Description of Postgraduate Courses -- Research Postgraduate Course Sharing Scheme (Fall Term 2026-2027)

Last Update: 19 August **2026**

Important Information about HKUST Courses:

Level of Courses

All courses offered in this scheme are at postgraduate level.

Medium of Instruction

The medium of instruction is English. Some courses will have the following notations in the course description to specify the language of reading materials or permitted spoken language (dialect) used in teaching.

[C] Courses may required students to read materials in Chinese. Students who have difficulty reading materials in Chinese should consult the instructor concerned prior to enrolling in these courses.

[Pu] / [Ca] Courses approved to be taught in Chinese carry a *[Pu]* or *[Ca]* notation in the course description, which indicates the spoken language used in teaching: *[Pu]* stands for Putonghua; and *[Ca]* for Cantonese.

Postgraduate Grades

Students receive a grade in each course in which they are enrolled. Grades range in equal increments from A+ to F (i.e. A+, A, A-, B+, B, B-, C+, C or F). The Pass, Ungraded (P) grade is given only for courses that are indicated in the course description that they will be graded as such.

AMCC

AMCC 5010	Research Methodology in Arts and Machine Creativity	3 credits
This course provides postgraduate students with an in-depth understanding of the research methodologies and techniques utilized in the fields of arts and machine creativity. Students will explore various approaches to generating creative outputs through machines, including artificial intelligence, computational creativity, and algorithmic art, while developing critical thinking and problem-solving skills in the creative domain.		
AMCC 5160	AI-Driven Animation and Video Generation	3 credits
This course delves into the intersection of artificial intelligence and visual arts, with a focus on AI-driven animation and video generation. Students will explore cutting-edge models such as Transformers, Diffusion, Denoising Diffusion Implicit Models (DiT), and autoregressive systems. Emphasizing hands-on learning, the course guides students in implementing key AI components like LSTMs, attention mechanisms, and diffusion models. By the end of the course, students will gain both theoretical knowledge and practical skills for creating AI-driven media. *Background:* Basic concepts in discrete mathematics and Python programming language are required.		
AMCC 5410	Art Theory: From Plato to Posthuman Future	3 credits
Taking a survey approach and employing a semi-seminar format, this course examines a range of theories on appreciating and critiquing art and art-making, from Plato to contemporary post-humanist thinkers. The course aims to trace intellectual connections between historical understandings of humanity and science, and today's technological conditions. Students will be guided to think critically and to develop the		

capacity to apply these theories to future projects related to machine creativity in the age of AI in the 21st century.		
AMCC 6090	Postgraduate Seminar	1 credit
Seminar topics presented by students, faculty and guest speakers. MPhil students must register and pass this course for one term before they graduate. PhD students must register and pass this course for two terms before they graduate. Graded PP, P or F. For students in the Division of Arts and Machine Creativity only.		
AMCC 6500H	World Models for Machine Creativity and Embodied AI	3 credits
This special topic course introduces world models as learned predictive representations that allow AI systems to anticipate future states, reason about actions, and simulate physical or digital environments. The course covers classical model-based reinforcement learning and latent dynamics, video prediction and diffusion-based simulators, joint-embedding predictive architectures (JEPA), and applications in world simulation, creative generation, generative games, autonomous driving, and embodied intelligence. For students in Arts and Machine Creativity, the course foregrounds world models as engines for creative media, interactive content generation, and computational imagination in visual art and animation.		
AMCC 6950A	Special Projects in Arts and Machine Creativity	3 credits
An independent project on selected topics related to arts and machine creativity under the supervision of a faculty member. The course may be repeated once for credits. Enrollment requires approval of instructor. Graded P/F or PP.		

BIEN

BIEN 5050	Global Health Ethics	3 credits
[Previous Course Code: BIEN 6930A*]* Through real-time videoconferencing with participants from different countries such as the United States, United Kingdom, Australia, Mexico, and Philippines, this ONLINE course aims at helping students learn the definitions of global health ethics and bioethics, the different protocol and systems in place to ensure adherence to ethical principles, and how different stakeholders and cultures may interpret ethics differently. Through case studies on ethical challenges from real-world situations, students will analyze and discuss the complexities of global health practice and research ethics in a global context. This course is co-offered with the University of Southern California. Besides the joint LIVE sessions, face-to-face sessions and group projects are also arranged for the introduction of background knowledge, case studies, group project discussion, and technical support.		

