

# THE CHINESE UNIVERSITY OF HONG KONG

## Materials Science and Engineering (CUHK) & X Double Major Programme

### Lists of Substitute / Equivalent / Alternative Courses between CUHK and CUHK(SZ)

(As of 21 February 2025)

(for students admitted by CUHK)

#### *Note:*

*The substitute / equivalent / alternative courses are not transitive. If Courses A and B are substitute / equivalent / alternative courses, and courses A and C are substitute / equivalent / alternative courses, it does not necessarily follow that B and C are also substitute / equivalent / alternative courses. Nonetheless, students should not take both courses B and C.*

#### **Faculty Package**

Courses offered by CUHK		Courses offered by CUHK(SZ)	
ENGG1110	Problem Solving by Programming	CSC1005	Intro to CE - Programming & Applications
ENGG1125/ MATH1010	Single Variable Calculus for Engineers / University Mathematics	MAT1001	Calculus I
PHYS1110/ PHYS1111	Engineering Physics: Mechanics and Thermodynamics/ Introduction to Mechanics, Fluids, and Waves (University Physics I)	PHY1001	Mechanics

#### **1<sup>st</sup> Major: Materials Science and Engineering – Required Courses**

Courses offered by CUHK		Courses offered by CUHK(SZ)	
CHEM1070	Principles of Modern Chemistry	CHM1001 / CHM1011	General Chemistry / Honours General Chemistry
ENGG1310	Engineering Physics: Electromagnetics, Optics and Modern Physics	PHY1010 / PHY2020	Principles of Physics II (Thermodynamics and EM) / Principles of Physics III (Optics and Modern Physics)
ENGG1130	Multivariable Calculus for Engineers	MAT1002	Calculus II
ENGG2780	Statistics for Engineers	STA2001	Probability and Statistics
MASE1001	Introduction to Materials Science and Engineering I	MSE2012 / CHM3520	Material Chemistry / Introduction to Materials Science and Engineering

MASE1002	Introduction to Materials Science and Engineering II	MSE2021 / BME4006	Basic Structure of Materials / Introduction to Materials Science and Engineering
MASE1801	Materials Laboratory	MSE2023	Materials Mechanics / Biomaterials
MASE2601	Technology, Society and Engineering Practice	MSE3011 / ERG3001	Engineering Economics and Management / Engineering Ethics, Safety and Practice

### 1<sup>st</sup> Major: Materials Science and Engineering – Elective Courses (covering all areas)

Please refer to the study scheme for the elective courses specific to each area of study.

Courses offered by CUHK		Courses offered by CUHK(SZ)	
BCHE3050	Molecular Biology	BIM3006	Macromolecules and Molecular Pharmacology
BMEG3102	Bioinformatics	BIM3001	Bioinformatics
BMEG3430	Biomaterials and Tissue Engineering	BME4007	Tissue Engineering
BMEG4450	Bionanotechnology	BME4011	Nanobiotechnology
CHEM1280	Introduction to Organic Chemistry and Biomolecules	CHM2317	Organic Chemistry and Biomolecules
CHEM2110	Fundamentals of Spectroscopic Analysis	CHM3130	Fundamentals of Spectroscopy, Microscopy and Chromatography
CHEM3230	Conjugated Molecules and Synthetic Polymers	CHM3530	Polymer Chemistry
CHEM4110	Frontier Organometallic Catalysis	CHM4330	Organometallic Chemistry and Catalysis
CHEM4303	Introduction to Nanoscience and Nanotechnology	MSE4005	Nanoscale Materials
IERG1080	Introduction to Python for Engineering Applications	CSC3002	C/C++ Programming
EEEN4020	Solar Energy and Photovoltaic Technology	ENE3004	Fundamentals of Photovoltaic Materials and Devices
EEEN4050	Energy Storage Devices and Systems	ENE3006	Materials for Energy Applications
EEEN4070	Green Building and Sustainable Technologies	ENE4001	Green Engineering and Environmental Compliance
ELEG2202	Fundamentals of Electric Circuits	ECE2001	Basic Circuit Theory
ELEG3201	Microelectronic Devices and Circuits	ECE3201	Introduction to Microelectronic Circuits
ELEG3301	Principles of Semiconductor Devices	MSE4570	Semiconductors and Devices

