香 港 資 優 教 育 學 苑
The Hong Kong Academy for Gifted Education

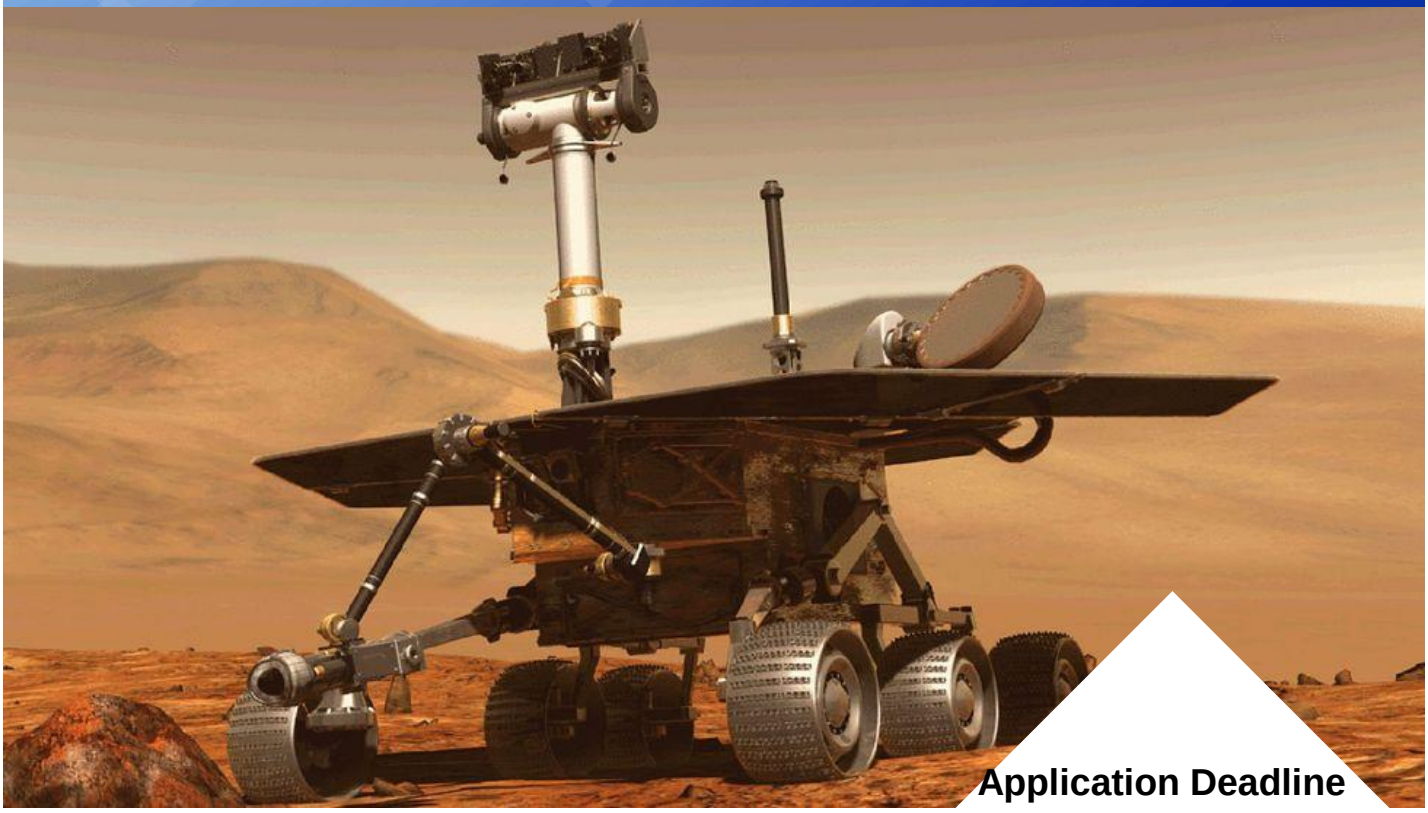
A4AER002C
(Token- required)

