

**The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent**

Autumn Courses 2021
Course Outline

CUSA1003 Molecular Biology and Biotechnology: An Introduction
分子生物學和生物技術導論

Introduction:

The structure of DNA was discovered by Watson and Crick in 1953. Since then, molecular biology has been developed rapidly and changed our lives in many ways. Another important milestone in biotechnology was the invention of Polymerase Chain Reaction (PCR) by Kary Mullis in 1983 to amplify DNA. One of the well-known examples using these new technologies is the production of recombinant insulin by bacteria for the treatment of diabetes. Now, these topics become part of the new senior secondary biology curriculum in Hong Kong. To prepare students for these challenges, this course aims at helping students to learn the major concepts and methods of molecular biology and biotechnology. Topics include DNA structure, principles of molecular biology and application of recombinant DNA technology. Students will gain hands-on experience in culturing bacteria, introducing foreign DNA into bacterial cells (bacterial transformation) for recombinant protein production, running PCR and using DNA electrophoresis for paternity test.

沃森(Watson)和克里克(Crick)於 1953 年解構了脫氧核糖核酸(DNA)的結構。從那時起,分子生物學得到迅速的發展,改變了我們生活的許多方面。及後凱利穆利斯(Kary Mullis)於 1983 年發明的聚合酶鏈反應(Polymerase Chain Reaction)DNA 擴增技術,亦是生物科技另一個重要的里程碑。結合這些新技術,其中一項比較著名的應用,是利用細菌生產重組胰島素作治療糖尿病之用。現在分子生物學課題已成為香港新高中生物課程的一部分。為迎接這個挑戰,本課程旨在幫助學生加深認識/了解分子生物學和生物技術的概念和方法。主題包括 DNA 的結構,分子生物學原理和重組 DNA 技術的應用。學生將親身體驗如何將外來 DNA 放入細菌內(細菌轉化)生產重組蛋白,怎樣進行聚合酶鏈反應(PCR)和如何應用 DNA 電泳鑑定親子關係等。

Medium of Instruction: Cantonese supplemented with English

Teacher:

Professor SK Kong
Programme of Biochemistry, School of Life Sciences, CUHK
E-mail: skkong@cuhk.edu.hk

Demonstrator:

To be determined

Course Content:

<p>28 December 2021 (Saturday)</p> <p>10:00 am – 12:30 pm 2:00 pm – 5:00 pm</p>	<p><u>Lecture:</u></p> <ul style="list-style-type: none">• Virus and Bacteria• Bacterial Growth (Bring your calculator)• Aseptic Techniques for Bacterial Culture• Bacterial Plasmid• Bacterial Transformation• Expression of Green Fluorescent Protein (GFP) from jellyfish in E. coli <p><u>Laboratory:</u></p> <ul style="list-style-type: none">• Basic Lab Safety• Basic Techniques – Use of pipettes• Aseptic Techniques to Prepare Agar Plates• Bacterial Culture – Part 1• Bacterial Transformation – Part 1• (Expressing GFP in E. coli: 2008 Nobel Prize in Chemistry Work)
<p>29 December 2021 (Saturday)</p> <p>10:00 am – 12:30 pm 2:00 pm – 5:00 pm</p>	<p><u>Lecture:</u></p> <ul style="list-style-type: none">• Gene and DNA Structure• Central Dogma: DNA → RNA → Protein• DNA Isolation, Restriction Enzymes, Ligase• Molecular Cloning to Make Recombinant Proteins• Polymerase Chain Reaction for DNA Isolation and Amplification <p><u>Laboratory:</u></p> <ul style="list-style-type: none">• Bacterial Culture – Part 2• Restriction Cut in DNA <p>Polymerase Chain Reaction</p>
<p>30 December 2021 (Saturday)</p> <p>10:00 am – 1:30 pm 2:30 pm – 5:00 pm</p>	<p><u>Lecture:</u></p> <ul style="list-style-type: none">• DNA Electrophoresis• DNA Fingerprinting• Biotechnology: Recombinant Insulin Production & Disease Diagnosis <p><u>Laboratory</u> (Bring your camera to record the results):</p> <ul style="list-style-type: none">• Bacterial Transformation – Part 2• DNA Electrophoresis• DNA Fingerprinting <p><u>Assessment:</u></p> <ul style="list-style-type: none">• Written short answer tests will be conducted at 4:30-5:00 pm
<p>31 December 2021 * (Saturday)</p> <p>10:00 am – 1:30 pm 2:30 pm – 5:00 pm</p>	<p>Make-up class</p>

