iSTEM

Stage 5

NSW Department of Education

NSW School Developed Board Endorsed Course

Version 3.5

https://sispprogram.schools.nsw.gov.au

NSW GOVERNMENT

SISP

Foreward

The original iSTEM curriculum developed in 2012 was in direct response to the growing need for students with STEM expertise to fill skill shortage positions required by local Defence Industries in the Hunter Region. In 2020 the need for a STEM enabled workforce in NSW and Australia has never been greater, with 75% of the fastest growing jobs requiring STEM skills and even more acute STEM skill shortages now threaten Australia's future economy prosperity. Australia's employers need to be able to access an increasingly STEM skilled workforce and the iSTEM curriculum provides students with the enterprise skills that prepare them for a lifetime of career opportunities in the STEM and Non-STEM related fields.

Since its inception in 2012 there has been over 320 schools across NSW that have received NESA endorsement to run iSTEM. It is estimated that over 10,000 NSW students are currently undertaking iSTEM instruction in State, Independent and Catholic schools across NSW, including 22 all girl schools. Between 2014 – 2020 over 8,000 students have received a Record of School Achievement (RoSA) in iSTEM. This number is tipped to grow in the coming years as the need for STEM skills in all aspects of the workforce is becoming more and more apparent. As the popularity of iSTEM has grown so has its need to adapt to a broader and more diverse student and industry base and this has been the impetus for the curriculum to be regularly updated.

Version 3.5 of the iSTEM curriculum has been developed out of the need for the curriculum to keep in touch with the rapidly changing nature of STEM. There are no changes to the objectives, outcomes or content of the course in Version 3.5, there are updates in some of the support materials. We are currently working on iSTEM 4.0 where there will be slight changes to the objectives, outcomes and content however, the major change will be in the addition of new electives. Version 4.0 will include the addition of new electives in Cyber Security, AgriTech and Substantiable design.

Although I led the development of the iSTEM curriculum, its strength has been in the collaborative nature in which the curriculum was developed and has subsequently evolved.

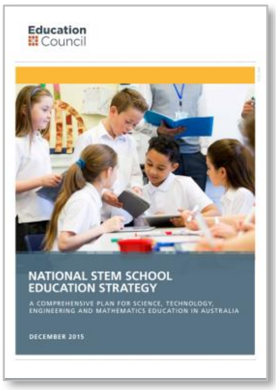
The iSTEM curriculum was initially designed in collaboration with Hunter Valley based Defence Industry partners and STEM teachers from Maitland Grossmann High School. This curriculum development was initially made possible through a grant from Regional Development Australia - Hunter and it's ME Program, supported by the Australian Department of Defence. The subsequent versions have utilised a much broader range of talent from a range of Australian industries, STEM professionals and educators.

One thing that has not changed since the initial development of iSTEM is its innovative pedagogical emphasis on inquiry, project and problem-based learning. Using Industry and business to develop real-world problems or STEM based competitions that emulate those skills required by industry, to enthuse and engage young people to take on challenges, work collaboratively and develop other enterprise skills.

I implore all teachers who utilise the iSTEM curriculum to use it as a framework to develop engaging and innovative teaching and learning programs that utilise local industries and businesses as partners, challenge students to solve real-world problems in collaborative ways and whenever possible, work in partnership with your STEM and Non-STEM colleagues.

Dr Scott Sleap
NSW Department of Education
iSTEM Course Developer

Rationale



In 2015 the Council of Australia Governments (COAG) Education Council's released the National STEM School Education Strategy 2016 – 2026. The strategy aims to equip young people with STEM skills and knowledge by; increasing student STEM ability, engagement, participation and aspiration, facilitating effective partnerships with tertiary education providers, business and industry; and supporting STEM education opportunities within school systems. iSTEM 3.5 has been heavily influenced by these Education Councils recommendations.

The NSW Department of Education, Secondary Education, learning and teaching directorate in 2018 developed the STEM Industry Schools Partnerships (SISP) program and established Academies of STEM Excellence throughout NSW to meet the challenges of effective STEM Education. The directorate identified that existing teaching and learning and curriculum models may not be able to achieve the desired outcomes of the program.

STEM education is the learning of science, technology, engineering and mathematics (STEM) in an interdisciplinary or integrated approach. Students gain and apply knowledge, deepen their understanding and develop creative and critical thinking skills within an authentic real world context. It may include inquiry, problem and project-based learning.

STEM is fundamental to shaping the future of Australia. It provides enabling skills and knowledge that increasingly underpin many professions and trades, and the skills of a technologically based workforce. After a sustained period of economic prosperity, Australia is facing some tough challenges. Slowing growth, declining real wages, falling productivity, and the end of the mining boom, effects of COVID19, bushfires, to name but a few. At the same time, businesses are coming to terms with the massive disruptive impact that digital technologies are having on business models, supply chains and customer behaviour in a more connected world.

These challenges are putting major pressure on the Australian workforce, and the companies that rely on it. Building on cutting edge work undertaken at Oxford University, new analysis by PwC shows that 44 per cent (5.1 million) of current Australian jobs are at high risk of being affected by computerisation and information and communication technologies over the next 20 years.

Businesses competing in a global economy driven by data, digital technologies and innovation will need more employees trained in science, technology, engineering and mathematics (STEM). Research indicates that 75 per cent of the fastest growing occupations now require these skills and by 2021, over one-third of skills (35%) that are considered important in today's workforce will have changed. Modelling by PwC finds that shifting just 1 per cent of the Australian workforce into STEM roles would add $57.4 billion to GDP (net present value over 20 years).

Australia's graduation rates in science, technology, engineering and mathematics are low by international standards. Yet a high output in these disciplines is seen to be a critical underpinning for the future of innovative economies. Policies are emerging around the world that focus on these fields and seek to grow the supply of graduates with the skills and knowledge developed through a quality education in STEM subjects.

There are several highly successful STEM based intervention programs in operation across Australia including; Science and Engineering Challenge, F1inSchools, First Robotics League, RoboCUP, Electric Vehicle Festival, Solar Car Challenge, Pedal Prix, P-TECH, Science and Technology Education Leveraging Relevance (STELR) program, and many others. The challenge for schools has been integrating these programs into their existing curriculum.

Many schools across NSW are involved in the above-mentioned STEM intervention programs. Many of these programs are run partially within, but mainly outside the current school curriculum. The development of the iSTEM course is in part as a result of the need for the school to provide a more structured approach to gaining the most out of these intervention programs. Although components of the NSW Education Standards Authority (NESA), Design & Technology, Graphics Technology and Industrial Technology – Engineering, syllabuses can be adapted to accommodate some parts of these STEM intervention programs, none are suitable to implement a full integrated program of study.

The iSTEM course utilises a practical integrated approach with engineering and technology being used to drive engagement in science and mathematics, through the development of technical skills and mechanical engineering knowledge. Its main purpose is to increase student STEM ability, engagement, participation and aspiration. This will lead to an increase in the number of students studying STEM based subjects in the senior years and ultimately the number of student matriculating to tertiary study in STEM and eventually STEM and Non-STEM based employment.

