CHEMISTRY FOR MEDICINE – CHEM2110 – SPRING 2025

	SULTAN QABOOS UNIVERSITY **COLLEGE OF MEDICINE AND HEALTH SCIENCES** **MD & BMS DEGREE PROGRAMMES** **(DEGREES: MD; BSC HS & MD; BSC HS; BSC MBS)** **COURSE OUTLINE**	Other logo

I. COURSE INFORMATION		
COURSE CODE	**CHEM2110**	
COURSE TITLE	**CHEMISTRY FOR MEDICINE**	
OMAN QUALIFICATION FRAMEWORK (OQF) LEVEL	**6**	
CREDIT HOURS	**4**	
CONTACT HOURS	**6**	
PRE-REQUISITES	**FPMT 0105**	
CO-REQUISITES	–	
EQUIVALENT COURSES	–	
INCOMPATIBLE COURSES	–	
COURSE CATEGORY	□ University Requirement	□ University Elective
	□ College Requirement (**MD**)	□ College Elective
	□ Department Requirement	□ Department Elective
	□ Specialization Requirement	□ Specialization Elective
	□ Other (specify): Major Requirement (**BMS**)	
COURSE OWNER	College:	Department:
	Center:	Unit:
DELIVERY MODE	□ Face to Face	□ Blended □ Online
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	
	□ Thesis	□ Other (specify):	
LANGUAGE OF INSTRUCTION	English		
COURSE DESCRIPTION	This course seeks to provide medical students with a solid foundation in general chemistry, organic chemistry and introductory biochemistry. Applications of chemical concepts and principles in everyday life and in particular in medicine and the allied health sciences are highlighted and emphasized. Analytical, critical-thinking and numerical problem-solving skills are acquired and developed during the coverage of topics such as scientific measurements, stoichiometry, ideal gas behaviour, solution chemistry and acid-base equilibria. To rationalize chemical and physical properties of various forms of matter, the course delves into chemical structure, bonding, intermolecular forces and reactivity of substances ranging from simple compounds to complex biomolecules. Students are rigorously trained to be independent and logical thinkers, capable of integrating knowledge to solve real-life problems. Not only does the practical work in the laboratory component reinforce the lecture subject matter, but it also helps students develop manipulative and organizational skills, make guided discoveries, record and analyse data skilfully as well as become effective team players and communicators. E-learning, which employs the Moodle platform, promotes pro-active learning.		
TEACHING AND LEARNING STRATEGIES	□ Augmented Reality	□ Flipped Classroom	
	□ Blended Learning	□ Problem-Based Learning	
	□ Guided Discovery-Based Learning	□ Project-Based Learning	
	□ Student-Centred Learning	□ Team-Based Learning	
	□ Work-Based Learning	□ Proactive Learning	
ASSESSMENT COMPONENT AND WEIGHT	□ Tests (30%)	□ Quizzes (10%)	□ Lab Test: (5%)
	□ Assignments (5%)	□ Project (%)	
	□ Final examination (40%)	□ Practical/ Lab (10%)	
TEXTBOOKS AND EDUCATIONAL MATERIAL			
GRADING METHOD	□ A-F Scale	□ Pass/Not Pass	□ Other (specify):

GRADING METHOD DESCRIPTION			
A-F GRADING SCALE:	**Range**	**Letter Grade**	**Description of Student Performance**
	90 – 100	A	**Exceptional**: virtually all learning outcomes achieved in an exceedingly consistent manner

	86 – 89	A–	**Excellent**: The vast majority of learning outcomes achieved consistently
	81 – 85	B+	**Very good**: The majority of the learning outcomes achieved consistently
	77 – 80	B	**Good**: Most of the learning outcomes achieved consistently
	73 – 76	B–	**Quite good**: Most of the learning outcomes achieved in a marginally consistent manner
	68 – 72	C+	**Satisfactory**: At least two-thirds of learning outcomes achieved
	64 – 67	C	**Acceptable**: At least half of the learning outcomes achieved
	60 – 63	C–	**Poor**: Learning outcomes achieved minimally
	55 – 59	D+	**Very poor**: The majority of the learning outcomes not achieved
	50 –54	D	**Unacceptable**: The great majority of the learning outcomes not achieved
	0 – 49	F	**Dismal**: Virtually all learning outcomes not achieved
PASS/NOT PASS:			
OTHER:			

