

Young Defence Scientists Programme (YDSP)
World of Science 2020

Module	Synopsis	Date and Time	Venue	Allocation	Prerequisites
Aerodynamics	<ul style="list-style-type: none"> • Have you ever wondered why airplanes can fly, and why their wings are of different shapes and sizes? Why are fighter aircrafts able to execute maneuvers with tight turns and various other aerobatic stunts? • Discover the answers through this module, which is centered on the science of air flow around bodies, through a variety of topics, ranging from fundamentals of aerodynamics to introductory airplane design and even applications in daily life. • This workshop consists of lectures, interspersed with demonstrations/experiments and hands-on sessions. • Topics covered include: <ul style="list-style-type: none"> ▪ Introduction to Fluid Mechanics ▪ Airfoil and Wing Design ▪ Stability and Control ▪ Aircraft Performance ▪ Propulsion ▪ Aerodynamics in Our Everyday Life ▪ Unconventional Aerodynamics ▪ Introduction to Airplane Design • Students will be exposed to various aspects of aircraft engineering in our local defence ecosystem through visits to our external partners. E.g. <ul style="list-style-type: none"> ○ Gain exposure to current research developments at Temasek Laboratories @ NUS ○ Get up-close views of some of Singapore's advanced aircraft systems operated by the Republic of Singapore Air Force (RSAF) 	1 - 5 Jun, (5-day workshop) 9am - 5pm	DSO (12, Science Park Drive) & NUS High School	Up to 2 seats per school	Strong interest in Physics and Math.

Module	Synopsis	Date and Time	Venue	Allocation	Prerequisites
	<ul style="list-style-type: none"> The module will end with a grand finale as students exercise their creative minds and apply what they have learnt in a Glider Building Competition! 				
Artificial Intelligence	<ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> Introduction to AI Can Machines Think & Learn? AI in Robotics Natural Language Processing Lab visit to university to look at the demonstration of AI-related research at the university level. Mini hands-on AI activities: <ul style="list-style-type: none"> Game Competition in a Virtual Simulated Environment Activity Recognition Neural Networks Hands-On Lego Mindstorm Programming 	<p>3 - 5 Jun (3-day workshop) Time: 9am - 5pm</p>	DSO (12, Science Park Drive)	Up to 2 seats per school	Strong interest in Artificial Intelligence, Cognitive Science and Computer Science.
Computer Security	<ul style="list-style-type: none"> You've heard all in the news: Cyber Warfare, the Snowden leaks, and closer at home, the SingHealth's and K Box's data leaks and MINDEF Cyber Breach. With the ubiquity of IT systems in business, banking, government, the military and everyday life, computer security has become an issue of prime concern. This workshop 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. To illustrate the breadth of cyber security, we will cover a broad spectrum of topics. 	<p>8 - 11 Jun (4-day workshop) Time: 9.30am - 5pm</p>	DSO (12, Science Park Drive)	Up to 3 seats per school	<p>Knowledge in computer programming is a plus but not necessary.</p> <p>Shortlisted candidates will need to attempt a quiz.</p>

Module	Synopsis	Date and Time	Venue	Allocation	Prerequisites
	<ul style="list-style-type: none"> • Topics to be covered: <ul style="list-style-type: none"> ▪ Network System Identification and Fingerprinting ▪ Mobile Security ▪ Hardware Security ▪ Binary and Malware Analysis ▪ Network Intrusion and Detection ▪ Digital Forensics ▪ Web Security 				
Cryptography	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ▪ Basic number theory ▪ Symmetric Ciphers ▪ Asymmetric Cryptography ▪ Factoring Algorithms ▪ Discrete Logarithms And many more! 	<p>8 – 11 Jun (4 day workshop)</p> <p>Time: 9am - 4.30 pm</p>	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.