Duration	3 whole day sessions (total 17 contact hours)
Date	28, 29, 30 December 2021 31 December 2021* (make up class)
Time	28, 29 December 2021: 10:00 am – 12:30 pm, 2:00 pm – 5:00 pm 30 December 2021: 10:00 am – 1:30 pm, 2:30 pm – 5:00 pm
Teaching Mode[#]	Face to Face (The Chinese University of Hong Kong)
Enrollment	16
Expected Applicants	Students who promoting to or studying S6 who are interested in molecular biology
Tuition Fee	HKD 3,320.00
Credit	1.25 Academy Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance.

* This date is reserved for make-up classes in case there is any cancellation of classes due to unexpected circumstances.

This course is only offered face-to-face lessons at CUHK campus.

The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent

Autumn Courses 2021
Course Outline

CUSA2013 Great Discoveries in Biomedical Sciences (Senior Class)
生物醫學大發現 (高級班)

Introduction:

This course aims at deciphering how the work of some famous scientists in the field of life sciences has affected our daily life and our society. The course first provides students with the general knowledge of some basic processes in life, namely biochemistry, cell biology, and immunology, followed by how the knowledge has helped us to cope with the natural adversities such as diseases. The improvements of our quality of life by the technological advances in life sciences will also be discussed. Finally, how the development in life sciences has brought revolutionizing impacts on our lives, civilization, and modernization will be presented. Through a series of learning activities, students are encouraged to comprehend and to connect the discoveries in life sciences to daily scenarios. This course is particularly suitable for students who want to understand more on how discoveries in life sciences, which have transformed the way we think and live throughout the centuries.

本科旨於探討一些卓越生命科學學家的研究成果及其科學意念如何影響現代人類的生活及社會發展。課程內容首先介紹一些生命運作的基本概念，即生物化學，細胞生物學及免疫學，然後再談及生命科學如何幫助人類抵禦疾病等自然災害。最後，課堂將進一步演繹那些生命科學的理論如何被應用，從而對現今社會作出貢獻。同學可以透過不同的課堂學習活動，增進了解這些當代重要的科學發明如何對人類生活及其對科研工作帶來革命性的影響及反思。本課程是為對生命科學感興趣的同學而設；課程內容讓同學們進一步了解生命科學的發現如何對我們日常生活帶來深遠的影響。

Medium of Instruction: Cantonese supplemented with English

Organising Unit:

Biochemistry Programme, School of Life Sciences, Faculty of Science, CUHK

Teacher:

Dr. LO Fai Hang

School of Life Sciences, CUHK

Rm G83, Science Centre South Block, CUHK

Tel: 3943 5019, E-mail: lofaihang@cuhk.edu.hk

Demonstrators:

Students from Programme of Biochemistry, School of Life Sciences, CUHK

Course Content:

13 November 2021 (Saturday) 10:00 am – 1:00 pm 2:00 pm – 5:00 pm	<u>Lecture:</u> <ul style="list-style-type: none"> • Introduction to life sciences and biochemistry • Microbes on human civilization • Battles between human beings and microbes • The discovery of microbes • Germ theory of disease • Introduction to cell biology • Tutorial/discussion/activities
20 November 2021 (Saturday) 10:00 am – 1:00 pm 2:00 pm – 5:00 pm	<u>Lecture:</u> <ul style="list-style-type: none"> • Introduction to cell biology • Introduction to immunology • The strategy of human beings to cope with microbial infections • Cell growth, cell death, and signalling • Cancer: the correlation to infections and oncogenes • Tutorial/discussion/activities
27 November 2021 (Saturday) 10:00 am – 1:00 pm 2:00 pm – 5:00 pm	<u>Lecture:</u> <ul style="list-style-type: none"> • Cell growth, cell death, and signalling • Cancer: the correlation to infections and oncogenes • Topics in focus: <ul style="list-style-type: none"> ▪ Quorum sensing mechanism (Shaw Prize 2015) ▪ Prion disease (Nobel Prize 1997) ▪ Induced pluripotent stem cell and other relevant knowledge (Nobel Prize 1935, 1995, 2012 and Shaw Prize 2008) ▪ Organ transplantation (Nobel Prize 1912, 1960, 1980, and 1990) ▪ CRISPR/Cas9 genetic scissors (Nobel Prize 2020) • Tutorial/discussion/activities/revision/Quiz
11 December 2021 * (Saturday) 10:00 am – 1:00 pm 2:00 pm – 5:00 pm	Make up class