ENGG3802	Introduction to Engineering Entrepreneurship	ERG4001	Principles of Entrepreneurship
LSCI1002	Introduction to Biological Sciences	BIO1001	General Biology
MAEG3010	Mechanics of Materials	MSE3004	Mechanic Behaviour and Fracture of Materials
MAEG4070	Engineering Optimization	MAT3007	Optimization
MASE2202	Metals and Ceramics	MSE3009	Introduction to Ceramics
MASE3002	Characterization of Materials	PHY4960	Methods of Materials Characterization
MASE3104	Solid-State Sensors	BME3006	Biosensors and Medical Devices
MASE4102	Photonic Materials and Devices	PHY3007	Optoelectronics
MASE4206	Electrochemical Corrosion	ENE3005	Electrochemical Energy Conversion Fundamentals of Electrochemistry and Batteries
MASE4208	Introduction to Materials Simulation	MSE3405	Computational Materials
MATH4230	Optimization Theory	MAT3220	Optimization II
MATH4240	Stochastic Processes	STA4001	Stochastic Process
PHYS1712	Physics Laboratory I	PHY1910	Physics Laboratory I
PHYS2041	University Physics III – Introduction to Heat and Electromagnetism	PHY2001	Electricity and Magnetism
PHYS2061	Basic Computational Physics	PHY2650	Computational Physics and AI Tools
PHYS2401	Introduction to Astronomy and Astrophysics	PHY3820	Introduction to Astronomy & Astrophysics
PHYS2711	Physics Laboratory II	PHY1920	Physics Laboratory II
PHYS3021	Quantum Mechanics I	PHY3410	Quantum Mechanics and its Applications I
PHYS3022	Applied Quantum Mechanics	PHY3420	Quantum Mechanics and its Applications II
PHYS3023	Introduction to Quantum Information Physics	PHY3421	Introduction to Quantum Information
PHYS3041	Electromagnetic Theory I	PHY3002	Electrodynamics I
PHYS3051	Methods in Theoretical Physics I	PHY2610	Mathematical Methods in Physics I
PHYS3061	Introduction to Computer Simulation of Physical Systems	PHY3650	Computer Simulation of Physical Systems
PHYS3410	Practical Electronics	PHY3950	Basic Electronics

PHYS4011	Classical Mechanics II	PHY3120	Classical Mechanics II
PHYS4031	Statistical Mechanics	PHY4510	Statistical Mechanics and its Applications
PHYS4050	Electromagnetic Theory II	MSE3007	Electronic, Optical, and Magnetic Properties of Materials
PHYS4061	Computational Physics	PHY4650	Computational Physics II
PHYS4440	Topics in Nanoscience and Technology	PHY4720	Topics in Nanoscience and Technology
PHYS4460	Relativity	PHY4810	Relativity
SEEM2440	Engineering Economics	ERG2001	Engineering Economics
SEEM3510	Human-computer Interaction	ECE4300	Systems Design in Human Computer Interaction

## 2<sup>nd</sup> Major: Electronic Engineering (offered by CUHK)

Courses offered by CUHK		Courses offered by CUHK(SZ)	
ENGG1120	Linear Algebra for Engineers	MAT2040	Linear Algebra
ENGG2740	Differential Equations for Engineers	MAT2002	Ordinary Differential Equations
ELEG2202	Fundamentals of Electric Circuits	ECE2001	Basic Circuit Theory
ENGG2030	Signals and Systems	ECE3001	Signals and Systems
EEEN4020	Solar Energy and Photovoltaic Technology	ENE3004	Fundamentals of Photovoltaic Materials and Devices
ELEG3202	Analog Integrated Circuits	EIE3202	Analog Integrated Circuits
ELEG3207	Introduction to Power Electronics	ENE4008	Power Electronics
ELEG3503	Introduction to Digital Signal Processing	EIE3510	Digital Signal Processing
ELEG3601	Introduction to Electric Power Systems	ENE3050	Electrical Power Systems
ELEG4211	CMOS Digital Integrated Circuits Design	ECE4102	CMOS Digital Integrated Circuits Design
ELEG4512	Digital Image Processing	EIE4512	Digital Image Processing

