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Enhancing Teaching and Learning and Graduate Employability
through University-enterprise Cooperation

ELEGANT

Curriculum Innovation in Artificial Intelligence and Machine Learning: Enabling Teaching-Research Nexus

Webinar

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Engineering Practice and Computer Engineering Curriculum

- Bureau of Labor Statistics (BLS, US) shows that computer occupations are expected to increase 17.7% by 2022
- Among the top emerging technologies:
  - Internet of Things
  - **Artificial Intelligence and Machine Learning**
  - 5G
  - Serverless Computing
  - Blockchain (Cybersecurity)
  - Robotics
  - Virtual Reality/Augmented Reality
  - Drones

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Computer Engineering Education & Employability

- General list of employability skills
- Choice of skills depends on job market (Example national list)
- Essential input in curriculum design to enable good professional practice

Personal Skills	Attitudes	Traits
Communication skills	Responsibility	Initiative
Personal presentation skills	Optimism	Sensitivity
IT and computer skills	Curiosity	Flexibility
Problem solving	Ambition	Individuality
Leadership	Desire for challenge	Sincerity
Visioning skills	Cooperation	Creativity
Goal-setting skills	Vitality	A balanced personality
Self-assessment skills		Entrepreneurial mind
Workplace-related life skills		
Health & workplace safety		

Employable personal qualities

- Communication skills
- Intercultural communication Skills
- Emotional Intelligence skills
- Creativity
- Teamwork
- Career management competences
- Computer skills/Digital Competences
- Learning skills
- Entrepreneurship skills
- Community and citizenship knowledge
- Organization & Time Management
- Information & communication literacy
- Problem solving
- Decision making
- Leadership
- Research skills

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Integration into Curriculum

Design Perspective 2
Key **Characteristics** of Computer Engineering Graduates

- System Level Perspective
- Depth and Breadth
- Design Experiences
- Use of Tools
- Professional Practice
- Communication Skills

Design Perspective 1
Curriculum **Components**

Good integration op.