Pure mathematics and science topics are not included in this course, it is not intended as being a vehicle to increase the number of hours in which students study pure science or mathematics in Stage 5. Instead students learn about STEM concepts which by their very nature are scientific and mathematical.

In the review of Science, Mathematics and Engineering (2012) by the Office of the Chief Scientist of Australia, it was commented that teaching needs to be high quality and inspirational while science and mathematics based content was generally seen as … "irrelevant to life after school." and "content based teaching is seen as boring because so much is seen as knowledge transmission of correct answers with neither time nor room for creativity, reflection or offering opinions".

The development of effective and attractive STEM curricula and teaching methods are at the heart of the drive to make STEM studies and careers a more popular option for young learners. Inspiring students to engage with mathematics and science can be best achieved by teachers who are passionate about the subject and have the knowledge and confidence to present the curriculum imaginatively. The iSTEM course has been developed to be a vehicle for the effective delivery of inquiry, problem and project-based learning activities whilst still valuing explicit teaching models.

The stage 5 iSTEM course has been designed to develop many of the enterprise skill sets identified in the Future of Jobs Report from the World Economic Forum. These skills will be fundamental to the ability of students to be able to gain employment in the future workforce. This will go some way to improving the current mismatch between the skills required by employers and those of job applicants.

'iSTEM is one of the great examples of STEM (science, technology, engineering and maths) education and exactly captures the practical nature of science and engineering'

Ian Chubb Australian Financial Review
July 2015

Inquiry, problem and project-based learning

To satisfy the requirements of the course students must undertake a range of inquiry-based, problem or project-based learning activities which occupy at least 70% of the course time. Inquiry-based, problem and project-based learning assists students to actively pursue and use STEM based knowledge beyond the simple transmission of content. Thus, in the course structure there are many points at which students raise questions and explore ideas.

In the core modules 1 and 2 'guided inquiry' strategies are used, but students are later encouraged to shape their own learning around questions/problems that interest them, such as in the minor and major project-based learning modules. This involves students being able to work individually or collaboratively to design solutions to complex problems that do not have a finite answer. Approaches would include; following the scientific method, an engineering design process such as the iSTEM process, as well as other identified approaches to complex problem solving.

The core principle behind these approaches to teaching and learning is for the student to discover the knowledge or skill through inquiry, problem solving, or project work rather than the materials simply being delivered. Therefore, the teacher must become a facilitator of learning rather than the source of all knowledge in the classroom.

Features of inquiry, problem and project-based learning

Inquiry-Based Learning

• Students get involved with initial exploration before ideas are introduced and explanations developed;
• Incorporate and value students' own questions;
• Involve open ended investigation as part of the teaching sequence;
• Use activities to explore and develop ideas rather than simply demonstrate previously presented ideas.

Problem-Based Learning

• A student-centred teaching pedagogy developed in the 1960's;
• Students learn about a topic through problem solving;
• Students generally work in groups to solve problems where there is no set answer;
• Empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem (Savery, 2006);
• Often uses scenarios and cases that are sometimes less related to the real-world;
• Learning is most likely to be a single subject and has a generally shorter duration.

Project-Based Learning

• A student-centred teaching pedagogy developed in the early 1900's from the work of Dewey and Kilptrick (Edutopia, 2014);
• Instructional approach where students learn by investigating a complex question, problem or challenge;
• Students also have some control over the project they will be working on, how the project will finish, as well as the end product;
• Promotes active learning, engages students, and allows for higher order thinking;
• Students explore authentic real-world problems and find answers through the completion of a project;
• Learning is often multidisciplinary and generally has a long duration.

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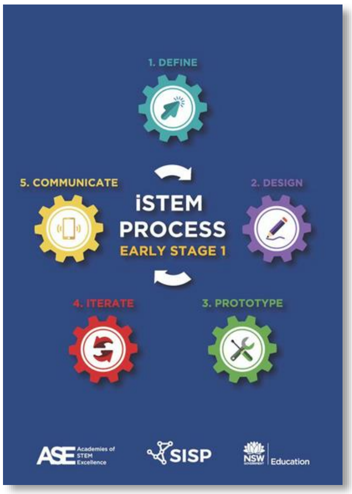
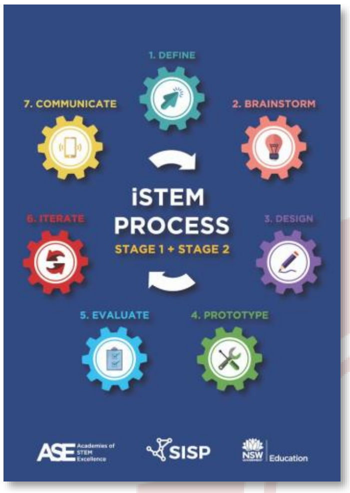
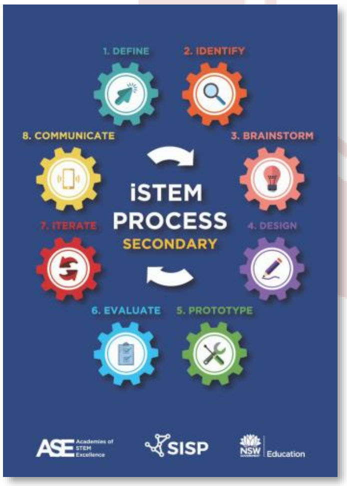
The iSTEM process

The iSTEM process sometimes referred to as the 'Cogs' is an engineering design process developed specifically for the iSTEM curriculum. It was initially developed by the Cessnock Academy of STEM Excellence (CASE) as part of the STEM Industry School Partnerships (SISP) program. It has been since refined with the input from a range of educators. It provides a consistent language and process across K-12 schools based on an industry-recognised engineering design process and scaffolds the understanding and application of design thinking.







The iSTEM process was developed for K – 12 with an Early Stage 1, Stage 1 – 3 and secondary version (Stage 4 - 5).

The Early Stage 1 version creates the foundations of the iSTEM process. When embedded within curriculum, students become familiar with each stage. Through continual application, mastery can be accomplished to assist a continuum of STEM learning.

With the Stage 1 - 3 version the addition of the Brainstorm cog allows students to expand on ideas for a possible solution. Evaluate provides an additional layer for students to reflect on their planning and practice in creating an effective solution. Both assisting in building skills in problem solving.

The Secondary iSTEM process adds the Identify cog which provides the last addition within the process and allows students to autonomously identify parameters in the early stages of the iSTEM process. This therefore leads to a clear understanding of expectations for planning and establishing the best possible solution.

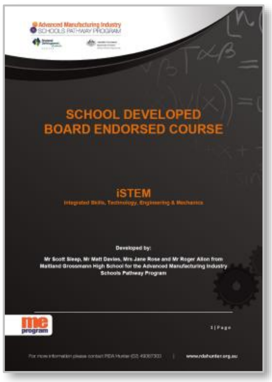
The SISP program is developing teaching and learning units that embeds the iSTEM process into the curriculum. The iSTEM process is available as a series of poster designs available for display in classrooms. Activity cards and resources are available through the SISP program to embed design thinking in the classroom.

iTeachSTEM

iTeachSTEM, launched in October 2020, is a website dedicated to STEM learning and teaching. iTeachSTEM has a significant proportion of its site dedicated to resources to support the Stage 5 iSTEM School Developed Board Endorsed Course. It is a collaborative initiative delivered under the auspices of the Institute of Technology Education (ITE) in partnership with Engineers Australia and the SISP program.

iTeachSTEM provides educational resources that will be made available to all schools. The resources are supported by a number of leading Australian industries, universities and businesses to provide real-world and authentic STEM materials.

