

QUALITY ASSURANCE UNIT

FACULTY OF SCIENCE

FAYOUM UNIVERSITY

Academic Reference

Basic Sciences

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I. National Academic Reference Standards (NARS)

I.1 National Academic Reference Standards for Single Programs

1. National Academic Reference Standards for Physics

Physics is the study of energy and behavior of single atom and its components. Physics is the foundation upon which the other physical sciences are based such as; astronomy, chemistry and geology. The beauty of physics lies in the simplicity of the fundamental physical theories and assumptions that can alter and expand our view of the world around us. Like all sciences, physics is based on experimental observations and quantitative measurements.

The main objective of physics is to use a limited number of fundamental laws that govern natural phenomena to develop theories that can predict the results of future experiment.

Physicists are expected to become investigators in industrial or research institutions. They can also have careers as air navigators and instrument manufacturers, scientific reporters, technical consultants and university staff members. They can also be employed in information technology companies, educational institutions and health care organizations.

1.1. The attributes of a Physicist

1.1.1. General Attributes of the graduates of basic sciences

The graduates must be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities.
9. Deal with scientific data in Arabic, English or other languages.

1.1.2. General Attributes of the graduates of the Physics program

In addition to the general attributes of basic sciences graduates, the physicists graduate must be able to:

1. Demonstrate a good basic knowledge of structural and functional aspects of physical systems at many spatial scales, from single molecule to the whole system.
2. Connect fundamental ideas about the physical behavior of matter and energy to system's structure and function.

1.2. National academic standards for Physics program

The academic references standards considered in the development of this program are the National Academic Reference Standards (NARS) published by the National Authority for Quality Assurance and Accreditation of Education for Physics program.

1.2.1. Knowledge and understanding:

At the end of the program, graduates acquire knowledge and understanding of:

1. The related basic scientific facts, concepts, principles and techniques.
2. The relevant theories and their applications.
3. The processes and mechanisms supporting the structure and function of the specific topics.
4. The related terminology, nomenclature and classification systems.
5. The theories and methods applied for interpreting and analyzing data related to discipline.
6. The developmental progress of the program-related knowledge.
7. The relation between the studied topics and the environment.

In addition to the previous general knowledge acquired by basic sciences graduates, the physics graduates must know and understand the:

8. Characteristics and the physical properties of matter.
9. Statics and dynamics properties of fluids.
10. The basics of electricity.
11. Concepts of electromagnetism.
12. Principles of heat transfer and thermodynamics.
13. Theoretical and practical aspects of optics, nuclear physics and other related branches.
14. Application of advanced physical techniques.

15. Basics and mechanisms of energy transfer.

1.2.2. Intellectual skills

At the end of the program, graduates of basic sciences must be able to:

1. Differentiate between subject-related theories and assess their concepts and principles.
2. Analyze, synthesize, assess and interpret qualitatively and quantitatively science relevant data.
3. Develop lines of argument and appropriate judgments in accordance with scientific theories and concepts.
4. Postulate and deduce mechanisms and procedures to handle scientific problems.
5. Construct several related and integrated information to confirm, make evidence and test hypotheses.

In addition to the general skills acquired by basic sciences graduates, the physicist must be able to:

6. Utilize theories of physics to interpret physical phenomena.
7. Apply appropriate physical principles to create and analyze system components.
8. Choose optimum solutions for physical problems based on analytical thinking.

1.2.3. Practical and professional skills

At the end of the program, graduates of basic science must be able to:

1. Plan, design, process and report on the investigated data, using appropriate techniques and considering scientific guidance.
2. Apply techniques and tools considering scientific ethics.
3. Solve problems using a range of formats and approaches.
4. Identify and criticize the different methods used in addressing subject related issues.

In addition to the general skills acquired by basic sciences graduates, the physicist must be able to:

5. Apply mathematical tools and techniques to analyze and interpret experimental results.
6. Implant comprehensive physical knowledge and understanding as well as intellectual skills in research tasks.
7. Use the national standards for laboratory equipment which are essential for practical research work.