CHEM

CHEM 5110	Advanced Organic Chemistry I	3 credits
Mechanism and theory in organic chemistry, molecular orbital theory, structure-activity relationships, isotope effects, solvent effects, neighboring group participation, and reactive intermediates. *Background:* CHEM 2118 (prior to 2017-18), CHEM 3120 and CHEM 4140		
CHEM 5210	Computational Chemistry	3 credits
Fundamentals and applications of various computational chemistry methods, including molecular orbital calculations, molecular mechanics and molecular dynamics. Computational laboratory practice will be emphasized. *Background:* CHEM 3420		
CHEM 5230	Quantum Chemistry	3 credits

Introduction to basic theories of Quantum Chemistry. Popular theories used in modern Quantum Chemistry such as Hantree-Fock theory, Density Functional theory. Perturbation Theories, and other quantum chemistry theories will be introduced in this course. *Background:* CHEM 3420 OR Equivalent		
CHEM 5310	Advanced Inorganic Chemistry I	3 credits
Symmetry, group theory; molecular orbitals, electronic states; ligand field theory; electronic structure of metal complexes; theory of bonding and structure of inorganic compounds; chemistry of the elements; major physical methods used in the determination of molecular structure and bonding.		
CHEM 5340	Chemical X-ray Crystallography	3 credits
Applications of X-ray diffraction methods to the determination of crystal structures, including crystal symmetry, reciprocal lattice, intensity of diffraction, the phase problem, and refinement of structure parameters, powder X-ray diffraction analysis.		

CIVL

CIVL 5220	BIM and Digital Construction	3 credits
[Previous Course Code: CIVL 6100B*]* This course covers the principles and applications of information technology for construction management. Topics include building information modeling, database management and implementation, web-based communication and project management technologies, decision support systems, knowledge management, and data processing and analysis. *Background:* CIVL 3210		
CIVL 5321	Structural Sensing and Health Monitoring	3 credits
[Previous Course Code: CIVL 6100P*]* This course offers a general overview of the structural health monitoring (SHM) technologies. This structure of the course can be divided into three parts: the first part presents various non-destructive evaluation (NDT) technologies for detecting damage at material and local (structural) level, including wave-based methods, thermography testing, etc; the second part introduces vibration based SHM and system identification, which exploits the accelerations of structural response for evaluating the global structural condition; the third part introduces the fundamentals and applications of fiber optic sensing technologies in infrastructure sensing and SHM. This course both equips students with the fundamental knowledge on structural sensing and health monitoring, as well as introduces the cutting-edge applications on this topic. *Prerequisites:* CIVL 4330		
CIVL 5390	Finite Element Methods	3 credits
[Co-list with MECH 5930*]* FEM formulation; variational and Galerkin principles for continuum; element technology; numerical integration scheme; solution of large systems of linear equations; applications to structural mechanics; fluid flow and heat transfer problems. *Exclusion:* AESF 5930, MECH 5930, MESF 5930 *Prerequisites:* CIVL 5830 or MECH 5010 or equivalent		
CIVL 5450	Hazardous Waste Treatment and Site Remediation	3 credits
Regulatory aspects of the handling and disposal of hazardous wastes, and innovative technologies for hazardous wastes treatment and contaminated soils such as bioremediation, and soil washing will be included. *Exclusion:* CIEM 5410, JEVE 5410 *Prerequisites:* CIVL 2410		
CIVL 5610	Urban Transportation Networks Analysis	3 credits

Reviews transportation planning models and traffic analysis; examines the assignment of traffic flow on a network according to user-equilibrium and system optimal objectives; addresses formulation methods and solution techniques. *Background:* CIVL 3610 AND IEDA 3010		
CIVL 5620	Travel Demand Analysis	3 credits
Overview of transportation planning process; population/employment forecasting techniques; discrete choice models; simplified transportation demand models. *Background:* CIVL 3610 *Exclusion:* CIEM 5620		
CIVL 5710	Advanced Soil Mechanics	3 credits
Selected topics from recent advances in theoretical and experimental development in soil mechanics; includes stress-strain behavior of soil, consolidation settlement, drained and undrained strength slope stability problems. *Background:* CIVL 3740		
CIVL 5730	Theoretical and Computational Soil Mechanics	3 credits
Advanced soil models and recent developments in numerical methods in geotechnical modeling, including constitutive laws, critical state soil mechanics, multiple yield surface models, finite elements for boundary value problems, diffusion and consolidation problems. *Background:* CIVL 3740		
CIVL 5750	Geotechnical Earthquake Engineering and Soil Dynamics	3 credits
Earthquakes and characterization of ground motions, seismicity assessment, soil dynamics and site response analysis, soil liquefaction assessment and post-liquefaction analysis, seismic analysis of slopes and embankments, lateral earth pressures and retaining systems, dynamic soil-structure interaction. *Background:* CIVL 3740		
CIVL 5760	Geotechnical Site Characterization	3 credits
Presents state-of-the-art geotechnical site characterization methodologies; includes basic principles of site characterization planning, drilling and sampling, soil and rock description, cone penetration test, standard penetration test, pressuremeter test, dilatometer test, geophysical methods, permeability and ground water monitoring, and fundamentals of geostatistics. *Background:* CIVL 3720 (prior to 2018-19)		