History of iSTEM



In 2013 Version 1 of iSTEM was developed by NSW Department of Education and teachers (Dr Scott Sleap, Mr Matt Davies, Mrs Jane Rose and Mr Roger Allon) from Maitland Grossmann High School in partnership with local Industry. Its original development was supported through an ME Program grant from Regional Development Australia – Hunter led by the ME Program Manger Mr Ashley Cox. The ME Program is funded by Department of Defence through its Schools Pathway Program which is part of the Industry Skilling Program Enhancement Initiative.

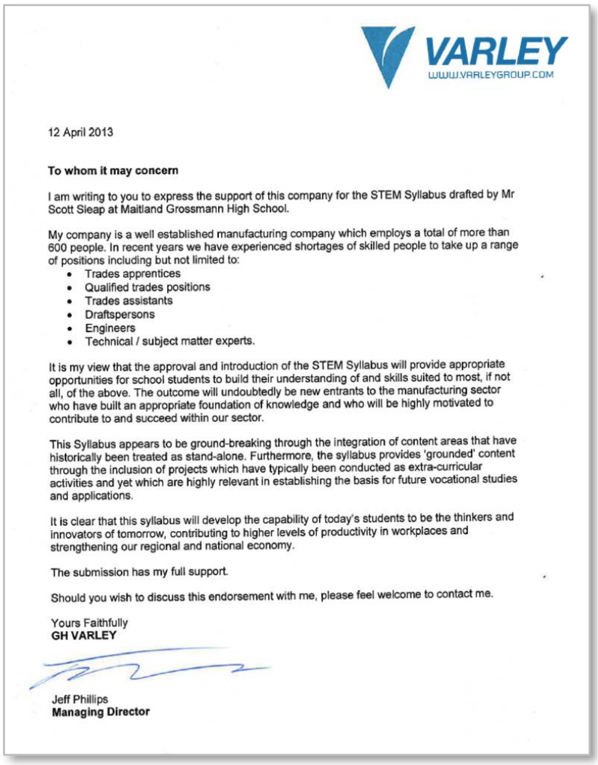
The original iSTEM syllabus was updated in subsequent years and Versions 2 and 3 were developed by Dr. Sleap in collaboration with a variety of industry partners whilst he was the Director of the ME Program.

The current Version (3.5) was updated by the NSW Department of Education's STEM Industry School Partnerships (SISP) program through the Learning and Teaching Directorate. This version was released in Term III 2020.

iSTEM 4.0 has been in development since 2019 and has been delayed due to the NSW Department of Education's curriculum review. It is hoped that it will be endorsed in 2021.

Industry Partners

The original iSTEM course was developed in collaboration with a number of industry partners from the Hunter Valley these included; BAE Systems Australia, AMP Control, Varley Group and Thales.



VARLEY
WWW.VARLEYGROUP.COM

12 April 2013

To whom it may concern

I am writing to you to express the support of this company for the STEM Syllabus drafted by Mr Scott Sleap at Maitland Grossmann High School.

My company is a well established manufacturing company which employs a total of more than 600 people. In recent years we have experienced shortages of skilled people to take up a range of positions including but not limited to:

- Trades apprentices
- Qualified trades positions
- Trades assistants
- Draftspersons
- Engineers
- Technical / subject matter experts.

It is my view that the approval and introduction of the STEM Syllabus will provide appropriate opportunities for school students to build their understanding of and skills suited to most, if not all, of the above. The outcome will undoubtedly be new entrants to the manufacturing sector who have built an appropriate foundation of knowledge and who will be highly motivated to contribute to and succeed within our sector.

This Syllabus appears to be ground-breaking through the integration of content areas that have historically been treated as stand-alone. Furthermore, the syllabus provides 'grounded' content through the inclusion of projects which have typically been conducted as extra-curricular activities and yet which are highly relevant in establishing the basis for future vocational studies and applications.

It is clear that this syllabus will develop the capability of today's students to be the thinkers and innovators of tomorrow, contributing to higher levels of productivity in workplaces and strengthening our regional and national economy.

The submission has my full support.

Should you wish to discuss this endorsement with me, please feel welcome to contact me.

Yours Faithfully
GH VARLEY

Jeff Phillips
Managing Director

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THALES

VARLEY
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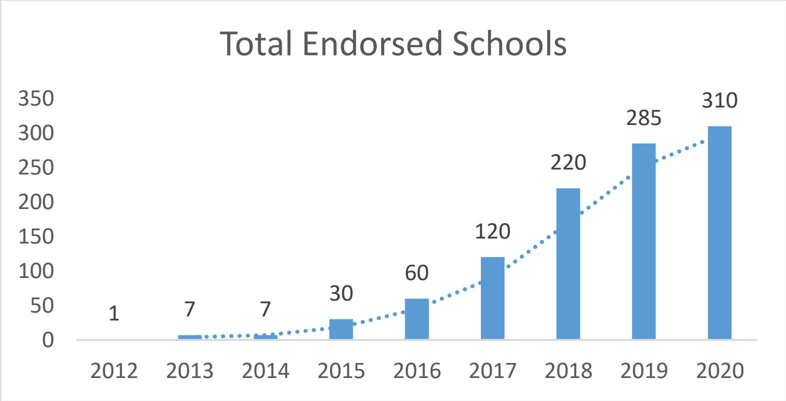
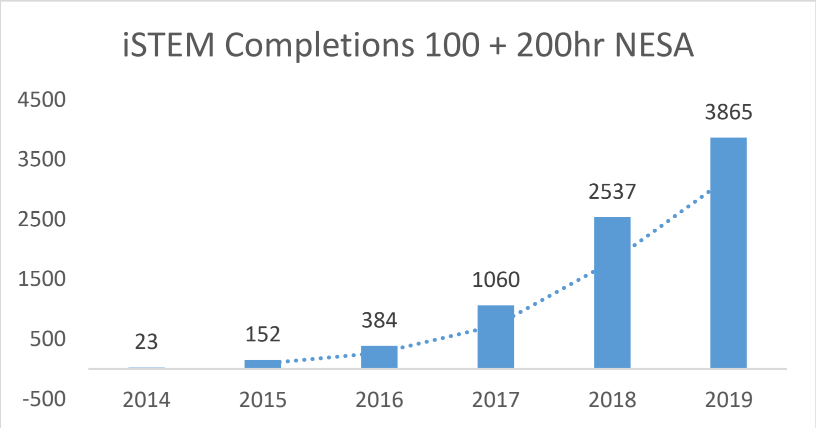
iSTEM success

Since its inception in 2012 the number of schools endorsed by the NSW Education Standards Authority (NESA) for iSTEM has steadily increased. Originally developed at Maitland Grossmann High School the program supported by the ME Program led to growth within Hunter Valley schools and then quickly spread throughout NSW.



