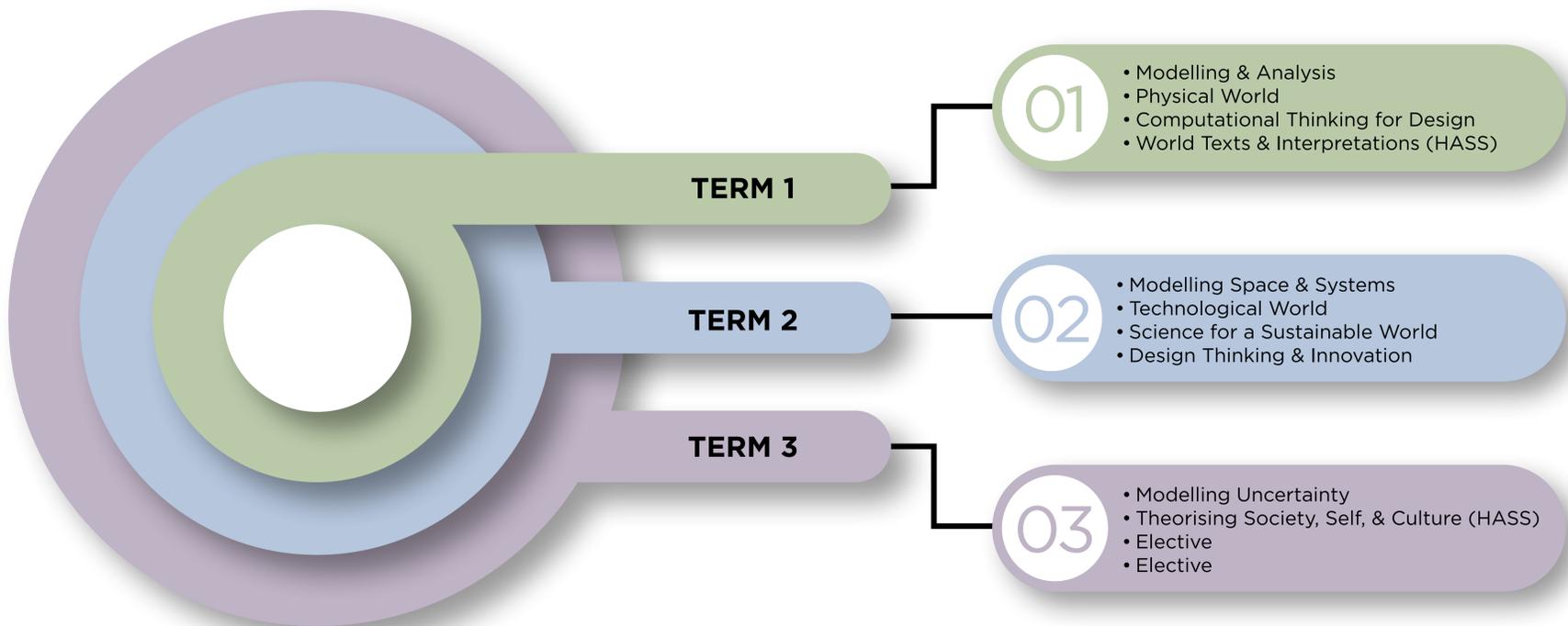


FRESHMORE CURRICULUM COURSE DESCRIPTIONS (from AY 2020 onwards)



01 TERM 1

MODELLING AND ANALYSIS

Equips students with a firm foundation in single variable calculus to model, analyse and solve applied math problems. Through inter-disciplinary group projects, it aims to motivate students by demonstrating the importance of calculus in engineering, physical and biological sciences, computer science, finance, economics, probability, statistics and other topics. Besides basic concepts, techniques and applications of differential and integral calculus, students will also learn to use simple software to implement numerical methods in calculus.