COMP

COMP 5211	Advanced Artificial Intelligence	3 credits
This advanced AI course will cover advanced concepts and techniques in AI. The major topics will be: problem solving, knowledge and reasoning, planning, uncertain knowledge and reasoning, learning, and robotics.		
COMP 5212	Machine Learning	3 credits
Introduction to major learning paradigms and techniques, basic applied statistics and information theory, decision trees, neural networks, Bayesian classification, kernel methods, clustering, density estimation, feature selection and extraction, hidden Markov models, reinforcement learning, case-based learning, model selection and various applications. *Background:* COMP 2012, probability theory and linear algebra *Exclusion:* ARIN 5103, CSIT 5910, MAIE 5212, MSBD 5012		
COMP 5222	Advanced Machine Learning with Graphs	3 credits
[Previous Course Code: COMP 6211B*] [Co-list with* MATH 5471*]* This course will introduce a number of advanced learning methods and modeling principles for analyzing large-scale complex data structures and		

graph data. Topics covered include semi-supervised learning, spectral graph theory, deep graph modeling, knowledge graph modeling, etc., as well as open research problems in this area. *Exclusion:* MATH 5471		
COMP 5331	Knowledge Discovery in Databases	3 credits
An introduction to knowledge discovery in databases. Different discovery and learning techniques are presented and compared. Automatic generation of query language expressions is discussed in depth. Potential applications are shown. *Background:* COMP 3311 *Exclusion:* CSIT 5210, MSBD 5002		
COMP 5411	Advanced Computer Graphics	3 credits
The first part of this course covers an introduction to mathematical tools and computational techniques for image synthesis and manipulation of 3D models. The second part covers more advanced topics which may include digital geometry processing, image processing, visualization, GPU computing, numerical optimization methods. *Background:* COMP 3711, Linear Algebra, Calculus *Exclusion:* CSIT 5400 (prior to 2024-25)		
COMP 5621	Computer Networks	3 credits
Principles, design and implementation of computer communication networks; network architecture and protocols, OSI reference model and TCP/IP networking architecture; Internet applications and requirements; transport protocols, TCP and UDP; network layer protocols, IP, routing, multicasting and broadcasting; local area networks; data link and physical layer issues; TCP congestion control, quality of service, emerging trends in networking.		
COMP 5713	Computational Geometry	3 credits
An introductory course in Computational Geometry. Algorithms for manipulating geometric objects. Topics include Convex Hulls, Voronoi Diagrams, Point Location, Triangulations, Randomized Algorithms, Point-Line Duality. *Background:* COMP 3711		
COMP 6411D	Data Visualization	3 credits
Data visualization (or information visualization) is a rich research area that focuses on the design, development, and utilization of visual representations and interaction techniques to help people understand, analyze, and make decisions using data. This introductory special topic course teaches the design principles, considerations, and applications of data visualization, providing best practices and hands-on experience for visualizing datasets across diverse domains for a variety of use-cases.		
COMP 6613F	Introduction to Quantum Information Processing	3 credits
This introductory course provides a foundational overview of quantum information processing, aimed at students with little or no prior background in quantum theory. Topics include basic principles of quantum mechanics relevant to computation, qubits and quantum gates, superposition, entanglement, and simple quantum algorithms. The course emphasizes the computer science perspective, exploring how quantum concepts translate into computational models and problem-solving approaches. Students will engage with selected contemporary literature, gaining exposure to emerging research directions such as quantum algorithms, quantum machine learning, and distributed quantum computing via student-led presentations. As a culminating activity, students will work individually or in small groups on a focused, research-oriented project-developing it from inception to realization and delivering a final presentation. By the end of the course, participants will understand core concepts, appreciate the potential and limitations of quantum computation, and be equipped to follow to some extend current developments in the field.		

ECON

ECON 6121C	Long-Run Economic Growth	4 credits
This course examines competing explanations for long-run differences in development and economic growth, asking the central question: Why are some countries so rich while others remain poor? We approach this question from a historical and comparative perspective, tracing the evolution of economies from the Middle Ages through the twentieth century. Although we emphasize Britain and Northwestern Europe - where sustained economic growth first emerged - we also study historical experiences in Asia, Latin America, and Africa. Prior exposure to the core analytical and empirical tools from first-year graduate coursework in microeconomics and macroeconomics is strongly recommended. The course has several objectives. First, it demonstrates how theoretical frameworks and quantitative methods can be applied to historical evidence. Second, it introduces students to research and academic writing in related applied fields. To this end, we will read and discuss research articles to understand how economic history scholarship is constructed. Students will also have multiple opportunities to develop their own research questions, present ideas, and engage actively with the material.		
ECON 6121F	Advances in International Trade	4 credits
Introducing key concepts in the study of international trade and investment, the course covers both the forces that determine international trade flows and how they impact domestic economies. The course will also examine the economics of international knowledge flows.		