Culminating Design Courses

Practicum, Internship, or Co-op Programs

Entrepreneurial Innovation Courses

Professionalism, Ethics, and Law Courses

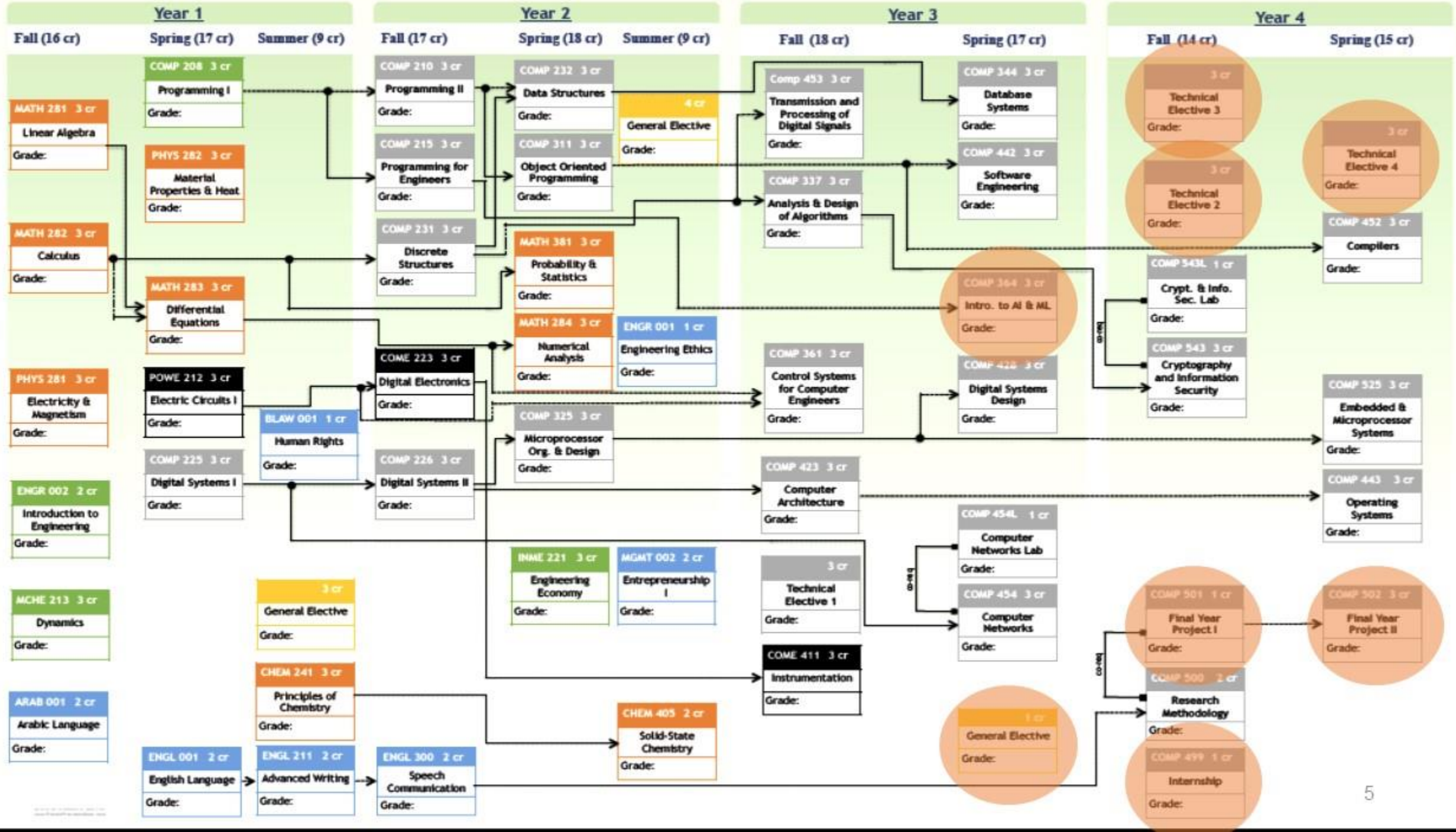
Team-based Implementation Courses

Good integration op.

Well-articulated in ABET EAC Student Outcomes 1 through 7

Well-observed in ACM/IEEE Curriculum Recommendations, Computer Engineering, 2016.

Circuits and Electronics	Computing Algorithms	Computer Architecture and Organization	Digital Design	Embedded Systems	Computer Networks
Preparation for Professional Practice	Information Security	Signal Processing	Systems and Project Engineering	Systems Resource Management	Software Design


