

SISC-ISSF 2019

Information Sheet

About SISC-ISSF

1. Conceptualised by **National Junior College (NJC)** in 2007, **Singapore International Science Challenge (SISC)** is a biennial international event that brings together gifted students of age 15 to 18 from around the world to compete, collaborate and innovate in Science. The multi-disciplinary foci and integrated nature of the challenges provides an authentic backdrop for students to apply scientific and technical knowledge to solving problems and innovate impactful solutions.
2. The **International Student Science Fair (ISSF)** is a major annual event promoted by the **International Science Schools Network (ISSN)**. The **ISSF** provides a unique forum for budding scientists to display their inquiry skills and defend their findings in a non-competitive environment. The event provides students from around the world valuable opportunities to work in collaborative settings to exchange ideas, hone their research techniques and engage their inquisitive minds in the fields of mathematics, science and technologies with like-minded peers. Opportunities are provided to extend student thinking, allowing them to use their knowledge in interesting ways and encourage all participants to explore their ethics and assumptions in the application of mathematics, science and technology. In particular, the team-work in problem solving and sharing sessions gives students and educators the opportunity to work with peers from different nations, thus promoting the inter-cultural understandings needed in the 21st Century. A significant component of **ISSF** is the cultural and social interactions which help develop friendships and collaborative opportunities amongst our students and educational leaders which may be the basis for future co-operation and study.

About SISC-ISSF 2019

3. NJC will be co-hosting the **15th International Student Science Fair (ISSF)** with the **7th Singapore International Science Challenge (SISC)**.
4. Bringing together the best minds of tomorrow, **SISC-ISSF 2019** is designed to enable students to apply multiple lensing and multidisciplinary thinking to improve the human condition. Students gifted in the Sciences from across the globe come together for 5 days to communicate their research in various modes, collaborate in innovating well-designed solutions, and network with one another to establish and sustain partnerships that enable endeavour and enterprise.

5. The objectives of **SISC-ISSF 2019** are:
 - a. To provide participants with a platform to effectively communicate scientific knowledge and concepts to an international audience.
 - b. To provide participants, both students and educators, a platform to publish research in science and education in the ISSF Proceedings.
 - c. To encourage the integration of knowledge and skills across the sciences through rigorous competition.
 - d. To develop in participants creative and critical thought that will lead to innovation and action for the local and global communities.
 - e. To encourage cross-cultural interaction and build lasting friendships between gifted science students as well as educators.
 - f. To provide opportunities for science educators to engage in professional discourse and establish ties with their international counterparts.
6. **SISC-ISSF 2019** also aims to build the capacities of our Science Educators through the teachers' and principals' programmes. These programmes enable the Science Educators to engage in professional discourse and, establish and develop ties with counterparts from other schools from around the world.
7. The theme for **SISC-ISSF 2019** is **Science for Society**. Many facets of life have seen positive change as a result of creative integration and application of Science and Technology. The thinking frames and process skills honed while engaged in cross-disciplinary work are fundamental to problem identification and design of elegant solutions that ultimately enable a paradigm shift in how we live and function as a society. Future academic and industry jobs are envisaged to be dynamic, where the prerogative of a thriving society is to create rather than operationalise. It is therefore crucial to equip ourselves with knowledge and skills to appreciate the Aesthetics in design, Build and Communicate solutions, that are requisite of the 4th Industrial Revolution¹ so that we can serve and impact our community positively. **SISC-ISSF 2019** is programatically designed to enable a platform for educators and students from across the globe to engage in deep conversations on the latest research in Science, Technology, Engineering and Mathematics (STEM), collaborate in problem-identification and innovating well-designed solutions for a community using the design thinking process, and to network to establish sustained partnerships that create unique entrepreneurial opportunities.
8. The working language of the event is English.
9. The event will be held from **18th to 22nd March 2019** in Singapore.

¹ The Fourth Industrial Revolution is "characterised by a range of new technologies that are fusing that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human" (Schwab, <https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab>, 2017).

10. *Table 1: Programme Outline* The programme outline for **SISC-ISSF 2019** is shown in Table 1.