ELEC

ELEC 5010	Introduction to the Design & Implementation of Micro-Systems	3 credits
Introduction to the concept of micro-systems. Dimensional scaling and its implications. Multi-physics modeling. Micro-fabrication techniques. Introduction to Coventor, a numerical simulation package for micro-systems. The design, implementation and testing of a micro-device. *Exclusion:* MECH 5950		
ELEC 5020	Optical Materials and Applications	3 credits
Previous Course Code: ELEC 6910F*]* The course introduces optical properties of isotropic (dielectric, metallic, semiconducting) and anisotropic (crystalline, liquid crystalline) materials and the influence of external fields (electric, magnetic, strain). The optical properties are discussed in various applications (lenses, mirrors, gratings, wave plates, modulators, liquid crystal devices).		
ELEC 5040	Advanced Analog IC Analysis and Design	3 credits
Noise analysis; Advanced op-amp design techniques; Analog VLSI building blocks: multipliers, oscillators, mixers, phase-locked loops, A/D and D/A converters; Passive filter design; Frequency scaling; Active filter design. *Background:* ELEC 4420 and ELEC 4510 *Exclusion:* EESM 5120		
ELEC 5080	Integrated-Circuit Fabrication Laboratory	4 credits
Laboratory course requiring hands-on work in fabricating MOS transistors. Process modules including photolithography, dry etching, wet etching, metal sputtering, oxidation, diffusion and low-pressure chemical-vapor deposition will be covered. Student will also learn to characterize the fabricated devices. *Prerequisites:* ELEC 5070		
ELEC 5090	Advanced Photonics Technologies	3 credits
A brief review of modern optics theories, Fourier optics based devices and systems, fundamentals of laser physics, optoelectronics, nonlinear optics and laser spectroscopy.		
ELEC 5120	Semiconductor Power and Energy Conversion Technologies	3 credits

[Co-list with ENEG 5250*]* Analysis of power semiconductor device technologies in the context of electric power conversion and transmission; emphasis on the understanding of the critical roles of semiconductor device technologies in power and energy conversion. The mainstream silicon and emerging semiconductor power devices technologies; material properties, device structure design, advanced fabrication techniques, and device characteristics. Critical device-circuit interaction issues and basic power electronics circuits will be covered focusing on the role of these circuits in electric power conversion and transmission. *Exclusion:* ENEG 5250		
ELEC 5130	RF Microsystems: Devices and Applications	3 credits
[Previous Course Code: ELEC 6910B*]* Students will receive the following knowledge: Electromagnetic fields & waves, transmission line theory, Smith Chart, S-parameters, and Network Analysis; RF wireless communication systems; Properties of passive components; Impedance Matching network, RLC networks, and 2-port parameters; Microwave measurement and calibration; Simulation methods for EM passive devices: HFSS & PathWave Advanced Design System (ADS); Micron passive acoustic wave devices: resonators, filters, delay lines; Simulation methods for multi-physic devices: COMSOL; MEMS technologies for RF microsystems. This course discusses methodologies to synthesize and model the operation of several key passive components currently employed in commercial Radio Frequency (RF) microsystems. The operation, design methodologies, and equivalent circuit representations relative to RF devices will be presented.		
ELEC 5170	Advanced AI Chips and Systems	3 credits
[Previous Course Code: ELEC 6910H*]* This is an introductory course to advanced processor architecture for AI computing. The topics covered include AI algorithm basics, processing element, dataflow, memory system, software-hardware co-design for AI processors. This course will also introduce benchmarking and recent advances of AI processors.		
ELEC 5360	Principles of Digital Communications	3 credits
The aim of this course is to provide an in-depth treatment of the theoretical basis, analysis, and design of digital communication systems. The first half of the course will focus on the theoretical foundations of a basic digital communication system, including source coding, modulating and channel coding, and introductory information theory. The second half will deal with advanced techniques including orthogonal frequency division multiplexing (OFDM), multi-antenna communications, spread-spectrum communications, and cooperative communications. *Background:* Probability theory *Exclusion:* EESM 5536		
ELEC 5460	Stochastic Optimization for Wireless Systems and Federated-Learning	3 credits
Stochastic Optimization plays a critical role in radio resource optimization of wireless networks, optimal control theory as well as financial engineering (portfolio optimization). This course will focus on the stochastic optimization theory and the application to the design and optimization of next generation wireless systems and federated learning applications. Topics covered include (A) Physical Layer Modeling: review of information theory for wireless fading channels, MIMO spatial diversity and spatial multiplexing, (B) Theory of Stochastic Optimization: classifications and motivating examples of stochastic optimizations [Type I stochastic Optimization and Type II stochastic optimization problems], theory of Stochastic Approximation, Stochastic Gradient, (C) Applications of Type I SO: Robust optimizations and Federated Learning: (D) Applications of Type II SO: Markov Decision Process, Stochastic Stability and Delay-optimal wireless resource control. *Background:* ELEC 4110 or equivalent		
ELEC 5470	Convex Optimization	3 credits
Convex optimization theory with applications to communication systems and signal processing: convex sets/functions/problems; Lagrange duality and KKT conditions; saddle points and minimax problems; numerical algorithms; primal/dual decomposition methods. Applications: filter design; robust		