Year 1
Fall (16 cr)
Spring (17 cr)
Summer (9 cr)
Year 2
Fall (17 cr)
Spring (18 cr)
Summer (9 cr)
Year 3
Fall (18 cr)
Spring (17 cr)
Year 4
Fall (14 cr)
Spring (15 cr)
MATH 281 3 cr
Linear Algebra
Grade:
MATH 282 3 cr
Calculus
Grade:
PHYS 281 3 cr
Electricity & Magnetism
Grade:
ENGR 002 2 cr
Introduction to Engineering
Grade:
MCHE 213 3 cr
Dynamics
Grade:
ARAB 001 2 cr
Arabic Language
Grade:
COMP 208 3 cr
Programming I
Grade:
PHYS 282 3 cr
Material Properties & Heat
Grade:
MATH 283 3 cr
Differential Equations
Grade:
POWE 212 3 cr
Electric Circuits I
Grade:
COMP 225 3 cr
Digital Systems I
Grade:
BLAW 001 1 cr
Human Rights
Grade:
3 cr
General Elective
Grade:
CHEM 241 3 cr
Principles of Chemistry
Grade:
ENGL 001 2 cr
English Language
Grade:
ENGL 211 2 cr
Advanced Writing
Grade:
ENGL 300 2 cr
Speech Communication
Grade:
COMP 210 3 cr
Programming II
Grade:
COMP 215 3 cr
Programming for Engineers
Grade:
COMP 231 3 cr
Discrete Structures
Grade:
COME 223 3 cr
Digital Electronics
Grade:
COMP 226 3 cr
Digital Systems II
Grade:
COMP 232 3 cr
Data Structures
Grade:
COMP 311 3 cr
Object Oriented Programming
Grade:
4 cr
General Elective
Grade:
MATH 381 3 cr
Probability & Statistics
Grade:
MATH 284 3 cr
Numerical Analysis
Grade:
COMP 325 3 cr
Microprocessor Org. & Design
Grade:
INME 221 3 cr
Engineering Economy
Grade:
MGMT 002 2 cr
Entrepreneurship I
Grade:
CHEM 405 2 cr
Solid-State Chemistry
Grade:
ENGR 001 1 cr
Engineering Ethics
Grade:
Comp 453 3 cr
Transmission and Processing of Digital Signals
Grade:
COMP 337 3 cr
Analysis & Design of Algorithms
Grade:
COMP 361 3 cr
Control Systems for Computer Engineers
Grade:
COMP 423 3 cr
Computer Architecture
Grade:
3 cr
Technical Elective 1
Grade:
COME 411 3 cr
Instrumentation
Grade:
COMP 344 3 cr
Database Systems
Grade:
COMP 442 3 cr
Software Engineering
Grade:
COMP 364 3 cr
Intro. to AI & ML
Grade:
COMP 428 3 cr
Digital Systems Design
Grade:
COMP 454L 1 cr
Computer Networks Lab
Grade:
COMP 454 3 cr
Computer Networks
Grade:
1 cr
General Elective
Grade:
3 cr
Technical Elective 3
Grade:
3 cr
Technical Elective 2
Grade:
3 cr
Technical Elective 4
Grade:
COMP 452 3 cr
Compilers
Grade:
COMP 543L 1 cr
Crypt. & Info. Sec. Lab
Grade:
COMP 543 3 cr
Cryptography and Information Security
Grade:
COMP 525 3 cr
Embedded & Microprocessor Systems
Grade:
COMP 443 3 cr
Operating Systems
Grade:
COMP 501 1 cr
Final Year Project I
Grade:
COMP 502 3 cr
Final Year Project II
Grade:
COMP 500 2 cr
Research Methodology
Grade:
COMP 499 1 cr
Internship
Grade:

