Skills to Learn:

1. Computer Code

A. National Instruments LabView object-oriented approach

Programming Basics: Common variable types, If/Then/Else, Do and While Loops, Data Acquisition and Control (DAQ) hardware

B. National Instruments LabView traditional code approach (some repeat of A)

C. C++ (Same programming concepts as above)

1. CodeBlocks with C++ (taught in class)

2. Eclipse (available online)

3. NetBeans (not at FIT)

D. Arduino (Same programming concepts as above)

E. G code (Same programming concepts as above)

F. Python (Same programming concepts as above)

G. MatLab (optional; instructions available online)

2. Drawing Skills

A. Hand-drawn sketch (drawing of a mounting bracket for attaching to a 3D printer)

B. PowerPoint (conversion of A into 2D drawing)

C. Computer-aided drawing programs (all available online; some taught in class;

same as A and B but in 3D)

1. SolidWorks

2. PTC Creo (taught secondarily)

3. AutoCAD

4. AutoCAD with Civ3D (only for CVE's at FIT)

5. Bentley Microstation

6. OpenSCAD (taught secondarily)

7. Blender (brief exposure in class)

8. Rhino

9. OnShape

10. TinkerCAD (taught primarily)

11. FreeCAD

12. SketchUp

D. Drawings of parts for 3D printers, wearable sensors, & tissue engineering test bed

E. Assembly of parts into subsystems

F. Process flow diagrams

G. Piping and instrumentation diagrams

H. Wiring diagrams

3. Wiring - Assembly of light bulb circuit with fuse (1 hour in Frueauff 104)

4. Soldering introduction & soldering header onto load cell shield (1 hour in maker space)

5. Arduino – TinkerCAD Circuits, LED Blink, Draining of a Capacitor in a Resistor/Capacitor Circuit (1 class)

6. Arduino/LabView DAQ for temperature, liquid level, pH, electrical conductivity (EC), dissolved O2 (DO), oxidation reduction potential (ORP), mass, and flow rate (1 week)

7. Arduino/LabView servo and stepper motor control, including robotic reinforcement of Python and/or C++ programming skills (1 week)

8. Concentration monitoring using a CheapStat potentiostat (1 class)

9. LabSmith microfluidic flow kit - assemble & test (1 class)

10. CAD drawing (2 weeks incl. fall break)

11. CAD to .stl and 3D printing, including G code modification (2 weeks)

12. Assembly of a fully instrumented bioreactor with automated feeds, aforementioned sensors & controls, stepper-based syringe pumps, etc., with instruction in and integration of prewritten computer code for mass and energy balance closure, process control, and hazardous operability (HAZOP) analysis (2 weeks of lab + 3 lectures)

13. Student design, parts fabrication, and assembly of wearable sensors (remainder of labs in course)

14. Final wearable sensors project explanation, with emphasis on Kern Entrepreneurial Education Network (KEEN) goals of curiosity, connections, and creating value (2 lectures), as well as multidisciplinary teamwork survey and expectations

15. Poster/demo contest for function & creativity to engender entrepreneurial mindset (in lieu of final exam)