



Information Systems Engineering & Management (ISEM) Overview

Graduate Studies in Technology Management with focus on Digital Transformation

The Information Systems Engineering and Management (ISEM) Program concentrates on the planning, engineering/re-engineering and management of Smart Businesses. ISEM supports management of large number of Digital Transformation Initiatives that are being launched in the public and private sectors around the globe. As displayed in Figure 1, a large number of digital technology components need to be planned, engineered and managed to support the existing and future enterprises and initiatives. Examples -- shown on the top layer of Figure1 -- are Smart Cities and Communities, Industry4.0 Enterprises, Digital Health Networks, eAgriculture Farms, Future Transportation Systems and many more. ISEM core courses focus on planning, engineering and management of these and other enterprises. Students can take electives to specialize in different topic areas displayed in Figure1. For example, students can specialize in technology management, smart cities and enterprises, digital transformation, AI for business, Techpreneurship, next generation technologies and others. Students with business and non-technical background can take beginning courses to gradually develop background in digital technologies.

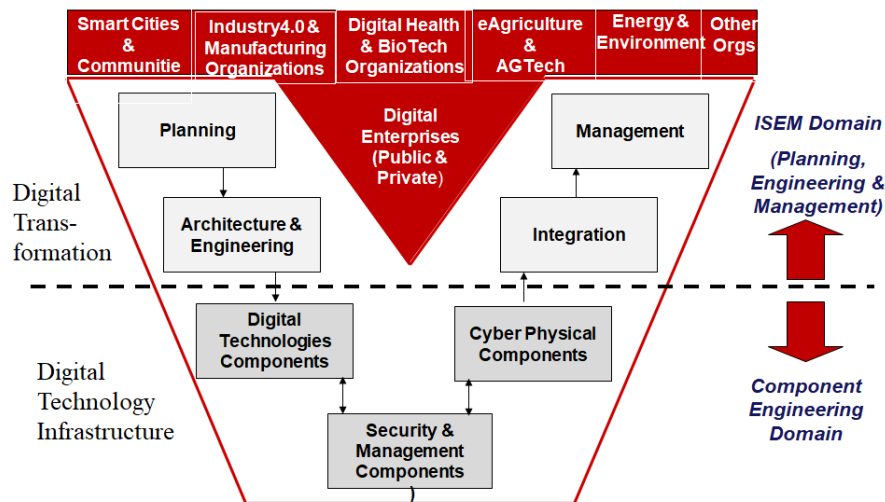


Figure1: How the Digital Technologies are Enabling Multiple Public and Private Sectors
(Based on: International Council on Systems Engineering - InCOSE)

The 36 semester hour MS Program in ISEM integrates knowledge from the following three active areas:

- **Information Systems:** latest digital technologies and approaches (e.g., artificial intelligence, Big Data, business intelligence, blockchains, cloud technologies, IoTs, satellites, web technologies, wireless communications)
- **Systems Engineering:** planning of digital transformations, enterprise architectures and integration of smart cities and smart communities, analysis and design of systems of systems that rely on people, processes and technologies
- **Management:** business strategies, entrepreneurship, strategic planning, cyber security and governance, global and agile enterprises

ISEM students gain knowledge of cutting edge technologies, systems engineering principles and management techniques and then apply them to sectors of their choice spanning, health, education, public safety, public welfare, energy, agriculture and others. The program emphasizes the entire Learn, Plan, Do, Check (LPDC) cycle instead of one narrow area of work (see Figure 2). Digital enterprises and the digital technologies that support such enterprises are at the center of ISEM. The core and recommended courses of the program allow the student to *Learn* about digital enterprises and technologies, *Plan* (i.e., translate their knowledge into working solutions), *Do* (i.e., architect, engineer and integrate the solutions), and *Check* (i.e., secure and manage the solutions).

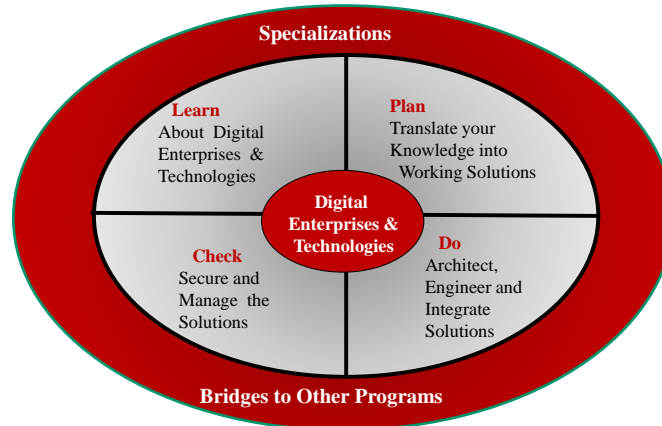


Figure 2: Conceptual View of ISEM

The student can then take elective courses in topics that span project management, analytics, multimedia management, entrepreneurship, digital health, enterprise management, leadership, financial aspects of systems, learning technologies, business intelligence, Internet technologies, information security and governance, mobile computing, and others. Specializations and “bridge courses” to other HU Programs, displayed as the outermost circle are also available to the ISEM students.