**2<sup>nd</sup> Major: Energy and Environmental Engineering (offered by CUHK)**

Courses offered by CUHK		Courses offered by CUHK(SZ)	
ENGG1120	Linear Algebra for Engineers	MAT2040	Linear Algebra
EEEN2020	Renewable Energy Technologies	ENE4003	Fundamentals of Thermal Energy Systems
EEEN2030	Energy and Environmental Economics and Management	ENE4007	Energy Economics
EEEN2040	Heating, Ventilation, and Air-Conditioning (HVAC) I	ENE3003	Heat and Mass Transfer for Energy Systems
ELEG2202	Fundamentals of Electric Circuits	ECE2001	Basic Circuit Theory
MAEG2030	Thermodynamics	PHY2002	Thermodynamics
MAEG3030	Fluid Mechanics	PHY2010	Fluid Mechanics
EEEN3030	Engineering Materials	ENE3006	Materials for Energy Applications
EEEN4060	Energy Distribution	ENE4009	Power System Stability and Control
ELEG3207	Introduction to Power Electronics	ENE4008	Power Electronics

**2<sup>nd</sup> Major: Mechanical and Automation Engineering (offered by CUHK)**

Courses offered by CUHK		Courses offered by CUHK(SZ)	
ENGG1120	Linear Algebra for Engineers	MAT2040	Linear Algebra
ENGG2740	Differential Equations for Engineers	MAT2002	Ordinary Differential Equations
ELEG2202	Fundamentals of Electric Circuits	ECE2001	Basic Circuit Theory
MAEG2030	Thermodynamics	PHY2002	Thermodynamics
MAEG3030	Fluid Mechanics	PHY2010	Fluid Mechanics
ENGG2720	Complex Variables for Engineers	MAT3253	Complex Variables
MAEG3010	Mechanics of Materials	MSE3004	Mechanic Behaviour and Fracture of Materials

**2<sup>nd</sup> Major: Chemistry (offered by CUHK)**

Courses offered by CUHK		Courses offered by CUHK(SZ)	
CHEM2110	Fundamentals of Spectroscopic Analysis	CHM3130	Fundamentals of Spectroscopy, Microscopy and Chromatography
CHEM2120	Main Group Chemistry	CHM2210	Inorganic Chemistry
CHEM2200	Organic Functional Groups: Structure and Reactivity	CHM2310	Organic Chemistry I
CHEM2300	Thermodynamics and Chemical Equilibrium	CHM2002	Physical Chemistry
CHEM2400	Analytical Chemistry	CHM2110	Analytical Chemistry
CHEM2868	Basic Integrated Chemistry Laboratory I	CHM2228	Inorganic Chemistry Laboratory
CHEM3130	Transition Metal Chemistry	CHM2210	Inorganic Chemistry
CHEM3320	Chemical Kinetics	CHM2002	Physical Chemistry
CHEM4040	Problem-based Learning in Chemistry II	CHM4510 & CHM4530	Undergraduate Special Project & Undergraduate Thesis
CHEM4100	Advanced Inorganic Chemistry	CHM3210	Advanced Inorganic Chemistry
CHEM4300	Advanced Physical Chemistry	CHM3420	Advanced Physical Chemistry (Structural Chemistry)
CHEM4303	Introduction to Nanoscience and Nanotechnology	MSE4005	Nanoscale Materials
CHEM4400	Advanced Analytical Chemistry	CHM3110	Advanced Analytic Chemistry and Experiments
CHEM4730	Special Topics in Chemistry	CHM4340	Modern Organic Synthesis

**2<sup>nd</sup> Major: Physics (offered by CUHK)**

Courses offered by CUHK		Courses offered by CUHK(SZ)	
PHYS1122	University Physics II – Introduction to Optics and Modern Physics	PHY2020	Principles of Physics III (Optics and Modern Physics)
PHYS2041	University Physics III – Introduction to Heat and Electromagnetism	PHY1010	Principles of Physics II (thermodynamics and EM)
PHYS3011	Classical Mechanics I	PHY3110	Classical Mechanics I
PHYS3021	Quantum Mechanics I	PHY3410	Quantum Mechanics and its Applications I
PHYS3031	Thermodynamics and Statistical Physics	PHY2002	Thermodynamics
PHYS3041	Electromagnetic Theory I	PHY3310	Electromagnetic Theory I
PHYS4610	Senior Project I	PHY4270	Senior Project I
PHYS1712	Physics Laboratory I	PHY1002	Physics Laboratory