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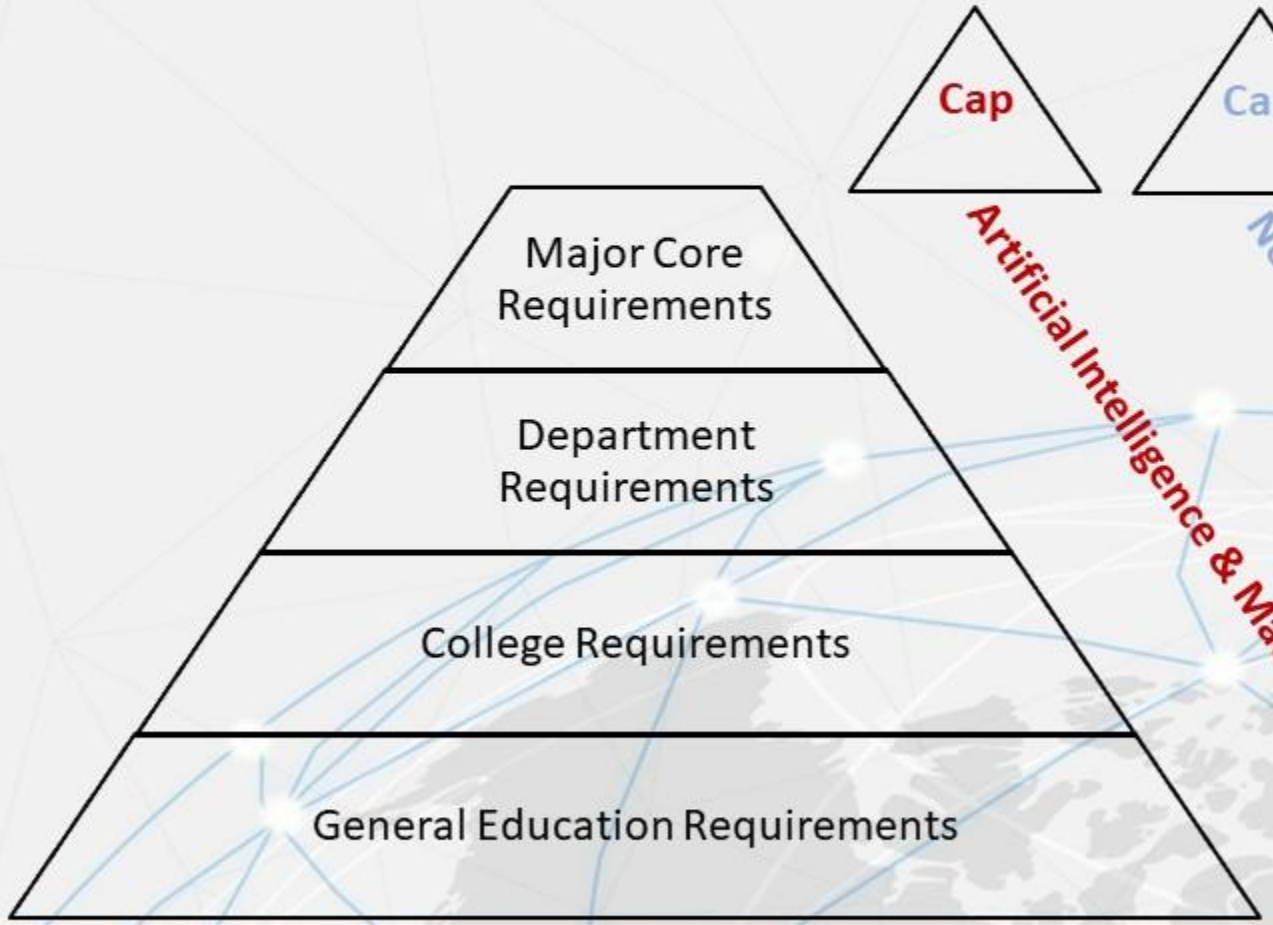
Artificial Intelligence and Machine Learning Track

BAU Computer Engineering Program



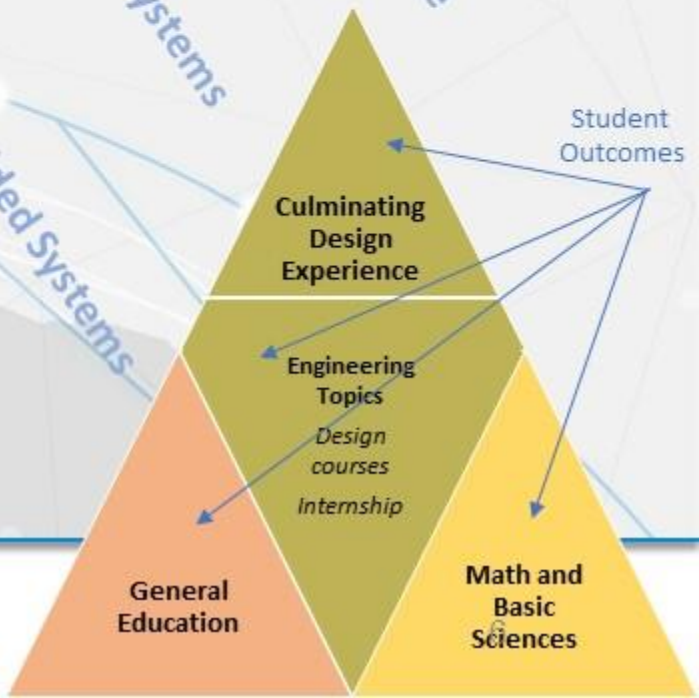
Artificial Intelligence & Machine Learning

