

The Importance of Standards for Product Innovation and Development: Educating the importance of standards related to emerging technology developments

Senior Capstone in SoET – 300 mixed-discipline engineering technology undergraduates

✓ Soft Launch in Spring 2025

Launch in Fall 2026 (In progress)

Purdue's Certificate in Entrepreneurship and Innovation – 400 mixed-level under/graduates

Launch in Fall 2026 (In progress)



Purdue Team:

Milton Aguirre, PhD, Assistant Professor in the School of Engineering Technology (SoET)

Paul McPherson, Associate Prof. in SoET, Director of Bechtel Innovation Center

Margaret Phillips, Interim Associate Dean for Research
Professor of Library Science & Engineering Information Specialist

Sukesh Jagannathan Ranganathan, Graduate Student in SoET

CAE.org

Graphic design and layout: alinaholtmann.com



Milton Aguirre, PhD

Assistant Professor

Director of seed 

School of Engineering Technology

Interests: Healthcare technologies,
Human-centered Design, Startups



2023 NIST Team Members

The Importance of Standards for Product Innovation and Development



Paul McPherson

Associate Professor

School of Engineering Technology

Director of Bechtel Innovation Center



Margaret Phillips

Interim Associate Dean for Research

Professor of Library Science &
Engineering Information Specialist

2016 NIST SCO Curriculum Development Grant

Standards are Everywhere: An information literacy approach to standards education



Sukesh Ranganathan

Graduate Student

School of Engineering Technology

The Motivation

- Developments in emerging technologies are transforming industries and shaping the future of skills development.
- Graduating students should understand the importance of technical standards in making these technologies viable in the global market.



The Goal

- 1) Design, create, implement, and evaluate undergraduate and graduate modules within a scalable badging platform.
- 2) Disseminate and promote our materials extensively across Purdue campuses so that any instructor can select the modules and badges for their students, à la carte, based on their specific needs.

A comprehensive course built using a badging platform for instructors and/or students to utilize the system and import badge information into their own open badge systems.

Module 1 Review of relevant industries and their standards

Module 2 Standards of emerging technologies

Module 3 Standards evolve with technologies

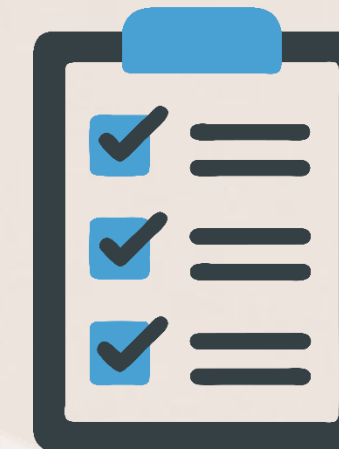
Module 4 Consumer Protection

Module 5 Locating relevant standards

Badging
Certificate



Supplement
Assignment



Module 1 - 5

3 to 4 short videos per Module (17 min)

Multiple Choice Quizzes

Critical Thinking Modules 2-5

- Multiple choice quiz
- Classroom discussion

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Developer of performance-based assessments that measure students' essential academic and career skills.

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Mobile Phone Technologies

Nova the Innovator

Stan the Standard



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List of Emerging Technologies [1, 2]

- ***Space Technologies***: Satellite-based 5G Network
- ***Semiconductors***: Evolution of Semiconductors
- ***Clean Energy Generation***: Batteries
- ***Data Privacy and Security***: ‘always listening’ devices