Table 1: Programme Outline

Date	Day	Programme
17 Mar (Sun)	0	Arrival of participants
18 Mar (Mon)	1	Opening Ceremony
		Research Challenge
		Oral Lecture
		Welcome Party and Welcome Dinner
19 Mar (Tues)	2	Presentation on ISSF2018 Projects
		Design Thinking Workshop
		Design & Build Challenge Workshop A
		Singapore Food Trail
20 Mar (Wed)	3	Learning Journey for Field Challenge
		Field Challenge
		Learning Journey to Museums
		Cultural Night Activities @ Marina Bay
21 Mar (Thurs)	4	Design & Build Challenge Workshop B
		Release of Design & Build Challenge Task Design & Build Challenge
22 Mar (Friday)	5	Design & Build Challenge
		Design & Build Challenge Judging
		Closing Ceremony
		Farewell Party
23 Mar (Sat)	6	Departure of participants

Competition Rules and Format

11. **SISC-ISSF 2019** is open to all students aged 15 – 18 years old in 2019.
12. Each school is allowed to field 1 team comprising of 3 students.
13. **SISC-ISSF 2019** will comprise 3 challenges: the Research Challenge, the Field Challenge, and the Design & Build Challenge.
14. In Research Challenge, students will present their research projects individually or in a group with a maximum of three students.

15. Student teams will be mixed, comprising one student each from 5-6 institutes, for the Field Challenge and the Design & Build Challenges.
16. Achievement within each challenge will be recognised by a range of awards.

Research Challenge – Poster Presentation

17. Each institute is invited to have students present posters on up to 3 research projects from any field of STEM (see Table 2), viz. minimum of 1 poster presented by 2 or 3 students and maximum of 3 posters presented by 1 student each.
18. Students must declare that they have worked on the projects themselves, and that they had only received advice or guidance from their teachers and/or mentors.
19. A **250-word abstract** and **the research paper** for each research project that is presented should be submitted to the organisers prior to the event.
20. The papers will be reviewed by referees of current peer-reviewed journals.
21. Papers that meet the criteria of the peer-review committee will be selected for presentation and publication in **SISC-ISSF 2019 Proceedings 2019**.
22. Each poster should be **A0** in size, should be printed by the participants themselves and should clearly indicate the project title, name(s) of the team member(s), the name and/or logo of the school, and the name and/or logo of other institutes involved in the work.
23. The poster should, though not exclusively, contain the following sections: abstract/introduction, methodology, results & discussion, conclusion/impact, references.
24. Participants are required to give a **maximum 10-minute presentation** of their research using their poster.
25. Students are assessed for their creativity, content, clarity, engagement and efficacy (rubrics of assessment will be furnished to participants upon confirmation of participation). Students are also to draw relevance of their research work in benefiting a community, and to communicate their solutions via a prototype where possible.
26. Only projects that are presented will be judged by independent academics from universities and/or research institutes.

27. All participants are required to be present during the exhibition of their projects and the release of the judging results.
28. A mean research poster presentation score, to be used for the overall **SISC-ISSF 2019** score, will be computed for each institute.

Research Challenge – Oral Lecture

29. Each team is invited to give a maximum of 3 Oral Lectures on their research projects to an audience of participating students, educators and independent academics from academic and research institutes.
30. To further motivate and enhance this Challenge, **SISC-ISSF 2019** will augment this challenge with a focus on creative and feasible solutions to better a chosen community. Similar to the Poster Presentation, participants are to draw relevance of their research work in benefiting a community, and to communicate their solutions via a prototype where possible.
31. Bonus points will be awarded to students selected to present these oral lectures.