II. SEMESTER INFORMATION			
SEMESTER/YEAR	**SP/2025**	**SECTION(S)**	**1 & 2**
DAY AND TIME	**SUN/TUE: 08:00–09:20** **MON: 10:00–12:50 (SEC 1)** **MON: 14:15–17:05 (SEC 2)**	**VENUE(S)**	**LT #2** **LAB B (SCI 2037)**
COURSE COORDINATOR	**M. S. SHONGWE**	**COURSE TEAM**	**TBA**
COORDINATOR OFFICE	**ROOM 2077A**	**OFFICE HOURS**	**TBA**
COORDINATOR EXTENSION	**2376**	**COORDINATOR EMAIL**	**musa@squ.edu.om**

III. Alignment of Course Learning Outcomes (CLO), Program Learning Outcomes (PLO), Graduate Attributes (GA), and Oman Qualification Framework (OQF) Characteristics			
CLO	**PLO**	**SQU GA**	**OQF Characteristics (Level)**
1. Demonstrate mastery of classification of matter, nomenclature of elements and simple compounds, and representations with chemical symbols and chemical formulae	**CHEM**: 1-3	A–C	1(5/6), 2(6), 4(6), 6(6)
2. Observe chemical & physical processes accurately using the relevant biological senses, make appropriate inferences and represent them with balanced chemical equation	**CHEM**: 1-3, 5-7 **BMS**: ***P***10,11	A–E	1(6)– 3(6), 5(6), 6(6)
3. Recognise and explain the role of essential elements in biological and physiological systems	**CHEM**: 1-3, 9 **MD**: 23	A–C	1(6)–3(6)
4. Assemble and set up apparatus, manipulate laboratory equipment and perform experiments competently, as well as record data accurately	**CHEM**: 1–6, 10, 11 **BMS**: ***K***3, ***P***4,6, ***E***1,8	A–F	1(6)–3(6), 4(6)
5. Analyse experimental data, evaluate the quality of the measurement and take remedial action whenever necessary	**CHEM**: 1–3, 11 **MD**: 24,25 **BMS**: ***P***4,6,10, ***E***4,8 ***R***11	A–F	1(6)–4(6), 6(6)
6. Work efficiently in a team and make significant contributions to discussions, problem-solving and execution of group tasks/activities	**CHEM**: 1–6, 10, 11 **MD**: 28 **BMS**: ***P***8, ***E***8	A–F	1(6)–6(6)
7. Demonstrate active learning and effective time management by utilizing available learning resources timely	**CHEM**: 1–4, 9 **MD**: 31 **BMS**: ***A***14,15	A–F	1(6)–6(6)
8. Perform scientific calculations concerning properties of matter and stoichiometry in chemical reactions occurring in the solid state and aqueous solution	**CHEM**: 1–3, 9	A–E	1(6)–4(6), 6(6)
9. Rationalise ideal gas behaviour with the established gas laws, perform gas stoichiometric calculations, and recognise relevant medical applications	**CHEM**: 1–3	A–C	1(6)–3(6)

10. Identify and explain the applications of electromagnetic radiation; compare and contrast the Bohr and quantum mechanical models and evaluate their contributions to the development of atomic structure	**CHEM**: 1–3, 9	A–C	1(5/6/7)–3(5/6/7)
11. Employ atomic orbitals for chemical bonding to explain chemical structures of inorganic and organic substances	**CHEM**: 1–4	A–F	1(6)–3(6)
12. Recognise and explain the role of intermolecular forces in everyday physical processes and biological systems	**CHEM**: 1–3, 9 **MD**: 23	A–F	1(7/8)–4(7/8), 6(7/8)
13. Explain the concepts of acidity of solutions and strengths of acids and bases in acid-base equilibria, perform relevant calculations and identify medical applications	**CHEM**: 1–3, 9 **MD**: 23	A–E	1(6)–4(6), 6(6)
14. Classify organic compounds, draw distinctions amongst organic families according to their characteristic behaviours, identify isomers, explain reaction mechanisms, and identify organic applications in medicine and everyday life	**CHEM**: 1–3, 9	A–F	1(8)–3(8), 4(7), 5(7), 6(8)
15. Apply acid-base equilibria, chemical bonding and organic chemistry principles to biochemistry especially protein structure	**CHEM**: 1–3, 9 **BMS**: ***K***1	A–F	1(8)–3(8), 4(7), 5(7), 6(8)