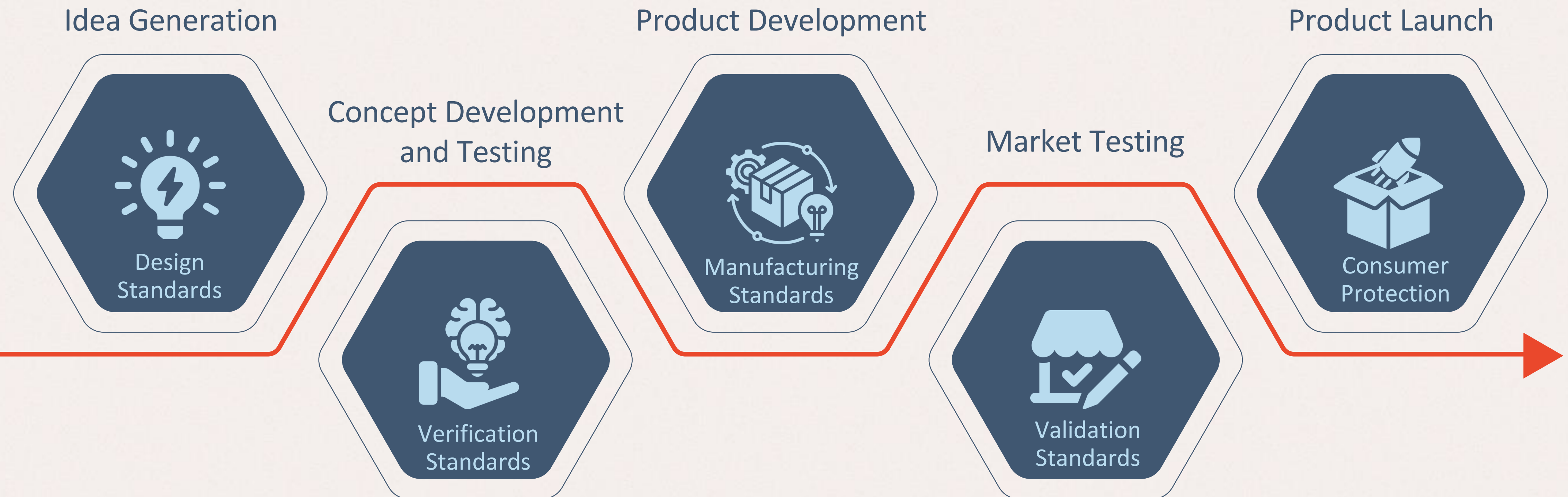


Product Dissection and Component Comparisons

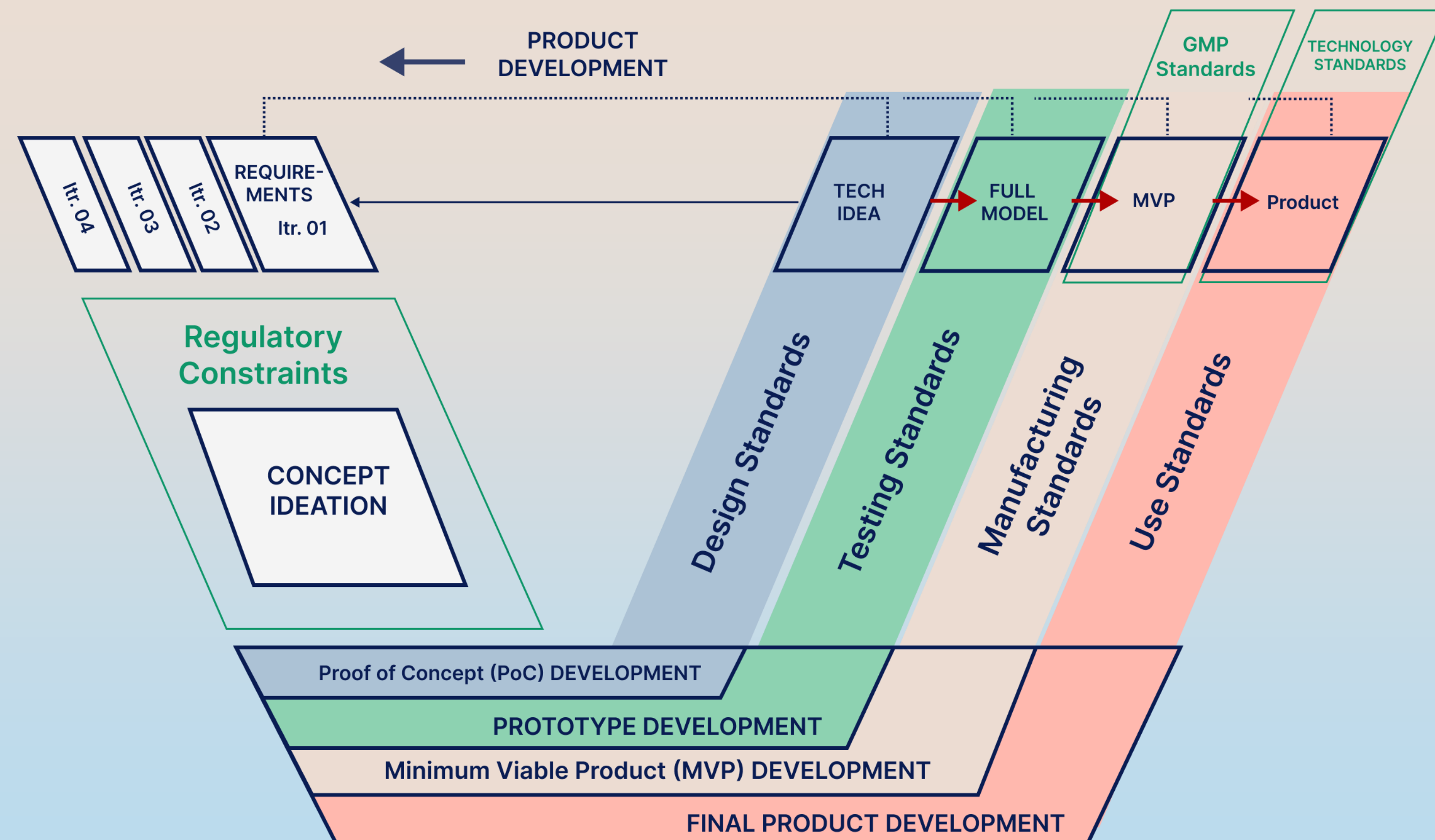
- [1] U.S. Government National Standards Strategy for Critical Emerging Technology. 2023. United States Government
- [2] Critical and Emerging Technologies List Update. 2024. National Science and Technology Council. A report by the Fast Track Action Subcommittee on the critical and emerging technologies