Table 2: Research Challenge Project Categories

CATEGORY	SUB-CATEGORIES
Biomedical & Health Sciences (BMHS) Deeper understanding in nature both in the macro and cellular level allowed great advances in the improvement of human health.	Biochemistry (BCY) Biochemical components found in cells (including the isolation, identification and quantification), biochemical processes (including chemical interaction and reactions) and any other studies on health and disease from the chemical perspective are key focus of this subcategory. Microbiology (MIB) Many diseases are caused by microorganisms such as bacteria, virus and fungi. The identification and understanding of these disease-causing microorganisms, development of vaccines and investigation of effectiveness of these treatment in killing and inhibiting growth of microorganisms are key focus of this subcategory. Translational Medicine (TMD) Development of novel assay for detection and diagnosis, identification of potential drugs and novel treatment for diseases are the key focus of this subcategory. Biomaterials (BMA) Studies on the creation or modification of biomaterial or biocompatible materials for constructing whole or a part of living structure are key focus of this subcategory. Biomedical Technologies (BTE) The study or design and construction of devices and technological methods through the application of electronics, analytical methods, computing and physical phenomenon for detection, diagnosis, prevention and treatment of disease are key focus of this subcategory. Bioinformatics & Computational Biology (BCB) Research work that focuses on utilising and/or developing mathematical models, software, big data, and computational methods in understanding biological systems are key focus of this subcategory. Others (OTH) Any other studies that cannot be assigned to one of the above subcategories.

Sustainable Energy (SUEN) Energy is the key driver of modern lifestyle and industrial development. However, this increasing demand of energy needs to be sustainable. Studies to encourage sustainable energy falls under this category.	Fuel Cell and Battery (FCB) Studies on development of chemical fuel cells and batteries, microbial fuel cells or other novel technique of energy storage are key focus of this subcategory. Alternative Fuel (AFE) Studies on the harnessing and increasing of energy production of new energy sources which does not involve fossil fuel, such as solar power, wind, thermal, hydro and etc are key focus of this subcategory. Sustainable Design (SUD) Engineering principles and design concepts applied to daily application such as architecture, infrastructure and device design to increase efficient energy use are key focus of this subcategory. Others (OTH) Any other studies that cannot be assigned to one of the above subcategories.
Computer and Computational Science (CCLS) Almost all technology we have today are driven by algorithms. All work pertinent to computer sciences (scientific computation, computational engineering) including modelling and fundamental theory can be presented in this category.	Embedded Systems (EBS) Studies on the development of Internet of Things (IoT) solutions, network and data communications, circuits and hardware design are key focus of this subcategory. Machine Learning and Artificial Intelligence (MAI) Studies on the designing and/or creating smart systems using machine learning and artificial intelligence that either reduce reliance on humans and/or support higher cognitive functionality are key focus of this subcategory. Software Development (SWD) Study involving the development of software and mobile application, front-end and back-end development techniques, user interface design, business logic and etc are key focus of this subcategory. Algorithm Design (AGD) Study of algorithms in data processing and computing are the key focus of this subcategory. Others (OTH) Any other studies that cannot be assigned to one of the above subcategories.

Mathematics (MATH) Interdisciplinary application of Mathematics to understand and solve phenomenon and problems.	Applied Mathematical Modelling (AMM) The study of mathematical modelling such as Game Theory and Cryptography are the key focus of this subcategory. Probability and Statistics (PST) Study of the use of probability and statistic to interpret and analyse data are the key focus of this subcategory. Others (OTH) Any other studies that cannot be assigned to one of the above subcategories.
Material and Chemical Sciences (MACS) Molecular understanding allows the precise and controlled synthesis of many of the materials and medicinal drugs. This category explores the various aspect of chemistry applied in synthesis of the substances and materials we use in everyday life.	Material Science (MAT) Study of design, synthesis and properties of substances and composites in developing materials with unique applications and technologies are the key focus of this subcategory. Analytical Chemistry (ANC) Study of spectroscopic methods for molecular structural elucidation and analysis (separation, identification and quantification) of chemical component systems are the key focus of this subcategory. Synthetic Chemistry (SYN) Study of novel organic and inorganic synthetic methods, reaction mechanistic studies, catalysis development, reaction kinetics and thermodynamics are the key focus of this subcategory. Computational Chemistry (CMC) The use of computation techniques to understand chemical reactions are the key focus of this subcategory. Others (OTH) Any other studies that cannot be assigned to one of the above subcategories.

