华南理工大学

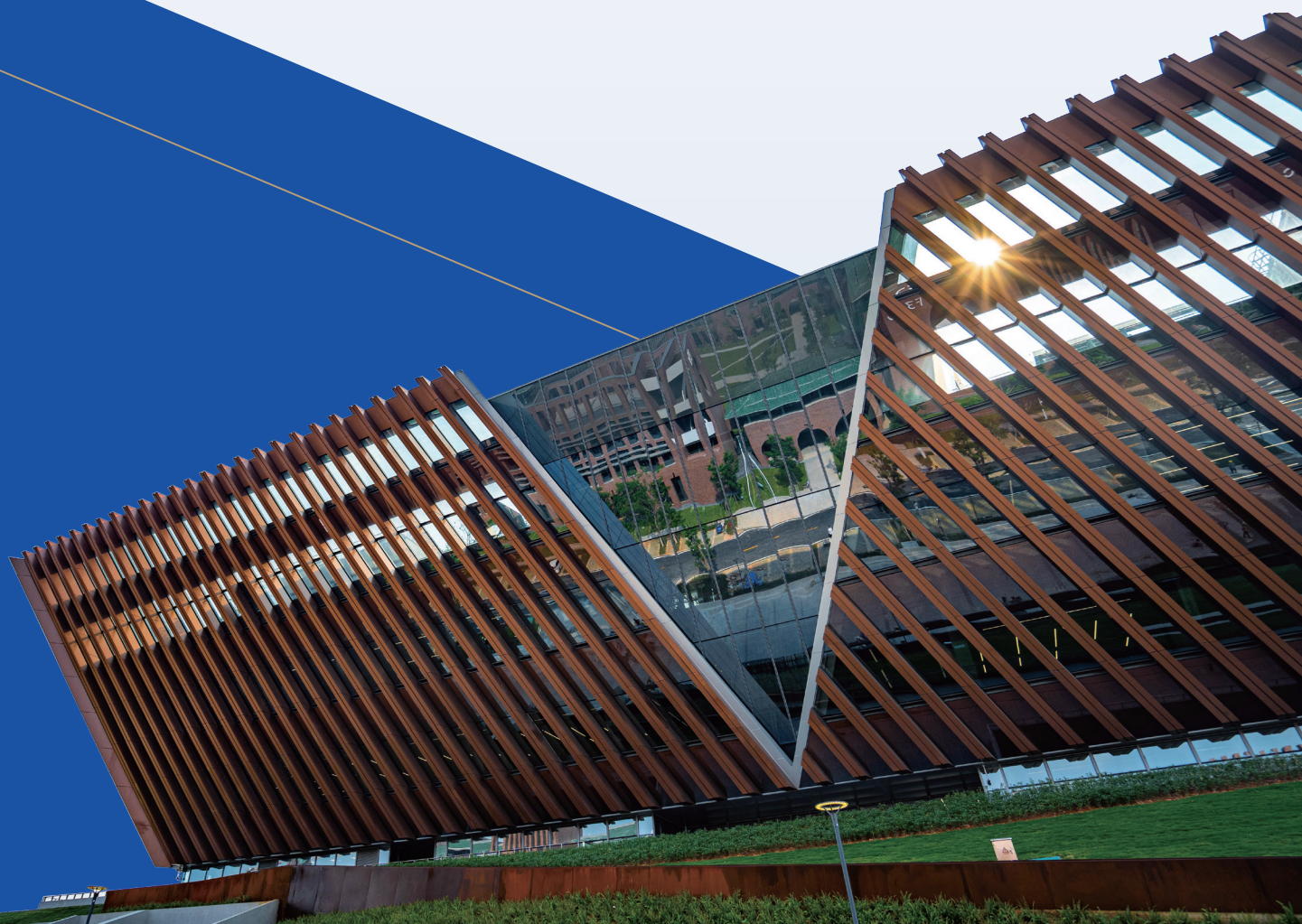**South China University of Technology**

2024 SCUT GLOBAL ENGINEERING SUMMER PROGRAM

JULY 14-27, 2024 (2 WEEKS)

SCUT GUANGZHOU INTERNATIONAL CAMPUS

Situated in Guangzhou, the heartland of the dynamic Guangdong-Hong Kong-Macao Greater Bay area, South China University of Technology (SCUT) is a prestigious research university particularly renowned for its excellence in Engineering, selected into the national Double First-Class initiative along with 30 plus universities across China.