Product development process

A structured approach to create new products or enhance existing ones.



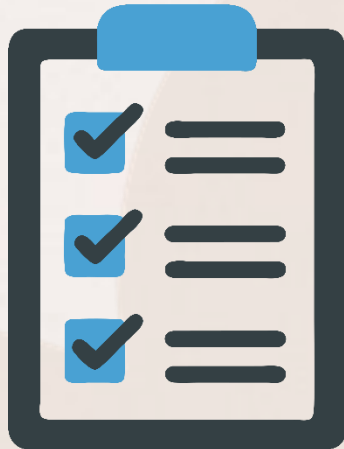
V-Model is a system development lifecycle model that connects Verification and Validation of a system



[3] Aguirre, M., McPherson, P., Ranganathan, S. and Phillips, M., 2026, February. Learning Modules for Standards Education in Entrepreneurial Programs. Proceedings in the **2026 Conference for Industry and Education Collaboration (CIEC)**.

Current Status: 5 High Fidelity Modules Completed

- Module 1Review of relevant industries and their standards
- Module 2Standards of emerging technologies
- Module 3Standards evolve with technologies
- Module 4Consumer Protection
- Module 5Locating relevant standards



Current Status: 4 HF supplemental assignments completed

A Capstone team advises an industry client on an entrepreneurial decision

6-7 Documents	Objectives
1. Financial Assessment	7-year revenue projections
2. Gov’t Incentives Memo	2023 US Government National Standards Strategy [1]
3. Standard Compliance	Introduce technology standards
4. Site Location Summaries	Introduce facilities and resources for the technology application.
5. News Brief	Share perspective on possible impact to the community
6. Testimonials	Share perspective on the possible opinions of those in community.
TEACHING NOTES	Summary of key arguments and resources

[1] U.S. Government National Standards Strategy for Critical Emerging Technology. 2023. United States Government

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Module 1 Review of relevant industries and their standards