PHYS2061	Basic Computational Physics	PHY2650	Computational Physics and AI Tools
PHYS2711	Physics Laboratory II	PHY1002	Physics Laboratory
PHYS3051	Methods in Theoretical Physics I	PHY2610	Mathematical Methods in Physics I
PHYS3061	Introduction to Computer Simulation of Physical Systems	PHY3650	Computer Simulation of Physical Systems
PHYS4041	Electromagnetic Theory II	PHY3320	Electromagnetic Theory II
PHYS4050	Electromagnetic Theory II	PHY4001	Solid-State Physics
PHYS4450	Optical Physics	PHY3007	Optoelectronics
PHYS4460	Relativity	PHY4810	Relativity
PHYS4610	Senior Project I	PHY4270	Senior Project I

## 2<sup>nd</sup> Major: Chemistry (offered by CUHK(SZ))

Courses offered by CUHK(SZ)		Courses offered by CUHK	
CHM2002	Physical Chemistry	CHEM2300 / CHEM3320	Thermodynamics and Chemical Equilibrium / Chemical Kinetics
CHM2110	Analytical Chemistry	CHEM2400	Analytical Chemistry
CHM2118	Analytical Chemistry Laboratory	CHEM2870	Integrated Chemistry Laboratory II
CHM2210	Inorganic Chemistry	CHEM2120 / CHEM3130	Main Group Chemistry / Transition Metal Chemistry
CHM2228	Inorganic Chemistry Laboratory	CHEM2868	Basic Integrated Chemistry Laboratory
CHM2310	Organic Chemistry I	CHEM2200	Organic Functional Groups: Structure and Reactivity
CHM2320	Organic Chemistry II	CHEM3220	Organic Reactions: Reactivity and Selectivity
CHM3418	Physical Chemistry Laboratory	CHEM3830	Physical Chemistry Laboratory I
CHM4510 & CHM4530	Undergraduate Special Project & Undergraduate Thesis	CHEM4040	Problem-based Learning in Chemistry II
CHM2338	Organic Chemistry Laboratory	CHEM2868	Basic Integrated Chemistry Laboratory
CHM3420	Advanced Physical Chemistry (Structural Chemistry)	CHEM4300	Advanced Physical Chemistry
CHM3110	Advanced Analytic Chemistry and Experiments	CHEM4400	Advanced Analytical Chemistry
CHM3210	Advanced Inorganic Chemistry	CHEM4100	Advanced Inorganic Chemistry

CHM3310	Advanced Structure Elucidation in Organic Molecules	CHEM3410	Instrumental Analysis
CHM3520	Introduction to Materials Science and Engineering	CHEM3340	Materials Chemistry
CHM4210	Transition Metals and Coordination Chemistry	CHEM3130	Transition Metal Chemistry
CHM4340	Modern Organic Synthesis	CHEM4730	Special Topics in Chemistry
CHM4422	Chemical Kinetics and Catalysis	CHEM3320	Chemical Kinetics
CHM4630	Medicinal Chemistry	CHEM4640	Pharmaceutical Chemistry

**2<sup>nd</sup> Major: New Energy Science and Engineering (offered by CUHK(SZ))**

Courses offered by CUHK(SZ)		Courses offered by CUHK	
MAT2040	Linear Algebra	MATH1030	Linear Algebra I
CHM1002	Chemistry Laboratory	CHEM1870	Chemistry Laboratory: STEM and Daily Life
ECE2001	Basic Circuit Theory	ELEG2202	Fundamentals of Electric Circuits
ENE3005	Fundamentals of Electrochemistry and Batteries	MASE4206	Electrochemical Corrosion
ENE3003	Heat and Mass Transfer for Energy Systems	EEEN2040	Heating, Ventilation, and Air-Conditioning (HVAC) I
ENE3004	Fundamentals of Photovoltaic Materials and Devices	EEEN4020	Solar Energy and Photovoltaic Technology
ENE4003	Fundamentals of Thermal Energy Systems	EEEN2020	Renewable Energy Technologies
CHM2002	Physical Chemistry	CHEM2300 / CHEM3320	Thermodynamics and Chemical Equilibrium / Chemical Kinetics
ENE3050	Electrical Power Systems	ELEG3601	Introduction to Electric Power Systems
ENE4005	Energy Resources and the Environment	EEEN3020	Energy Utilization and Human Behaviour
ENE4007	Energy Economic	EEEN2030	Energy and Environmental Economics and Management
ENE4008	Power Electronics	ELEG3207	Introduction to Power Electronics
ENE4011	Smart Grid	EEEN4060	Energy Distribution
PHY2010	Fluid Mechanics	MAEG3030	Fluid Mechanics
MAT3007	Optimization	MATH4230	Optimization Theory