Networks & Cybersecurity

Hardware and Embedded Systems

Software Systems

Free Choice



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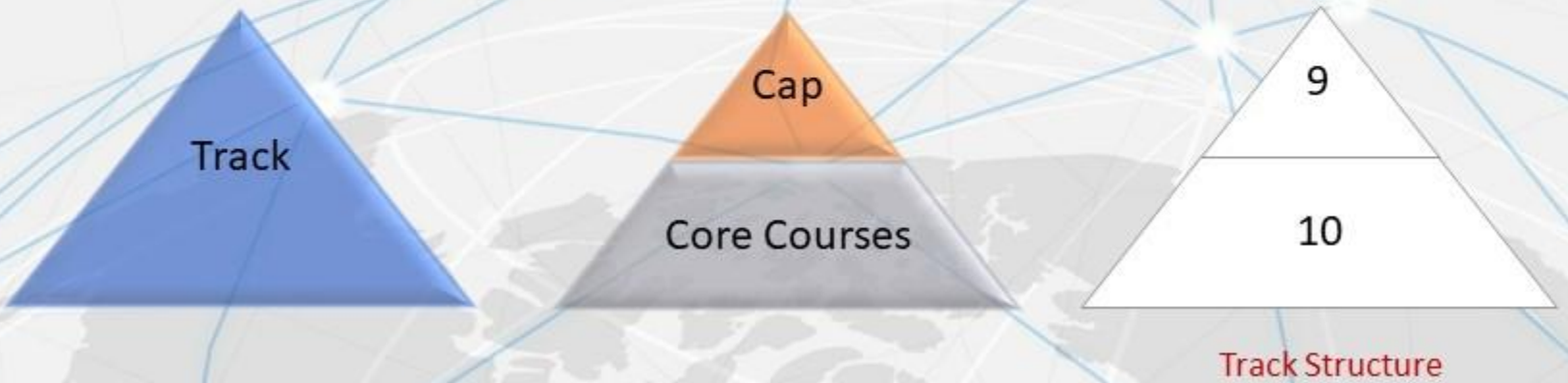
Cap and Track Structures

- A Track is a preset list of 19 Credits of major core and elective courses.
- A Cap is a preset list 9 Credits of Elective Courses.
- A Track has a 10-Credit foundation from Core Courses and a Cap.
- Select a Cap of elective courses and join a Track.



Track Structure

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Artificial Intelligence and Machine Learning Track

Introduction to Computer Programming

Intermediate Computer Programming

Data Structures and Algorithms

Introduction to Artificial Intelligence and Machine Learning

Capstone Design Project: Artificial Intelligence and Machine Learning

Track Elective in AI &Ml 1

Track Elective in AI &Ml 2

Track Elective in AI &Ml 3

Computer Vision	Smart Cities	Autonomous Vehicles	Human Computer Interaction	Machine Learning in Hardware	Bio-inspired Computing	Fuzzy Logic	Artificial Intelligence	Deep Learning
Machine Learning	Computer Vision	Programming in Python	Big Data Analytics	Data Visualization	Natural Language Processing	Computational Linguistics	Model Cognition and Human Reasoning	Data Mining

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Intelligent Hardware Research Group

- An Enabling Academic Structure
- Mission:
  - The Intelligent Hardware (iHW) Research Group is a dynamic constituent of its wider community and aims at making world-class research contributions, disseminating knowledge, and building collaborations.
- Primary Research Interests:
  - Hardware Design
  - Performance Evaluation
  - Smart Cities
  - Artificial Intelligence and Machine Learning

