SULTAN QABOOS UNIVERSITY

COURSE OUTLINE

PROGRAM: Chemistry

1. Course Code	CHEM3311	
2. Course Title	Inorganic chemistry I	
3. Credits	3	
4. Pre-requisite Course(s)	CHEM 2102 and MATH 2107	
5. Co-requisite Course(s)	None	
6. Equivalent Course(s)	None	
7. Incompatible Course(s)	CHEM 3310	
8. Course Category	☐ University Requirement	☐ University Elective
	☐ College Requirement	☐ College Elective
	☒ Department Requirement	☐ Department Elective
	☐ Specialization Requirement	☐ Specialization Elective
	☐ Other (specify):	
9. Course Owner	College: Science	Department: Chemistry
10. Course Type	☐ Lecture	☐ Lecture/Lab
	☐ Lecture/Seminar	☐ Lecture/Studio
	☒ Lecture/Tutorial	☐ Lecture/Lab/Tutorial or Seminar
	☐ Tutorial	☐ Laboratory (Practical)
	☐ Field or Work Placement	☐ Studio
	☐ Seminar	☐ Internship
	☐ Workshop	☐ Project
11. Language of Instruction	English	

12. Course Description

This is the first of two courses in Inorganic chemistry aimed at introducing students to fundamental concepts and principles of Inorganic chemistry. In this course we will lay the foundation of Inorganic Chemistry: atomic structure, symmetry elements & operations, point groups, molecular orbital theory, acid-base concepts, formulas and structure, chemistry of main group elements and their compounds.

13. Teaching/Learning Strategies

This course will familiarise students with fundamental concepts and principles in Inorganic chemistry and bring about awareness of the diverse roles played by inorganic compounds in our everyday lives. In this course emphasis will be placed on understanding fundamental concepts of Inorganic chemistry and developing active learning, problem-solving and critical thinking skills, thereby steering students away from rote learning.
Moodle is used as an online platform to support student leaning.

14. Assessment Components and Weight [%]

☐ Quizzes 15%	☐ Practical	☐ Other (specify):
☐ Homework assignments	☐ Project	
☐ In-term examination(s) 45	☐ Final examination 40%	

15. Grading Method

☒ A-F Scale ☐ Pass/Not passed

16. Textbook(s) and Supplemental Material

Inorganic Chemistry, by Miessler & Tarr; Prentice-Hall, 5th edition.
The following books will be referred to:
Cotton, Wilkinson, and Gaus, Basic Inorganic Chemistry, Wiley

Cotton, Chemical Applications of Goup Theory, Wiley,
Douglas, McDaniel, and Alexander, Concepts and Models of Inorganic Chemistry,Wiley,Huheey, Keiter, and Keiter, Inorganic Chemistry, 4th Ed. HaperCollins, Shriver, Atkins, and Langford, Basic Inorganic Chemistry, W. H. Freeman, Porterfield, Inorganic Chemistry, Academic Press
Cotton and Wilkinson, Advanced Inorganic Chemistry, Wiley
Greenwood and Earnshaw, Chemistry of the Elements, Butterworth Heineman

17. Matching Course Objectives with Program Outcomes and SQU Graduate Attributes

SQU Graduate Attributes

A. SQU graduates should be able to:	**B. SQU graduates possess**	**C. SQU graduates should**
1. apply the knowledge and skills relevant to the specialization 2. communicate effectively and use information and communication technologies 3. critically analyze complex information and present it in simple clear manner	1. interpersonal communication skills and alignment with culture of international labour market to assist them in practical life and in living successfully 2. skills and motivation for independent learning and engagement in lifelong learning and research 3. work ethics and positive values, and intellectual independence and autonomy 4. teamwork skills and display potential leadership qualities	relish good citizenship qualities, be conscious of their national identity and be socially responsible, engage in community affairs and be mindful of contemporary issues.

#	Intended Student Learning Outcome /Course Learning Objective	Relevant Program Outcome(s)	Applicable Attribute(s)
1.	Define electromagnetic radiation, continuous and atomic line emission spectra, Recognise and explain the dual nature of electromagnetic radiation, Apply the Bohr model to the line emission spectrum of the hydrogen atom	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
2.	Sketch the energy levels of the hydrogen atom and explain absorption, emission and ionization processes	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
3.	Write the Schrödinger equation for the particle in a box, Determine the wave function and the energy of the particle, Recognize the difference between classical and quantum mechanical behaviour of an electron in such a box,	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
4.	Draw the wave functions, squared wave functions and Recognize the difference between classical and quantum mechanical behaviour of an electron in such a box, Compare between particle in a box and electron in a hydrogen atom	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
5.	Write the Schrödinger equation in Cartesian and Sperical Polar coordinates	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.3
6.	Write the wave function of an atomic orbital using the radial (R) and angular functions (θ and Φ)	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
7.	Apply the Aufbau principle, the Pauli exclusion principle and Hund's rule to write ground-state electron configurations of neutral atoms and monatomic ions	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1, A.3 & B.2
8.	Estimate effective nuclear charge (Zeff) of a given electron in an atom	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem	A.1 & B.2