ISEM students may select well defined Concentrations (e.g., Techpreneurship, Next Generation Technologies and Quantum Information Sciences) or build their own specialization by taking different courses from the large pool of graduate courses available at HU to specialize in areas such as Technology Management, Smart Cities and Communities, and AI and BI for Business. Figure 3 shows a more detailed view of ISEM that displays the overall structure of the 36 semester hours (12 courses) program:

- The five core required courses that provide a mixture of technical and management background
- The five electives that can be chosen from a large pool of courses in diverse topic areas at HU Graduate School. The students may select these electives from any of these topic areas to build their own specialization or choose to specialize in predetermined concentrations. Well defined Concentrations and Specialization within Individualized Concentrations shown in Figure 2, are based on analysis of the job market and student needs.
- The two capstone courses that allow the students to synthesize their knowledge into an experiential project or a research thesis.

Degrees and Certificates from ISEM Program

- MS and PhD degrees in ISEM
- Post Master Certificate: Advanced Studies in Smart Enterprises (18 semester hours).
- Certificates for specializations in AI/BI for Business, Next Generation Technologies, Smart Cities & Communities, Technology Management, and Others (Build Your Own)

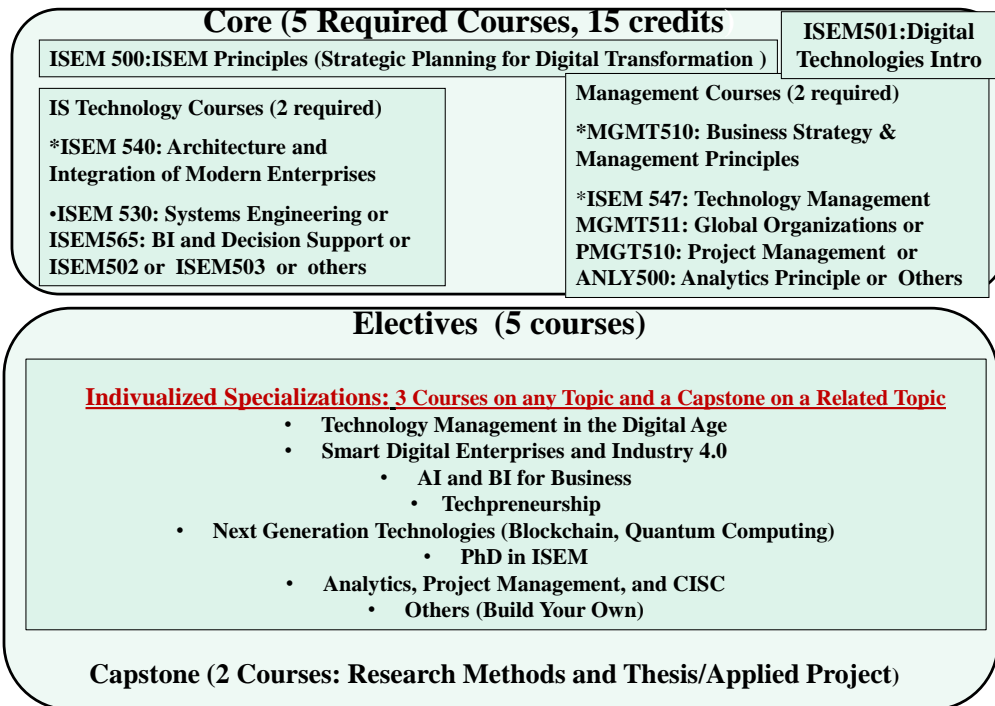


Figure 3: More Detailed View of ISEM Program

Concentrations Versus Specialization: A Concentration is a predetermined set of courses and is declared soon after a student enters the ISEM Program – it appears on a student transcripts. Instead of a predetermined Concentration, students may choose an Individualized Concentration that allows them to build their own specializations by focusing on areas of their own interest such as Technology Management and AI for Business. Specializations are much more flexible than predetermined Concentrations.