IV. Course Learning Outcomes (CLOs) and Assessment Criteria and Methods (for each CLO)

CLO 1: Demonstrate mastery of classification of matter, nomenclature of elements and simple compounds, and representations with chemical symbols and chemical formulae

Assessment Criteria (to achieve this objective, the student must)		Assessment Methods
A)	Classify a diverse range of substances according to type of matter, and the elements according to their location in the Periodic Table of the Elements	Assignment 1, Quiz, Test 1, Final Exam
B)	Apply rules of nomenclature to name elements, ions, compounds and mixtures systematically	Assignment 1, Quiz, Test 1, Final Exam

C)	Write chemical symbols of atoms and monatomic ions, and chemical formulae of compounds and mixtures properly	Practical 3, Assignment 1, Quiz, Test 1, Final Exam
CLO 2: Observe chemical & physical processes accurately using the relevant biological senses, make appropriate inferences and represent them with balanced chemical equation		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Carry out chemical reactions and physical processes in the chemical laboratory and make accurate observations	Practicals 3 &12 Assignment 1, Quiz, Test 1
B)	Deduce the different types of chemical and physical processes and name them	Practicals 3 & 12 Assignment 1, Quiz, Test 1
C)	Write chemical equations to represent the observed chemical and physical processes	Practicals 3 & 12 Assignment 1, Quiz, Test 1
CLO 3: Recognise and explain the role of essential elements in biological and physiological systems		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Identify the key functions played by elements and ions in the human body	Test 2
B)	Explain the involvement and metal ions in biological systems such as metalloenzymes	Test 2
C)	Classify the elements of life in terms of nutritional importance, content and essentiality	Test 2
CLO 4: Assemble and set up apparatus, manipulate laboratory equipment and perform experiments competently, as well as record data accurately		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Assemble equipment, set up experiments and use laboratory gadgets correctly	All practicals, Lab Exam
B)	Carry out laboratory experiments following carefully the procedures and instructions given	All practicals, Lab Exam
C)	Observe experiments carefully and record the results accurately	All practicals, Lab Exam
CLO 5: Analyse experimental data, evaluate the quality of the measurement and take remedial action whenever necessary		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**

A)	Perform calculations and interpret experimental data by integrating knowledge within the relevant topic	Assignment 2, Practicals 2, 4–7, 10, 11, Lab Exam, Quiz, Test 1, Test 2, Final Exam
B)	Draw conclusions in accordance with the aims and objectives of the experiment	Assignment 2, Practicals 2, 4–7, 10, 11, Lab Exam, Quiz, Test 1, Test 2, Final Exam
C)	Judge for themselves the quality of the data considering the precision and accuracy of the measurements and make a decision to improve the measurements if necessary	Assignment 2, Practicals 2, 4–7, 10, 11, Lab Exam, Quiz, Test 1, Test 2, Final Exam
CLO 6: Work efficiently in a team and make significant contributions to discussions, problem-solving and execution of group tasks/activities		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Participate actively in group work by performing assigned tasks to achieve a common goal	Practicals 5, 9, 11, 12
B)	Communicate ideas effectively in group discussions	Practicals 5, 9, 11, 12
CLO 7: Demonstrate active learning and effective time management by utilizing available learning resources timely		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Select and answer end-of-chapter questions well in advance of quizzes, tests and exams	Recommended end-of-chapter homework questions
B)	Carry out homework and submit assignments timely	All assignments
CLO 8: Perform scientific calculations concerning properties of matter and stoichiometry in chemical reactions occurring in the solid state and aqueous solution		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Perform calculations based on the mole concept and percentage composition by mass	Practical 4, Assignment 2, Test 2, Final Exam & Lab Exam
B)	Determine limiting reactant and calculate percent yield of chemical reaction	Test 2, Final Exam
C)	Prepare aqueous solutions and perform volumetric and titrimetric analysis	Practicals 5, 6, 7, 11, Lab Exam, Final Exam
CLO 9: Rationalise ideal gas behaviour with the established gas laws, perform gas stoichiometric calculations, and recognise relevant medical applications		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**