		solving, critical thinking and analytical reasoning	
9.	Explain the variation of ionization energy, electron affinity, covalent & ionic radius with atomic no.	Demonstrate factual knowledge of Chemistry; Assimilate new information into existing knowledge; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
10.	Draw Lewis structures of neutral atoms, monatomic ions, molecules and polyatomic ions	Demonstrate factual knowledge of Chemistry; Assimilate new information into existing knowledge; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
11.	Connect VSEPR formula with orbital shape, molecular shape and hybridisation of the central atom	Demonstrate factual knowledge of Chemistry; Assimilate new information into existing knowledge; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
12.	Apply the concept of formal charge to predict better Lewis structure and resonance structure	Demonstrate factual knowledge of Chemistry; Assimilate new information into existing knowledge; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
13.	List symmetry elements and symmetry operations and determine the point group of a given molecule or polyatomic ion	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning; Work within a team	A.1, A.3 & B.2
14.	Sketch the molecular orbitals from two interacting s, p & d atomic orbitals in a covalent bond	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
15.	Construct MO energy-level diagrams for homo-nuclear and hetero-nuclear diatomic molecules and ions	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
16.	Recognise the Bronsted-Lowry concept of an acid and a base, the concept of conjugate acids and bases, Bronsted-Lowry strength of oxyacids, Bronsted-Lowry acidity of aqueous cations	Demonstrate factual knowledge of Chemistry; Assimilate new information into existing knowledge; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
17.	Recognise the (i) Lewis acid-base and (ii) hard and soft acid and base concepts in terms of frontier orbitals, (iii) Steric effects on Lewis acidity and basicity	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
18.	Define unit cell and estimate the numer of atoms/ions in given unit cells	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
19.	Construct Born-Haber cycle and calculate lattice enthalpy, electron affinity or enthalfy of formation from given thermodynamic parameters	Demonstrate factual knowledge of Chemistry; Assimilate new information into existing knowledge; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1 & B.2
20.	Describe the structure and important properties of selected compounds of the main group elements and explain the structure/property relations	Demonstrate factual knowledge of Chemistry; Integrate knowledge in problem solving, critical thinking and analytical reasoning	A.1, A.3 & B.2

16. Student Responsibilities

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirement and students` academic code of conduct.

For attendance, it is the student's responsibility to be punctual and to attend all classes.

Students are expected to perform their work with honesty and avoid any academic misconduct, which is defined as the use of any dishonest or deceitful means to gain some academic advantage or benefit. This can take many forms, including but not limited to, the following: copying, plagiarism, collusion and forging documents. For full details, please refer to the Undergraduate Academic Regulations and to the Student Academic Misconduct Policy.

Additionally, this course requires that you:

endeavor to understand the fundamental concepts of Inorganic Chemistry, develop indpendent learning, critical thinking & problem solving skills and do not resort to rote learning.

COURSE INFORMATION			
Course Code	CHEM3311	**Course Title**	Inorganic chemistry 1
Semester/ Year	Spring/2023	**Section**	10
Day, Time, and Place	Tuesday, 10:00 - 11:20 am and Thursday; 8:00 - 9:20 am; CMT/E13		

Course Coordinator	Muhammad S. Khan		
Office Location	Science 2050	**Office Hours**	Monday, Wednesday; 10:00 - 11:00
Office Tel. Ext.	1493	**Email**	msk@squ.edu.om

Tentative Schedule

Week	Lecture/ Topic	Material to be covered	Assessment
1	1 & 2	Overview of Atomic Structure: Electromagnetic radiation, Dual nature of matter, The Bohr Theory of the Hydrogen Atom, Quantum Mechanical Model of the Atom	
2	3 & 4	Overview of Atomic Structure: Qunatum numbers, Orbital shapes and energies, Electron spin and Paul exclusion Principle, The Aufbau principle, Hund's rule and the Periodic Table	
3	5 & 6	Particle in a box, Comparison between particle in a box and electron in hydrogen atom, The Schrodinger Equation	Quiz 1
4	7 & 8	Radial & Angular functions, Radial & Angular Nodes, Effective nuclear charge, Ionization energy, Electron affinity, Covalent & ionic radius	
5	9 & 10	Configurations, Microstates and Terms, Atomic qunatum numbers for many-electron configurations, Spin-orbit coupling	
6	11	Lewis structure for neutral atoms, molecules, monatomic & polyatomic ions, Formal charge	In-term Exam 1
7	12 & 13	VSEPR Model and molecular geometries, Hybridization, Symmetry elements & symmetry operations, Symmetry point groups	
8	14 & 15	Classification of symmetry point groups, Application of symmetry in chemistry, Molecular Orbital Theory: Liner combination of atomic orbitals, Molecular orbitals from s, p & d orbitals	
9	16 & 17	Orbital mixing, Molecular orbital energy level diagram & molecular electron configuration for Homonuclear diatomic molecules	Quiz 2
10	18 & 19	Polar bonds, Bonding in carbon monoxide, Conjugate acids & bases, Lewis acids and bases	
11	20 & 21	Hard & soft acids and bases, Stregth of oxo acids,The crystalline solid state, Unit cell, Number of atoms/ions in unit cells	
12	22	Born-Haber cycle, Lattice energy	In-term Exam 2
13	23 & 24	Main group elements, Compounds of main group elements	
14	24 & 25	Structure and properties of compounds of main group elements	
15	26 & 27	Revision and discussion	

APPENDIX A: INSTRUCTORS OF MULTIPLE SECTIONS					
Section	**Instructor**	**Day, Time, and Place**	**Office Location and Extension**	**Email**	**Office Hours**

APPENDIX B: ADDITIONAL INFORMATION