beamforming; power control in wireless systems; design of MIMO systems; GP duality in information theory; network utility maximization. For PG students in second year or above. *Background:* Linear algebra (also basic digital communications and basic signal processing)		
ELEC 6910J	Deep Reinforcement Learning	3 credits
This course covers theoretical foundations and state-of-the-art algorithms, and pratical applications in DRL, including machine learning basics, value-based methods, policy gradients, actor-critic methods, exploration, model-based RL, multi-agent RL, offline RL, inverse RL, and students will explore other recent research developments in RL contexts. The course emphasizes both theoretical rigor and practical implementation, featuring paper readings, critical discussions of recent research works, programming assignments using modern DRL frameworks, and a substantial research project. Upon completion, students will be equipped to understand current research literature, implement and analyze advanced DRL algorithms, and conduct independent research in the field.		

ENEG

ENEG 5250	Semiconductor Power and Energy Conversion Technologies	3 credits
[Co-list with ELEC 5120*]* Analysis of power semiconductor device technologies in the context of electric power conversion and transmission; emphasis on the understanding of the critical roles of semiconductor device technologies in power and energy conversion. The mainstream silicon and emerging semiconductor power devices technologies; material properties, device structure design, advanced fabrication techniques, and device characteristics. Critical device-circuit interaction issues and basic power electronics circuits will be covered focusing on the role of these circuits in electric power conversion and transmission. *Exclusion:* ELEC 5120		

ENGG

ENGG 5010	Scientific Communication for Research Postgraduate Students	3 credits
[Previous Course Code: ENGG 6020A*]* This course equips engineering research students with the advanced scientific communication skills, such as writing skills for research papers (including communication with editors and reviewers), posters, oral presentation materials, and grant proposals. It also addresses such topics as publication ethics and research integrity that has significant impact on scientific communication between researchers. Through hands-on practice and case studies, students will be able to apply these skills in everyday research practices and real-life situations after the course.		

HUMA

HUMA 5160	Chinese Phonetics and Phonology	3 credits
This course is an introduction to the study of sounds in Mandarin Chinese. The course will cover fundamental concepts in phonetics and phonology and compare the sounds of Mandarin with those of other languages. Other topics include: methodology, the typology, learning and evolution of sounds, the subgrouping of Chinese dialects, etc. *Exclusion:* HMMA 5002		
HUMA 5310	Traveling Texts and Images: Modern Chinese Literature and Print Culture	3 credits

[Previous Course Code: HUMA 6001U*]* This course employs an interdisciplinary approach to examine literary and pictorial magazines and journals from the late Qing to the Republican era. In light of contemporary theories of the public sphere, travel, and the interaction between image and text, we will explore critical issues around the innovative writing practices associated with new print media, the formation of a literary public space, the role of the editor, publisher and reader, as well as the dynamics between image and word.		
HUMA 5340	Modern Chinese Literary Criticism	3 credits
Examines the transformation of Western literary theories in the Chinese context. Focuses on practices of individual Chinese literary theorists and the relationship between literary criticism and socio-cultural criticism from historical and comparative perspectives.		
HUMA 5350	Socialist Film Culture	3 credits
[Previous Course Code: HUMA 6001X*]* This graduate course concentrates on the film culture in socialist China (1949-1976). The major theoretical problematic of the course resides in the convoluted relationship between totalitarian politics and film as propaganda and art. Focusing on live-action feature films, model operas, animated films, and documentaries, this course will explore aspects of film industry, aesthetics, authorship, projection and viewing, soundscape, and internationalism. It will also discuss conceptual issues regarding national identity, ethnicity, gender, children, machines, and animals against the backdrop of an authoritarian regime. Following a chronological order, the course will begin with the socialist transition in 1949, and then move to the Seventeen Years (1949-1966) and the Cultural Revolution (1966-1976).		
HUMA 5370	Animation Theories	3 credits
Animation existed as optical toys long before the birth of cinema, but it was not until the digital age that animation experienced its explosive boom. Recently animation theories began to emerge as a new field of research, offering critical interventions in film studies and even challenging our conventional views of the world. This course explores various theoretical issues in animation studies, such as movement, stasis, affect, automation and agency, TV serialization, digitality, media mix, sound, authorship and spectatorship, animals, race, gender, cuteness, animism and environment. Animated films made in China, Japan, and other parts of the world will be analyzed as case studies.		
HUMA 5451	Images of Asia	3 credits
This course examines various films and visual media that deploy the imagination of different locations in Asia as a central feature of their narratives. Discussions will take up such focal points as: ethnographic cinema, the politics of travel and translation, the intersections of race and gender, the cultural politics of alternate histories, and the ramifications of techno-orientalist discourse.		
HUMA 5543	Excavated Documents	3 credits
As excavated documents gain increasing importance in early China research, this course introduces students to various types of excavated texts, familiarizes them with fundamental research methods and approaches, and opens the door to advanced studies in Chinese history, literature, philosophy, and culture. In addition, students will explore cutting-edge methodologies in digital humanities, enhancing their future research or work. *Background:* Basic Chinese reading and listening skills are necessary		
HUMA 5690	Major Issues in the History of U.S.-China Relations	3 credits
This course examines the historical origins and evolution of the complex relations between China and the United States from the early 19th century to the late 20th century. It explores some of the most important events and persistent issues in political, military, economic, and cultural relations between the two countries. It also introduces students to major competing interpretations by American and Chinese scholars.		

HUMA 5755	Ethnicity in Chinese Context	3 credits
This course explores the issue of ethnicity in China in the context of a nation-state. Issues of nationalism, ethnic identities, and ethnic diversity will be examined from anthropological perspectives.		
HUMA 5800	Fundamentals of Chinese Philosophy	3 credits
This course is designed to guide students to in-depth researches into important issues in Chinese philosophy. The subject matter of the course may vary from one year to another depending on the particular interests of the instructors. *Exclusion:* HMMA 5007		
HUMA 5902	Philosophy of Biology	3 credits
This module will provide students with the opportunity to become involved in contemporary issues in the philosophy of biology. The students will be provided an overview of the history of the biological sciences (especially evolutionary biology and genetics). In addition, the module will cover some of the central issues in the philosophy of biology, including reductionism, scientific change, level of selection, design and creationism, and examine some important concepts in the life sciences such as 'gene', 'species', and 'causation'. *Background:* Students are expected to have some background in the humanities (e.g. philosophy) and natural sciences (e.g. biology).		

LIFS

LIFS 5710	Cellular Regulation	3 credits
Molecular basis of cellular regulation. Cellular signal transduction cascades.		

MARK

MARK 5710	Analytical Modeling in Marketing	3 credits
[Previous Course Code:MARK 6900Z] This course provides Marketing MPhil/PhD students with foundational knowledge in quantitative marketing, with a focus on analytical modeling. It will cover a range of theoretical topics including pricing, advertising, two-sided markets, consumer search and learning, and information design.		

MATH

MATH 5111	Advanced Algebra I	3 credits
Advanced theory of groups, linear algebra, rings, modules, and fields, including Galois theory. *Background:* MATH 3121 and MATH 4121 (prior to 2014-15)		
MATH 5145	Introduction to Lie Groups	3 credits
This course is an introduction to the structure and representation theory of compact and noncompact reductive Lie groups. Topics include general properties of Lie groups and Lie algebras, Peter-Weyl Theorems, representations of compact Lie groups, theorems of the highest weight, Harish-Chandra isomorphism, Weyl character formula, the structure theory of noncompact semisimple and reductive Lie groups, classification of simple real Lie algebras, induced representation and Frobenius reciprocity, classical branching theorems. *Prerequisites:* MATH 5111 and MATH 5143		

