Course Code	PHYS8750 (RPG)		
Title	Physics of Nanoelectronics		
Offering Department	Physics		
Course Co-ordinator	Prof D K Ki Physics		
Course Co-ordinator Email	dkki@hku.hk		
Teachers Involved	Name	Department	Percentage
	Prof D K Ki	Physics	100
Course Objectives	This course is designed to deliver fundamental concepts and principles of quantum transport phenomena in nanoelectronic systems to fresh postgraduate students.		
Course Contents & Topics	The course will cover various topics in nanoelectronics, such as zero-, one-, and two-dimensional electronic gas systems, quantum dots, graphene and 2D materials, semiconductor heterostructures, quantum Hall effects, Coulomb blockade effects, single electron effects, field effect transistors, phase-coherent interference effects, and more. While most discussions will be made based on experimental findings, the basics of the relevant theories will also be covered using the tight-binding model, basic quantum mechanics, and Landauer-Buttiker formula. The principles and applications of nanoelectronics and nanotechnology as well as low-temperature physics will also be discussed.		
Course Learning Outcomes (CLO)	On successful completion of this course, students should be able to: CLO 1 recall basic concepts and knowledge of nanoelectronics, such as electronic band structure, dimensionality, density of states, quantum size/tunneling effect, semiconductor device operation and nanofabrication techniques CLO 2 identify and compare various transport phenomena occurring at low energy and low dimensions, such as quantum Hall effects, quantum tunneling, Coulomb blockade, Aharonov-Bohm effects, and strong/weak localization effects CLO 3 understand the physics and applications of low-dimensional electron systems and can explain them effectively to colleagues		
Pre-requisites (and Co-requisites and Impermissible combinations)	Nil		
Offer in 2026 - 2027	Y 1st sem	Examination	Dec
Course Grade	A+ to F		
Grade Descriptors	A: 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. B: Demonstrate substantial command of a broad range of knowledge and skills required for attaining at least most of the course learning outcomes. Show evidence of analytical and critical abilities and logical thinking, and ability to apply knowledge to familiar and some unfamiliar situations. Apply effective organizational and presentational skills. C: Demonstrate general but incomplete command of knowledge and skills required for attaining most of the course learning outcomes. Show evidence of some analytical and critical abilities and logical thinking, and ability to apply knowledge		

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<tr><td></td><td colspan="3">to most familiar situations. Apply moderately effective organizational and presentational skills.
D: Demonstrate partial but limited command of knowledge and skills required for attaining some of the course learning outcomes. Show evidence of some coherent and logical thinking, but with limited analytical and critical abilities. Show limited ability to apply knowledge to solve problems. Apply limited or barely 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.</td></tr>
<tr><td>Course Type</td><td colspan="3">Lecture-based elective course</td></tr>
<tr><td rowspan="4">Course Teaching & Learning Activities</td><td>Activities</td><td>Details</td><td>No. of Hours</td></tr>
<tr><td>Lectures</td><td></td><td>36</td></tr>
<tr><td>Tutorials</td><td></td><td>12</td></tr>
<tr><td>Reading/Self study</td><td></td><td>80</td></tr>
<tr><td rowspan="4">Assessment Methods and Weighting</td><td>Methods</td><td>Details</td><td>Weighting in final course grade (%)</td></tr>
<tr><td>Assignments</td><td>Including in-class quizzes (12%)</td><td>24</td></tr>
<tr><td>Examination</td><td>2-hour written exam</td><td>50</td></tr>
<tr><td>Test</td><td>mid-term test</td><td>26</td></tr>
<tr><td>Quota</td><td colspan="3">9999 (9999 if no quota)</td></tr>
<tr><td>Required/recommended reading and online materials</td><td colspan="3">Lecture notes provided by Course Coordinator
Y. Imry, Introduction to mesoscopic physics, Oxford, 1997
T. Heinzel, Mesoscopic Electronics in Solid State Nanostructures, Wiley-VCH, 2003
J.J. Sakurai, Modern Quantum Mechanics, Addison-Wesley, 1994
M. Tinkham, Introduction to Superconductivity, 2nd Edition, Dover, 1996
N. Ashcroft and N. Mermin, Solid State Physics, Holt, Rinehart and Winston, 1976
J.K. Jain, Composite Fermions, Cambridge, 2007</td></tr>
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