**2<sup>nd</sup> Major: Physics (offered by CUHK(SZ))**

Courses offered by CUHK(SZ)		Courses offered by CUHK	
PHY2020	Principles of Physics III (Optics and Modern Physics)	PHYS1122	University Physics II – Introduction to Optics and Modern Physics
PHY1010	Principles of Physics II (thermodynamics and EM)	PHYS2041	University Physics III - Heat and EM
PHY2610	Mathematical Methods in Physics I	PHYS3051	Methods in Theoretical Physics I
PHY3110	Classical Mechanics I	PHYS3011	Classical Mechanics I
PHY3410	Quantum Mechanics and its Applications I	PHYS3021	Quantum Mechanics I
PHY2002	Thermodynamics	PHYS3031	Thermodynamics and Statistical Physics
PHY3002 / PHY3310	Electrodynamics I / Electromagnetic Theory I	PHYS3041	Electromagnetic Theory I
PHY4270	Senior Project I	PHYS4610	Senior Project I
PHY1910	Physics Laboratory I	PHY1712	Physics Laboratory I
PHY1920	Physics Laboratory II	PHYS2711	Physics Laboratory II
PHY2650	Computational Physics I	PHYS4061	Computational Physics
PHY2910	Physics Laboratory III	PHYS2722	Physics Laboratory III
PHY3421	Introduction to Quantum Information	PHYS3023	Introduction to Quantum Information Physics
PHY3320 / PHY4002	Electromagnetic Theory II / Electrodynamics II)	PHYS4041	Electromagnetic Theory II
PHY3650	Computer Simulation of Physical Systems	PHYS3061	Introduction to Computer Simulation of Physical Systems
PHY3610	Mathematical Methods in Physics II	PHYS4051	Methods in Theoretical Physics II
PHY4001	Solid-State Physics	PHYS4050	Solid-State Physics
CHM2002	Physical Chemistry	CHEM2300 / CHEM3320	Thermodynamics and Chemical Equilibrium / Chemical Kinetics
MAT3007	Optimization	MAEG4070	Engineering Optimization
STA4001	Stochastic Process	MATH4240	Stochastic Processes

**2<sup>nd</sup> Major: Biomedical Science and Engineering (offered by CUHK(SZ))**

Courses offered by CUHK(SZ)		Courses offered by CUHK	
BIO2002	Cell and Molecular Biology	BIOL2120	Cell Biology
BIO2101	Comprehensive Biology Laboratory	LSCI2002	Basic Lab Techniques in Life Sciences
BME2001	Anatomy/Physiology	BIOL3630	Animal Physiology

BME3001	Introduction to Biomedical Engineering I	BMEG2001	Introduction to Biomedical Engineering
BME3006	Biosensors and Medical Devices	MASE3104	Solid-State Sensors
BME4009	Clinical Laboratory Science	SBMS2105	Laboratory Techniques in Biomedical Sciences
BME3201	Biomedical Instrument Design	BMEG3111	Medical Instrumentation and Design
BIO3213	Protein Structure Analysis and Proteomics	CMBI4203	Proteomics
BIO3214	Neurobiology	BMEG3330	Neuroengineering
BIO4203	Immunology	BCHE4060	Basic and Applied Immunology
BME4003	Systems Bioengineering II: Neural System	BCHE4040	Aspects of Neuroscience
BME4008	Biomechanics of the Human Body	BMEG2210	Orthopaedic Biomechanics and Musculoskeletal Injury
BME4007	Tissue Engineering	BMEG3430	Biomaterials and Tissue Engineering
CHM1002	Chemistry Laboratory	CHEM1870	Chemistry Laboratory: STEM and Daily Life
PHY1002	Physics Laboratory II	PHYS2711	Physics Laboratory II