**Course Information**

MFET 27300 Industrial Internet of Things, Networks, and Systems I

3 credit hours

**Pre/Corequisite**

(CP) ECET 22400 Electronic Systems

(P) CS 17700

**Course Description**

An introduction to devices, networks, and standards present in converged industrial automation systems. Course topics include an examination of Information Technology (IT) and Operational Technology (OT) networks, hardware, architecture, protocols, standards, and security practices in the context of industrial applications. Course laboratories focus on specifying, provisioning, securing, and integrating Industrial Internet of Things (IIoT) devices in greenfield and brownfield scenarios.

**Learning Resources, Technology & Texts**

Hands-On Industrial Internet of Things. Veneri, G. and Capasso, A. Birmingham: Packt Publishing Ltd. 2018.

ISBN 978-1789537222

**Learning Outcomes**

By the end of the course, you will be able to:

1. explain the history of IT and OT development and detail differences in priorities and capabilities.
2. describe and analyze the hardware and transmission media that comprise an industrial network and demonstrate how these components integrate to form a networked solution.
3. explain key Information Technology (IT) and Operational Technology (OT) protocols, and their hierarchical relationship in the context of a conceptual model, such as the OSI and TCP/IP framework.
4. demonstrate how to configure host and network level technical security controls in IT and OT systems.
5. utilize industry standards and reference architectures to ensure best practices in the selection, deployment, and operation of IIoT devices.

**Course Topics**

1. Smart Manufacturing Communication Systems and Principles (3 weeks)
   * IT and OT Definition, Development, and Roles
   * Communication System Model
   * OSI Model
   * Protocols and Standards
   * Synchronization
2. Smart Manufacturing Reference Architectures and Devices (4 weeks)
   * Reference Architectures
   * Network Devices
   * Media
   * Local – On machine
   * On Premises
3. Industrial IoT Sensor Technology (3 weeks)
   * Types of Sensors
   * Accuracy, Resolution, Sampling, Digitization
   * Packaging for Industrial Applications
4. IoT Industrial Controls, Output Devices, & Actuators (3 weeks)
   * Standards
   * Safety Concerns
5. Power in IoT Deployments (1 week)
   * Efficiency
   * Stability/Reliability/Redundancy
   * Power over Ethernet (PoE)
6. Smart Manufacturing Security (1 week)
   * Standards and Best Practices
   * Firewalls and Security Devices

**Evaluation & Grading Scale**

Student will be assessed on:

Exams: 30%

Quizzes: 10%

Activities/Project: 20%

Laboratory: 40%

Total: 100%

Course Grades:

A = 90-100%

B = 80-89%

C = 70-79%

D = 60-69%

F = Below 60%

# Attendance Policy

Students are expected to be present for every meeting of the classes in which they are enrolled. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email or phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor’s department because of circumstances beyond the student’s control, and in cases of bereavement, the student or the student’s representative should contact the Office of the Dean of Students via [email](mailto:odos@purdue.edu?subject=Student%20Bereavement%20Needs) or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

# Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

# Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. More details are available on our course Brightspace table of contents, under University Policies.

# Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: [drc@purdue.edu](mailto:drc@purdue.edu) or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

# Mental Health Statement

* If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](https://purdue.welltrack.com/). Sign in and find information and tools at your fingertips, available to you at any time.
* If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](http://www.purdue.edu/odos). Normal drop-in hours are M-F, 8 am- 5 pm.
* If you’re struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services (CAPS)](https://www.purdue.edu/caps/) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

# Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

# References

Heer, R. (n.d.). A Model of Learning Objectives–based on *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom’s Taxonomy of Educational Objectives.* Center for Excellence in Learning and Teaching, Iowa State University. <https://www.celt.iastate.edu/wp-content/uploads/2015/09/RevisedBloomsHandout-1.pdf>

Stanny, C.J. (2016). [Reevaluating Bloom’s Taxonomy:](https://doi.org/10.3390/educsci6040037) What Measurable Verbs Can and Cannot Say about Student Learning*. Educ. Science, 6*(4), 37. <https://doi.org/10.3390/educsci6040037>.