The SCUT Guangzhou International Campus integrates advanced global educational philosophies and premier resources, equipped with modern and well-furnished rooms, advanced research equipment, and architecture incorporating both eastern and western styles.

SCUT Highlights

- 101-150 worldwide (Academic Ranking of World Universities 2023)
- Engineering top 0.1% (ESI Global Rankings 2023)
- U.S. News Subject Rankings 2023:

  | # 1 Chemical Engineering | # 39 Artificial Intelligence | # 39 Materials Science |

Discover Guangzhou

Guangzhou is a city with a history of over 2000 years, also China's third largest city with modern skyscrapers.

Location: 30 minutes train to Shenzhen & 1 hour train to Hong Kong

Food: Canton cuisine is one of the four cuisines in China, renowned for its clearness, freshness, and true to original flavor. Meanwhile, you will also find plenty of restaurants with cuisines from almost all around the world.

Shop: From a range of international big brands, to shops with inexpensively priced goods, can be located in Guangzhou as you prefer.

Culture: Since ancient times, Guangzhou is the centre for culture of Lingnan region, especially well-known for its dialect, opera, carving and embroidery, architecture etc.

Domains

You are free to choose one of the following three domains:
- Advanced Materials of Soft Matter and Biomedicine
- Artificial Intelligence and High-end Manufacture
- Chemistry and Chemical Engineering

Contents

- **Academic courses** (8 credit hours for each course)
- **Lectures** from Oxford, MIT, Princeton etc.
- **Cultural courses** including Chinese traditions, Lingnan (southern China) culture, the Greater Bay Area development, etc. (15 credit hours in total)
- **Enterprise visits** including Rayvision, iFLYTEK, VIPS, Guangzhou Automobile Group Company, etc.

Application

Applicants: Junior & senior undergraduates and graduates will be accepted with priority
Website: https://scut.17gz.org/
Deadline: April 30

Fees

Application and tuition fees waived, round airfare and local expenses self-covered (accommodation around 500-1000 RMB for each)

2024 SCUT Global Engineering Summer Program Schedule

Date	Time	Courses
July 14 (Sun.)		Opening & Orientation 开营仪式
July 15 (Mon.)	AM	Academic course
	PM	品味汉语美, 学唱中国歌 The beauty of mandarin (Greetings & Chinese songs)
July 16 (Tue.)	AM	Academic course
	PM	中国经济之窗—粤港澳大湾区 The window of China' s economy – The Guangdong- Hong Kong-Macao Greater Bay Area
July 17 (Wed.)	AM	Academic course
	PM	传承千年的国粹—中国功夫 Heritage for thousands of years- Chinese Kungfu
July 18 (Thu.)	AM	Academic course
	PM	行云流水的艺术—中国书法 Flowing art – Calligraphy
July 19 (Fri.)	AM	Academic course
	PM	时代中的建筑：广州城市规划中心 Architecture in times: Guangzhou Urban Planning Center
July 20 (Sat.)		视觉之旅，自然之行—深圳瑞云科技、红树林自然保护区参观 Feast on eyes, journey to nature - Shenzhen Rayvision & Mangrove forest natural reserve visit
July 21 (Sun.)		Break 休息
July 22 (Mon.)	AM	Academic course
	PM	一方水土一方味：食在岭南 One of the Four Cuisines in China: Canton Cuisine
July 23 (Tue.)	AM	Academic course
	PM	品质生活— 科大讯飞、唯品会参观 Quality life: iFLYTEK & VIPS visit
July 24 (Wed.)	AM	Academic course
	PM	科技先行—世界500强企业参观（广汽研究院、广汽生产线） Technology First: Fortune Global 500 enterprise visit- Guangzhou Automobile Group Company (GAC) R&D Center, GAC production line
July 25 (Thu.)	AM	Academic course
	PM	传统与现代—广州城市参观（广东省博物馆、陈家祠） A city of modern and tradition: Guangzhou city tour (Guangdong Provincial Museum, Chen Clan Academy)
July 26 (Fri.)	AM	Academic course
	PM	传统与现代—广州城市参观（余荫山房、珠江夜游） A city of modern and tradition: Guangzhou city tour (Yu Yin Garden, Pearl River night cruise)
July 27 (Sat.)		Closing & Departure 结业&返程

Rayvision: Founded by SCUT alumnus, Rayvision provides cloud rendering technology and pioneers in self-serving cloud rendering.

iFLYTEK: A leading listed company in intelligent speech and artificial intelligence technology across Asia-Pacific region

VIPS: A renowned e-commerce enterprise in China, popular for its online outlets business mode

Guangzhou Automobile Group Company: A Fortune Global 500 state-owned enterprise

Guangdong Museum: A national First-rate museum and must-see cultural landmark of the Greater Bay Area, highlights of the museum include the bronze wine ware in the Western Zhou dynasty (1046 BC-771 BC), the Monkey King ink-stone in the Qing dynasty (1616-1912), the gold lacquer wood-carving shrine in the Qing dynasty etc.

