

# Embedded Computing 11.42700 (2021)

Demonstrate employability skills required by business and industry. [IT-EP-1](#)

- 1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities [IT-EP-1.1](#)
- 2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. [IT-EP-1.2](#)
- 3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. [IT-EP-1.3](#)
- 4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. [IT-EP-1.4](#)
- 5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. [IT-EP-1.5](#)
- 6 Present a professional image through appearance, behavior and language. [IT-EP-1.6](#)

Explain Embedded Computing (EC) and the Internet of Things (IoT). [IT-EP-2](#)

- 1 Define the basic terminology of EC/IoT. [IT-EP-2.1](#)
- 2 Create a glossary of basic EC/IoT terminology. [IT-EP-2.2](#)
- 3 Compare and contrast microprocessors and microcontrollers. [IT-EP-2.3](#)
- 4 Research and report on popular microcontrollers and EC/IoT platforms (e.g., Arduino, Raspberry Pi, spark.io, BASIC Stamp, Espruino, LightBlue Bean, LittleBits Arduino). [IT-EP-2.4](#)

Demonstrate a working knowledge of basic networking protocols for industry, homes, and the internet including speed, power requirements, and popularity in industry

- 1 Compare and contrast Radio Frequency (RF) networking technologies, (e.g., Wi-Fi, bluetooth, BLE, Zigbee, Zwave) including speed, power requirements, and popularity in industry and personal devices. [IT-EP-3.1](#)
- 2 Explain advantages and disadvantages of wireless networking compared to wired networking. [IT-EP-3.2](#)

and personal devices. [IT-EP-3](#)

**3 Demonstrate a working knowledge of serial networking technologies used by microcontrollers (e.g., I2C, RS-232, RS-422, RS-485, SPI, master/slave).** [IT-EP-3.3](#)

Develop and investigate interfacing circuits. [IT-EP-4](#)

**1 Explain the difference between a source and a sink.** [IT-EP-4.1](#)

**2 Identify the differences between analog and digital circuits.** [IT-EP-4.2](#)

**3 Describe the function of a pull-up resistor.** [IT-EP-4.3](#)

**4 Calculate the current draw of series and parallel circuits.** [IT-EP-4.4](#)

**5 Build an operational LED circuit with a switch to turn it on/off, giving examples of why this is helpful in an IoT scenario.** [IT-EP-4.5](#)

**6 Research and report the current and voltage I/O limitations of the embedded platform/microcontroller used in the class.** [IT-EP-4.6](#)

**7 Discuss the characteristics of digital input and output ports on a microcontroller** [IT-EP-4.7](#)

**8 Demonstrate an understanding of analog to digital (ADC) and digital to analog ports (DAC) on a microcontroller.** [IT-EP-4.8](#)

Classify and categorize multiple kinds of sensors. [IT-EP-5](#)

**1 Classify and explain examples of the following kinds of sensors: temperature, distance, light, sound, contact, pressure, position – GPS (Global Positioning System), encoders, potentiometer, gyro, and accelerometer.** [IT-EP-5.1](#)

**2 Explain the basic functioning principles of the sensors above and their possible uses.** [IT-EP-5.2](#)

Manipulate, connect, and examine performance aspects of motors. [IT-EP-6](#)

**1 Demonstrate an understanding of stepper motors.** [IT-EP-6.1](#)

**2 Explain how a servo motor operates.** [IT-EP-6.2](#)

**3 Describe the operation of brushed motor controller** [IT-EP-6.3](#)

**4 Explain how a brushless motor controller works** [IT-EP-6.4](#)

**5 Demonstrate an understanding of pulse width modulation (PWM) control of motors.** [IT-EP-6.5](#)

**6 Select the proper motor and controller for a given task, including exceptions that require a different action (if/then scenarios).** [IT-EP-6.6](#)

Investigate and draw connections within the context of programming as it relates to Embedded

**1 Identify and utilize popular programming languages used for EC/IoT applications.** [IT-EP-7.1](#)

**Computing/Internet of Things.** IT-EP-7

- 2 Analyze the process of software development for an embedded application.** IT-EP-7.2
- 3 Compare and contrast interpreted and compiled applications.** IT-EP-7.3
- 4 Define real time programming and interrupt driven programming.** IT-EP-7.4
- 5 Analyze and explain when integer and floating point numbers are needed.** IT-EP-7.5
- 6 Design the use of a finite state machine using real-world examples (e.g. vending machines, assisted GPS on smartphones, various radio/connectivity states).** IT-EP-7.6

**Interpret debugging techniques in hardware and software.** IT-EP-8

- 1 Gather, organize, and interpret data to identify simple bugs in EC/IoT applications.** IT-EP-8.1
- 2 Utilize proper methods for debugging, including systematically changing, then checking, one item at a time.** IT-EP-8.2
- 3 Evaluate the breakpoint, interrupt, main loop, event driven, and race condition in EC/IoT applications.** IT-EP-8.3
- 4 Prove how to debug an actual program using a debugging tool and explain the reasons behind the steps taken.** IT-EP-8.4

**Compare, contrast, and utilize Cloud Service features.** IT-EP-9

- 1 Debate Security/Privacy concerns of EC/IoT applications.** IT-EP-9.1
- 2 Explore available cloud-based application program interfaces (APIs).** IT-EP-9.2
- 3 Develop an application that connects with one or more cloud-based services/storage solutions (e.g., Twitter, IFTTT [If This Then That], Dropbox, Google)** IT-EP-9.3

**Design an embedded computing application that solves a current problem (e.g., robotics, artbotics, visual, and kinetic art).** IT-EP-10

- 1 Design, develop, and debug an embedded computing application interfacing to an external sensor, switch, LED, or other device.** IT-EP-10.1
- 2 Design, develop, and debug an external application on a PC or mobile device accessing data from a remote embedded computer.** IT-EP-10.2

**Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service**

- 1 Explain the goals, mission, and objectives of the career-technical student organization (CTSO).** IT-EP-11.1
- 2 Explore the impact and opportunities a student organization can develop to bring business and education together in a positive working relationship through innovative leadership and career development programs.** IT-EP-11.2

**projects and  
competitive events.** IT-  
EP-11

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- 3** Explore the local, state, and national opportunities available to students through participation in related student organization including but not limited to conferences, competitions, community service, philanthropy, and other CTSO activities. IT-EP-11.3
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- 4** Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development. IT-EP-11.4
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- 5** Explore the competitive events related to the content of this course and the required competencies, skills, and knowledge for each related event for individual, team, and chapter competitions. IT-EP-11.5