Duration	3 whole day sessions (total 18 contact hours)
Date	13, 20, 27 November, 11* December 2021
Time	10:00 am – 1:00 pm & 2:00 pm – 5:00 pm
Teaching Mode[#]	Face to Face (The Chinese University of Hong Kong)
Enrollment	20 – 25
Expected Applicants	Students who promoting to or studying S5-S6 who are interested in biomedical sciences
Tuition Fee[@]	HKD 3,180.00 [@] For students who apply with the certificates of CUSA1013 Great Discoveries in Biomedical Sciences, their tuition fee will be HKD\$1,590.
Credit	1.25 Academy Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance.

* This date is reserved for make-up classes in case there is any cancellation of classes due to unexpected circumstances.

This course is offered face-to-face lessons at CUHK campus. It may switch to online teaching in accordance with the pandemic development and the policy of the university.

The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent

Autumn Courses 2021
Course Outline

CUSA2023 Introduction to Bionics
仿生學淺談

Introduction:

Bionics is the branch of science dedicated to the studying of the characteristics, structure or functions of bio-systems for innovations in developing new technology, it is also known as “Biomimicry” or “Biomimetics”. Since 1960s, bionics has developed quickly and applied widely in various fields of science and technology. With an emphasis on the scientific basis of various processes or phenomena in nature, this course aims to introduce to the students the various inspirations which human beings acquired from nature, the methodology, the major applications, and the advancements of bionics. Students will learn in form of lectures, videos, demonstrations, quizzes, discussions, and also gain hands-on experience through participating in worksheets and self-exploratory activities.

仿生學又稱為「模擬生物學」或「生物模仿學」，是一門研究生物系統的特質、結構及功能原理的科學，主要用以研發各種創新科技。自六十年代開始，仿生學的迅速發展使其在各個科學及技術範疇中漸漸普及。本課程旨在以各種科學現象或過程的原理為基礎，通過講解、視頻、示範、測驗、及討論等內容介紹仿生學的原理及仿生學在各方面的應用。學生亦可通過工作紙及在家實驗等活動，親身了解仿生學的基本原理。

Medium of Instruction: Cantonese supplemented with English

Organising Unit: Centre for Promoting Science Education, Faculty of Science, CUHK

Teacher:

Dr. Chung Kwok Cheong
School of Life Sciences, CUHK
Email: kcchung@cuhk.edu.hk

Course content:

6 November 2021 (Saturday) 2:00 pm – 5:00 pm	<p><u>Lecture:</u></p> <ul style="list-style-type: none"> • Introduction: history, methodology and scope of Bionics <p><u>Demonstration:</u></p> <ul style="list-style-type: none"> • Relationship between the number of setae in Gecko foot & its holding force
20 November 2021 (Saturday) 2:00 pm – 5:00 pm	<p><u>Lecture:</u></p> <ul style="list-style-type: none"> • Application of Bionics: structures / materials / architecture <p><u>Demonstration:</u></p> <ul style="list-style-type: none"> • Superhydrophobicity, the lotus effect and water striders <p><u>Homework:</u></p> <ul style="list-style-type: none"> • How to build stronger bones?
27 November 2021 (Saturday) 2:00 pm – 5:00 pm	<p><u>Lecture:</u></p> <ul style="list-style-type: none"> • The secrets of flying: Principle of animal flight & aerodynamics <p><u>Homework:</u></p> <ul style="list-style-type: none"> • Practice flying with a Glider/Pterosaur model
4 December 2021 (Saturday) 2:00 pm – 5:00 pm	<p><u>Lecture:</u></p> <ul style="list-style-type: none"> • Use of sound by animals • Application of Bionics: art / energy / management <p><u>Homework:</u></p> <ul style="list-style-type: none"> • The folding leaves exercise
11 December 2021 (Saturday) 2:00 pm – 5:00 pm	<p><u>Lecture:</u></p> <ul style="list-style-type: none"> • Application of Bionics: health / medicine
18 December 2021 (Saturday) 2:00 pm – 5:00 pm	<p><u>Lecture:</u></p> <ul style="list-style-type: none"> • Application of Bionics: environmental and sustainability <p><u>Homework:</u></p> <ul style="list-style-type: none"> • Find out the golden ratio: Constructing the “Golden Section Gauge”
23 December 2021* (Thursday) 2:00 pm – 5:00 pm	Make-up Class