In 2018 the Hunter had over 80% of their high schools endorsed for iSTEM with a number of the early adopting schools collectively reporting a **19.22%** increase in overall participation in senior STEM subjects compared to the NSW average **-0.5%** over the same period.



Between 2014 and 2019 iSTEM student completions have totalled 8021. 75% of completions are boys and 25% have been girls. In 2020 over 10,000 students are currently studying iSTEM as part of their Years 9 and 10 pattern of study. As the number of schools adopting iSTEM, which currently represents about 35% of all NSW secondary schools, increases so will the number of students completing the course

iSTEM has been widely recognised as an innovative and engaging subject that has been instrumental in turning around the declining STEM enrolment numbers.

The success of iSTEM has led to it being highlighted as best practice in the 'Optimising STEM Industry-School Partnerships' report from the Education Council, chaired by Professor Alan Finkel Australia's Chief Scientist, and in the Australian Government's first defence industry skilling and STEM strategy.

RDA Hunters STEMship program

The STEMship program is Australia's first VET pre-employment program focusing on the development of STEM skills at a technical level. The program was developed by RDA Hunter's ME Program and the NSW Department of Industry (Training Services NSW), and is delivered by Hunter TAFE (now TAFE NSW) to contribute to a highly-skilled job-ready talent pool. The STEMship program development was led by Dr Scott Sleap as the Director of the ME Program as a vocational extension of the Stage 5 iSTEM curriculum. The STEMship program which was developed from iSTEM was recongised in 2019 as international best practice by Employment and Skills Unit at the Organisation for Economic Co-operation and Development (OECD). Similar programs have been developed from this including STEMstart which is funded by Lockheed Martin. This initiative offers a vocational pathway for technical training that will include critical skills in ICT, cyber security and programming.

iSTEM has also been backward mapped into cross-curriculum versions in Stage 4 as well as stage 1 – 3 primary units, providing a continuum or pipeline of STEM learning.

iSTEM Version 3.5 NSW Department of Education ©

Course structure

The iSTEM School Developed Board Endorsed Course covers a number of STEM based fields, including; STEM Fundamentals, Aerodynamics, Motion, Mechatronics, Surveying, Aerospace, Statistics, CAD/CAM and Biotechnology. These specific modules are not reflected together in any existing BOSTES Syllabus document.

There are four core modules (STEM Fundamentals 1, STEM Fundamentals 2, Mechatronics 1 and Mechatronics 2) and ten elective modules (Aerodynamics, Motion, CAD/CAM1, CAD/CAM2, STEM PBL Minor, STEM PBL Major, Surveying, Design for Space, Statistics in Action and Biomedical Innovation).

Each elective module is 25 hours (indicative) in duration. Schools must design their curriculum around 100 hours in each school year i.e. 100 hours in Year 9 and 100 hours in Year 10. If you are completing the 200 hour course, schools need to include the four core modules (50 hours) and six elective modules (150 hours). If your school is offering the 100 hour course, schools need to include the four core modules (50 hours) and two elective modules (50 hours).

The order of completion of the modules is up to the school, based on teacher knowledge, timetabling and school preference, however, the four core modules must be completed within the 100 or 200 hour courses. Elective modules have been developed as alternatives for schools in order for the course to better cater for the individualised needs of the students in the local area. Schools may take a unit of work approach to programming and may wish to combine modules across a unit, taking advantage of a Project Based Approach to learning.

Year 9		Year 10	
100 Hours		**100 Hours**	
Core Module 1 STEM Fundamentals 1 10 hours **Core Module 2** STEM Fundamentals 2 15 Hours	**Core Module 3** Mechatronics 1 10 Hours **Core Module 4** Mechatronics 2 15 Hours	**Elective Module 5** Aerodynamics 25 Hours	**Elective Module 8** 3D CAD / CAM 2 25 Hours
Elective Module 8 3D CAD/CAM 1 25 Hours	**Elective Module 6** Motion 25 Hours	**Elective Module 7** STEM Project-Based Learning Minor 25 Hours	**Elective Module 8** STEM Project Based Learning Major 25 Hours

Year 9		Year 10	
100 Hours		**100 Hours**	
Core Module 1 STEM Fundamentals 1 10 hours **Core Module 2** STEM Fundamentals 2 15 Hours	**Core Module 3** Mechatronics 1 10 Hours **Core Module 4** Mechatronics 2 15 Hours	**Elective Module 14** Biomedical Innovation 25 Hours	**Elective Module 11** Surveying 25 Hours
Elective Module 12 Design For Space 25 Hours	**Elective Module 9** STEM Project Based Learning Minor 25 Hours	**Elective Module 13** Statistics in Action 25 Hours	**Elective Module 10** STEM Project Based Learning Major 25 Hours

Aim

The aim of the iSTEM course is to promote the areas of science, technology, engineering and mathematics through the study of technology, engineering, skills and mechanics.

Students will learn to use a range of tools, techniques and processes, including relevant technologies in order to develop solutions to a wide variety of problems and challenges relating to their present and future needs and aspirations.

iSTEM aims to reverse the lowered STEM participation rates by engaging and enabling secondary school students to appreciate the role and potential of science, technology, engineering and mathematics in the world in which they live, and to learn from their journey of technological inquiry, the essence of evidence-based critical thinking.

It aims to increase the number of students studying physics, chemistry, engineering studies, design and technology, computing and the higher levels of mathematics at the upper secondary school level. This is to be achieved through an integrative technology and engineering course structure, which gives practical relevance to scientific and mathematical concepts.

iSTEM also aims to increase the participation rate of female students in science, technology, engineering and mathematics via the use of engaging learning and teaching customised to meet the individualised learning needs of students. Through the engagement of business and industry and providing curricula which promotes an understanding of processes involved in the STEM professions, particularly in a way that female students can relate, are critical in making career decisions.

Aims of the iSTEM course include

- Promote the areas of STEM through the study of technology, engineering, skills and mechanics;
- Increase the number of students studying physics, chemistry, biology, engineering, design and technology, computing and the higher levels of mathematics in the senior school;
- Increasing student STEM ability, engagement, participation and aspiration;
- Increase the quantity of STEM instruction in NSW schools;
- Improve the quality of classroom teaching practices and enable teachers to develop confidence and skills in inquiry, problem and project-based learning;
- Supporting a wide range of STEM education opportunities within the classroom;
- Utilising effective partnerships with tertiary education providers, business and industry to enhance STEM instruction in the classroom;
- Prepare students to engage with STEM ideas and be knowledgeable about the way scientists, mathematicians, engineers and technologists work;
- Increase students' awareness of careers in STEM areas including trades;
- Improve teaching quality through a cross-curriculum approaches to programming and lesson delivery.