A Program for Career Change and/or Enrichment

ISEM is a very flexible interdisciplinary program that is especially suitable for *career change and/or career enrichment*. Table 1 displays the backgrounds of entering students, why do they join ISEM and how the ISEM concentrations/focus areas are of possible value to them.

How to Prepare for a PhD in ISEM

- Complete the ISEM Core courses (5 Courses)
- Select Specialization ‘PhD in Specialization’ that consist of the following courses:
 - ISEM530 – Systems Engineering
 - ISEM503 – Artificial Intelligence
 - GRAD 509 - Research Methods
 - Capstone with a Thesis Option

GOOD NEWS

MS in ISEM Program Ranked among the top 10 out of almost 400 well established Information Systems (IS) programs in the US

In a 2021 National Survey, ISEM Master's Degree Program Ranked among the top 10 out of almost 400 well established Information Systems (IS) programs in the US. ISEM is ranked better than Arizona State, Colorado State, GWU, NYU, Penn State, Purdue, UC Berkeley, UPenn and many more.

URL: <https://www.intelligent.com/best-masters-in-information-systems-degree-programs/>

Table1: Who Joins ISEM and Why (based on Data Collected from Student Orientations Since 2015)

Student Background	Why Do They Join ISEM	Possible Specializations
Computer science , software engineers and IT Specialists	To develop some management skills but also keep track of emerging technology management to prepare for positions in software project leadership, IT managers, and Techpreneurship	Technology Management, Techpreneurship, Smart Digital Enterprises, Project Management, etc
Business and management, financial and banking industries, Insurance, etc	To develop some technology background and possibly to transition into technology careers (e.g., IT Quality Assurance, Business Intelligence Specialists, Systems Analysts)	AI and BI for Business, Technology Management, Smart Digital Enterprises. Build Your Own
Engineers (civil, electrical, mechanical, aerospace, chemical, agricultural, etc)	To advance their careers and improve job prospects (e.g., smart cities, advanced manufacturing, eagricultural specialists, Techpreneurship)	Smart Digital Enterprises, Possibly Next Generation Technologies or Digital Infrastructure, Build Your Own
Others: lawyers, dentists, healthcare and life sciences specialists, fashion designers, etc	To apply latest developments in digital technologies to their domains (e.g., job changers, smart health specialists, entrepreneurs, legal information systems specials, website designers)	AI and BI for Business, Technology Management, Techpreneurship or Individualized Concentration

ISEM Program Flow, Areas of Focus and Additional Information

As shown in Figure4, all entering students take the IS Planning course (ISEM 500) that covers the core concepts of ISEM. Students with minimal or no training in IS/IT are required to take a *bridge* course on ICT principles (ISEM 501) that covers the needed IS/IT concepts through hands-on experiments. The student then takes two management courses and two IS/IT courses for a well-rounded background. After the 15 semester hours of required courses, the student can then take 15 semester hours in areas of their interest (management, IS/IT or mixture). The student can therefore study more management, more technologies or a mixture as part of the ISEM program. If needed, the student can use the 15 elective semester hours to specialize in concentrations and focus areas displayed in Figure2 and better explained in Table2. A student may also choose to build a customized program of study by taking different electives from different areas of study.

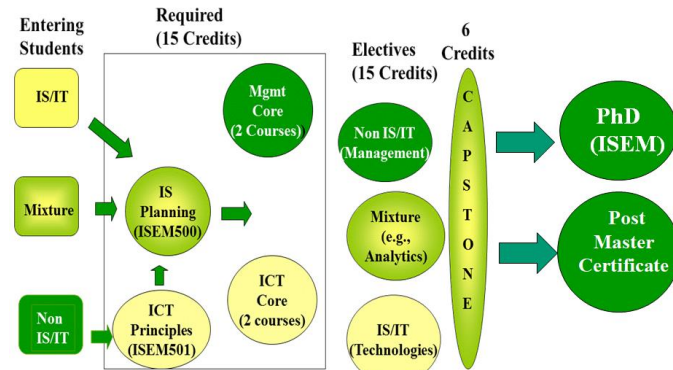


Figure 4: ISEM Program Flow

Table 2 shows the possible Areas of Focus/Concentrations and what career paths could they support. Exhibit 1 shows ISEM Courses at a glance. This information can be used for planning purposes. For course descriptions and administrative details, please consult the Graduate Catalog at MyHU home Page.

