

TAIST-Tokyo Tech Artificial Intelligence and Internet of Things Program

**(Even we plan to approve the program in academic year 2020,
it may delay to academic year 2021)**

**Master of Engineering Program in
Artificial Intelligence and Internet of Things**

**Master of Engineering Program in Artificial Intelligence and Internet of Things
(International Program)**

In this curriculum, we study science and technology related to artificial intelligence (AI) and internet-of-things (IoT), including concepts and hand-on practices related to AI and IoT for both software and hardware components. When “things” such as wearable devices, cameras, home appliances, digital assistants, sensors and other digital equipment are connected to the internet, we have a large amount of various data. Such data can be processed and analyzed by artificial intelligence in order to perform optimization, then provide good suggestions, and take suitable actions. We aim to produce graduates who apply AI and IoT to create innovations and/or new technology.

1.	Compulsory Courses	15	Credits
2.	Compulsory Elective Courses	3	Credits
3.	Technical Elective Courses	6	Credits
4.	Master’s Thesis	15	Credits
		39	Credits

Course Code	Curriculum 2020/2563	Credits
ICT700	Software Concept for Artificial Intelligence and Internet of Things	3 (3-0-9)
ICT710	Software Design for Artificial Intelligence and Internet of Things	3 (2-3-7)
ICT720	Hardware Concepts for Artificial Intelligence and Internet of Things	3 (3-0-9)
ICT730	Hardware Designs for Artificial Intelligence and Internet of Things	3 (2-3-7)
ICT740	Communication Theory and Connectivity	3 (3-0-9)
ICT750	Digital Signal Processing and Internet of Things	3 (3-0-9)
ICT760	Data Science and Intelligence Processing	3 (3-0-9)
ICT770	Control Theory and Smart Control	3 (3-0-9)
ICT780	Current Topics in Artificial Intelligence and Internet of Things	3 (3-0-9)
ICT781	Advanced Topics in Artificial Intelligence and Internet of Things	3 (3-0-9)
ICT782	Selected Topics in Artificial Intelligence and Internet of Things	3 (3-0-9)

Curriculum 2020/2563 (new)	
<p>ICT700 Software Concept for Artificial Intelligence and Internet of Things</p> <p>Introduction to artificial intelligence (AI) and internet-of-things (IoT) systems. AI concepts: searching, inferencing, reasoning, knowledge representation, fuzzy theory, planning, decision making, machine learning, deep learning, and multi-agent processing. Data structures, sequential and binary searches, merging and sorting for AI. IoT concepts: software issues in design of IoT systems, communications and networking, real-time system design, software design, verification and testing.</p>	3(3-0-9)
<p>ICT710 Software Designs for Artificial Intelligence and Internet of Things</p> <p>Hand-on training and experiments on artificial intelligence (AI) and internet-of-things (IoT) systems, including software design, verification and testing for artificial intelligence (AI) and internet-of-things (IoT) system, software concepts on microcontroller architectures and peripherals, software implementation of AI and IoT systems communication and algorithms. Examples of applications for Railway Electronics or Electrification.</p>	3(2-3-7)
<p>ICT720 Hardware Concepts for Artificial Intelligence and Internet of Things</p> <p>Basic digital system design for artificial intelligence and internet of things, processor architecture design for artificial intelligence and internet of things, AI hardware design: control parts, peripherals, device interfaces, FPGA hardware implementation for communications and networking related to for artificial intelligence and internet of things. AI accelerator, smart sensors, ARM architecture, Single-board microcontroller, GPU architecture, Microelectromechanical systems (MEMS) architecture.</p>	(3-0-9)
<p>ICT730 Hardware Designs for Artificial Intelligence and Internet of Things</p> <p>Hand-on training and experiments on basic digital system design for artificial intelligence (AI) and internet of things (IoT), testing and experiments on the control parts, peripherals, device interfaces, FPGA hardware implementation hardware for communications and sensor interfaces related to for artificial intelligence and internet of things. Examples of applications for Railway Electronics or Electrification.</p>	3(2-3-7)
<p>ICT740 Communication Theory and Connectivity</p> <p>Information theory, communication systems, wireless communications, wireless channel characteristics, link budget, source coding and decoding, channel coding and decoding, modulation techniques, multiple-access techniques, wireless networks, wireless network protocols and standards, mobile networks, RFID, communication for Internet of Things, communication protocol: Bluetooth, LPWAN such as LoRA, Wi-Fi, and WAN. Cryptography and Network Security.</p>	3(3-0-9)
<p>ICT750 Digital Signal Processing and Internet of Things</p> <p>Digital signal processing theory, video and audio processing, discrete-time signals and systems, linear time-invariant systems, sampling of continuous-time signals and convolution, finite and infinite impulse response filter designs, discrete Fourier transform, fast Fourier transform algorithms, relations between Fourier transforms: discrete-frequency Fourier transform, Fourier series, discrete-time Fourier transform, and discrete Fourier transform. Image and speech coding and decoding, trans-multiplexers, filter banks, channel estimation and equalization, synchronization, array processing, power spectral estimation, adaptive filtering, analog digital converter and digital analog converter algorithms, digital signal processing on Internet of Things.</p>	3(3-0-9)
<p>ICT760 Data Science and Intelligence Processing</p> <p>Introduction and application of data science, data mining and data analytics; classification, regression, clustering, and association rule mining. Eigenvalues, singular values, PCA, gradient descent, stochastic gradient descent, and block coordinate descent. MapReduce programming model. Human interface, computer graphic, concept and design of human-computer interface, trends of human interface design, graphic user interface, interactive software design, hardware technology for human interface, presenting and animating two- and three-dimensional objects. AR/VR concept, Digital Twin concept, Human sensory information processing.</p>	3(3-0-9)

ICT770 Control Theory and Smart Control	3(3-0-9)
Control system theory, control system description, State space description of systems, Sampling of systems, Stability, Robustness, Controllability and Observability, State space design, Pole placement dynamics of typical controlled systems, Introduction to advanced control topics: optimal control, Adaptive control systems. Smart analytic tools for predicting system response and performance, applications for artificial intelligence and internet of things, Smart control system; Examples of applications for railway control systems; Design of a cyber-physical system.	
ICT780 Current Topics in Artificial Intelligence and Internet of Things	3(3-0-9)
Current topics in artificial intelligence and internet of things at the master's degree level. Topics are subject to change each semester.	
ICT781 Advanced Topics in Artificial Intelligence and Internet of Things	3(3-0-9)
Advanced topics in artificial intelligence and internet of things at the master's degree level. Topics are subject to change each semester.	
ICT782 Selected Topics in Artificial Intelligence and Internet of Things	3(3-0-9)
Selected topics in artificial intelligence and internet of things at the master's degree level. Topics are subject to change each semester.	
ICT801 Thesis	15 credits
This course guides students how to develop and carry out master research in the field of artificial intelligence and internet of things as well as related information and communication technology: Thesis writing, thesis presentation, publication, and research ethics.	