Chen Clan Academy: A clan hall constructed and financed by the Chen Clan of Guangdong Province, and inaugurated in 1893. It is the largest, best reserved and ornamented clan architecture extant in China, renowned as the Pearl of the Lingnan Architecture Art.

Yuyin Garden: One of the four ancient private gardens in the Qing dynasty, fully demonstrating the uniqueness and skilled art of the Lingnan garden, reflecting the philosophy of harmony between nature and human.

Pearl River night cruise: Pearl River is the largest river in southern China, the night cruise offers you a glimpse of Guangzhou modern buildings and its rapid development.

2024

SCUT GLOBAL ENGINEERING SUMMER PROGRAM

Tissue Engineering and Artificial Organ

This course is aimed at covering the important multi-disciplinary research field of tissue engineering and artificial organ. The limited supply of donor tissues and organs has become a major medical challenge that compromises the treatment outcome of many diseases and injuries. This course will cover the key elements of tissue engineering paradigm including the therapeutic cells, biomaterial scaffold, inductive factors, and recent developments and challenges in the field of tissue engineering and artificial organs. Specific topics including stem cells, extracellular matrix, biomimetic biomaterial design, morphogens, controlled delivery, and mechanotransduction will be discussed in this course.

Advanced Materials in Biomedical Imaging and Diagnostics: Introduction, Principles and Applications

This course provides an introduction of different biomaterials that underpin modern biomedical imaging and diagnostic applications. The course will cover state-of-the-art biomedical imaging and diagnostic technologies that are currently applied clinically, in clinical trials or under active preclinical development, including but not limited to optical imaging, ultrasound imaging, photoacoustic imaging, MRI, CT, nuclear imaging, point-of-care diagnostics, synthetic biomarkers, etc. Attendees will have a basic understanding of the principles associated with each technology and how material science was leveraged to solve healthcare challenges.

Biomaterials

This course focuses on the structure of biomaterials and the formation of material structure, and discusses the basic theoretical issues of biomaterials science and engineering from the perspective of physical chemistry. Describes the fundamentals of various materials related to biomedical engineering, including metal, inorganic non-metal and organic polymer materials, in terms of composition, structure, chemical and physical properties. Introduces thermodynamic functions and laws governing equilibrium properties, relating macroscopic behavior to atomistic and molecular models of materials. Introduces structure of crystalline and noncrystalline states, symmetry and tensor properties of materials, point, line, and surface imperfections in materials, materials phenomena such as phase transformations, multiphase equilibria, chemical reactions, mechanical property, synthesis and application of polymeric materials. Through studying of the course, Student will master the basic theories of material structures, the relationship between materials structures and materials properties, materials thermodynamics and materials kinetic.

Hybrid Techniques of Emergent Soft Matter

Soft matter are usually defined as materials made of mesoscopic entities, sensitive to thermal fluctuations and to weak perturbations. Archetypal examples are colloids, polymers, amphiphiles, liquid crystals, foams. The importance of soft materials in everyday commodity products, as well as in technological applications, is enormous. The objectives of the course are to stimulate the students' interest in material and technique development based on soft matter materials. In this course, we will have three or four professors to give individual lectures. They will introduce the emergent technologies of soft matter, with polymers as the representative, involving: affordable and clean energy from polymer solar cells, energy storage technologies with polymers, gas separation and water cleaning with porous materials, and polymers supported new display technologies. Students learn via lecture, tutorial, and group discussion.

Optics of Emergent Soft Matter

Soft matter is a special category with high flexibility to respond to and control light fields. From the big success in many industries like display, light modulator, and the like, we now face new challenges in soft matter optics and photonics. In this course, we aim to clarify emerging material science and technology in modern optics of soft matters (e.g., polymer, liquid crystal, and supramolecular systems), as well as a brief introduction to fundamental physics in optics. In addition to lectures, the students will be able to enjoy related experiments during the class, which would be intuitive and straightforward.

Biomimics of Emergent Soft Matter

Biomimetics in soft materials is an innovative field of study where scientists and engineers draw inspiration from the natural world to design and fabricate materials that replicate the remarkable properties of biological tissues and organisms. This interdisciplinary approach leverages the principles of biology, chemistry, materials science, and engineering to create soft materials with functionalities that often surpass conventional synthetics. In this course, professors will talk about developing soft materials with uses ranging from biomedical applications and advanced robotics to responsive materials and beyond. The exploration of biomimetics in soft materials not only holds the promise for technological breakthroughs but also offers profound insights into the symbiosis between synthetic and biological systems.

Academic courses   Artificial Intelligence and High-end Manufacture

Large Language Models and Prompt Engineering

This course aims to briefly introduce the recently popular Large Language Model (LLM), and how to teach it to work in the way we want using Prompt Engineering. The prompt engineering is to generate a set of prompts (i.e., instructions) designed specifically for LLMs so they can perform specific tasks that they have never seen before. For instance, teach LLMs to become a poet that can produce poetry of given topics, or a writer that can generate reports given a set of keywords. In this course, we will learn how to design effective prompts by looking into the typical properties of LLMs, with exercises provided.

Soft Robotics

This innovative summer course in Soft Robotics offers a comprehensive introduction to the exciting and rapidly developing field of soft robotics. Over the course of 16 hours, participants will delve into the design, modeling, and analysis of typical soft actuators, such as pneumatic artificial muscles, gaining a thorough understanding of their unique properties and capabilities.

The course also explores the wide range of applications for soft robots in various fields, including biomedicine, industrial automation, service robotics, and more. Through a combination of lectures, hands-on laboratory sessions, and project-oriented learning, students will develop the skills necessary to design and create their own soft robots, including soft grippers and mobile platforms.

With a focus on practical application and hands-on experience, this course is perfect for students interested in robotics, mechatronics, materials science, and related fields. By the end of the course, participants will have a basic understanding of the fundamental principles and practical applications of soft robotics, positioning them well for further studies or careers in this exciting and emerging field.

Smart Factory

This course offers a dynamic exploration of how interconnected factories, driven by the Internet of Things (IoT), artificial intelligence (AI), and data analytics, are reshaping the manufacturing landscape. We'll explore the integration of advanced robotics, the transformative power of AI and machine learning in production, and the pivotal role of big data in operational optimization. Additionally, we will delve into the innovative realms of sustainable manufacturing practices, ensuring a comprehensive understanding of how these technologies contribute to efficiency and environmental sustainability. The course also addresses crucial aspects of cybersecurity and ethical considerations in automated systems. Through a blend of theoretical knowledge and practical insights, including case studies and industry expert interactions, this course is designed to ignite your curiosity and equip you with a deep understanding of the future of manufacturing.

3D Vision Intelligence

3D Visual Intelligence is a course designed for students with interests in computer vision and deep learning. This course emphasizes collaboration with enterprises, and as a result, a portion of the course content will be sourced from Orbbec Technology Co., Ltd., and the OpenCV community. Throughout the program, students will gain a solid understanding of fundamental concepts in artificial intelligence and 3D vision, and learn how to apply this knowledge to solve practical engineering problems. Key topics covered in this course include basic concepts of artificial intelligence and 3D vision, 3D visual data representation and visualization, 3D imaging principles, 3D rendering and visualization, visual recognition based on point cloud, and synchronous localization and mapping algorithms.

Metaverse Introduction and Practice

Metaverse Introduction and Practice is a course tailored for students intrigued by metaverse-related technologies. The metaverse entails the virtualization and digitization of the real world, leading to significant transformations in content production and user experiences. This course uniquely blends theory with hands-on practice, incorporating NVIDIA Omniverse-related software systems to provide a solid foundation for experimentation. Throughout the curriculum, students will delve into key areas such as 3D engines, digital twins, enabling the conversion of theoretical knowledge into practical skills. The course is designed to empower students in applying these techniques to solve real engineering problems. Major topics covered include AIGC and the metaverse, blockchain, human-computer interaction, 3D engines, digital twins.

