Details of courses offered in Semester 1, 2024/25

Faculty of Science
The University of Hong Kong

Last update: **August 13, 2024**

Course Code	Course Title	Level (RPG/TPG)	Pre-requisites	Class Dates	Class Time	Venue	Course Syllabus URL	Contact Information (Name & Email)	Remarks (e.g. Please specify if the medium of instruction is NOT English)
BIOL6009	Advanced studies in Ecology & Biodiversity for Postgraduate Students	RPG	RPG	---	---	---	http://www.biosch.hku.hk/course/RPGmodules.html	Ms. Flora Chan ppchan@hku.hk	Student will select BSc course in our School and we will notify the corresponding timetable.
EASC6009	Evolving Earth Systems	RPG	Nil	The timetable will be decided until after meeting with students.			https://www.earthsciences.hku.hk/education/postgraduate_students/research_postgraduates/coursework_requirement/	Prof. Ryan McKenzie ryan00@hku.hk	Nil
MATH6101	Intermediate complex analysis	RPG	Nil	Sep 4 - Nov 27, 2024 (Wednesdays)	13:30 - 16:30	RR210	https://hkumath.hku.hk/web/current/pg-course.php	Ms. Mimi Lui mimi@hku.hk	Nil
PHYS8351	Graduate Quantum Mechanics	RPG	Nil	Sep 3 - Nov 26, 2024 (Tuesdays)	13:30 - 16:20	KKLG103	https://www.physics.hku.hk/graduate_studies/for_research_postgraduate/course_Information/	Ms Carfulin Tam carfulin@hku.hk	Nil
PHYS8352	Quantum Information	RPG	Nil	Sep 2 - Nov 28, 2024 (Mondays and Thursdays)	12:30 - 14:20 (Mondays) 12:30 - 13:20 (Thursdays)	KKLG107	https://www.physics.hku.hk/graduate_studies/for_research_postgraduate/course_Information/	Ms Carfulin Tam carfulin@hku.hk	Nil

PHYS8654	General Relativity	RPG	Nil	Sep 3 - Nov 29, 2024 (Tuesdays and Fridays)	09:30 - 10:20 (Tuesdays) 09:30 - 11:20 (Fridays)	MB142 (Tue) MW103 (Fri)	https://www.physics.hku.hk/graduate_studies/for_research_postgraduate/course_Information/	Ms Carfulin Tam carfulin@hku.hk	Nil
PHYS8852	Photonics and Metamaterials	RPG	Nil	Sep 6 - Nov 29, 2024 (Fridays)	09:30 - 12:20 (Fridays)	CYCC501	https://www.physics.hku.hk/graduate_studies/for_research_postgraduate/course_Information/	Ms Carfulin Tam carfulin@hku.hk	Nil

BIOL6009 Advanced studies in Ecology & Biodiversity for postgraduate students

OBJECTIVES
This course aims to provide student centred learning opportunities which will be designed for each individual student. Students will be required to take parts of existing Masters courses or advanced courses from the BSc curriculum which are considered necessary for their particular needs and which they have not previously taken. Opportunities for internships with local conservation organizations (1 day per week over at least one semester), that will allow students to gain relevant practical experience, may also be available.

ASSESSMENT
Examination (70-80%) and continuous assessment (20-30%) depending on the studies selected; pass/fail

Coordinator: Prof. Gray A Williams

EASC6009 (Evolving Earth Systems)		Academic Year	2024 - 25
Offering Department	Earth Sciences	Compulsory (C)/ Elective (E)	E
Course Co-ordinator	Prof Ryan McKenzie (ryan00@hku.hk)		
Teachers Involved	Variable depending on topics each semester		
Course Objectives	Evaluate various integrative Earth systems in space and time.		
Course Contents & Topics	Biogeochemical and tectonic processes that influence Earth's surface environment. Each semester topics may cover: "Origin of the Continental Crust", "The Carbon Cycle", "Oxygenation of the Atmosphere", "Mountains and Climate", amongst others.		
Course Learning Outcomes	Upon successful completion of this course, students should: 1) generate an understanding of "systems science" as pertaining to topics in Earth and Planetary Sciences; 2) understand topics covered such that they can actively participate in critical research-related discussions, as well as provide coherent presentations explaining the fundamentals of specified topics; and 3) understand topics to the level that they can formulate new scientific questions relevant to their personal research, from which they can generate new ideas for future scientific proposals of their own.		
Pre-requisites (and Co-requisites and Impermissible combinations)	N/A		
Offer in 2024 - 2025	Yes (1st sem)	Examination	No Exam
Offer in 2025 - 2026	Yes		
Course Grade	Pass/Fail		
Grade Descriptors	Pass: Completion of weekly objectives. Demonstrate understanding of various topics covered, primarily through active participation in group discussions and ability to present and lead discussion on select topics. Short writing exercise on select topic to		

	<table><tr><td></td><td>be determined with instructor.</td></tr><tr><td>Fail</td><td>Lack of participation, failure to present/lead discussions on select topics or complete course objectives.</td></tr></table>
Course Type	Lecture-based / discussion-based
Course Teaching & Learning Activities	<table><tr><th>Activities</th><th>Details</th><th>No. of Hours</th></tr><tr><td>Lectures</td><td></td><td>2 hours/week</td></tr></table>
Assessment Methods and Weighting	<table><tr><th>Methods</th><th>Details</th><th>Weighting in final course grade (%)</th></tr><tr><td>Assignment</td><td>Participation in readings & discussion, leading discussion via presentation of select readings.</td><td>100%</td></tr></table>
Required/recommended reading and online materials	Scientific journal articles TBD each semester.
Additional Course Information	This course is for RPg students of: All Faculties of HKU and other UGC-funded Universities.

Graduate Courses
(Updates Autumn 2024)

MATH6101 Intermediate Complex Analysis

by Professor Ngaiming Mok

Meeting Date / Time: Wednesdays, September 4 - November 27, 2024, 1:30 - 4:30pm
Class suspension on October 16, 2024.

Venue: Room 210, Run Run Shaw Bldg., HKU

In the course we study meromorphic functions on compact Riemann surfaces and on open Riemann surfaces using analytic and algebraic techniques. Topics on meromorphic functions include the constructions of meromorphic functions on compact Riemann surfaces, elliptic functions, Poincare series, the Mittag-Leffler Problem and the Weierstrass Problem on compact Riemann surfaces and on open Riemann surfaces.

References:

1. R. Narasimhan: Complex Analysis in One Variable (Birkhauser, 2001, 2nd edition)
2. O. Forster: Lectures on Riemann Surfaces (Springer-Verlag, 1981)
3. J.B. Conway: Functions of One Complex Variable I (Springer-Verlag, 1995) (Updates Autumn 2023)
4. K. Chandrasekharan: Elliptic Functions (Springer-Verlag, 1985)
5. K.G. Krantz, Geometric Function Theory (Birkhauser, 2006)

July 15, 2024

Course Code	PHYS8351 (RPG)		
Title	Graduate quantum mechanics		
Offering Department	Physics		
Course Co-ordinator	Prof S Q Shen Physics		
Course Co-ordinator Email	sshen@hku.hk		
Teachers Involved	Name	Department	Percentage
	Prof S Q Shen	Physics	100
Course Objectives	This course introduces postgraduates to theory and advanced techniques in quantum mechanics, and their applications to selected topics in condensed matter physics.		
Course Contents & Topics	The course covers the following topics: Dirac notation; quantum dynamics; the second quantization; symmetry and conservation laws; permutation symmetry and identical particles; perturbation and scattering theory; introduction of relativistic quantum mechanics.		
Course Learning Outcomes (CLO)	On successful completion of this course, students should be able to: CLO 1 formulate and solve problems in quantum mechanics using Dirac notation CLO 2 examine and predict the properties of identical quantum particles CLO 3 argue the importance of symmetry and conservation laws in quantum mechanics CLO 4 explain physical phenomena in the modern language of quantum mechanics CLO 5 analyse physical system in a quantum mechanical way CLO 6 recognise the connection between relativity and quantum mechanics		
Pre-requisites (and Co-requisites and Impermissible combinations)	Nil		
Offer in 2024 - 2025	Y 1st sem	Examination	Dec
Course Grade	Pass or Fail		
Grade Descriptors	Pass: Demonstrate thorough mastery at an advanced level of extensive knowledge and skills required for attaining all the course learning outcomes. Show strong analytical and critical abilities and logical thinking, with evidence of original thought, and ability to apply knowledge to a wide range of complex, familiar and unfamiliar situations. Apply highly effective organizational and presentational skills. Fail: Demonstrate little or no evidence of command of knowledge and skills required for attaining the course learning outcomes. Lack of analytical and critical abilities, logical and coherent thinking. Show very little or no ability to apply knowledge to solve problems. Organization and presentational skills are minimally effective or ineffective.		
Course Type	Lecture-based elective course		
Course Teaching & Learning Activities	Activities	Details	No. of Hours
	Lectures		36
	Tutorials		12
	Reading/Self study		80
Assessment Methods and Weighting	Methods	Details	Weighting in final course grade (%)

	Assignments		20
	Examination	3-hour written exam	50
	Test		30
Quota	9999 (9999 if no quota)		
Required/recommended reading and online materials	Lecture notes provided by Course Coordinator J. J. Sakurai: Modern Quantum Mechanics (Addison-Wesley, 1994) L. I. Schiff: Quantum Mechanics (McGraw-Hill, 1968)		

Course Code	PHYS8352 (RPG)		
Title	Quantum information		
Offering Department	Physics		
Course Co-ordinator	Prof H F Chau Physics		
Course Co-ordinator Email	hfchau@hku.hk		
Teachers Involved	Name	Department	Percentage
	Prof H F Chau	Physics	100
Course Objectives	This course covers the theory of quantum information and computation and its applications in physics and computer science.		
Course Contents & Topics	Topics include: Quantum computer; quantum algorithms; quantum error correction; quantum information processing; quantum entanglement and quantum cryptograph.		
Course Learning Outcomes (CLO)	On successful completion of this course, students should be able to: CLO 1 examine the advantage and disadvantage of quantum computing over classical computing CLO 2 explain the inner workings of common quantum algorithms and quantum key distribution CLO 3 analyze the performance of quantum algorithms and quantum error correction codes CLO 4 apply quantum information techniques to solve problems in physics and computer science		
Pre-requisites (and Co-requisites and Impermissible combinations)	Nil		
Offer in 2024 - 2025	Y 1st sem	Examination	Dec
Course Grade	Pass or Fail		
Grade Descriptors	Pass: Demonstrate thorough mastery at an advanced level of extensive knowledge and skills required for attaining all the course learning outcomes. Show strong analytical and critical abilities and logical thinking, with evidence of original thought, and ability to apply knowledge to a wide range of complex, familiar and unfamiliar situations. Apply highly effective organizational and presentational skills. Fail: Demonstrate little or no evidence of command of knowledge and skills required for attaining the course learning outcomes. Lack of analytical and critical abilities, logical and coherent thinking. Show very little or no ability to apply knowledge to solve problems. Organization and presentational skills are minimally effective or ineffective.		
Course Type	Lecture-based elective course		
Course Teaching & Learning Activities	Activities	Details	No. of Hours
	Lectures		36
	Tutorials		12
	Reading/Self study		80
Assessment Methods and Weighting	Methods	Details	Weighting in final course grade (%)

	Assignments		20
	Examination	2-hour written exam	50
	Test		30
Quota	9999 (9999 if no quota)		
Required/recommended reading and online materials	Lecture notes provided by Course Coordinator M A Nielsen and I L Chuang: Quantum Computation And Quantum Information (CUP, 2000) V Vedral: Introduction To Quantum Information Science (OUP, 2006)		

Course Code	PHYS8654 (RPG)		
Title	General relativity		
Offering Department	Physics		
Course Co-ordinator	Dr K M Lee Physics		
Course Co-ordinator Email	kmlee1@hku.hk		
Teachers Involved	Name	Department	Percentage
	Dr K M Lee	Physics	100
Course Objectives	This course serves as a graduate level introduction to general relativity. It provides conceptual skills and analytical tools necessary for astrophysical and cosmological applications of the theory.		
Course Contents & Topics	Topics include: The principle of equivalence; inertial observers in a curved space-time; vectors and tensors; parallel transport and covariant differentiation; the Riemann tensor; the stress-energy tensor; the Einstein gravitational field equations; the Schwarzschild solution; black holes; gravitational waves detected by LIGO, and Freidmann equation.		
Course Learning Outcomes (CLO)	On successful completion of this course, students should be able to: CLO 1 apply the mathematical and physical ideas of the theory of general relativity for the study of various systems in astrophysics and cosmology CLO 2 explain the observational effects at the scale of the Solar System that cannot be described by Newtonian gravity from a general relativistic point of view CLO 3 demonstrate knowledge and discuss the dynamic interactive physical processes in astrophysics by using a general relativistic approach		
Pre-requisites (and Co-requisites and Impermissible combinations)	Nil		
Offer in 2024 - 2025	Y 1st sem	Examination	Dec
Course Grade	Pass or Fail		
Grade Descriptors	Pass: Demonstrate thorough mastery at an advanced level of extensive knowledge and skills required for attaining all the course learning outcomes. Show strong analytical and critical abilities and logical thinking, with evidence of original thought, and ability to apply knowledge to a wide range of complex, familiar and unfamiliar situations. Apply highly effective organizational and presentational skills. Fail: Demonstrate little or no evidence of command of knowledge and skills required for attaining the course learning outcomes. Lack of analytical and critical abilities, logical and coherent thinking. Show very little or no ability to apply knowledge to solve problems. Organization and presentational skills are minimally effective or ineffective.		
Course Type	Lecture-based elective course		
Course Teaching & Learning Activities	Activities	Details	No. of Hours
	Lectures		36
	Tutorials		12
	Reading/Self study		80

Assessment Methods and Weighting	Methods	Details	Weighting in final course grade (%)
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	Examination	2-hour written exam	50
	Test		30
Quota	9999 (9999 if no quota)		
Required/recommended reading and online materials	Lecture notes provided by Course Coordinator R. M. Wald: General Relativity (University of Chicago Press, 1984) T. A. Moore: A General Relativity Workbook (Univ Science Books, 2012) J. B. Hartle: Gravity: An Introduction to Einstein's General Relativity (Addison-Wesley, 2003) B. Schutz: A First Course in General Relativity (Cambridge University Press, 2009)		

Course Code	PHYS8852 (RPG)		
Title	Photonics and Metamaterials		
Offering Department	Physics		
Course Co-ordinator	Prof S Zhang Physics		
Course Co-ordinator Email	shuzhang@hku.hk		
Teachers Involved	Name	Department	Percentage
	Prof S Zhang	Physics	100
Course Objectives	In the last two decades, tremendous progress has been made in the manipulation of light propagation using structured photonic media - metamaterials, with negative refraction, super-imaging and invisibility cloaking as the most well-known examples. These new discoveries are paving ways towards many potential applications of photonic structures, including imaging, display, holography, and information processing. This course aims at providing the fundamental understanding of the interaction of light with structured media whose unit cells are much smaller than the wavelength of light, and the design and functionalities of various metamaterial-based photonic devices. The course text is primarily designed for senior undergraduate students and postgraduate students and requires some knowledge on electromagnetism and optics. On the other hand, it will also be of interest to graduate students since it includes some most recent results in the field of metamaterials and nanophotonics.		
Course Contents & Topics	Topics include: Modeling of interaction of light with periodic structures, gratings, photonic crystals; coupled mode theory; interaction of light with metals, covering both propagating and localized surface plasmon polaritons; effective-medium description of the unconventional electromagnetic properties of metamaterials, such as negative permeability and negative refraction, zero refractive index, hyperbolic metamaterial, chirality and bi-anisotropy; design of the unit cells of the metamaterials based on plasmonic structures for achieving various electromagnetic properties and functionalities; transformation optics and invisibility cloaks; metamaterial devices, including super-imaging lenses, meta-lenses, metasurface holography etc.; nonlinear optical properties of metamaterials and metasurfaces; photonic systems with Parity-time symmetry; metamaterial approach for designing the topological properties for light.		
Course Learning Outcomes (CLO)	On successful completion of this course, students should be able to: CLO 1 learn the modeling of interaction of light with periodic structures; CLO 2 understand the interaction of light with plasmonic structures at subwavelength scale; CLO 3 learn the homogenization and retrieval of electromagnetic properties for structured media. CLO 4 learn how to design metamaterials with bespoke electromagnetic properties. CLO 5 understand the operation of various metamaterial based photonic devices. CLO 6 understand the linear and nonlinear interaction of light with metasurfaces. CLO 7 understand the topological properties of metamaterials.		
Pre-requisites (and Co-requisites and Impermissible combinations)	Nil		
Offer in 2024 - 2025	Y 1st sem	Examination	Dec
Course Grade	Pass or Fail		

Grade Descriptors	Pass: Demonstrate thorough mastery at an advanced level of extensive knowledge and skills required for attaining all the course learning outcomes. Show strong analytical and critical abilities and logical thinking, with evidence of original thought, and ability to apply knowledge to a wide range of complex, familiar and unfamiliar situations. Apply highly effective organizational and presentational skills. Fail: Demonstrate little or no evidence of command of knowledge and skills required for attaining the course learning outcomes. Lack of analytical and critical abilities, logical and coherent thinking. Show very little or no ability to apply knowledge to solve problems. Organization and presentational skills are minimally effective or ineffective.		
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Assessment Methods and Weighting	Methods	Details	Weighting in final course grade (%)
	Assignments		50
	Examination	2-hour written exam	50
Quota	9999 (9999 if no quota)		
Required/recommended reading and online materials	S. A. Maier, *Plasmonics: Fundamentals and Applications*, Springer, 2007 W Cai and V. M. Shalaev, *Optical Metamaterials*, Springer, 2010		