Table 2: ISEM Areas of Specializations/ Concentrations and the Possible Career Paths Supported

ISEM Specializations and/or Concentrations	Possible Careers
(DEFAULT) Technology Management in the Digital Age: take ISEM547 (Technology Management), 2 courses in MGMT and use Technology Management concepts in Capstone.	Manage, plan, architect & integrate the digital enterprises
Smart Digital Enterprises: take ISEM572 or ISEM558 and at least 6 semester hours from (ISEM503, ISEM565, ISEM530) & using smart enterprise concepts in Capstone.	Planners, Architects, System Analysts, Integrators and Managers
Techpreneurship (ENTP): take 9 semester hours in ENTP & Capstone in ENTP or choose the ENTP Concentration	Launch your own business in the technology sector or join one
Next Generation Technologies (Blockchains and Quantum Information Science): take at least 9 semester hours in QIS/BC and Capstone in NGT	R&D of BC & QIS solutions in supply chains, Cyber security, etc
AI and BI for Business: take at least 9 semester hours in AI/BI (e.g., ISEM503, ISEM565, ISEM761) and use AI/BI concepts in ISEM Capstone. or choose the NGT Concentration	Manage, lead or participate in future AI/BI applications
Digital IT Infrastructure (IoTs, 5G): take at least 9 semester hours in Digital Infrastructure (DI) -- e.g., ISEM534, ISEM536. ISEM555, ISEM558 -- and use DI concepts in Capstone	Technology Architect and a DI Specialist for Smart City Projects
Analytics, Project Management, and CISC Focus: take 3 courses from any of these programs and using any of these concepts in ISEM Capstone (thus having a double major).	Plan, architect. integrate and manage data & computer science initiatives
Build Your Own (BYO): Almost unlimited number of highly creative Specializations by combining any graduate course work in ISEM shown in Exhibit 1 with any other HU courses to meet the changing needs of modern digital enterprises. For example, a student can take two courses in digital health, one in security, one in analytics, and one in entrepreneurship to launch a unique company in health. Other examples of possible area of focus are Cyber Security, Management of Integration Projects, Digital Health, or any other topic area by taking 3 courses in those topics & a related Capstone.	A very large number of interesting scenarios. For example, an ISEM student with fashion degree took ISEM502 to start web design shop. Also, a practicing lawyer developed a legal information system for her country by taking ISEM courses. .

Post Master Certificate: Advanced Studies in Smart Enterprises (18 semester hours).

Complete all the following courses – the semester hour value of each course appears in parentheses ():

- ISEM 775 Advanced Design Project (3)
- ISEM 600-700 level course (3)
- Any other graduate courses (12) with focus on smart enterprises in different sectors (e.g., Smart Cities, Industry4.0, Digital Health, and Others)

EXHIBT 1: RECOMMENDED SPECIALIZATIONS: TECHNOLOGY MANAGEMENT Or SMART DIGITAL ENTERPRISES

Required courses are flagged with * and +.

First Semester

*ISEM 500: Strategic Planning for Digital Transformation (3 Credits)
*MGMT 510: Business Strategy & Management Principles (3 Credits)
or ISEM501: ISEM 501: Information & Communication Technologies

Second Semester

*ISEM 540 - Architecture and Integration of Smart Enterprises (3 Credits)
* ISEM 547: Technology Management for TM or MGMT 511, or PMGT510 or ANLY500

Semester 3 to 5 (Take Any Six courses from the following list - at least one should be from the

Required Pool with * and one from the pool with +)

*ISEM 502 - User-Centered Design (3 Credits)
*ISEM 503 - Artificial Intelligence Applications (3 Credits)
*ISEM 530 – Systems Engineering Principles (3 Credits)
*ISEM 565 - Business Intelligence and Decision Support Systems (3 Credits)
ISEM 534 - Database Design and Management (3 Credits)
ISEM 536: IT Infrastructure & the Cloud
ISEM 550 - Cyber Security Management (3 Credits)
+ISEM 558 - IoTs and Industry 4.0 (3 Credits)
+ISEM 572 - Smart Cities and Strategic Intelligence (3 Credits)
ISEM 574 - Block Chains and Trusted Systems (3 Credits)

NEW COURSES UNDER DEVELOPMENT :

- Market Engineering, E-Agriculture, Energy and Environment, Disaster Resilience and Management

Semester 5 and 6 -- ISEM Capstone (6 Semester Hours):

- GRAD 695: Research Methods & Writing
- GRAD699/ISEM 699: Applied Project or Research Thesis

Extending MS in ISEM by Pursuing Advanced Studies in Smart Enterprises

The Post Master Certificate (Advanced Studies in Smart Enterprises) gives an opportunity to students to further explore the developments in several vertical Smart Digital Enterprises. This 18 semester hours program allows you to:

- Select courses such as: ISEM72 (Smart Cities), ISEM558 (IoTs and Industry 4.0), ISEM 543 (Digital Health), and others in Agriculture and Energy.
- Take advanced courses in Machine Learning Applications and Satellite Applications
- Do a Capstone (ISEM 775 Advanced Design Project) to design an innovative solution that leverages your knowledge gained so far.