8. Present theoretical and experimental results in understandable forms such as tables and graphs.

1.2.4. General and transferable skills

At the end of the program, graduates of the physics program must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, and their performing manner.
3. Think independently, set tasks and solve problems on scientific basis.
4. Work in groups effectively; manage time, collaborate and communicate with others positively.
5. Consider community linked problems, ethics and traditions.
6. Acquire self and long life learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with scientific patents considering property right.
9. Exhibit the sense of beauty and neatness.

2. National Academic Reference Standards for Chemistry

Chemistry is the science which provides the concepts, knowledge, principles and theories necessary for the intellectual framework of understanding the properties of atoms and molecules as well as the relationship between structure and reactivity from fundamentals to the frontiers of current research. The study of chemistry focuses strongly on a wide range of analytical and practical skills required to practice the subject. Chemistry enables students to examine changes of materials during physical and chemical processes, and learn how to observe and measure results.

Chemistry in turn, draws on the facts and theory of physics and mathematics as tools necessary to evaluate and express quantitative chemical information. Therefore, knowledge of the dynamic and the evolving science of chemistry is essential to the discovery, understanding and development of other sciences such as biology, medicine, pharmacy, materials science, engineering and many other related sciences.

Studying for a degree in Chemistry is a sound basis for the students where they can extend their knowledge of the subject and develop many of the scientific and employability skills which are necessary for most occupations. Therefore, chemists can have opportunities to work as scientists in research activities in governmental agencies and private laboratories. They can be employed as product developers and quality control of manufactures in the industrial sectors. Chemists can utilize their wide chemistry knowledge and skills in other areas such as sales representative for chemical products, pharmaceuticals or laboratory equipment. In addition, chemistry graduates can be involved in educational institutions.

The Academic Reference Standards represent general expectations about the standards for the award of qualifications at the B. Sc. degree in chemistry, and articulate the attributes and capabilities that the graduates should be able to demonstrate. Regardless of the institution, the undergraduates of chemistry programs should provide students with an education in the main branches of chemistry, namely:

1. Analytical chemistry: study of the structure, composition and analysis of substances,
2. Inorganic chemistry: study of non-carbon-based compounds,
3. Organic chemistry: study of carbon-based compounds,
4. Physical chemistry: application of concepts and laws to study the characteristics of atoms and molecules as well as chemical reactions,
5. Computational chemistry: study of the principles and theories of quantum mechanics.

2.1 The Attributes of Chemistry

2.1.1. General Attributes of the graduates of basic sciences:

The graduate must be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities.
9. Deal with scientific data in Arabic, English or other languages.

2.1.2. General attributes of the graduates of chemistry program

In addition to the general attributes of the basic science graduates, the chemist must develop a group of attributes which are the ability to:

1. Design and conduct experimental work, critically evaluate the outcomes, review and report on practice.
2. Have knowledge and experience of working with relevant and advanced laboratory techniques.
3. Participate in and review quality control processes, manage risks and organize time to finish jobs.
4. Demonstrate wide background knowledge related to the different branches of chemistry.

2.2. National Academic Standards for Chemistry Program

National Academic Reference Standards (NARS) for Basic Science prepared by National Authority for Quality Assurance and Accreditation of Education (NAQAAE).

2.2.1. Knowledge and Understanding:

At the end of the program, graduates acquire knowledge and understanding of:

1. The related basic scientific facts, concepts, principles and techniques.
2. The relevant theories and their applications.
3. The processes and mechanisms supporting the structure and function of the specific topics.
4. The related terminology, nomenclature and classification systems.
5. The theories and methods applied for interpreting and analyzing data related to discipline.
6. The developmental progress of the program-related knowledge.
7. The relation between the studied topics and the environment.

In addition to the previous general knowledge acquired by basic sciences graduates, the graduates must know and understand the:

8. Chemical concepts, nomenclature, formulae and units.
9. Characteristics of the different states of the matter and elements including trends within the periodic table and the related theories.
10. The principles, procedures and techniques used in chemical analysis, characterization and structural investigations of different chemical compounds.
11. The major types of chemical reactions, their characteristics and mechanisms as well as their kinetics including catalysis.
12. The principles of thermodynamics and quantum mechanics including their applications in chemistry.
13. The constitution and properties of the different chemical compounds, including the main synthetic pathways and the relation between the properties of individual atoms and molecules.
14. The current issues of chemical research and technological development.