PHYSICAL WORLD

Emphasises on providing students with the ability to understand and explain the inner mechanism of the physical world based on the principles of mechanics and thermodynamics. It aims to help students appreciate the beauty of physics and enable them to apply key concepts learnt to evaluate and address physics-based problems to make a positive impact on the world. By using concepts established through simplified mathematical models, reverse engineering case studies and experiential learning through hands-on demonstrations, connections between physics concepts and theoretical models are reinforced with practice.

COMPUTATIONAL THINKING FOR DESIGN

An introductory programming course that combines programming both in the architectural design and computing contexts targeted at novice programmers. It will introduce students to programming and design computing skills that are essential for their studies in SUTD, regardless of their choice of major. Students will learn visual programming and python programming together with design concepts, and will apply these skills in related projects.

WORLD TEXTS & INTERPRETATIONS (HASS)

Human beings tell stories as a way to understand ourselves and our world. Some of these stories have endured for centuries and spread far beyond their locus of origin. They raise questions that resonate with our lives even today. World Texts and Interpretations equips students with critical reading, thinking, and writing skills by engaging with the richness of these classic texts. Students will learn to identify the connections between various texts and between thinkers from throughout history—from ancient China and Greece to contemporary Singapore. Different ways of reading and interpreting classic texts will also be explored as students develop their own interpretations.

02 TERM 2

MODELLING SPACE AND SYSTEMS

Provides the knowledge on how to model real life problems by casting them against a rigorous modelling framework on the topics of multivariable calculus and linear algebra. This course builds upon the Term 1 course, Modelling and Analysis, and will cover the following topics: differentiation and integration in multiple dimensions, optimisation, line integrals, linear maps, eigenvalues and eigenvectors. By working in group projects and writing

MATLAB codes, students will appreciate the various topics and connections between mathematics and physics, computer science, probability, statistics and other topics.

TECHNOLOGICAL WORLD

Provides students with a strong physics foundation for a holistic perspective of current and emerging technologies in modern society. The working principles of various products will be used to explain electromagnetism and its translation to circuit analysis and product design. Quantum mechanics is introduced to better appreciate emerging applications in quantum engineering. This course aims to cultivate strong scientific knowledge and engineering thinking capabilities in students, skills which are important for technological design and innovation.

SCIENCE FOR A SUSTAINABLE WORLD

Focuses on the need for sustainable development by creating awareness of climate change and human impact on the environment. Prioritising on the Sustainable Development Goals (SDGs) from the United Nations, this course will address issues and challenges related to sustainability: green materials, clean water, sustainable energy, and biodiversity. Emphasis is placed on the knowledge of science and engineering approaches towards achieving the SDGs. This course intends to enhance students' critical thinking skills in analysing strategies based on scientific facts and current technologies.

DESIGN THINKING AND INNOVATION

Introduces concepts of design at a variety of scales and design disciplines. Participants will be exposed to core technologies and design concepts including design principles, processes, modes of thinking and analysis, prototyping skills and social aspects of design. The subject introduces essential skills and mindset of innovation, entrepreneurship, and methodologies in design including teamwork and workflow organisation, team building and leadership, written and oral communication, graphic and analytical representation, and fabrication techniques. Student teams formulate and complete design projects, setting and achieving milestones under a team of instructors composed of engineers and architects.

03 TERM 3 (CORE)

MODELLING UNCERTAINTY

Uncertainty appears everywhere in life, arising naturally in the fields of science, engineering, design, and humanities. Probability and statistics are two powerful and complementary ways to explain, forecast, and visualise uncertainty. Probability uses knowledge of a system's behaviour to predict its future outcomes, while statistics analyses data from past outcomes to model a system's behaviour. Both probability and statistics are crucial in the study of other disciplines such as finance, big data, artificial intelligence, machine learning, and more. In this course we will learn the fundamentals of probability and statistics through real life applications, software and projects.