A)	State gas laws in words and in mathematical expressions	Practical 10, Assignment 3, Test 2, Final Exam
B)	Perform calculations based on gas stoichiometry	Practical 10, Assignment 3, Test 2, Final Exam
C)	Recognize applications of gas laws in our everyday lives and in medicine	Practical 10, Assignment 3, Test 2, Final Exam
CLO 10: Identify and explain the applications of electromagnetic radiation; compare and contrast the Bohr and quantum mechanical models and evaluate their contributions to the development of atomic structue		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Recognize the uses of electromagnetic radiation in everyday life, medicine and in chemical reactions	Assignment 4, Test 2, Final Exam
B)	Explain the Bohr model in the development of atomic structure and point out its pitfalls	Assignment 4, Test 2, Final Exam
C)	Discuss the quantum mechanical model and the establishment of atomic orbitals	Assignment 4, Test 2, Final Exam
D	Write ground-state electron configurations and apply them to explain the structure and organization of the Periodic Table of the Elements	Assignment 4, Test 2, Final Exam
CLO 11: Employ atomic orbitals for chemical bonding to explain chemical structures of inorganic and organic substances		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Demonstrate sigma- and pi-bonding using the linear combination of atomic orbitals, and identify such chemical bonding in small molecules and large biomolecules	Practical 9, Assignment 4, Test 2, Final Exam
B)	Explain the exchange of electrons in ionic bonding using atomic orbitals and Lewis dot symbols	Practical 9, Assignment 4, Test 2, Final Exam
C)	Draw Lewis structures and 3-D shapes of molecules and polyatomic ions	Practical 9, Assignment 4, Test 2, Final Exam
D)	Classify chemical bonds according to electronegativity difference, assign bond polarities, and determine molecular polarities	Practical 9, Assignment 4, Test 2, Final Exam
CLO 12: Recognise and explain the role of intermolecular forces in everyday physical processes and biological systems		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**

A)	Predict and explain physical properties of matter and everyday physical processes using intermolecular forces	Practical 11, Test 2, Final Exam
B)	Apply noncovalent interactions to protein structures and DNA folding	Practical 11, Test 2, Final Exam
CLO 13: Explain the concepts of acidity of solutions and strengths of acids and bases in acid-base equilibria, perform relevant calculations and identify medical applications		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Distinguish between acidity of a solution and strength of an acid or base, and perform calculations involving pH, pOH, pK_a and pK_b values	Practicals 11 & 12, Test 2, Final Exam
B)	Derive the Henderson-Hasselbalch equation and apply it to explain the concept of buffer solutions	Final Exam
C)	Discuss the buffering of blood under physiological conditions	Final Exam
D)	Determine and prepare a Buffer solution for specific pH conditions	Final Exam
CLO 14: Classify organic compounds, draw distinctions amongst organic families according to their characteristic behaviours, identify isomers, explain reaction mechanisms, and identify organic applications in medicine and everyday life		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Recognize different families of organic compounds by their functional groups and characteristic behavior, and name them according to IUPAC rules	Practical 11, Assignment 5, Test 2, Final Exam
B)	Predict and identify existence of constitutional isomers and stereoisomers in organic compounds	Assignment 5, Test 2, Final Exam
C)	Predict products of organic reactions and explain mechanistic pathways	Practical 11, Final Exam
D)	Identify functional groups in large biomolecules and explain the biochemical properties of such biological substances	Final Exam
CLO 15: Apply acid-base equilibria, chemical bonding and organic chemistry principles to biochemistry especially protein structure		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**

A)	Classify amino acids according to the nature of their side groups and explain their pKa values	Final Exam
B)	Describe and explain the nature of the peptide bond	Final Exam
C)	Discuss and exemplify the levels of protein structure	Final Exam

WEEK	LECTURES #	TOPICS/ SUBJECTS
1	1 & 2	Matter: classification, physical states and their interconversion Physical and chemical properties of matter; physical and chemical processes Atomic structure, chemical symbols, isotopes, monatomic and polyatomic ions
2	1 & 2	Allotropes, molecules, chemical bonds, formulae (chemical, molecular & empirical) Periodic Table of the Elements: classification into periods and groups; monatomic anions Metal cations, types of compounds, acids and conjugate bases, ionic compounds
3	1 & 2	Hydrated compounds, covalent compounds, chemical reactions and reaction types Chemical equations, acids & bases, acid-base reactions, solubility rules, precipitation reactions Redox reactions & equations, enzymatic catalysis, elements in biological systems
4	1 & 2	Measurement: units and some laboratory equipment, uncertainty in measurement Temperature scales, density, specific gravity, dimensional analysis Accuracy and precision, significant figures
5	1 & 2	Mathematical operations, scientific notation; The mole concept & Avogadro's number Isotopes & average atomic masses, molecular masses, molar masses Percentage composition by mass; empirical and molecular formulae
6	1 & 2	Stoichiometry: limiting reactants and yields of reactions Properties of gases, gas laws The ideal gas law, gas stoichiometry, Dalton's law of partial pressures
7	1 & 2	Electromagnetic radiation and the nature of light Bohr model and quantum mechanical model Quantum numbers and atomic orbitals
8		Electron configurations, valence orbitals, valence electrons Lewis dot symbols, Lewis structures, bond order, bond types, formal charges, resonance

	1 & 2	Electronegativity, types of bonds, bond polarity
9	1 & 2	Orbital shape, VSEPR model, molecular shape, polarity of molecule Hybridisation of orbitals; σ and π bonds in organic molecules Non-covalent intra- and intermolecular forces: H-bonding, dispersion & dipole-dipole
10	1 & 2	Introduction to organic chemistry and classification of organic compounds Nomenclature of aliphatic hydrocarbons: alkanes, alkenes and alkynes Isomerism in alkanes and alkenes
11	1 & 2	Types of reagents and types of organic reactions Characteristic reactions of alkanes, alkenes and alkynes The structure of benzene, aromaticity, aromatic compounds, characteristic reactions
12	1 & 2	Functional groups, characteristic reactions, functional groups in biological systems Stereoisomerism and medical applications Amino acids and condensation polymerisation; the nature of the peptide bond
13	1 & 2	The structure and classification of proteins Water as a solvent, chemical behaviours of solutes in water Standard solutions and dilutions
14	1 & 2	Various expressions of concentration Chemical reactions in aqueous solution & stoichiometric calculations Acid-base reactions & titrations
15	1 & 2	Weak and strong acids and bases (pK_a and pK_b values) pH measurement, hydrolysis of salts The concept of buffers, physiological buffers

VI. Additional Information (e.g., Rubrics, etc.)

VII. Students 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 requirements and student academic code of conduct.

ACADEMIC INTEGRITY	The University expects the students to approach their academic endeavors with the highest academic integrity. Please refer to the **Undergraduate Academic Regulations**.
ADD AND DROP	Students who wish to drop or add the course should review the **Undergraduate Academic Regulations**.
ATTENDANCE	Sultan Qaboos University has a clear requirement for students to attend courses, detailed in the **Undergraduate Academic Regulations**.
ASSESSMENT AND GRADING	To ensure the provision of a sound and fair assessment and grading, please review the **Undergraduate Academic Regulations**.
GRADE APPEAL	Students who wish to appeal their grades should review the **Undergraduate Academic Regulations**.
CLASSROOM POLICIES	Students are expected to dress professionally during class time as required by the University. Use of phones or any other electronic devices in the classroom during class time is strictly prohibited. Unauthorized use may lead to faculty member confiscation of the device for the remainder of the class. Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. A student responsible for disruptive behavior may be required to leave the class.
LATE AND MAKE-UP WORK	Students are required to meet the course objectives by submitting coursework no later than the assigned due date. Students may be allowed to submit late work if approved by the course coordinator. Assignments submitted after the due date may be penalized.
MISSED EVALUATIONS	All quizzes, tests, clinical evaluations, and exams must be completed by the date they are assigned. If a quiz, test, or exam is missed due to a documented emergency situation (e.g., medical emergency, death in the immediate family), it is the student's responsibility to contact the instructor.
OTHER	

Course Outline Appendix

1. PROGRAM LEARNING OUTCOMES

1. Demonstrate factual knowledge of chemistry
2. Assimilate new information into existing knowledge
3. Integrate knowledge in problem-solving, critical thinking, and analytical reasoning.
4. Appraise time requirements for assigned tasks, and manage time appropriately
5. Work within a team
6. Use modern instrumentation and techniques to conduct experiments following established procedures
7. Use and dispose of chemicals safely following appropriate procedures and regulations
8. Employ efficient use of computers for data acquisition and analysis
9. Use information sources to retrieve chemical information
10. Formulate hypothesis, design, and perform experiments
11. Communicate chemical information to specialist and non-specialist audience

2. SQU Graduate Attributes and Competencies for Undergraduate Studies

GRADUATE ATTRIBUTES	GRADUATE COMPETENCIES FOR UNDERGRADUATE STUDIES
A. Cognitive Capabilities: The graduate has sufficient general and specialized theoretical knowledge that enables him/her to deal well with his/her specialty and other related fields.	1. Demonstrates familiarity and works with advanced specialized knowledge in the area of specialization.
	2. Demonstrates a general understanding of the relationship of advanced specialized knowledge with knowledge in other relevant professional fields and aspects.
	3. Demonstrates a comprehensive understanding of the theories, principles, and methods used in his/her specialty, and how to create and apply new knowledge.
	4. Demonstrates general knowledge of the legal environment and necessary relevant regulatory frameworks.
	5. Shows awareness of contemporary literature and

	research.
B. Skill and Professional Capability: The graduate has sufficient skill and practical experience that enables him/her to perform all tasks related to the specialization and other related fields.	1. Applies concepts, theories, and investigative methods to synthesize and interpret information to evaluate conclusions.
	2. Applies appropriate research methods and techniques and employs digital knowledge
	3. Evaluates and critiques information independently
	4. Uses cognitive and technical skills to analyze complex issues and develop appropriate solutions.
	5. Initiates new ideas or processes in the professional, educational or research context.
C. Effective Communication: The graduate has the ability to communicate effectively with others to achieve the desired results	1. Explains, presents, and adapts information to suit the recipients.
	2. Employs appropriate information and communication technology to collect and analyze information.
D. Autonomy and Leadership: The graduate has the ability to lead, make decisions and take responsibility for decisions.	1. Performs advanced professional activities independently.
	2. Demonstrates leadership skills.
	3. Takes professional responsibility.
	4. Assumes full accountability for the tasks and their output.
E. Responsibility and Commitment: The graduate appreciates the importance of available resources and deals with them effectively and is committed to the ethics of the profession and society.	1. Manages time and other resources assigned to accomplishing tasks effectively and responsibly.
	2. Demonstrates effective practices when working in teams.
	3. Demonstrates advanced levels of understanding of values and ethics relevant to the specialization, profession and local and international society and promotes them among others.
	4. Works within the professional, institutional, and

	specialization guiding frameworks and strategic plans.
	5. Interacts with community affairs positively and preserves national identity.
F. Development and Innovation: The graduate has a passion for development and innovation in the field of specialization.	1. Demonstrates the ability to independently manage learning tasks, with an awareness of how to develop and apply new knowledge.
	2. Utilizes specialized knowledge and skills for entrepreneurship.
	3. Utilizes creative and innovative skills in the field of specialization.

3. OQF Characteristics

1. Knowledge
2. Skills
3. Communication, Numeracy, and Information and Communication Technology Skills.
4. Autonomy and Responsibility
5. Employability and Values
6. Learning to learn