iHW
intelligent hardware research group

ASME
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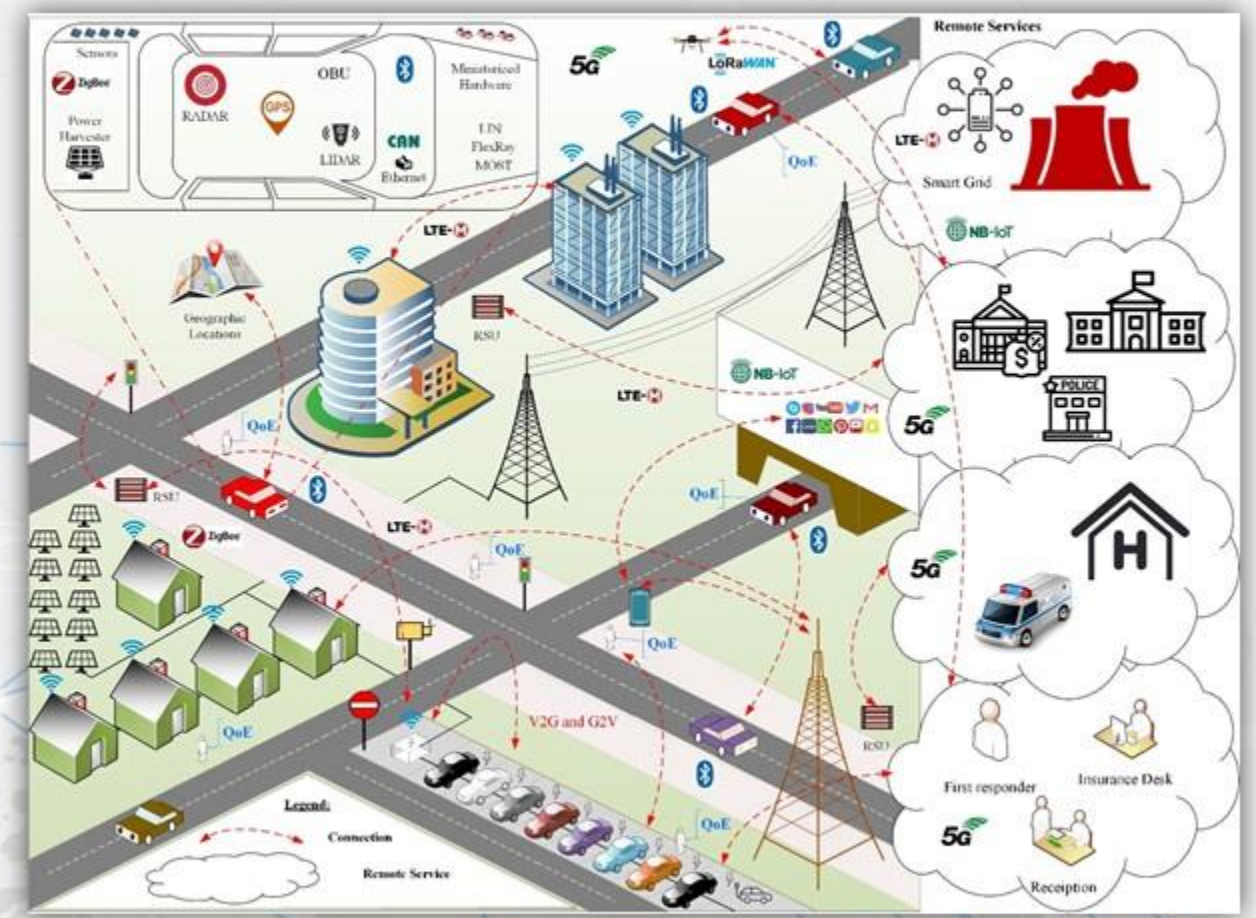
Teaching-Research Nexus

- **Course COMP 438 Performance Evaluation**
- An iHW Research Group Project
- Research Team
  - I. Damaj, S. Al Khatib, T. Naous, W. Lawand, and Z. Abderazzak
- Survey Paper Objectives:
  - **Present** applications within ITS where ML is of benefit.
  - **Identify** MHDs that satisfy the needs of ML-driven ITS.
  - **Identify** the choice factors of ML techniques and MHDs.
  - **Synthesize** different taxonomies.
  - **Develop** an evaluation framework that enables cross-matching.
  - **Validate** the developed framework.
  - **Analyze** common and good practices.
  - **Determine** important limitations and gaps.
  - **Refine** a set of pointers to future directions.

Intelligent Transportation Systems: A Survey on Modern Hardware Devices for the Era of Machine Learning



Under Review by IEEE Transactions on ITS