THEORISING SOCIETY, SELF, & CULTURE (HASS)

This subject is an introduction to the social sciences that provides students with the conceptual tools necessary to make sense of the complex problems that they face in the

- Modelling & Analysis
- Physical World
- Computational Thinking for Design
- World Texts & Interpretations (HASS)

- Modelling Space & Systems
- Technological World
- Science for a Sustainable World
- Design Thinking & Innovation

- Modelling Uncertainty
- Theorising Society, Self, & Culture (HASS)
- Elective
- Elective

modern world. The subject cultivates an understanding of core issues, fundamental theories and philosophical stances in the social sciences, and explores the manner in which social scientists formulate questions about society that can be addressed with empirical research. Canonical social science texts and methodologies are explored in lecture, discussion and group exercises.

TERM 3 (ELECTIVES)

SCIENCE AND TECHNOLOGY FOR HEALTHCARE

Focuses on the basic concepts in chemistry and biology that are important for the understanding and solving of healthcare problems in Singapore. Using case studies, leading chronic conditions (e.g. cancer and diabetes) will be studied throughout the term. Major topics covered by this course include the life of a cell, DNA, genes and organ systems. Function and regulation between healthy and diseased states are compared. The course also introduces emerging technologies to show the advancement of our understanding of disease conditions and their respective treatments. Importance of public health is explored to appreciate healthcare at the community level.

DATA DRIVEN WORLD

Project-based and introduces students to data structures, algorithm, and introductory learning algorithm in a practical way. Students learn to analyse and design programs revolving around data and algorithms, introductory machine learning algorithms for continuous and categorical data. Students will undertake various mini-projects where they apply what they have learnt to develop applications in mobile platforms. The course requires some basic programming knowledge and some proficiency in one of the programming languages.

DESIGNING ENERGY SYSTEMS

Provides students the necessary physical, design concepts and technical knowledge on energy related products and systems such as lightings, mobile phones and photovoltaic systems. Through reverse engineering, experimentation, data analysis, modelling and simulations, students will synthesise innovative solutions to real world problems and be able to evaluate limitations and performance of such solutions. This hands-on approach aims to provide the technical know-hows and practical experiences for designing an efficient energy system.

