *Portfolio, Project-Based, Evaluation, Summative, Formative, Observation* | **Rating**  0-*Not Yet Demonstrated*  *1 - Emerging*  *2 - Competent*  *3 -Highly Competent* | **Narrative Feedback for Student**  *Faculty, Mentor, Peer, Self* |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

# Competency-Based Assessment Tool

# Intro to Robotics

| **Competency** | **Benchmarks** | **Evidence**  *Portfolio, Project-Based, Evaluation, Summative, Formative, Observation* | **Rating**  0-*Not Yet Demonstrated*  *1 - Emerging*  *2 - Competent*  *3 -Highly Competent* | **Narrative Feedback for Student**  *Faculty, Mentor, Peer, Self* |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

# Competency-Based Assessment Tool

# Intro to Drones

| **Competency** | **Benchmarks** | **Evidence**  *Portfolio, Project-Based, Evaluation, Summative, Formative, Observation* | **Rating**  0-*Not Yet Demonstrated*  *1 - Emerging*  *2 - Competent*  *3 -Highly Competent* | **Narrative Feedback for Student**  *Faculty, Mentor, Peer, Self* |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |