課程大綱 syllabus

課程（course）：General Chemistry I

教師（teacher）：Keng Pei Yuin

項目	此科目對應之系所課程規畫所欲培養之核心能力 Core capability to be cultivated by this course	權重（百分比） Percentage
1	運用數學、科學及材料科學與工程知識的能力 The ability to employ the knowledge of mathematics, science, and materials science & engineering.	40
2	設計及執行實驗，以及分析解釋數據的能力 The ability to design and execute experiments, analyze and interpret data.	n/a
3	執行實驗所需技術、技巧及使用實驗工具解決問題之能力 The ability to employ the techniques and tools that are needed in executing experiments and in solving problems.	10
4	設計工程系統或製程之能力 The ability to design engineering systems or processes.	n/a
5	有效溝通及團隊合作的能力 The ability to communicate and cooperate in team works.	10
6	發掘、分析及處理問題的能力 The ability to discover, analyze, and solve problems.	15
7	認識當代材料問題，瞭解材料對於環境、社會及全球的影響，並培養持續學習的習慣與能力 The ability to know contemporary materials issues, to realize the influences of materials on the environment, the society, and the globe, and to keep the habit of learning continuously.	15
8	瞭解專業倫理及社會責任 The ability to realize professinal ethics and social responsibility.	10

課程簡述(必填) Brief Course Description (required)：

(50-200 words if possible, up to 1000 letters / 最多500個中文字)，

The General Chemistry I is the first out of the two semester of General Chemistry course aims at providing the fundamental understanding of Chemistry to undergraduate students. This General Chemistry I first provide fundamental knowledge on atoms and molecules and their physical and chemical behavior to enable students to comprehend the matters and phenomenon in this world through the molecular lenses. This is also the prerequisite course to many advanced elective and core courses. General Chemistry I will begin with the introduction of matters, atoms, elements, molecules and their compounds. Specifically students will strengthen and expand their fundamental knowledge in atomic structures to chemical bonding to intermolecular forces and apply these fundamental concepts to understanding chemistry of surrounding our daily lives such acid rains (acid and base),

solution formation (solutions), rust, batteries, electricity, electroplating (electrochemistry), smells (organic chemistry), and biomolecules that sustain a living organism (biochemistry), which will be introduced in the subsequent semester in General Chemistry II.

關鍵字(必填) course keywords(required)：
課程內容「中文暨英文關鍵字」至少5個，每個關鍵字至多20個中文，以半形逗點分隔(必填)Please fill in at least 5 course keywords (up to 40 letters for each keyword) and use commas to separate them.(required)

Matters, atoms, molecules, chemical reaction, thermochemistry, periodic properties

General Chemistry I

1. Matter, Measurement of Problem solving (2 weeks)
   1.1. Atoms and Molecules
   1.2. Matters
   1.3. Energy
   1.4. Units of measurements

2. Atoms and Elements (2 weeks)
   2.1. Atomic theory
   2.2. Structure of the Atom
   2.3. The periodic law
   2.4. Atomic mass and molar mass

3. Molecules and Compounds (2 weeks)
   3.1. Chemical bonds
   3.2. Ionic Compounds
   3.3. Molecular compounds
   3.4. Chemical formula

4. Chemical Reactions and Chemical quantities (2 weeks)
   4.1. Chemical equations
   4.2. Stoichiometry Relationships
   4.3. Chemical reactions

5. Introduction to solutions and aqueous reactions (2 weeks)
   5.1. Solution concentration
   5.2. Aqueous solutions and solubility
   5.3. Precipitations
   5.4. Acid-base reactions
   5.5. Oxidation-reduction reactions

6. Gases (2 weeks)
   6.1. Pressure
   6.2. Gas Laws
   6.3. Mixtures of gases and partial pressures
   6.4. Kinetic molecular theory

7. Thermochemistry (2 weeks)
   7.1. First law of thermodynamics
   7.2. Determining enthalpies of reactions

8. The quantum-mechanical model of the atom
   8.1. The nature of light
   8.2. Atomic spectroscopy and the Bohr Model
   8.3. Quantum mechanics and the atom

9. Periodic properties of the elements
   9.1. Electron configurations
   9.2. Periodic trends in size of atoms
   9.3. Ions: Electron configuration
   9.4. Electron affinities

10. Chemical bonding I: Lewis model
   10.1. Bonding models
   10.2. Ionic bonding
   10.3. Covalent bonding
   10.4. Electronegativity and bond polarity
   10.5. Lewis structures of molecular compounds
   10.6. Resonance and formal charge

11. Chemical bonding II: Molecular shapes, valence bond theory
   11.1. VSEPR theory
   11.2. Molecular shape and polarity
   11.3. Valence bond theory
   11.4. Molecular orbital theory

12. Liquids, solids, and intermolecular forces
   12.1. Solids, liquids, and gases
   12.2. Intermolecular forces
   12.3. Vaporization and vapor pressure
   12.4. Phase diagrams

Textbook: Chemistry: A molecular approach, Fourth Edition, Nivaldo J. Tro

Assessments: three exams, the 1st exam (30%), the 2nd exam (30%) and final exam (30%). Class participation and attendance 10%

Generation Artificial Intelligence (A.I.) Ethics Statement. The use of AI is conditionally open in this course. Based on the principles of transparency and responsibility, this course encourages students to use AI to collaborate or learn from each other to improve the quality of the course output. According to the "Guidelines for AI Collaboration, Co-learning and Quality Cultivation in University Educational Fields" announced by our University, this course is conditionally open. The following explains how to use generative AI in course output.

1. Students must briefly explain how to use generative AI for topic ideation, sentence modification, or structural reference in the "title page footnote" or "after citing literature" in class assignments or reports. If it is checked and used but not marked in the homework or report, the teacher, school or related units have the right to re-grade the homework or report or not to score.
2. If there are references to self-generated AI in the teaching materials or learning materials of this course, the teacher will also mark them on the slides or orally.
3. Students who take this course are deemed to have agreed to the above ethics statement when choosing courses.