Duration	6 half day sessions (total 18 contact hours)
Date	6, 20, 27 November, 4, 11, 18, 23* December 2021
Time	2:00 pm – 5:00 pm
Teaching Mode[#]	Face to Face (The Chinese University of Hong Kong)
Enrollment	40
Expected applicants	Students who are promoting to or studying S2-S3
Tuition Fee	HKD 3,380.00
Credit	1.25 Academy Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance and awarded B grade or above in the course.

* This date is reserved for make-up classes in case there is any cancellation of classes due to unexpected circumstances.

This course is offered face-to-face lessons at CUHK campus. It may switch to online teaching in accordance with the pandemic development and the policy of the university.

**The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent**

Autumn Courses 2021
Course Outline

CUSA2043 An Ocean of Inspiration and Beauty
海洋啟示錄

Introduction:

The oceans cover 70% of the Earth's surface and is the biggest biome on Earth as well as the most important component of the biosphere. Being the cradle of life on Earth, the ocean is also the crucial factor for maintaining life on Earth. In the history of mankind, the oceans have been admired and greatly respected for its significance in the exploration of nature, as well as in the development of human civilization. This course intends to offer an overview of the oceans from perspectives such as culture, history, science, philosophy and arts; as well as to acknowledge the importance of the oceans to mankind and other life forms on Earth. The core concepts include the roles played by the oceans in the development of human civilization, the impact and reliance of human beings on the oceans, ocean processes and the physical, chemical and biological properties of the oceans, diversity of marine ecosystems and marine organisms, how marine organisms solve their specific problems and provide inspirations for solving human problems, the importance of the oceans in maintaining global climatic and ecological balances, as well as how we should protect, conserve and sustainably exploit the oceans for our future generations and all life forms on Earth.

海洋覆蓋了地球七成的表面，是地球最大的生物群系和生物圈最重要的部份。海洋既是地球上生命產生的搖籃，又是維持生命的必要關鍵因素。自古以來人類對神祕莫測的海洋既敬畏又嚮往；海洋是人類對自然的探索 以至文明的產生和發展過程中極重要部份。本課程旨在讓學員從文化、歷史、科學、哲學、及藝術等角度去認識海洋；及了解海洋對人類以至其他生物的重要性。主要課程內容包括海洋在人類文明發展的角色、人類對海洋的影響和依賴、各種海洋過程及海洋的物理，化學，生物等方面的特性、海洋生態系和海洋生物的多樣性、海洋生物如何適應獨海洋環境並為人類提供解決問題的靈感、海洋在調節全球氣候和生態平衡的功能、及我們應如何維護、保育及永續地開發海洋等。

Medium of Instruction: Cantonese supplemented with English

Organising Unit:

Centre for Promoting Science Education,
Faculty of Science,
The Chinese University of Hong Kong

Teacher:

Dr. Chung Kwok Cheong
School of Life Sciences, CUHK
Email: kcchung@cuhk.edu.hk

Course Content:

18 September 2021 (Saturday) 2:00 pm – 5:30 pm	<u>Theme 1. Ocean and Man:</u> 1. The oceans and the marine environment; 2. Importance of the oceans; 3. A history of maritime development; 4. The rise and fall of maritime power.
25 September 2021 (Saturday) 2:00 pm – 5:30 pm	<u>Theme 1. Ocean and Man:</u> 1. Marine resources and their exploitation; 2. Deterioration & conservation of the marine environment.
2 October 2021 (Saturday) 2:00 pm – 5:30 pm	<u>Theme 2. Marine Ecosystems:</u> 1. The marine environment, zonation of the oceans, physical and chemical properties; 2. Plate tectonics & associated phenomena; 3. Ocean processes.
9 October 2021 (Saturday) 2:00 pm – 5:30 pm	<u>Theme 2. Marine Ecosystems:</u> 1. Coastal marine ecosystems: rocky shores, mangrove forests, estuary / soft-bottom intertidal ecosystems, coral reefs, kelp forests etc. 2. Oceanic marine ecosystems: open oceans and deep oceans, hydrothermal vents and cold seeps etc.
16 October 2021 (Saturday) 2:00 pm – 5:30 pm	<u>Theme 3. Marine Organisms:</u> 1. Classification of living organisms; 2. Major types of marine organisms.
23 October 2021 (Saturday) 2:00 pm – 5:30 pm	<u>Theme 3. Marine Organisms:</u> 1. Survival, adaptation & evolution of marine organisms; 2. Inspirations from marine organisms.
30 October 2021* (Saturday) 2:00 pm – 5:30 pm	Make-up Class