Objectives

Skills

Students will develop:

1. initiative, entrepreneurship, resilience and cognitive flexibility through the completion of practical STEM based activities
2. planning and project management skills using iterative and collaborative design processes
3. communication and critical evaluation skills, working both independently and collaboratively
4. problem solving and decision-making skills in a range of STEM contexts

Knowledge and Understanding

Students will develop knowledge and understanding of:

5. the application of cognitive processes to address real world STEM based problems
6. STEM education principles and processes

Values and Attitudes

Students will develop:

7. an appreciation of the value of STEM in the world in which they live
8. an appreciation of the importance of working collaboratively, cooperatively and respectfully

Objectives & outcomes

Objectives Students will develop:	**Stage 5: Outcomes** A Student:
1. initiative, entrepreneurship, resilience and cognitive flexibility through the completion of practical STEM based activities	5.1.1 develops ideas and explores solutions to STEM based problems 5.1.2 demonstrated initiative, entrepreneurship, resilience and cognitive flexibility through the completion of practical STEM based activities
2. knowledge, understanding and application of cognitive processes to address real world STEM based problems	5.2.1 describe how scientific and mechanical concepts relate to technological and engineering practice 5.2.2 applies cognitive processes to address real world STEM based problems in a variety of contexts
3. knowledge and understanding of STEM principles and processes	5.3.1 applies a knowledge and understanding of STEM principles and processes 5.3.2 identifies and uses a range of technologies in the development of solutions to STEM based problems
4. skills in planning and managing projects using an iterative and collaborative design process	5.4.1 plans and manages projects using an iterative and collaborative design process 5.4.2 develops skills in using mathematical, scientific and graphical methods whilst working as a team
5. skills in communicating and critically evaluating	5.5.1 applies a range of communication techniques in the presentation of research and design solutions 5.5.2 critically evaluates innovative, enterprising and creative solutions
6. problem solving and decision making skills in a range of STEM contexts	5.6.1 selects and uses appropriate problem solving and decision making techniques in a range of STEM contexts 5.6.2 will work individually or in teams to solve problems in STEM contexts
7. an appreciation of the value of STEM in the world in which they live	5.7.1 demonstrates an appreciation of the value of STEM in the world in which they live
8. an appreciation of the importance of working collaboratively, cooperatively and respectfully	5.8.1 understands the importance of working collaboratively, cooperatively and respectfully in the completion of STEM activities

Content: Stage 5 iSTEM

CORE: MODULE ONE: STEM FUNDAMENTALS 1
INDICATIVE TIME: 10 HOURS

This module develops an understanding of the basic principles associated with iSTEM. To satisfy the requirements of this module, students must undertake a range of experimental, group work and inquiry based learning activities that occupy the majority of the time. These activities should be used to develop a deep knowledge and understanding of the integration of STEM subjects.

Skills	
Students Learn About:	**Students learn to:**
1.1 STEM investigations - systematic observation - measurement - experiment - formulation, testing and modification of hypotheses	- design investigations which produce valid and reliable data - investigate STEM based problems using primary and secondary source - use identified investigative strategies to develop a range of solutions to STEM based problems
	Technologies
1.2 the use of STEM in developing solutions to problems - hardware - software	- describe a range of technologies used to collect, organise and analyse data - use a variety of technologies which assist in investigations into engineered solutions - utilise various hardware and software technologies to solve a broad range of STEM based problems

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CORE: MODULE TWO: STEM FUNDAMENTALS 2
INDICATIVE TIME: 15 HOURS

This module develops an understanding of the basic principles associated with iSTEM. To satisfy the requirements of this module, students must undertake a range of experimental, group work and inquiry based learning activities that occupy the majority of the time. These activities should be used to develop a deep knowledge and understanding of integrated STEM.

STEM Principles & Processes	
Students Learn About:	**Students learn to:**
2.1 STEM principles - strength of materials - material properties - fluid mechanics - electricity & magnetism - thermodynamics	- carry out experiments to demonstrate basic STEM principles - determine the properties of materials - use models to demonstrate and describe Pascal's Principle - complete basic experiments involving electricity and magnetism explain basic thermodynamic processes
	Mechanics
2.2 fundamental mechanics - basic units - prefixes - statics - dynamics - modelling	- apply units to concepts of mechanics - utilise metric prefixes related to everyday technologies - complete basic calculations related to statics - describe the difference between a static and a dynamic - simulate mathematical problems using appropriate modelling techniques
	Problem Solving & Design
2.3 problem solving - nature of - strategies to solve - evaluation - collaboration	- identify the nature of problems - use identified strategies to develop a range of possible solutions to every day STEM based problems - evaluate the appropriateness of different problem solving strategies - work collaboratively to solve problems - draw information from a range of sources to aid in the solution of practical everyday problems - uses appropriate design processes and techniques in the context of developing STEM based solutions

CORE: MODULE THREE: MECHATRONICS 1
INDICATIVE TIME: 10 HOURS

Select one or more related areas as a theme for an introduction to STEM concepts related to Mechatronics. Possible examples include: Mars Rover Challenge, Robotics, Lego Mindstorms, PLC's, Pneumatic & Hydraulic systems, etc. In this module students will utilise inquiry and /or problem based learning strategies to design & develop solutions to problems associated with combined mechanical and electrical systems.

Skills	
Students Learn About:	**Students learn to:**
3.1 mechatronics - building mechatronic components - programming logic - writing macros - fault finding	- build mechatronic components using a variety of electrical and mechanical componentry - use a range of equipment to carry out experiments and construct projects in relation to mechatronic systems - use a programming language to control mechatronic devices - write macros to complete a variety of operations involving mechatronics
	Technologies
3.2 technologies related to robotics - sensors and transducers - manipulators - PLC's - actuators (pneumatic & hydraulic)	- apply and understand the uses of a range of sensor and transducer technologies - incorporate mechatronic hardware to complete a variety of problem solving tasks - use a programmable logic controller to actuate a pneumatic or hydraulic device - utilise and program devices to perform a variety of control or monitoring tasks

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CORE: MODULE FOUR: MECHATRONICS 2
INDICATIVE TIME: 15 HOURS

Select one or more related areas as a theme for an introduction to STEM concepts related to Mechatronics. Possible examples include: Mars Rover Challenge, Robotics, Lego Mindstorms, PLC's, Pneumatic & Hydraulic systems, etc. In this module students will utilise inquiry and /or problem based learning strategies to design & develop solutions to problems associated with combined mechanical and electrical systems.

STEM Principles & Processes	
Students Learn About:	**Students learn to:**
4.1 mechatronics and control technology - logic gates - mechanical and electrical actuation systems - motors	- plan solutions to problems using logic gates - design, construct and evaluate motorised mechatronic systems which solve identified problems - use a variety of mechanical and electrical actuation systems to solve everyday problems - develop programming skills to manipulate sensors, motors and actuators
	Mechanics
4.2 programming & computations - algorithms - calculating distance - trigonometry - circle geometry input/output systems	- solve practical logic problems with applications to mechatronics using algorithmic functions - make predictions involving, time, distance, speed, velocity - use trigonometry to determine efficient pathways - use circle geometry to understand movement in order to solve problems
	Problem Solving & Design
4.3 design mechatronic solutions for a range of applications	- design solutions to various mechatronic applications to meet set criteria(s) - produce peripheral enhancements to mechatronic devices to provide additional functions - use innovative processes to create mechatronic devices which meet societal needs in the near future

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ELECTIVE: MODULE FIVE: AERODYNAMICS INDICATIVE TIME: 25 HOURS

Select one or more related areas as a theme for an introduction to the engineering concepts related to aerodynamics. Possible examples include: Aeronautics, Aeronautical Velocity Challenge, F1inSchools program, CO_2 dragsters, Scalextric cars, Bottle Rockets, kites, motor racing, sports science, etc. In this module students will utilise inquiry and/or project-based learning strategies to develop solutions to aerodynamic problems.