Module 2 Standards of emerging technologies

Suppl. M2 Acquiring an AI chip manufacturing plant

DEMO

Module 3 Standards evolve with technologies

Suppl. M3 Module 3: Review a smartphone screen materials

Module 4 Consumer Protection

Suppl. M4 Module 4: Residential or industrial reverse osmosis (RO) water filtration

Module 5 Locating relevant standards

Suppl. M5 Module 5: Course Implementation – Update of project list of requirements

Play Demo Video of Module 2
'Student Perspective'

Supplemental Assignment Module 2
"Acquiring an AI chip manufacturing plant"



Sept. 8, 2026 [4] – Amazon Leo and AT&T Business announced a strategic agreement that will bring broadband services to AT&T Business customers nationwide. AT&T is the first major U.S. telecommunications provider to offer converged connectivity solutions that include Amazon Leo’s low Earth orbit satellite services into its world-class fiber and 5G networks, extending its business-grade connectivity with a new layer of resilient, fully managed connectivity.

[4] AT&T Business Expands Enterprise and Public Sector Connectivity Architecture with Amazon Leo Satellite . Available at: <https://about.att.com/> (Accessed: 9/9/26)

Soft Launch

Spring 2026

Partial introduction to the senior capstone course (M1, M2, M5).

- Module 1 Badge: Review of relevant industries and their standards – 185 students
- Module 2 Badge: Standards of emerging technologies - 185 students
- Module 5 Badge: Locating relevant standards – 186 students
- **556 badges awarded**
- **86% conversion** (217 enrolled)

Hard Launch

Fall 2026

Full introduction to the senior capstone course (M1-M5).

- 295 students enrolled
- + Certificate in Entrepreneurship and Innovation
- STRT 492: Intellectual Property Management
- **Projection** +250 x 5 badges

Scale Up

Spring 2026

Looking beyond Purdue

Design for Medical Devices Conference, March 29-31, 2027

The University of Minnesota Twin Cities



The Role of Standards in Product Innovation

Educating the importance of standards related to emerging technology

Every emerging technology has to meet a set of technical standards and regulations before it can be sold, and most of the product development needs that. This five-module course covers what standards are and where they come from, how they shape a product through design, testing, manufacturing and use, why they change as the technology changes, what happens to companies that miss them, and how to locate the full text of the ones your own project needs. Real industry cases from electric vehicles to satellites to direct-to-cell 5G to semiconductor standards and more.

	MODULE	PARTS	CASE STUDY
IDEATION 	MODULE 1 Introduction to Standards & Regulations	1 Industries and their standards 2 Standards and technology innovation 3 Standards for emerging technologies 4 Where standards come from	Electric Vehicle, concept to showroom. Every stage has a standard already waiting: ISO 26262 for safety, IEC 62660 and UL 2580 for the battery, IATF 16949 for the factory, ISO 14040 for the footprint.
DESIGN TO USE 	MODULE 2 Standards for Emerging Technologies	1 Value of standards 2 How standards impact development 3 Design and testing standards 4 Manufacturing and usage standards	A phone call with no cell-tower in sight. Satellite direct-to-cell works only because everyone agreed on the same rules first: ITU-R IMT-2020, ETSI EN 303 978, ISO 14721.
SCALING UP 	MODULE 3 Standards Evolve With Technology	1 Why standards evolve 2 Key indicators for change 3 Powering and protecting the future	From 1 transistor in the 1950s to 92 Billion today. Standards were repeatedly revised to keep pace with chip scale-up: JESD22-A100, JESD51, JESD209, JEP30.
TRUST & MARKET ACCESS 	MODULE 4 Standards for Consumer Protection	1 Consumer-centric standards 2 Hardware safety standards 3 Software safety standards	The phone the airlines banned. Note7 batteries caught fire, and IEC 62133 and UL 2054 were rewritten around the failure. Standards are often written in hindsight, this is what that costs.
RESEARCH & DISCOVERY 	MODULE 5 Discovering & Accessing Standards	1 Approaches to discovery 2 Subscription databases 3 Standards indexes 4 Free sources	Knowing a standard exists is half the solution. Learn the ways through: indexes like ICS 35.030, library databases, and free full-text sources including the ANSI IBR Portal and the ASTM Reading Room.



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