Duration	6 half-day sessions (total 21 contact hours)
Date	18, 25 September, 2, 9, 16, 23, 30* October 2021
Time	2:00pm - 5:30pm
Teaching Mode[#]	Face to Face (The Chinese University of Hong Kong)
Enrollment	40
Expected applicants	Students who are promoting to or studying S4-S6
Tuition Fee	HKD 3,360.00
Credit	1.5 Academy Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance and awarded B grade or above in the course.

* This date is reserved for make-up classes in case there is any cancellation of classes due to unexpected circumstances.

This course is offered face-to-face lessons at CUHK campus. It may switch to online teaching in accordance with the pandemic development and the policy of the university.

The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent

Autumn Courses 2021
Course Outline

CUSA1035 Mysteries in the Atomic World
原子世界的奧秘

Introduction:

This course will bring students to retrace the thinking paths of physicists in the early 20th century to unravel the mysteries of atoms. The course includes lectures, experiments, and a visit. Students will glimpse through the basic concepts of quantum physics, such as wave particle duality, quantization, wave function and its probabilistic interpretation, spin, and their applications to understand some atomic and nuclear phenomena, including energy levels in atoms, atomic spectra, formation of molecules, as well as a more advanced topic on magnetic resonance imaging (MRI), which is now widely applied to medical imaging.

Students will gain hands-on experience in using modern laboratory equipment to measure atomic spectra, and determine the charge mass ratio of electron. A visit to a company in Hong Kong Science and Technology Park will also be included to let students see the operation of a medical MRI machine.

本課程帶領學生重溫二十世紀初物理學家探索原子奧秘的過程。課程包括講座、實驗，和參觀三部分。學生將瞥見量子物理的基本概念，包括波粒二象性、量子化、波函數及其或然率詮釋，自旋；這些概念如何應用於了解原子和核子的現象，包括原子的能階、光譜、分子的形成，以及一個較深入、目前廣泛應用於醫療造影的現象：磁力共振。

學生也會學習如何利用現代科學儀器測量原子的光譜，以及電子的電荷質量比。課程也包括到香港科學技術園參觀一間儀器公司，以觀察醫學磁力共振儀器的運作。

Medium of Instruction: Cantonese supplemented with English

Organising Unit:

Department of Physics, Faculty of Science, CUHK

Teacher:

Dr. TONG Shiu Sing

Department of Physics, Faculty of Science, CUHK

Rm. 223, 2/F, Science Centre North Block, CUHK

Tel: 3943 6400, E-mail: sstong@phy.cuhk.edu.hk

Course Content:

<p>4 December 2021 (Saturday)</p> <p>9:00 am – 12:30 pm 2:00 pm – 5:30 pm</p>	<p><u>Lecture and demos:</u> Discovery of subatomic particles, atomic spectra, wave particle duality, relationship between classical wave phenomena and quantization, atomic models and quantization of atomic energy, and the emergence of quantum physics</p> <p><u>Laboratory Activities:</u></p> <ul style="list-style-type: none"> • Study of atomic spectra, and charge to mass ratio of electron
<p>11 December 2021 (Saturday)</p> <p>9:00 am – 12:30 pm 2:00 pm – 5:30 pm</p>	<p><u>Lecture and demos:</u> Basic concepts of quantum physics, conceptual understanding of Schrodinger equation, wave function and probabilistic interpretation. Electron microscope, quantum phenomena such as quantum tunnelling and our existence.</p> <p><u>Laboratory Activities:</u></p> <ul style="list-style-type: none"> • Visiting the modern physics laboratory at the Department of Physics, CUHK. Experiments with a scanning electron microscope and a transmission electron microscope, seeing microscopic objects, atoms, and electron diffraction patterns
<p>18 December 2021 (Saturday)</p> <p>9:00 am – 12:30 pm 2:00 pm – 5:30 pm</p>	<p><u>Visit:</u> Visiting a Magnetic Resonance Imaging (MRI) company at Hong Kong Science Park. Experience the operation of a MRI machine and acquisition of MRI images.</p> <p><u>Lecture and demos:</u> Introduction to the concepts of spin, Pauli Exclusion Principle and atomic orbitals, and their applications to understand some atomic and nuclear phenomena including MRI.</p> <p><u>Discussion:</u></p> <ul style="list-style-type: none"> • Summary of essential ideas and findings, assessment
<p>1 January 2022 * (Saturday)</p> <p>9:00 am – 12:30 pm 2:00 pm – 5:30 pm</p>	<p>Make up Class</p>