Skills	
Students Learn About:	**Students learn to:**
5.1 research and exploration - interpreting and analysing data - quantitative and qualitative research - surveys - interviews - observation - testing and experimenting	- analyse, interpret and apply research data in the development of aerodynamic projects - complete quantitative and qualitative research - use research techniques to develop design ideas by testing and experimenting - select and use a variety of research methods to inform the generation, modification, and development of aerodynamic projects - experiment to optimise solutions for aerodynamics related projects
	Technologies
5.2 technologies related to aerodynamics - wind tunnels - smoke tunnels - computational fluid dynamics (CFD)	- describe a range of technologies used in aerodynamics - perform experiments using a range of aerodynamic technologies to solve STEM based problems - utilise modelling software to determine optimum aerodynamic conditions using CFD techniques
	STEM Principles and Processes
5.3 aerodynamics principles - dynamic, static friction - lift / drag ratios - lift, drag, weight, thrust - Finite Element Analysis (FEA) - flight	- explain aerodynamic principles - describe the effects of lift, drag, weight and thrust - design, construct or simulate solutions to problems related to friction - construct models for the purpose of solving aerodynamic problems - describe how Finite Element Analysis is applied aerodynamic systems

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	Mechanics
5.4 aerodynamics forces - lift, drag, weight, thrust - simple vectors efficiency	- apply mathematical and graphical methods to solve aerodynamic related problems - determine solutions using vector notation - solve aerodynamic problems related to lift, drag, weight and thrust - perform simple calculations related to efficiency
	Problem Solving and Design
5.5 aerodynamic design solutions	- develop engineered solutions to meet detailed specifications - evaluate results from testing to improve aerodynamic performance of engineered solutions

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ELECTIVE: MODULE SIX: MOTION TIME: 25 HOURS

Select one or more related areas as a theme for an introduction to STEM concepts related to motion. Possible examples include solar & electric powered vehicles, alternative energy devices, UAV's, subs, rockets, etc. In this module students will utilise inquiry and/or project-based learning strategies to develop solutions to problems associated with motion.

Skills	
Students Learn About:	**Students learn to:**
6.1 electronics - circuitry - motors & generators - fault detection - prototypes - making models - practical applications	- design and construct basic electronic circuitry - develop basic motors and generators - use fault diagnosis techniques to isolate problems - use multimeters to test circuits and components - use continuity testers/multimeters in the production and testing of practical projects - develop prototypes using a variety of materials to simulate motion produce models in order to solve problems related to motion
	Technologies
6.2 technologies related to motion - gyroscopes - accelerometers - sensors	- describe how various technologies related to motion function - apply various motion technologies to the design of student projects
	STEM Principles and Processes
6.3 energy - energy sources - motors - electric vehicles - motion	- identify and describe a range of energy sources including renewables and non-renewables - utilise electric motors to develop a project related to motion - select and use a range of components and hardware in the development and production of a practical project related to motion
	Mechanics
6.4 motion calculations - velocity - acceleration - inertia - circular motion - momentum	- apply mathematical and graphical methods to solve motion related problems involving velocity, acceleration, inertia, circular motion and momentum - determine solutions to simple problems related to motion perform simple calculations related to momentum
	Problem Solving and Design
6.5 developing projects related to motion	- apply problem solving techniques to identified problems related to motion - plan, implement and evaluate a sequence of operations for the completion of a design project related to motion

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ELECTIVE: MODULE SEVEN: 3D CAD / CAM 1
INDICATIVE TIME: 25 HOURS

Students develop skills in Computer Aided Design (CAD) and Computer Aided Manufacture (CAM). Possible examples of CAD Software include: Fusion 360, AutoDesk 123, CREO, CATIA, Google Sketchup, Solid Works, etc. Possible examples of CAM hardware include 3D printers, CNC Mills, CNC Routers, CNC Lathes, Laser cutters, etc. In this module students will learn about manufacturing three dimensional objects for which they have designed.

Skills	
Students Learn About:	**Students learn to:**
7.1 CAD / CAM - 3D drawing on an x, y & z axes in planes - Basic commands in a 3D CAD package - CAM processes - engineering drawing	- use common features in a 3D CAD package to produce parts, products and assemblies in order to design 3D objects - use rendering techniques to represent 3D designs - use AS1100 standards to interpret engineering drawings
	Technologies
7.2 technologies related to CAM - additive and Subtractive manufacturing - Computer Numerical Controls - CNC, mills, routers & lathes - LEAN Manufacturing processes	- describe a range of technologies used in CAD and CAM processes - perform experiments using a range of CAM technologies to solve engineering problems - develop an awareness of LEAN manufacturing processes
	STEM Principles and Processes
7.3 CAD / CAM operations - Reading and interpreting engineering drawings - rapid prototyping - 3D CAD operations - Computer Aided Manufacturing (CAM) - 3D modelling	- read and interpret basic drawing conventions - explain the operation of CAD / CAM software and hardware describe how rapid prototyping works

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	Mechanics
7.4 3D environments - vectors - 3D Shapes - Computer Numerical Control - spatial comprehension - 3D Surface Modelling	- apply mathematical and graphical methods to solve questions related to 3D vectors - determine solutions to simple problems using vector notation manipulate 3D shapes and objects

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ELECTIVE: MODULE EIGHT: 3D CAD / CAM 2 INDICATIVE TIME: 25 HOURS

Students develop skills in Computer Aided Design (CAD) and Computer Aided Manufacture (CAM). Possible examples of CAD Software include: Fusion 360, AutoDesk 123, CREO, CATIA, Google Sketchup, Solid Works, etc. Possible examples of CAM hardware include: 3D printers, CNC Mills, CNC Routers, CNC Lathes, Laser cutters etc. In this module students will manufacture three dimensional objects for which they have designed. *Note:* Students must complete elective module seven prior to completing elective module eight. However, schools can choose to only complete elective module seven in their scope and sequence.