Module	Synopsis	Date and Time	Venue	Allocation	Prerequisites
Electromagnetics	<ul style="list-style-type: none"> In this technological age, electromagnetics is encountered in almost all aspects of our daily lives. Electromagnetics allows you to watch television, listen to the radio, talk with your friends through a handphone, navigate with a GPS, surf on the internet, etc. Like it or not, you are exposed to electromagnetic fields all the time. In this module, you will learn some of the basic principles behind electromagnetics and gain an appreciation of its influence in your everyday lives. The module will include foundational lectures with demonstrations and hands-on sessions covering the principles of electric, magnetic and electromagnetic fields. You will also learn how to measure the speed of light and to improve the gain of your wireless modem. This module is intended for students who want to go beyond the classroom to explore the applications of electromagnetics in the real world. To this end, you will be challenged to apply the principles that you learn to build electroscopes, simple motors, Wi-Fi antenna and an EM gun. The objective is to let students have a taste of the challenges faced by engineers in a real-life project. Where possible, you will visit some of the facilities that are used by DSO engineers for their work, viz. EMERL in NTU, compact range (for antenna and radar cross-section measurement) and near-field antenna range in NUS, tapered chamber (for antenna measurement) and bistatic range (for material measurement) in TL@NUS. 	<p>8 - 11 Jun (4-day workshop)</p> <p>Time: 9am - 4.30pm</p>	DSO (12, Science Park Drive), TL@NUS & NTU	Up to 3 seats per school	Strong interest in Engineering and Physics.
Sensors, reducing the fog of war	<p>“Making good decisions is hard! From life’s small choices (like where to eat), to the big decisions (like what course to study), gathering information is the cornerstone on which superb decisions are made.</p>	<p>1 – 5 Jun (5-day workshop)</p>	DSO (12, Science Park Drive)	Up to 2 seats per school	Strong interest in Physics and Math.

Module	Synopsis	Date and Time	Venue	Allocation	Prerequisites
	<p>In defence, this is even more challenging! Any potential enemy would be actively seeking to conceal their real intentions, while simultaneously trying their best to misdirect you. As Sun Tzu said, “Secret operations are essential in war; upon them the army relies to make its every move.”</p> <p>In this module, you will see how the things you learn in school can be applied in sensor technologies that are used to gather information, ensuring that decision makers can take the best course of action.</p> <p>In this module, you will learn:</p> <ul style="list-style-type: none"> ▪ To design satellite orbits to uncover enemy operations from space ▪ To listen for ships and identify them using underwater sonar ▪ To covertly communicate with your allies using radio commands ▪ To tune, operate and process signals of a real radar! ▪ To tackle real-world target recognition problems with machine learning and AI techniques ▪ To integrate all the above technologies harnessing their different strengths 	<p>Time: 9am - 5.30pm</p>			<p>Shortlisted candidates will need to attempt a quiz.</p>
<p>Robotics</p>	<ul style="list-style-type: none"> • Ranging from cutting edge smartphones devices that stretch the boundaries of what are thought possible, to the highly critical airplane avionics that many lives depend on, electronics from the foundation on which these technological marvels are built on. Many of us take for granted that a huge amount of engineering effort is required for the successful creation of each product. • The aim of this course is to encourage the participants to find out more about how electronic devices work and carry out some exploration of their own. It introduces the participants to 	<p>1 – 5 Jun (5-day workshop)</p> <p>Time: 9am - 5pm</p>	<p>DSO (12, Science Park Drive)</p>	<p>Up to 2 seats per school</p>	<p>Strong interest in Math, Physics and/or Engineering</p> <p>Knowledge in computer programming is a plus but not necessary.</p>

Module	Synopsis	Date and Time	Venue	Allocation	Prerequisites
	<p>the practical basics of analog and digital electronics by building and programming their very own autonomous robot.</p> <ul style="list-style-type: none"> • The course consists of brief lectures covering fundamentals, followed by tutorials teaching the participants on analog, digital electronics and embedded programming. The participants would then apply these concepts by developing a robot, and their skills would be tested in a friendly competition. • This course is meant for participants who are interested in experimenting and building small robotics and electronics DIY projects. 				

Please note the dates of the modules.

Sign up only if you are able to **commit**.

Please be informed that Certificates of Participation will only be issued to students who attend **all days of the workshop**.