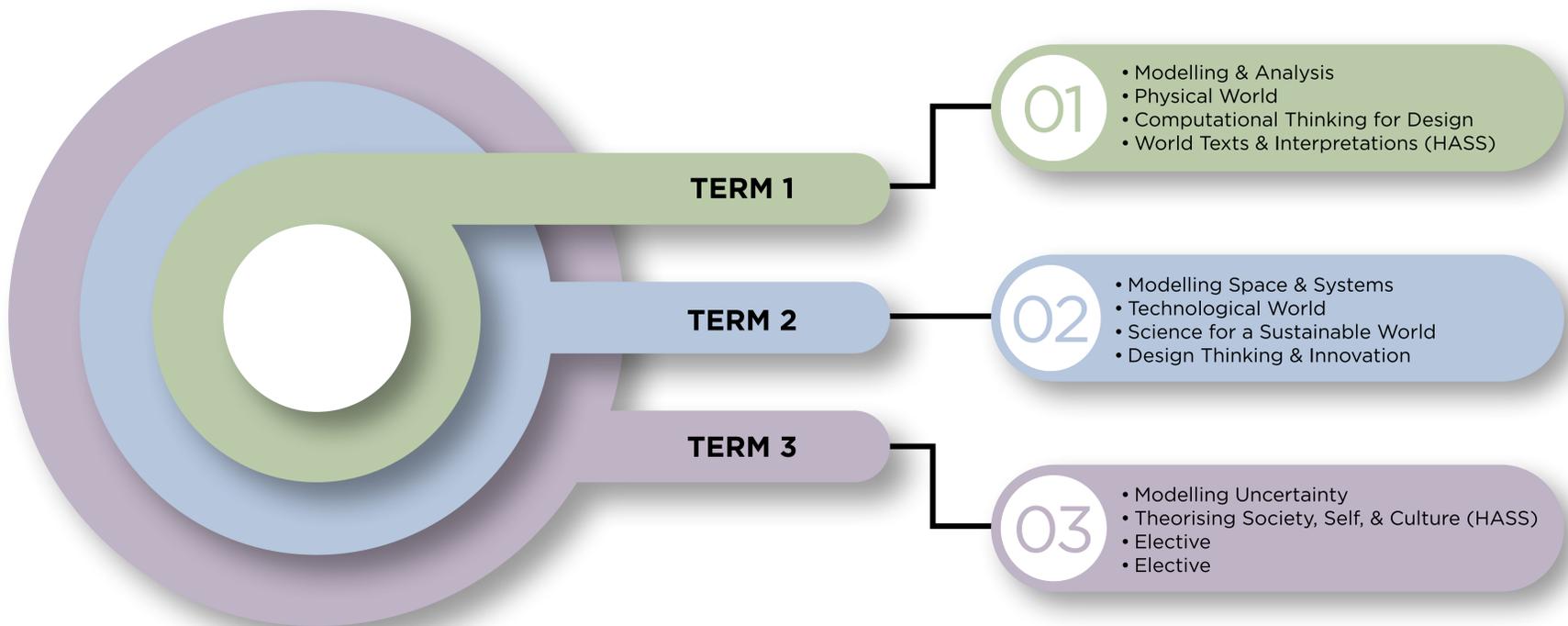
SPATIAL DESIGN WORLD

Focuses on data as it pertains to the (built) environment. Collection, analysis, modelling, and visualisation of data will be a part of this course. Students will use 3D scanning and other technology to represent a real environment, and form a 3D model. They will then analyse and visualise this environment for various purposes, and use both computational and physical representation techniques to make design proposals.



FRESHMORE CURRICULUM KEY ENHANCEMENTS

(from AY 2020 onwards)



SUTD has recently revamped the Freshmore curriculum and the new courses will be offered from AY 2020 cohort onwards. Some key elements of the revamped curriculum include the following:

01 FOUNDATION

The first three terms are **common to all students** and build the foundation in Science and Mathematics, Humanities, Arts and Social Sciences (HASS) and design. This approach provides a broad and rigorous education, and aims to provide the students with a strong base to select and excel in their pillar of choice, while building foundational literacy for future careers and endeavours.

The incorporation of design projects within and across subjects further imbues design thinking, critical inquiry, problem solving, communication and collaboration skillsets, which are highly relevant and useful in the industry. These design projects will also be reflected in the academic transcript from AY 2020 onwards.

02 EXTENSION OF GRADE-FREE SYSTEM

In addition to all modules in Term 1 being grade-free (Pass/Fail), students can now choose two other modules in Terms 2 and 3 to be grade-free. With this arrangement, students can better embrace learning in the new environment, even for subjects in which they have no prior background in.

03 MORE FLEXIBILITY TO PURSUE INTERESTS

Students are now allowed to choose any 2 of the following 4 elective modules in Term 3, to provide them with more options to pursue their own educational interests.

- Science and Technology for Healthcare
- Designing Energy Systems
- Data Driven World
- Spatial Design World

04 NEW COMPUTATIONAL DESIGN COURSES

Computational Thinking for Design (Term 1) and **Spatial Design World (Term 3 elective module)** are newly designed modules to strengthen students' digital literacy in preparation for the data-driven world.

05 MATHEMATICS AND PHYSICS

The following core modules were developed with increased correlation between Mathematics and Physics in mind, with enhanced linkages and translation to the choice of majors.

Term 1:

- Modelling and Analysis
- Physical World

Term 2:

- Modelling Space and Systems
- Technological World

Term 3:

- Modelling Uncertainty

06 CHEMISTRY AND BIOLOGY

Science for a Sustainable World (Term 2) and **Science and Technology for Healthcare (Term 3 elective module)** are designed from the point of view of the Sciences to address current issues relevant to Singapore and globally. Innovative solutions to these issues will also be explored.