2.2.2. Intellectual Skills

At the end of the program, graduates of basic sciences must be able to:

1. Differentiate between subject-related theories and assess their concepts and principles.
2. Analyze, synthesize, assess and interpret qualitatively and quantitatively science relevant data.
3. Develop lines of argument and appropriate judgments in accordance with scientific theories and concepts.
4. Postulate and deduce mechanisms and procedures to handle scientific problems.
5. Construct several related and integrated information to confirm, make evidence and test hypotheses.

In addition to the general skills acquired by basic sciences graduates, he chemist must be able to:

6. Differentiate between the different states of the matter, elements and compounds based on the recognition and quantification of the properties.
7. Employ computational software's and data processing skills in handling of chemical information and analysis of chemical data.
8. Explain concepts and determine the efficiency of chemical systems by applying mathematical expressions.
9. Analyze chemical data to identify and confirm chemical structures as well as determine chemical composition.
10. Propose and conclude mechanisms for physical and chemical processes.

2.2.3. Practical and professional skills

At the end of the program, graduates of basic science must be able to:

1. Plan, design, process and report on the investigated data, using appropriate techniques and considering scientific guidance.
2. Apply techniques and tools considering scientific ethics.
3. Solve problems using a range of formats and approaches.
4. Identify and criticize the different methods used in addressing subject related issues.
5. In addition to the general skills acquired by basic sciences graduates, graduates must be able to:

6. Assess risk in laboratory work taking into consideration the specific hazards associated with the use of chemical materials as well as the safe and proper operation of the laboratory techniques.
7. Conduct standard laboratory procedures involved in analytical and synthetic work.
8. Monitor by observation and measurements the chemical properties or changes, including systematic recording and technical reporting.
9. Use computational packages and tools in chemical investigations.

2.2.4. General and Transferable Skills

At the end of the program, graduates of the chemistry program must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, and their performing manner.
3. Think independently, set tasks and solve problems on scientific basis.
4. Work in groups effectively; manage time, collaborate and communicate with others positively.
5. Consider community linked problems, ethics and traditions.
6. Acquire self- and long life-learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with scientific patents considering property right.
9. Exhibit the sense of beauty and neatness.

3. National Academic Reference Standards for Mathematics

Mathematics is one of the oldest and most fundamental sciences. It constitutes a body of established facts, achieved by reliable methods, verified by practice, and agreed on by qualified experts. Mathematicians advance mathematical knowledge by developing new principles and recognizing previously unknown relationships between existing principles of mathematics.

Mathematicians also use theories and techniques, such as mathematical modeling and computational methods to formulate and solve practical problems. Students of mathematics programs today bring a rich diversity of experiences. This diversity challenges educators to define clear goals and standards, develop effective instructional strategies, and present mathematics in appropriate contexts. Mathematics can be offered as a single program, and also joint with other disciplines, such as statistics, computer science, physical applied mathematics, and theoretical physics.

Graduates of such programs are employed in a wide range of careers such as teaching and research jobs in a variety of educational institutions. Graduates also work with others as part of a team, in business, industry and commerce, to solve a variety of problems, such as translating mathematical situations into computational procedures, or designing mathematical models to predict the behavior of phenomena in a physical or a life science.

The standards have to be built in a framework through which it will be reflected in performances to satisfy the main aims of the program. The framework of these standards should be consistent with frameworks presented in other mathematics reform initiatives and are intended to affect every aspect of a university mathematics program.

3.1. The attributes of Mathematicians

3.1.1. General Attributes of the graduates of basic sciences programs

The graduate should be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.

6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities.
9. Deal with scientific data in Arabic, English or other languages.

3.1.2. General Attributes of the graduates of Mathematics program

In addition to the general attributes of basic sciences graduates, the mathematics graduates must be able to:

1. Understand, recognize, and describe patterns and make abstractions about them.
2. Draw conclusions about the real world using mathematical concepts.
3. Find true statements that can be made about mathematical objects.
4. Apply techniques, tools, and formulas to understand an object's attributes.
5. Recognize and use various types of reasoning and methods of proof.
6. Create and use representations to model and interpret mathematical ideas.
7. Recognize and understand how mathematical ideas interconnect and build on one another.