## Aerospace Course (Level IV)

# Space Mission (Phase II)

## - Mars Exploration Rover Engineering

10Botics Limited



**Application Deadline**
~~25 Jan 2023 12:00 noon~~
29 Jan 2023 12:00 noon

**Result Release**
~~30 Jan 2023~~
1 Feb 2023

## Intended Learning Outcomes

Upon completion of the programme, participants should:

1. Design and prototype a Mars rover using the rocker-bogie suspension system, with the goal of creating a rover that is capable of navigating the challenging Martian terrain.
2. Program a microcontroller in C++ to process wireless commands and implement a Six-Wheel-Drive (6WD) motor control system;
3. Develop a strong understanding of the principles of robotic engineering, including how to design and build a robot from scratch using construction hardware and electronic modules rather than relying on pre-built kits;

If student members withdraw from the programme after the Application Deadline, the token will be deducted.

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# Introduction

Tired of all those robotic toys? Are you ready for the next level to design and build your own?

Join HKAGE and Billy Hau, an aerospace enthusiast and former NASA engineer, on an exciting journey to explore the engineering technologies behind Mars robotic rovers!

This course is designed for students interested in exploring the field of robotic engineering and designing their own Mars rover prototypes. Through hands-on projects and interactive lessons, students will learn how to use Arduino microcontrollers and C++ programming to create a rover that can navigate and explore the surface of Mars. They will also learn about the rocker-bogie suspension system and how it can be applied to enable a rover to handle the rough terrain of Mars. In addition to building and programming their own rovers, students will also gain a deeper understanding of the principles of robotic engineering and how to design and build robots from scratch using construction materials and mechatronics. By the end of the course, students will have a fully functional Mars rover prototype and the skills and knowledge to continue exploring the exciting world of robotics.

The course consists of Three phases. Phase 1 finished on 4 Feb. If you are interested, you are welcome to apply for Phase 2.

The Phase 3 course on Aircraft Design is tentatively scheduled for April to May 2023.

# Schedule (Phase II)

| Session | Date | Time | Venue | Topic |
|---|---|---|---|---|
| 1 | 11 Feb 2023 | 9:00am – 1:00pm | HKAGE | Robotic Engineering: AI & Mechatronics Overview |
| 2 | 18 Feb 2023 | | | Microcontrollers & C++ Programming |
| 3 | 25 Feb 2023 | | | Rocker-Bogie Suspension Mechanism |
| 4 | 4 Mar 2023 | | | Six Wheel Drive (6WD) Motor Controls |
| 5 | 11 Mar 2023 | | | Telemetry and Wireless Communications |
| 6 | 18 Mar 2023 | | | Sensors and Actuators |
| 7 | 25 Mar 2023 | | | Rover Pilot Training |
| 8 | 25 Mar 2023 | 2:30pm – 4:30pm | | Rover Off-Road Challenge |

**Enquiries** 3940 0101 programme@hkage.org.hk

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## Target Participants

- **S1 – S6** HKAGE student members in 2022/23 school year
- Priority will be given to student members who have participated in phase 1 (A4AER001C)
- Class size: 30

## Medium of Instruction

Cantonese with English handouts

## Certificate

E-Certificate will be awarded to participants who have:

- fulfilled **80%** attendance of the programme; AND
- completed **all the assignments** with satisfactory performance

## Screening

All applicants please answer the screening question in the online application form.

*The screening question is designed to help the applicant understands the course level and the course content. The question must be answered by the student applicant and it can only be attempted once. The answer cannot be changed once the application is submitted. Selection is based on students' performance in answering the question. Only students who can demonstrate passion, motivation and the knowledge of Aerospace Engineering in the screening question can be enrolled in the programme.

## Technical Requirements

- The course will make use of software development tools to program the robot. Therefore, students **are required to** bring a **laptop** to attend the course.
- The mobile rover controller used in the course for real-time driving is available on **Android** only. Therefore, students are highly encouraged to bring an Android device, or join a team with someone who has an Android smartphone. Alternately, a laptop version of the rover controller is available as well, though not as convenient.
- A standard **USB port** or **Adapter** is required

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