Skills	
Students Learn About:	**Students learn to:**
8.1 CAD / CAM - 3D drawing on an x, y & z axes in planes. - CAM processes	- modify 3D CAD drawings so they can be manufactured using 3D technologies - manipulate Computer Aided Manufacturing processes to produce parts for an assembly
	Technologies
8.2 technologies related to CAM - Additive and Subtractive manufacturing - Computer Numerical Controls - CNC, mills, routers & lathes	- use a variety of technologies which assist in the rapid prototyping process - utilise 3D drawing and manufacturing software to produce new products
	STEM Principles and Processes
8.3 CAD / CAM operations - rapid prototyping - 3D CAD operations - Computer Aided Manufacturing (CAM) - 3D modelling	- design, construct parts, products or assemblies using CAD software and producing them using appropriate CAM software - produce solutions to set problems by constructing 3D models
	Mechanics
8.4 3D environments - Computer Numerical Control	- construct source code for 3D CAM operations.
	Problem Solving and Design
8.5 **CAD / CAM**	- design parts, products or assemblies to meet specific criteria - solve problems related to typical Computer Aided Manufacturing issues

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ELECTIVE: MODULE NINE:
STEM PROJECT-BASED LEARNING TASK MINOR
INDICATIVE TIME: 25 HOURS

In this module students are to develop and realise a *minor* STEM related Project-Based Learning Task. The project involves students utilising a project-based learning strategies to apply appropriate design, production and evaluation skills to a contemporary STEM based problem. The students relate the techniques and technologies used in previous modules to those used in the development of the STEM project. It is suggested that students follow the iSTEM process for the completion of minor PBL tasks.

Skills	
Students Learn About:	**Students learn to:**
9.1 processes of design - identifying problems - project management - developing solutions to problems - generating ideas	- develop a project proposal, a design specification or design brief. - respond to the findings of experimentation and research - follow a process to identify and solve contemporary needs of society - formulate management plans including; i) action ii) time iii) finance - manage a minor project-based learning task that successfully solves an identified problem - select and apply appropriate research methods to solve a minor STEM based problem - justify decisions made based on the analysis of data - identification and exploration of the research problem - areas of investigation - criteria to evaluate success
	Technologies
9.2 presentation and communication technologies	- select and use appropriate digital communication techniques for the development of a minor project-based learning task - use appropriate technological processes in the completion of a minor project-based learning task
	STEM Principles and Processes
9.3 realisation, evaluation, research methods and experimentation	- test possible solutions to problems - use tools, materials and processes to produce a solution to an identified problem - develop methods to communicate solutions to problems through a visual display - conduct continual evaluations throughout the design and production of the minor project - evaluate the project in terms of the identified criteria for success.

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	Mechanics
9.4 mechanical knowledge	- demonstrate mechanical aptitude in the development of solutions to a minor project

	Problem Solving and Design
9.5 creative and innovative approaches to solve problems	- demonstrate creativity and problem solving skills in the development of the STEM related Minor Project-Based Learning Task

ELECTIVE: MODULE TEN:
STEM PROJECT-BASED LEARNING TASK MAJOR
INDICATIVE TIME: 25 HOURS

In this module students are encouraged to extend their minor STEM related Project Based Learning Task into a more substantial *major project.* The project involves students utilising a project-based learning strategies to apply appropriate design, production and evaluation skills to a contemporary STEM based problem. The students relate the techniques and technologies used in previous modules to those used in the development of the STEM project. *Note:* Students must complete elective module nine prior to the completion of elective module eight. However, schools can choose to only complete elective module nine in their scope and sequence.

Skills	
Students Learn About:	**Students learn to:**
10.1 processes of design - identifying problems - project management - developing solutions to problems - generating ideas	- manage a major project-based learning task that successfully solves an identified problem - select and apply appropriate research methods to solve a major STEM based problem - manage a major design based project through to completion
	Technologies
10.2 presentation and communication technologies	- select and use appropriate digital communication techniques for the development of a major project-based learning task - use appropriate technological processes in the completion of a major project-based learning task
	STEM Principles and Processes
10.3 realisation, evaluation, research methods and experimentation	- test possible solutions to problems - use tools, materials and processes to produce a solution to an identified problem - develop methods to communicate solutions to problems through a visual display - conduct continual evaluations throughout the design and production of the major project - evaluate the major project in terms of the identified criteria for success.
	Mechanics
10.4 mechanical knowledge	- demonstrate mechanical aptitude in the development of solutions to a major project
	Problem Solving & Design
10.5 creative and innovative approaches to solve problems	- demonstrate creativity and problem solving skills in the development of the STEM related Minor Project-Based Learning Task

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ELECTIVE: MODULE ELEVEN: SURVEYING
INDICATIVE TIME: 25 HOURS

In this module students develop skills and understanding associated with surveying by completing an inquiry-based and/or problem based learning task. Possible examples include civil structures, architectural design, industrial design, etc. Students develop skills in fundamental surveying concepts, then apply this to both simulated and real world applications.

Skills	
Students Learn About:	**Students learn to:**
11.1 site risk management and WHS in surveying - common surveying workplace hazards and associated risk control - site safety plan - PPE equipment - surveying software	- identify hazards - outline appropriate skills to work safely - use tools and equipment to control risks - communicate and report relevant WHS information (potential and existing risks and hazards) - use software related to surveying produce surveying related drawings
	Technologies
11.2 technologies related to surveying - Total Station Theodolite (TST) - GPS - digital terrain models laser scanning	- describe how surveying principles are utilised by contemporary technologies - perform relevant tasks using surveying technologies - simulate
	STEM Principles and Processes
11.3 fundamental surveying principles - cadastral surveyors - engineering surveyors - mining engineers - hydrographic engineers - geodetic surveyors - GIS - photogrammetry	- carry out basic surveying activities in the field to determine spatial elements - communicate findings using surveying terminology - outline the working environment and conditions for a range of surveying occupations - recognise the mathematical and physical science knowledge that underpins surveying
	Mechanics
11.4 spatial data - appreciation of spatial skills - calculating distance - trigonometry - geometry - mapping	- solve practical surveying based problems - make predictions involving, height, depth, breadth, dimension, position - use trigonometry to determine efficient pathways - use geometry and spatial data to produce maps

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	Problem Solving & Design
11.5 problem solving - design surveying solutions to a range of applications	- design, construct or simulate solutions to surveying problems - work individually or in teams to solve surveying problems using appropriate technologies

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ELECTIVE: MODULE TWELVE: DESIGN FOR SPACE INDICATIVE TIME: 25 HOURS

Select one or more related areas as a theme for an introduction to STEM concepts related to Space. Possible examples include: Create for Space, Mars vs plants, Bottle Rocket Challenge, Deep Space Program, Mars Rover, Lego, PLC's, Arduino, etc. Students will develop skills and understanding of space, technology, electronics and coding. In this module students will utilise inquiry and /or problem based learning strategies to design & develop solutions to problems associated with space.