Duration	3 whole day sessions (total 21 contact hours)
Date	4, 11, 18 December 2021, 1 January 2022 *
Time	9:00 am – 12:30 pm; 2:00 pm – 5:30 pm
Teaching Mode[#]	Face to Face (The Chinese University of Hong Kong)
Enrollment	30
Expected Applicants	Students who are promoting to or studying S4-S6 who have basic knowledge on mechanics and waves
Tuition Fee	HKD 3,560.00 (including materials for experiments)
Credit	1.5 Academy Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance.

* This date is reserved for make-up classes in case there is any cancellation of classes due to unexpected circumstances.

This course is only offered face-to-face lessons at CUHK campus.

The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent

Autumn Courses 2021
Course Outline

CUSA1075 Wonderful World of Physics
奇妙的物理世界

Introduction:

This course is designed for students to learn about some basic physics topics and the important role of physics in understanding the way nature works. This course also allows students to learn the applications and development of physics in the modern world. Students will learn the basic physics topics including motions and forces, optics and waves, electricity and electric circuits, energy, etc.

This course includes lectures and hands-on experimental sessions.

本課程的設計旨在讓同學學習到一些基礎物理學課題及物理學在了解大自然運作的重要性。課程同時讓同學認識物理學在現代世界中的應用和發展。同學在課程中將學習到運動與力、光學與波動、電與電路、能量等課題。課程以講課及實驗形式進行。

Medium of Instruction: Cantonese supplemented with English

Organising Unit: Department of Physics, Faculty of Science, CUHK

Teachers:

Dr. LIN Lap Ming

Department of Physics, CUHK

Rm. 221, Science Centre North Block, CUHK

Tel: 3943 4072, E-mail: lmilin@phy.cuhk.edu.hk

Dr. LEUNG Po Kin

Department of Physics, CUHK

Rm. 220, Science Centre North Block, CUHK

Tel: 3943 4078, E-mail: pkleung@cuhk.edu.hk

Dr. Yu Hang Marco LAI

Department of Physics, CUHK

Rm. 216A, Science Centre North Block, CUHK

Tel: 39434076, E-mail: yhmlai@cuhk.edu.hk

Course Content:

6 November 2021 (Saturday) 9:30 am – 12:30 am	-- Kinematics of translation motion -- Vectors -- Newton's laws of motion -- Assessment
13 November 2021 (Saturday) 9:30 am – 12:30 pm	-- Uniform circular motion -- Newton's law of gravitation -- Kepler's laws of planetary motion -- Assessment
20 November 2021 (Saturday) 9:30 am – 12:30 pm	-- Geometric optics -- Mirrors and lenses -- Simple Optical Instrument -- Assessment
27 November 2021 (Saturday) 9:30 am – 12:30 pm	-- Optical Phenomena in Nature -- Light and Wave motions -- Online Demonstrations (Optional) -- Assessment
4 December 2021 (Saturday) 9:30 am – 12:30 pm	-- Electricity, voltage and current -- Resistance and Ohm's law -- Equivalent resistance -- Assessment
11 December 2021 (Saturday) 9:30 am – 12:30 pm	-- Power in electric circuit -- Kirchhoff's laws -- Assessment
18 December 2021 * (Saturday) 9:30 am – 12:30 pm	Make-up Class

Duration	6 half day sessions (total 18 contact hours)
Date	6, 13, 20, 27 November, 4, 11, 18* December 2021
Time	9:30 am – 12:30 am
Teaching Mode[#]	Face to Face (The Chinese University of Hong Kong)
Enrollment	24
Expected applicants	Students who are promoting to S2-S3
Tuition Fee	HKD 3,380.00
Credit	1.25 Academy Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance.

* This date is reserved for make-up classes in case there is any cancellation of classes due to unexpected circumstances.