Exhibit2: ISEM Courses and Other Related Courses at a glance (Please Refer to HU Catalog for Additional Information)

<p><u>Core Courses for MS in ISEM (15 semester hours)</u></p> <ul style="list-style-type: none"> • ISEM 500: Strategic Planning for Digital Transformation • MGMT 510: Business Strategy & Management Principles • ISEM 540: Architecture & Integration of Smart Enterprises • ISEM 502 or ISEM503, or ISEM530 or ISEM565 or ISEM574 ENTP500 or QISC530 or CISC510 or LTMS531 • MGMT 511 or PMGT510 or ANLY500 or ISEM528 or ENTP510 or QISC550 <p>NOTE: You can take more than 1 course from 'Or' list (as elective)</p> <p><u>ISEM Capstone (6 Semester Hours)</u></p> <ul style="list-style-type: none"> • GRAD 695: Research Methods & Writing • GRAD699/ISEM 699: Applied Project or Research Thesis <p style="text-align: center;"><u>ISEM Elective Courses</u></p> <p><u>Digital Technology Courses</u></p> <ul style="list-style-type: none"> • ISEM 501: Introduction to Digital Technologies • ISEM 534: Database Design and Management • ISEM 536: IT Infrastructure & the Cloud • ISEM 551: Web-based Software Engg • ISEM555: Mobile Computing and Wireless Communications • ISEM 558: IoTs and Industry 4.0 • ISEM570: IT Quality Assurance <p><u>Business Intelligence (BI) Related Courses</u></p> <ul style="list-style-type: none"> • ISEM 503: Artificial Intelligence Principles and Applications • ISEM564: Big Data & Machine Learning • ISEM 565: Business Intelligence & Decision Support • ISEM572: Smart Cities and Strategic Intelligence <p><u>Enterprise Engineering Courses</u></p> <ul style="list-style-type: none"> • ISEM 530: Systems Engineering Principles • ISEM 550: Cyber Security Management • ISEM 525: Business Process Modeling & Workflow • ISEM539: Enterprise Architectures Frameworks • ISEM 560: eGovernment and eCommerce 	<p><u>Techpreneurship (ENTP) Courses</u></p> <ul style="list-style-type: none"> • ENTP 500 Entrepreneurship and Innovation • ENTP 510 Entrepreneurship:: From Traction to Scale • ENTP 520 Economics of Innovation • ENTP 530 Financial Sustainability <p><u>Quantum Information Science (QISC) Courses</u></p> <ul style="list-style-type: none"> • QISCS530-Foundations of Quantum Information Science • QISC550-Programming Quantum Computers • QISC570-Algorithms and Applications of Quantum Computing • QISC699-Applied Project in Next Generation Technologies • QISC575 Emerging Topics in Quantum Information Science <p><u>Blockchain and Industry Analysis Courses</u></p> <ul style="list-style-type: none"> • ISEM 574: Block Chains and Trusted Systems • ISEM 5xx: Ethereum and Smart Contract Programming • ISEM 5xx: Blockchain Applications and Scalability • ISEM 515: Commercialization of New Technologies • ISEM 528: Industry Analysis & Technology Patterns <p><u>Enterprise Management & Entrepreneurship Courses</u></p> <ul style="list-style-type: none"> • ISEM 547: Technology Management • MGMT 512: Marketing in the Digital Age • MGMT 513: Financial and Managerial Accounting • MGMT 531: Business Entrepreneurship Principles • MGMT 532: Business Entrepreneurship Management • MGMT 533. Business and Entrepreneurial Financing <p><u>Digital Health and Life Sciences Courses</u></p> <ul style="list-style-type: none"> • ISEM 521: Life Science for IT Professionals • ISEM 541: Healthcare Systems • ISEM 542: Health Informatics • ISEM 543: Digital Health • ISEM 545: Healthcare Data <p><u>ADVANCED COURSES IN ISEM:</u></p> <ul style="list-style-type: none"> • ISEM 735 Advanced Applications of Machine & Deep Learning • ISEM 720 Advanced Application of Satellites <p>COURSES FROM OTHER PROGRAMS: CISC, ANLY, PMGT, etc</p>
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