MATH 5240	Algebraic Topology	3 credits
Fundamental group, covering space, Van Kampen theorem, (relative) homology, exact sequences of homology, Mayer-Vietoris sequence, excision theorem, Betti numbers and Euler characteristic.		
MATH 5251	Algebraic Geometry I	3 credits
Projective spaces, algebraic curves, divisors, line bundles, algebraic varieties, coherent sheaves, schemes. Some commumative algebra and homological algebra such as notherian ring, regular ring, valuation ring, kahler differentials. *Background:* MATH 5111 or equivalent postgraduate algebra		
MATH 5311	Advanced Numerical Methods I	3 credits
Numerical solution of differential equations, finite difference method, finite element methods, spectral methods and boundary integral methods. Basic theory of convergence, stability and error estimates.		
MATH 5350	Computational Fluid Dynamics for Inviscid Flows	3 credits
Derivation of the Navier-Strokes equations; the Euler equations; Lagriangian vs. Eulerian methods of description; nonlinear hyperbolic conservation laws; characteristics and Riemann invariants; classification of discontinuity; weak solutions and entropy condition; Riemann problem; CFL condition; Godunov method; artificial dissipation; TVD methods; and random choice method.		
MATH 5351	Mathematical Methods in Science and Engineering I	3 credits
Modeling and analytical solution methods of nonlinear partial differential equations (PDEs). Topics include: derivation of conservation laws and constitutive equations, well-posedness, traveling wave solutions, method of characteristics, shocks and rarefaction solutions, weak solutions to hyperbolic equations, hyperbolic Systems, linear stability analysis, weakly nonlinear approximation, similarity methods, calculus of variations.		
MATH 5411	Advanced Probability Theory I	3 credits
Probability spaces and random variables, distribution functions, expectations and moments, independence, convergence concepts, law of large numbers and random series.		
MATH 5431	Advanced Mathematical Statistics I	3 credits
Theory of statistical inference in estimation. Topics include: sufficiency, ancillary statistics, completeness, UMVU estimators, information inequality, efficiency, asymptotic maximum likelihood theory. Other topics may include Bayes estimation and conditional inference.		

MECH

MECH 5010	Foundation of Solid Mechanics	3 credits
Continuum concept for deformation of solids; analysis of stress and strain; constitutive equations; solution of problems relevant to materials processing, fracture mechanics and structural analysis; energy methods and numerical solutions. Background: MECH 3020 Exclusion: MESF 5010		
MECH 5940	Continuum Mechanics for Crystalline Solids	3 credits
[Previous Course Code: MECH 6910Q] This is an interdisciplinary course covering the fundamental laws of the mechanics and physics of crystalline solids, the general description of a periodic structure and their specific characterization methods. The course will start with tensor analysis, and basic calculations of tensor fields. After that, basic kinematics such as deformation gradient, Cauchy-Green tensor will be introduced and defined, followed by the mathematical description of symmetry of crystals. Finally, the		

course will discuss reciprocal lattices and the X-ray diffraction for structural solving. Background: Solid mechanics related courses. Basic symmetry knowledge. Linear algebra and multivariable calculus		
MECH 5961	Acoustics and Aeroacoustics	3 credits
[Previous Course Code: MECH 6910L] The aims of this module are to acquaint students with the knowledge of acoustics and aerodynamically generated sound, its generation either through turbulent flow or unsteady aerodynamic force-surface interaction, and numerical methods for accurate numerical prediction of aerodynamically generated noise as well as its propagation and far-field characteristics. The wide applications of the subject are noise, environmental impact of noise and transport related noise. Exclusion: AESF 5390 (prior to 2021-22) Prerequisites: MECH 3640		
MECH 6910X	Fundamentals and Applications of Solid-state Elastocaloric Refrigeration Technology	3 credits
This course aims to provide an introduction to the fundamentals and applications of solid-state elastocaloric refrigeration technology. It consists of (1) basic concept and theoretical principles; (2) design and fabrication of elastocaloric materials; (3) design and fabrication of elastocaloric refrigeration structures; (4) design and fabrication of elastocaloric devices; (5) system-level refrigeration performance characterization and analysis.		
MECH 6910Y	Advanced Computational Design and Manufacturing	3 credits
This course aims to give students a deep understanding and practical experience in applying computational techniques to solve design and manufacturing problems. It will introduce the underlying concepts behind three-dimensional geometry representations, algorithms, and the underlying mathematical foundations, essential to solving a wide variety of problems in computer-aided design (CAD), computer-aided manufacturing (CAM), and computer-aided engineering (CAE). It will also train the students with hands-on computational skills by working on team-based course projects. The course will consist of four parts: (1) preparation with an introduction, (2) geometric representation of three-dimensional solid objects, (3) basic geometric computation algorithms, and (4) real-world applications of modeling and computation in solving some design and manufacturing problems such as feature recognition, CNC tool path planning, RP process simulation, and computer-aided inspection, etc. This PG-level course is intended for students who plan to have a career in product development, CAD/CAM/CAE, robotics, manufacturing automation, virtual reality, technology management, entrepreneurship, etc. The course will help students understand the principles behind CAD, CAM, and CAE systems, and develop novel software applications for computational design and manufacturing. The course will also prepare the students to read literature, understand real-world problems, and identify possible future innovations, especially in the age of artificial intelligence (AI).		

MGCS

MGCS 6001C	The Scientific Revolution (1450 to 1750)	3 credits
This postgraduate course explores the scientific revolution in early modern Europe, examining the cultural and intellectual framework in which new discoveries were made, the shift towards a mathematic vision of the world, and the development of new experimental techniques. Through the comparison with other intellectual traditions, especially the Chinese scientific tradition, students will gain a deeper understanding of the scientific revolution and its impact on modern science and the modern world. The course aims to develop students' analytical and communication skills, as well as their understanding of early modern intellectual history.		