Low Carbon Smart Energy

Low Carbon Smart Energy is a course designed for students interested in machine learning and power systems. This course emphasizes the application of machine learning in the power market and energy field, and provides rich experiments and video cases to enhance students' participation and cultivate students' innovative thinking and problem-solving ability in the energy field. Throughout the course cycle, students will develop a solid understanding of the basic concepts of machine learning and power systems, and learn how to apply what they have learned to practical engineering problems. The main content of this course includes the basic concepts of low-carbon smart energy, the principles and technologies of energy management, the operation mechanism of electricity market and related policies, and the specific application of machine learning in the field of energy management.

- **Biomaterials**
- **Optics of Emergent Soft Matter**
- **Hybrid Techniques of Emergent Soft Matter**
- **Frontiers of Chemical Biology**

Chemical biology combines the scientific ideas and approaches of chemistry, biology, and allied disciplines to understand and manipulate biological systems with molecular precision. This course mainly introduces significant concepts or research progress reported in any field that intersects chemistry and biology. The teaching methods are quite diverse, including concept introduction, topic discussion, experimental verification and summary. Through these processes, the aim is to provide students with a deeper understanding of the cutting-edge research hotspots in chemical biology, including but not limited to biological orthogonal synthesis chemistry, molecular imaging, etc.

Molecular Magnetism

Magnetism is a generalized phenomenon in our daily life, which is originated from the electron spin. This course aims to give a brief introduction of the magnetic properties of molecules, that possess unpaired electrons with net spin angular momentum. During the course the cut-edge overview, theoretical deduction, and knowledges of molecular magnetism will be presented, and the mathematical tools as well as their applications in molecular magnetism will also be elucidated.

Metal Catalysis towards Functional Molecular Synthesis

Welcome to our in-depth exploration of the fascinating world of metal catalysis and its crucial role in driving functional molecular synthesis! In this course, we will embark on a journey through the fundamental principles, cutting-edge methodologies, and diverse applications of metal-catalyzed reactions in modern organic synthesis. Metal catalysis has revolutionized the way chemists construct complex molecules, enabling the efficient formation of intricate carbon-carbon and carbon-heteroatom bonds with remarkable selectivity and efficiency. As we delve into this course, we will unravel the underlying mechanisms, explore the synthetic potential of different transition metal complexes, and examine the pivotal role of ligand design in steering the reactivity and selectivity of metal-catalyzed transformations.
Get ready to embark on an illuminating journey into the world of metal catalysis and its transformative impact on functional molecular synthesis!

Cultural courses

The beauty of mandarin (Greetings & Chinese songs)

Mandarin is the official language of China and is one of the six working languages of the United Nations. This class will introduce the simple application of Mandarin and Chinese traditional songs. Students can learn the Chinese "pronunciation" and Chinese traditional culture through songs.

The window of China's economy – The Guangdong- Hong Kong-Macao Greater Bay Area

The lecture introduces the basic situation of the Guangdong-Hong Kong-Macao Greater Bay Area (GBA), one of China's national strategies. Prosperous bay area economies, represented by the New York Bay Area in the US and Tokyo Bay Area in Japan, have been growing and attracting worldwide attention. Nowadays, as a rapidly rising economy and the world's second-largest economy, China has been constructing three major bay areas including the GBA. Compared with other bay areas at home and abroad, the GBA enjoys its unique feature of covering two different sociopolitical systems, three independent customs territories, and three jurisdictions. Therefore, the GBA is not only economically significant but also is a grand experiment for China's political system and social governance.

Heritage for thousands of years- Chinese Kungfu

Chinese Kungfu is one of the precious cultural heritages of the Chinese nation. It has a long history and changes with the continuous evolution of Chinese traditional culture. The main task of the class is to teach students to strengthen their body through Chinese Kungfu, while learning self-defense.

Flowing art – Calligraphy

Chinese calligraphy is an important part of Chinese traditional culture. It is not only an art form, but also a way of cultural inheritance and spiritual transmission. This calligraphy class mainly includes the development of calligraphy and calligraphy fonts, the specification of writing pens, and the explanation, demonstration and practice of works.

One of the Four Cuisines in China: Canton Cuisine

In China, different cities and regions have their own unique food culture. Located in the south of China, Guangdong has rich natural resources and unique climatic conditions, which provide advantages for the development of Guangdong cuisine. Cantonese cuisine pays attention to the freshness of ingredients and exquisite production techniques. This class is designed to allow students to understand the evolution of Cantonese cuisine and experience the process of making Cantonese food.

Contact

Cynthia Yi SUN, International Office
Phone: 86-20-87114526/ 86-188-9869-9066
Email: glsunyi@scut.edu.cn