Enquiry for Course Details

CHEM3144 Fundamentals of Nuclear Magnetic Resonance (6 credits)		Academic Year	2023
Offering Department	Chemistry	Quota	40
Course Co-ordinator	Dr K K H Ng, Chemistry < kkhn3@hku.hk >		
Teachers Involved	(Dr K K H Ng,Chemistry) (Dr X Y Chen,Chemistry)		
Course Objectives	Nuclear magnetic resonance (NMR) spectroscopy is one of the most powerful and versatile analytical techniques for chemists studying the conformational, structural, and dynamic properties of a wide range of materials: from small organic molecules, organometallic species, up to macromolecules and polymers. However, the associated theories and concepts in NMR can sometimes appear formidable; and as a consequence, a modern NMR spectrometer is often treated as a 'black box', which could lead to the inadvertent generation of artefacts and misinterpretation of experimental data. This course aims to provide students with both the fundamental theories of NMR spectroscopy and hands-on training at the spectrometer, thus allowing them to gain a genuine understanding of the subject, and be competent in setting up experiments and obtaining reliable data independently.		
Course Contents & Topics	Students will first be equipped with the basic theory of nuclear magnetism where the physical origins of the NMR phenomenon will be explored. An in-depth examination of the instrumentation will follow, highlighting the practical aspects of NMR experiments, with a particular focus on how the correct setup of the hardware is key to acquire valid and reliable data. Different data processing techniques will also be introduced. The Bloch vector model will serve as an introductory teaching tool to allow students to gain a qualitative understanding of basic NMR pulse sequences, which are at the heart of modern NMR techniques. On the practical side, in addition to the use of simulation programmes, emphasis will be placed on gaining hands-on experience at a spectrometer.		
Course Learning Outcomes	On successful completion of this course, students should be able to: CLO 1: account for the theoretical foundation of NMR spectroscopy and relate NMR parameters such as chemical shift, scalar coupling constants, and relaxation time constants to molecular structure CLO 2: analyse and understand commonly employed one-dimensional NMR pulse sequences using basic NMR theory CLO 3: select suitable NMR experiments for structure elucidation of organic and organometallic complexes and investigation of dynamic equilibria CLO 4: perform common NMR experiments and analyse, interpret, present and document the results		
Pre-requisites (and Co-requisites and Impermissible combinations)	Pass in CHEM2241 or CHEM2341 or CHEM2441 or CHEM2541		
Course Status with Related Major/Minor /Professional Core	2U000C00 Course not offered under any Major/Minor/Professional core 2023 Minor in Chemistry (Disciplinary Elective)		
Course to PLO Mapping			
Offer in 2023 - 2024	Y 2nd sem	Examination	May
Offer in 2024 - 2025	Y		
Course Grade	A+ to F		

Grade Descriptors

A	Demonstrate a thorough grasp of the knowledge and skills required in both theory and laboratory work regarding nuclear magnetic resonance spectroscopy as described in the course learning outcomes. Show strong analytical abilities, critical and logical thinking and capability to apply and integrate knowledge learnt to solve related issues and problems. Display highly effective organisation and presentation skills during assessments.
B	Demonstrate substantial knowledge and skills required in both theory and laboratory work for attaining at least most of the course learning outcomes. Show reasonable analytical abilities, critical and logical thinking and capability to apply and integrate knowledge learnt to solve related issues and problems. Display effective organisation and presentation skills during assessments.
C	Demonstrate general but incomplete command of knowledge and skills required in theory and laboratory work required for attaining most of the course learning outcomes. Show analytical abilities, critical and logical thinking and capability to apply and integrate knowledge learnt to solve related issues and problems. Display some organisation and presentation skills during assessments.
D	Demonstrate partial and limited command of knowledge and skills required in theory and laboratory work for attaining some of the course learning outcomes. Show limited analytical abilities, critical and logical thinking and capability to apply and integrate knowledge learnt to solve related issues and problems. Display poor organisation and presentation skills during assessments.
Fail	Demonstrate little or no evidence of command of knowledge and skills required in theory and laboratory work for attaining the course learning outcomes. Show little analytical abilities, critical and logical thinking and capability to apply and integrate knowledge learnt to solve related issues and problems. Display lack of organisation and presentation skills during assessments.

Course Type	Lecture with laboratory component course

Course Teaching & Learning Activities

Activities	**Details**	**No. of Hours**
Laboratory		24
Lectures		24
Tutorials		8
Reading / Self study		100

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<tr><td>Assessment Methods and Weighting</td><td>
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<tr><th>Methods</th><th>Details</th><th>Weighting in final course grade (%)</th><th>Assessment Methods to CLO Mapping</th></tr>
<tr><td>Examination</td><td></td><td>40</td><td>CLO 1,2,3</td></tr>
<tr><td>Laboratory reports</td><td></td><td>20</td><td>CLO 1,3</td></tr>
<tr><td>Project report</td><td></td><td>25</td><td>CLO 1,2,3,4</td></tr>
<tr><td>Test</td><td></td><td>15</td><td>CLO 1,2,3</td></tr>
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<tr><td>Required/recommended reading and online materials</td><td>Malcolm H. Levitt: Spin Dynamics: Basics of Nuclear Magnetic Resonance (Wiley, 2nd edition, 2008)
James Keeler: Understanding NMR Spectroscopy (Wiley, 2nd Edition, 2010)
P. J. Hore: Nuclear Magnetic Resonance (Oxford University Press., 2nd Edition, 2015)</td></tr>
<tr><td>Course Website</td><td>NIL</td></tr>
<tr><td>Additional Course Information</td><td>References to specialized texts and other published materials will be made throughout the course.</td></tr>
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