MGMT

MGMT 7120	Doctoral Seminar in Management	3 credits
Presentations and discussions of current research topics in Organizational Behavior and Human Resources Management for doctoral students.		
MGMT 7160	Doctoral Seminar: Frontiers in Strategy Research	3 credits
[Previous Course Code: MGMT 6501N] This course is designed as a doctoral seminar discussion that provides an overview of some of the most contemporary research topics in strategic management. We will survey a select set of strategy topics including ESG and sustainability, global strategy, corporate governance, innovation models, digital economy, mergers and acquisitions, and global value chains. Through in-depth and in-class discussion of some of the cutting-edge research in the field of strategic management, we focus on developing ideas for a research proposal in terms of theory development and research design.		

PHYS

PHYS 5110	Mathematical Methods in Physics	4 credits
Review of vector analysis; complex variable theory, Cauchy-Rieman conditions, complex Taylor and Laurent series, Cauchy integral formula and residue techniques, conformal mapping; Fourier series; Fourier and Laplace transforms; ordinary differential equations, Bessel functions; partial differential equations, wave and diffusion equations, Laplace, Helmholtz and Poisson's equations, transform techniques, Green's functions; integral equations, Fredholm equations, kernals; Rieman sheets, method of steepest descent; tensors, contravariant and covariant representations; group theory, matrix representations.		
PHYS 5200	Electro and Magneto Statics	4 credits
Coulomb and Gauss's law, Poisson and Laplace Equations, Green's functions, methods of images, solution of boundary value problems, special functions expansions, electrostatics of dielectrics, local fields, magnetostatics, conservation laws and Maxwell equations.		
PHYS 5260	Advanced Quantum Mechanics	4 credits
Discussion of various applications of quantum mechanics, such as collision theory, theory of spectra of atoms and molecules, theory of solids, second quantization, emission of radiation, relativistic quantum mechanics.		
PHYS 5530	Introduction to General Relativity	4 credits
[Previous Course Code: PHYS 6810E] This is an introductory course on general relativity (GR). The covered topics mainly include Einstein field equation and its application in black hole physics, gravitational waves astronomy and Friedman cosmology. Background: Undergraduate-level classical mechanics, electrodynamics and mathematics		
PHYS 5820	Diffraction and Imaging Techniques in Materials Science	3 credits
[Co-list with NANO 5250] Fundamental crystallography; crystalline structure and defects; X-ray and electron diffractions; imaging contrast mechanisms; structure determination; analytical electron microscopy. The instructor's approval is required for taking this course. Exclusion: NANO 5250		

SOSC

SOSC 5340	Econometric Approaches to Social Science Research	3 credits
Management and analysis of multivariate data sets, including simple and multiple regression analysis, and econometric approaches to causal inference. Enrollment by students from outside the Division of Social Science by instructor permission. Background: Knowledge in Social Science Prerequisites: SOSC 5090		
SOSC 6030T	The Political Economy of Development	3 credits
This seminar course is devoted to understanding various dimensions of development, including economic growth, state building, and democratic accountability. Why are some countries rich while others remain poor? Why do some countries have well-functioning states while others do not? Why do some countries have strong laws and property rights protection that support economic development, while others do not? Why are some countries stable democracies, and others authoritarian? This course explores the key analytical concepts and theories that explain the development trajectories of countries, with an emphasis on the rigorous application of empirical methods.		
SOSC 6500	Seminars in Cognitive Science	3 credits
[Previous Course Code: SOSC 6030S] This course aims to introduce current issues in Cognitive Science to postgraduate students. Cognitive Science is the interdisciplinary, scientific study of the mind and mental phenomena, encompassing Artificial Intelligence, Psychology, Linguistics, Neuroscience, Philosophy, Anthropology, and Education. At each week's class, we will read and discuss research papers from major Cognitive Science journals including Trends in Cognitive Sciences and Topics in Cognitive Science, or other related interdisciplinary journals. This course is open to all postgraduate students who are interested in learning more about interdisciplinary studies on the mind and behavior, including both human and artificial intelligence. Background: Students are expected to have prior knowledge in at least one of the related fields within the scope of Cognitive Science, including psychology/social science, computer science/engineering, linguistics, philosophy, neuroscience, anthropology, and education.		

[C] = Courses may required students to read materials in Chinese. Students who have difficulty reading materials in Chinese should consult the instructor concerned prior to enrolling in these courses.

[Pu] / [Ca] = Courses approved to be taught in Chinese carry a *[Pu]* or *[Ca]* notation in the course description, which indicates the spoken language used in teaching: *[Pu]* stands for Putonghua; and *[Ca]* for Cantonese.