Young Defence Scientists Programme (YDSP)
World of Science 2022

Module	Synopsis	Date and Time	Venue	Allocation	Prerequisites
Artificial Intelligence	The module presents a broad overview of Artificial Intelligence (AI) and aims to give students an appreciation of current AI topics and a basic understanding of their underlying concepts. Topics to be covered: - Introduction to AI - Computational Thinking - Natural Language Processing - Computer Vision - Social AI - Lecture by NUS Professor on Computational Thinking - Lecture by SUTD Professor on Social AI Hands-on AI Workshop: - Game AI Agent 2.0 - Revised version from the popular game AI workshop conducted in 2021. - The goal remains the same: Program your agent to navigate and complete tasks in a sandbox environment, but with much more game mechanics and a higher difficulty level - Competitive hackathon – Immerse in a highly competitive and exciting code-camp environment to create your truly intelligent agent to defeat your competitors!	31 May - 2 Jun (3-day workshop) 9am - 5pm	DSO (12 Science Park Drive)	Up to 2 seats per school	Strong interest in Artificial Intelligence, Cognitive Science and Computer Science. Knowledge in basic programming skillset (Python, C++ preferred)

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Cryptography	From the days of the Caesar cipher to the complex cryptosystems and protocols that we use in everyday applications today, cryptography is a time-honoured field that will remain relevant for as long as secrets exist. Our privacy, identity and communications are all protected by various cryptographic algorithms and protocols that have to withstand scrutiny and attacks by malicious parties. In this Cryptography module, you will learn about some of the most important algorithms used in private key and public key cryptography today. You will also learn about how important Mathematical concepts such as number theory and algebra are used in establishing the security of these algorithms, and how weaknesses in the implementation of these algorithms can allow adversaries to decipher your secrets. Topics to be covered: - Basic number theory - Symmetric Ciphers - Asymmetric Cryptography - Factoring Algorithms - Discrete Logarithms And many more!	6 – 9 Jun (4-day workshop) 9am - 4.30 pm	DSO (12 Science Park Drive)	Up to 3 seats per school	Nothing more than an inquisitive mind, a thirst for adventure and a knack for puzzle solving! Keen interest in Math and Cryptography preferred.

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Computer Security	You've heard all in the news: Hackers in Cyber Warfare, secrets from the Snowden leaks, and closer at home, unprecedented cyber breach of SingHealth's, K Box's and MINDEF's personal data. With the ubiquity of IT systems in business, Cloud, banking, government, the military, IoT (Internet of Things) and everyday life, computer security has become an issue of prime concern. This module introduces computer security from a technical angle and shows what it's like to be a researcher in a field that defends against these threats. You will learn life-changing skills to better protect yourselves against such attacks! To illustrate the breadth of cyber security, we will cover a broad spectrum of topics. Topics to be covered: - Network System Identification and Fingerprinting - Mobile Security - Hardware Security - Binary and Malware Analysis - Network Intrusion and Detection - Digital Forensics - Web Security	7 - 10 Jun (4-day workshop) 9.30am - 5pm	DSO (12 Science Park Drive)	Up to 2 seats per school	Knowledge in computer programming is a plus but not necessary. Shortlisted participants will need to attempt a quiz.

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Electromagnetics	Electromagnetics is ubiquitous in our daily lives. Be it streaming a YouTube video using WiFi or 4G connectivity or paying our transport fare using our EZ-Link card, these activities are only made possible through the understanding of electromagnetic principles. In this module, you will learn about electromagnetics through coverage of the following topics: - Antennas: Characteristics of antennas and selection of the right type for any given application - Electromagnetic Compatibility (EMC): Concepts of electromagnetic information leakage and shielding - Periodic Structures: Natural and man-made materials with a repeating pattern which interact and control electromagnetic waves in useful ways - Pulsed Power: Energy storage and switching elements (such as capacitors) - Magnetic Fields and Forces: Magnetism and electromagnetic induction You will also put your creativity and ingenuity to the test through a myriad of exciting hand-on activities. These activities include the building of antennas, shielding boxes, capacitors and electromagnetic launchers.	14 – 16 Jun (3-day workshop) 9am - 5pm	DSO (12 Science Park Drive)	Up to 3 seats per school	A strong interest in Engineering and Physics.

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Robotics	Robotics is an interdisciplinary research area that brings together the cutting edge of mechanical engineering, electronics, and computer science. In this module, you will get hands-on experience with 3D printing, electronics prototyping, and LiDAR-based navigation. Come build your very own autonomous robot to perform a rescue mission in a disaster relief scenario – with the chance to win exciting prizes!	13 to 17 Jun (5-day workshop) 9am – 5pm	DSO (12 Science Park Drive)	Up to 2 seats per school	No prior skillsets needed. Prior programming and electronics background will be useful but not a requirement as concepts will be taught throughout the course. Students with strong interest in robotics and good foundation in Math/Science are welcomed to apply.

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Sensors, reducing the fog of war	In the world of defence, making good decisions is hard. Adversaries conceal their intentions beneath the fog of war, inhibiting the quality of your information and choices. Sun Tzu said, “Secret operations are essential in war; upon them the army relies to make its every move.” In any conflict, to know what your opponent is thinking and doing is to have an overwhelming advantage at every step. In this module, you take upon yourself the mantle of a newly minted defence analyst, equipped with an assortment of technologies that can sense from afar. In a time when the fragile peace is broken by a war between multiple neighboring lands, your mission is to gather various types of actionable intelligence from your sensors and make decisions on the battlefield to take out your opponents. At the beginning, your sensing tools are limited, but as you learn about what they are and how they are used you will beef up your systems and unlock stronger capabilities. Some of the things you will do will be to: - Plan satellite orbits to look deep into enemy territory - Uncover and identify enemy vessels through underwater sonar - Covertly communicate with your allies using radio commands while listening in to enemy chatter - Process and utilise radar signals to localise enemy assets - Use machine learning and AI to tackle target-recognition problems The fog of war blows thick and grim; all hopes rest on your ability to harness your technologies and gain tactical advantages over your opponents. Peer into the unknown and deliver victory for your crew!	20 – 24 Jun (5-day workshop) 9am – 5pm	DSO (12 Science Park Drive)	Up to 2 seats per school	Strong interest in Physics and Math. Basic computer programming in e.g. Python. Shortlisted participants may need to attempt a quiz.

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Aerodynamics	Join us on an exciting adventure as we uncover the secrets behind flying machines! From learning how airplane wings are designed to gaining insights into aerodynamic theories, this course will be a blast for those with a passion in aerospace, physics or engineering. Your journey will comprise a combination of in-person and interactive online lessons, supplemented with practical demonstrations, computer flight simulator sessions and culminating in an exciting glider design competition. Through this new and improved format, the module will provide a uniquely hands-on learning experience. Learn from the experts in these topics: - Airfoil & Wing Design - Stability & Control - Introduction to Fluid Mechanics - Aircraft Performance - Aerodynamics in Our Everyday Life - Unconventional Aerodynamics By the end of the module, you would have attained an intuitive understanding of basic aeronautical concepts, and obtained a glimpse into the challenging yet exciting life of an aircraft designer!	21 - 24 Jun (4-day workshop) 9am - 5pm	DSO (12 Science Park Drive)	Up to 2 seats per school	Strong interest in Physics and Engineering. Participants should have an inquisitive nature and an interest in aerospace in order to benefit most from this programme.

Notes:

- Please note the module dates and sign up only if you are able to commit.
- Please be informed that the Certificate of Participation will only be issued to participants with 100% attendance.