

# 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