This course is offered face-to-face lessons at CUHK campus. It may switch to online teaching in accordance with the pandemic development and the policy of the university.

The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent

Autumn Courses 2021
Course Outline

SAYT1006 Risk Management and Actuarial Science
風險管理與精算學

Introduction:

The uncertainty in an event or an activity is known as risk. Risks are encountered in trivial events such as travelling and in professional activities such as business partnership. We take risk every day. This course provides a broad perspective on both current practices and mathematical theories of risk management. Topics include qualitative and quantitative classifications of risks, mathematical modelling of financial markets and derivatives, current financial issues and crises, and statistical analysis of financial data, mathematics of insurance and Actuarial Science. This course is designed for the students who are interested in the scientific and mathematical aspects of risk management, financial market and actuarial science.

任何事件或活動的不確定性皆可視為風險。我們於日常中會遭遇到各項大大小小的風險。小如平日生活之衣食住行、大如商業之投機活動，風險總是伴隨左右。本課程為風險管理的實際應用和數學理論提供廣泛概要。本課程涵蓋範圍包括：風險的質化與量化分類，金融市場與衍生產品的數學建模，現今金融的課題與危機，金融數據的統計分析，保險數學與精算。本課程為有興趣於風險管理，金融市場或精算學之數理概念的同學而設。

Medium of Instruction: Cantonese supplemented with English

Organising Unit:

Department of Statistics, CUHK

Teacher:

Professor CY Yau

Department of Statistics, CUHK

Room 110, Lady Shaw Building, CUHK

E-mail: cyyau@sta.cuhk.edu.hk

Course Content:

4 September 2021 (Saturday) 9:30am - 12:30pm 2:00pm - 5:00pm	<u>Lecture: Overview of Risk Management</u> <ul style="list-style-type: none"> • Risk and management • Qualitative and quantitative aspects of risks • Mathematical and statistical measure of risks • Case studies and management tools <u>Computer-lab Session: Introduction to R language and data acquisition</u>
11 September 2021 (Saturday) 9:30am - 12:30pm 2:00pm - 5:00pm	<u>Lecture: Modelling of Market and Financial Products – Part I</u> <ul style="list-style-type: none"> • Stock prices and limit order market • Futures and options as financial derivatives for hedging and leverage • One-step binomial tree • No-arbitrage principle and risk-neutral probability <u>Computer-lab Session: Simulation techniques for pricing derivatives</u>
18 September 2021 (Saturday) 9:30am - 12:30pm 2:00pm - 5:00pm	<u>Lecture: Modelling of Market and Financial Products – Part II</u> <ul style="list-style-type: none"> • Vector and matrix operations • Portfolio allocation • Markowitz portfolio theory <u>Computer-lab Session: Hedge fund manager case Study</u>
25 September 2021 (Saturday) 9:30am - 12:30pm 2:00pm - 5:00pm	<u>Lecture: Analysis of Credit Risk</u> <ul style="list-style-type: none"> • Bankruptcy, liquidity and default Risk • Logistic regression analysis • Basel Accords and stress testing <u>Computer-lab Session: Data applications in credit card approval</u>
2 October 2021 (Saturday) 9:30am - 12:30pm 2:00pm - 5:00pm	<u>Lecture: Health and Environmental Risks</u> <ul style="list-style-type: none"> • Life contingency table • Pricing insurance products • Survival modelling and actuarial theories • Spatial analysis of environmental hazards <u>Computer-lab Session: Evaluation of insurance contracts & HK forest fire map</u>
9 October 2021 * (Saturday) 9:30am - 12:30pm 2:00pm - 5:00pm	Make-up class

Duration	5 whole day sessions (total 30 contact hours)
Date	4, 11, 18, 25 September, 2, 9* October 2021
Time	9:30am - 12:30pm; 2:00pm - 5:00pm
Teaching Mode[#]	Face to Face (The Chinese University of Hong Kong)
Enrollment	30
Expected applicants	Students who are promoting to or studying S4-S5 with good knowledge in mathematics, knowledge in economic is preferable but not necessarily
Tuition Fee	HKD 3,900.00 (Students who have attended all sessions will be granted a HKD 1000 scholarship)
Credit	1 University Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance.

* This date is reserved for make-up classes in case there is any cancellation of classes due to unexpected circumstances.

This course is offered face-to-face lessons at CUHK campus. It may switch to online teaching in accordance with the pandemic development and the policy of the university.