

Gifted Education Fund: Off-school Advanced Learning Programmes

Title of Programme	AIoT Coding, Engineering and Entrepreneurial (AIoT CE²) Skills Education for Gifted Students
Programme Provider	Department of Electrical Engineering, City University of Hong Kong
Theme	<ul style="list-style-type: none"> • STEM-related Mentorship Programme • Self-initiated Research Study
Maximum No. of Participants and Class Level in the 2021/22 School Year	40 students (Secondary 4-5)
Pre-requisite	<ul style="list-style-type: none"> • Applicants should demonstrate great interest and outstanding performance in mathematics, and should be experienced in at least one computer programming language such as Python, C/C++, Java, JavaScript, etc. • They should also show eagerness to learn how to setup business in AIoT (Artificial Intelligence and Internet of Things) domain. At recruitment stage, applicants will be required to present an initial start-up idea for solving a real daily life problem.
Programme Delivery Period	From June 2022 to March 2023 (10 months) (tentative)
Medium of Instruction	Course Material: English Class teaching/ Discussion: English supplemented with Cantonese
Objectives	<ul style="list-style-type: none"> • To provide gifted students with knowledge of foundation mathematics for use in artificial intelligence (AI) and Python programming for development of relevant applications; • To equip students with engineering skills and experiences, through practical and projects, to design and implement AI models and also the Internet of Things (IoT) devices by using advanced hardware and software utilised in the industry; • To provide an opportunity for students to demonstrate their creativity and talents by presenting their designs to representatives of technology companies and other participants in a large-scale event; • To nurture positive values and attitudes among students such as ethical use of AIoT for the well-being of mankind and perseverance to overcome problems; and • To develop students' abilities and relevant experiences needed to turn an idea into a seed project in the start-up ecosystem.
Programme Outline*	This programme aims to equip the gifted students with the knowledge and skills in solving authentic problems in daily life with AI and IoT. Besides studying the theories and the mathematics underlying machine learning, hardware and software design, and also evaluation of the AI models designed by students are covered

in this programme. Positive values and attitudes essential for students' growth and development are also emphasised in this programme. The programme consists of six phases.

Phase I: Foundational guest lectures on AI, IoT and entrepreneurship (12 hours in total)

- Lectures to be conducted by academics and start-up leaders with relevant experiences
- Students will acquire background knowledge of AI, IoT, Hong Kong and global start-up ecosystem, incubation and various funds available, intellectual property protection, business plan writing, etc.

Phase II: Acquisition of knowledge of Python programming (12 hours in total)

- Lectures with practical
- Students will acquire knowledge of Python programming, from basic to advanced progressively, and learn to create a GitHub repository.
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Phase III: Basic theory of AI and machine learning, hands-on AI coding in Python (18 hours in total)

- Lectures and laboratory sessions
- Students will learn the history and development of AI and machine learning, and build their own convolutional neural network (CNN) models to solve real world problems using open-source dataset.

Phase IV: Basic FPGA design using Python Productivity for ZYNQ (PYNQ) (12 hours in total)

- Lectures and laboratory sessions
- Students will learn basic FPGA design using Python Productivity for ZYNQ (PYNQ) and create a quantized neural network (QNN) model running on the PYNQ board. A hardware-assisted image recognition model running on the PYNQ board will be built.

(Note: FPGA is the short form of Field Programmable Gate Array and ZYNQ is the ARM-based System on Chip [SoC].)

Phase V: AI Internet of Things (AIoT) Design (10 hours in total)

- Lectures and laboratory sessions
- Students will learn the AIoT design and Printed Circuit Board (PCB) designs of the extension board for the PYNQ board. They will then propose and build their own AIoT applications with the PYNQ board as a project.
- Students will meet their mentors regularly to update their project progress and seek advices from their mentors.

Phase VI: HK Tech 300 start-up project pitching competition/ presentation/ exhibition and experience sharing/ publishing a proceeding to consolidate the learning outcomes from students

- Students will prepare and participate in a one-day exhibition at City University of Hong Kong to showcase their talents and achievements through project presentation and experience sharing with parents, teachers and other guest participants.
- During the start-up project pitching competition, students' projects and presentations will be judged by a panel consisting of representatives from major technology companies.
- Each student is required to submit a summary report on self-reflection of his/ her learning journey by the end of the programme. The summary reports will be compiled as a proceeding for dissemination.

* In view of the latest development of the COVID-19 pandemic, the programme provider may need to modify the learning and teaching activities as a contingency.