Environmental Studies and Sustainability (ENSS) Research pertinent to the study of earth and environment with the aim of tackling critical global issues should be presented in this category. Research work that focuses on geological systems and sciences, and resource and systems engineering, should be presented in this category.	Environmental Chemistry (ENC) Solutions to reduce or eliminate the generation of hazardous substances, study of effect of particular chemical species on the natural environment are the key focus of this subcategory. Climatology, Atmospheric Science and Geology (CAG) Any studies on the climate, atmosphere or earth crust, their changes and effects on the ecosystem are the key focus of this subcategory. Environmental Engineering (EEG) Study on the development of improvement of engineering solution for the treatment of water, disposal of waste and control of pollution through the use of biological agent, recycling, waste and water management are the key focus of this subcategory. Others (OTH) Any other studies that cannot be assigned to one of the above subcategories.
Design and Engineering (DSEG) Encompassing a multitude of fields, including electrical, mechanical, chemical, aeronautical, civil and industrial, this category focuses on the attention to design and the end-user. Design thinking is a quintessential feature to the work flow or plan of projects in this category.	Engineering Design (EGD) The thought process behind the innovative engineering design of solutions to solve real life problems is the key focus this subcategory. Solutions can be applied to any field. Others (OTH) Any other studies that cannot be assigned to one of the above subcategories.

Field Challenge

32. Design thinking is a fundamental process that underpins how we transcend the status quo of the study of STEM. The second challenge in **SISC-ISSF 2019** will be the **Field Challenge**, designed to elucidate participants' problem identification and solution brainstorming skills.
33. In this challenge, participants in mixed groups will visit selected communities in Singapore to empathise and learn about the challenges faced by the local communities, before coming up with innovative solutions for the challenges.
34. To better prepare participants for the challenge, participants will be engaged in workshops and learning journeys on design thinking which will place participants in good stead for the Field Challenge.
35. The Field Challenge, like the Design & Build Challenge, will be released during **SISC-ISSF2019** itself, i.e. there is no preparation required on the part of the participants.
36. The rubrics of assessment will also be made available during the challenge itself.

Design & Build Challenge

37. A highly anticipated mainstay of previous SISCs, the **Design & Build Challenge** is kept confidential, and the details of this challenge will only be made known to the participants during **SISC-ISSF 2019** itself.
38. In the Design & Build Challenge, participants can (1) engage in developing solutions that can be applied to serve the society, (2) use their **SISC-ISSF 2019** experience to further their network and cooperation beyond **SISC-ISSF 2019** and (3) market and pitch their solutions to potential venture capitalists and experts from academic and research institutes.
39. At **SISC-ISSF 2019**, the Design & Build Challenge will be an extension of the Field Challenge, allowing the participants to build and actualize their ideas before pitching them to potential venture capitalists and experts from academic and research institutes.
40. Participants are given **less than 24 hours** to design and build their solutions to a scenario that is presented during **SISC-ISSF 2019**.
41. All teams consist of participants from different countries and educational institutions to facilitate discussions of various issues.
42. To better prepare participants for the challenge, participants will be engaged in workshops which will place participants in good stead for the Design & Build

Challenge.

43. Participants are recommended to pick up basic programming skills (using blocks or in languages such as Python) which will be useful in tackling the challenge. A learning guide would be provided on **SISC-ISSF 2019** website for participants to self-learn basic programming.
44. Experts from academic and research institutes will be invited to share their expertise in fields pertinent to this challenge and mentor participants in the design and engineering of their products.

Overall Challenge Scoring, Prizes and Awards

45. The weight of the Research, Field and Design & Build Challenges are 30%, 30% and 40% respectively.
46. The judging criteria, viz. creativity, scientific thought, meeting of engineering objective, etc. will be detailed at **SISC-ISSF 2019**.
47. The awards for the respective **SISC-ISSF 2019** Challenges are summarised in the table below:

Challenge	Prizes
Research Challenge	Best Young Research Student Best Poster for each category
Field Challenge	Overall 1 st Award Overall 1 st Runner Up Award Empathiser Award Ideator Award Best Sketchboard Award
Design & Build Challenge	Overall 1 st and 1 st Runner Up Award Most Creative Design Award Best Ergonomic Design Most Enterprising Award Best Engineering Award Best Social Impact Award
Most Outstanding Student Participant	Outstanding Young Scientist Award

48. All participants will be given certificates of participation.
49. All decisions made by the **SISC-ISSF 2019** Organising Committee are final.