Skills	
Students Learn About:	**Students learn to:**
12.5 Coding for Space - basic coding to manipulate wireless devices - manipulate sensors, actuators, remote sensing **space** - history and future - impact on daily life - space applications	- use common features within a programming environment to run and control sensors - utilise wireless communications devices to control sensors and actuators - evaluate the historical and current significance of space and its importance in various fields - develop solutions to problems related to space applications
	Technologies
12.2 technologies related to coding and space - microcontrollers - electronics - computer software - satellites and rockets radio communication	- design and use electronic circuits and systems including microcontrollers - perform experiments using a range of electronic devices to solve real STEM based problems - describe a range of technologies used in satellites, rockets and space communication
	STEM Principles and Processes
12.3 space vehicles and experiments - STEM design methodologies - engineering requirements - circuit diagrams - electricity, radio and other waves, thermal conductivity, spectra, motion in 3D	- read and interpret basic drawing conventions - explain the operation of circuits and various electronic components - describe design processes related to space - create design plans and requirements - produce practical solutions to space related problems - produce circuit diagrams

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	Mechanics
12.4 data analysis and modelling - modelling data using software - analysing and drawing useful conclusions from data - efficiency	- apply mathematical and graphical methods to represent data sets - determine statistical properties and draw useful conclusions from visual representations of data - use formulas and theories to explain and describe phenomena - perform simple calculations
	Problem Solving & Design
12.5 experimental design - design solutions to space related applications	- design, construct or simulate solutions to problems - work individually or in teams to solve space related problems using appropriate technologies - evaluate experiments and solutions in order to identify possible improvements

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ELECTIVE: MODULE THIRTEEN: STATISTICS IN ACTION
INDICATIVE TIME: 25 HOURS

In this module students develop skills and understanding associated with statistical literacy and decision making. This unit supports the International Statistical Literacy Project promoting statistical literacy around the world. Students will utilise project-based learning activities to collect and interpret data that addresses practical research questions in areas such as business, industry, healthcare and medicine. Students develop fundamental skills in data collection, analysis and reporting methods and apply this to both simulated and real world applications.

Skills	
Students Learn About:	**Students learn to:**
13.1 research methods - 3Rs (randomisation, replication and ARRR), blocking - understanding variation - survey design - bias and precision visualisation	- complete research using a variety of methods (including both summarising data and testing hypotheses based on that data) - describe aspects of well-designed data collection methods - identify problems using survey and comparison methods - implement data collection methods - work collaboratively to succinctly communicate and report relevant recommendations to real-world applications (citing limitations)
	Technologies
13.2 technologies related to statistical analysis - computer software for simulations - computer software for design and analysis	- use software and computing technologies to simulate and/or analyse data in contemporary business, medicine, healthcare and industry contexts for the purposes of making data-informed recommendations - describe how analytical principles are utilised within contemporary technologies - perform relevant simulations, create visual displays and perform analyses using computing technologies
	STEM Principles and Processes
13.3 fundamental statistical analysis - basic statistical key figures **concepts describing society** - product comparisons, consumer behaviour, inflation, gross domestic product **Data** - data sources - evaluation of data sources	- engage in study design and apply data collection principles to field activities/projects - communicate project's purpose, design, analysis and recommendations succinctly in an A1-sized poster - recognise the statistical thinking that underpins data-based investigations and decision-making participate in a national competition

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	Mechanics
13.4 analyse, interpret and evaluate statistical information - communicate statistical findings	- identify the issues or questions, specify objectives and formulate hypotheses - determine appropriate analytical techniques and undertake data analysis - assess the results of analysis against the objectives and expectations - review the objectives, iterate data analysis cycle as appropriate to refine the analysis - using tables, graphs and maps to communicate statistical findings
	Problem Solving & Design
13.5 creative and innovative approaches to solve practical research problems	- work in teams to design, implement & creatively report upon an investigation on a topic of interest, based on the collection and interpretation of data

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ELECTIVE: MODULE FOURTEEN: BIOMEDICAL INNOVATION

In this module students develop skills and understanding associated with Biomedical Innovation. Select one or more related areas as a theme for an introduction to STEM concepts related to Biomedical Innovation. Possible examples include design of a medical innovation, biomedical engineering, forensics, biotechnology, national secondary poster competition, etc. Students will develop skills and understanding related to biomedicine. In this module students will utilise inquiry and/or problem based learning strategies to design and develop solutions to problems associated with biotechnology.

Skills	
Students Learn About:	**Students learn to:**
14.1 **Biomedical Innovation** - applying processes - designing - researching - investigating - communicating - managing projects - evaluating	-use a process to develop solutions to biomedical related problems -design investigations that allow valid and reliable data and information to be collected -use appropriate technologies and strategies for data collection or gathering information -collect, analyse and apply the results of research and investigation -produce solutions to problems related to biomedical - manage the development of a biomedical project - effectively communicate solutions to problems evaluate processes and solutions to biomedical problems
	Technologies
14.2 Biotechnologies - range of technologies used in biotechnology	- describe a range of technologies used in developing biomedical solutions perform experiments using a range of technologies to solve biomedical related problems - use appropriate technologies for collecting data including data loggers and sensors - use technologies typically used in the biosciences - assesses the impact of new technologies on biomedical engineering
	STEM Principles and Processes
14.3 Biomedical Innovation concepts - biomedical innovations - design and engineering processes - environmental health - molecular biology - forensics - bioengineering - scope and nature of biomedicine	- use biomedical processes to develop solutions to problems - utilise biomedical principles to evaluate current and emerging bioengineering solutions harness cellular and biomolecular processes - describe solutions to biomedical and/or bioengineering problems - solve problems using forensic science methods - explain how biomedical innovation has been able to solve environmental issues that have impacted human health - use techniques related to genetic engineering and molecular biology - develop an understanding of the scope and nature of the biomedical professions

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	Mechanics
14.3 Analysis - statistics - using data to develop evidence based arguments and conclusions	- use mathematical, scientific and/or graphical methods to solve biomedical related problems - analyse data using statistical methods to develop evidence-based arguments and conclusions for biomedical based problems - undertakes investigations to collect valid and reliable data and information, individually and collaboratively

	Problem Solving & Design
14.4 Designing solutions to biomedical problems	- apply an appropriate design process to design solutions to identified problems related to biomedicine

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SAMPLE ASSESSMENT SCHEDULE

Year 9

Outcomes	Modules	Weighting	Components	Task 1 Inquiry Based Learning Task	Task 2 Aerodynamic Design	Task 3 CAD/CAM Project	Task 4 Portfolio	Total
5.1.2, 5.2.2	STEM Fundamentals, Aerodynamics, 3D CAD/CAM	10	Research	5	5			**10**
5.1.1, 5.4.1, 5.4.2, 5.5.1	STEM Fundamentals, Aerodynamics, 3D CAD/CAM	40	Skills	5	15	20		**40**
5.6.1, 5.6.2, 5.3.2, 5.5.2	STEM Fundamentals, Aerodynamics, 3D CAD/CAM	30	Problem Solving	5	10	15		**30**
5.2.1, 5.3.1	STEM Fundamentals, Aerodynamics, 3D CAD/CAM	20	Knowledge & Understanding				20	**20**
TOTAL		100		15	30	35	20	100

Year 10

Outcomes	Modules	Weighting	Components	Task 1 Motion Project	Task 2 Mechatronics Design Task	Task 3 STEM Project Based Learning Task	Task 4 Portfolio	Total
5.1.2, 5.2.2	Motion, Mechatronics, STEM Project-Based Learning Task	10	Research			10		**10**
5.1.1, 5.4.1, 5.4.2, 5.5.1	Motion, Mechatronics, STEM Project-Based Learning Task	40	Skills	10	10	20		**40**
5.6.1, 5.6.2, 5.3.2, 5.5.2	Motion, Mechatronics, STEM Project-Based Learning Task	30	Problem Solving	10	10	10		**30**
5.2.1, 5.3.1	Motion, Mechatronics, STEM Project-Based Learning Task	20	Knowledge & Understanding				20	**20**
TOTAL		100		20	20	40	20	100