3.2. National academic Reference Standards for Mathematics Program

The academic references standards considered in the development of this program are the National Academic Reference Standards (NARS) published by the National Authority for Quality Assurance and Accreditation of Education for mathematics program.

3.2.1. Knowledge and understanding:

At the end of the program, graduates acquire knowledge and understanding of:

1. The related basic scientific facts, concepts, principles and techniques.
2. The relevant theories and their applications.
3. The processes and mechanisms supporting the structure and function of the specific topics.
4. The related terminology, nomenclature and classification systems.
5. The theories and methods applied for interpreting and analyzing data related to discipline.
6. The developmental progress of the program-related knowledge.
7. The relation between the studied topics and the environment.

In addition to the knowledge and understanding acquired by basic sciences graduates, the mathematics graduates must acquire knowledge and understanding of:

8. Numerical mathematics, and the different ways in which numerical information is used.
9. Abstract algebraic structures and their roles in solving problems expressed with symbols and in developing mathematical theories and techniques.
10. Mathematical methods and techniques that deal with differential equations and their applications.
11. Geometrical concepts, and processes used in measuring attributes of objects.
12. The concept of function, and its role in mathematical analysis.
13. Discrete mathematics, algorithms, and combinatorial abilities in order to solve problems of finite character and enumerate sets without direct counting.
14. Probability and statistical models to make inferences about real-world situations.
15. Modeling and symbolic representations of problem situations.
16. The deductive nature of mathematics, and the roles of definitions, axioms, and theorems to identify and construct valid deductive arguments.
17. Theories and applications of other mathematical trends and/or applied mathematics and/or mathematical statistical and/or computer science.

3.2.2. Intellectual skills

At the end of the program, graduates of basic sciences must be able to:

1. Differentiate between subject-related theories and assess their concepts and principles.
2. Analyze, synthesize, assess and interpret qualitatively and quantitatively science relevant data.
3. Develop lines of argument and appropriate judgments in accordance with scientific theories and concepts.
4. Postulate and deduce mechanisms and procedures to handle scientific problems.
5. Construct several related and integrated information to confirm, make evidence and test hypotheses.

In addition to the general skills acquired by Basic Sciences graduates, the graduates of Mathematics program must be able to:

6. Formulate mathematical ideas and procedures using appropriate mathematical vocabulary and notation.
7. Construct symbolic forms of problem situations through modeling real-world situations, develop and use the models to make predictions and informed decisions.
8. Recognize, compare, and transform mathematical objects.
9. Represent, abstract and interpret problems.
10. Develop connections within branches of mathematics and between mathematics and other disciplines.
11. Utilize appropriate processes in applied mathematical studies.
12. Judge the validity of mathematical arguments and the reasonableness of results.

3.2.3. Practical and Professional skills

At the end of the program, graduates of basic science must be able to:

1. Plan, design, process and report on the investigated data, using appropriate techniques and considering scientific guidance.
2. Apply techniques and tools considering scientific ethics.
3. Solve problems using a range of formats and approaches.
4. Identify and criticize the different methods used in addressing subject related issues.

In addition to the general skills acquired by Basic Sciences graduates, the graduates of mathematics program must be able to:

5. Apply reasoning techniques to build convincing mathematical arguments.
6. Develop conjectures and draw appropriate conclusions, and test these conjectures.
7. Identify required mathematics and other technical information independently.
8. Use technology to enhance mathematical thinking and understanding.
9. Conduct independent nontrivial exploration in mathematics.
10. Develop and reinforce tenacity and confidence in their abilities to use mathematics.

3.2.4. General and transferable skills:

At the end of the program, graduates of Mathematics program must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities and their performing manner.
3. Think independently, set tasks and solve problems on scientific basis.
4. Work in a team effectively, manage time, collaborate and communicate with others positively.
5. Address community linked problems with considerable attention to the community ethics and traditions.
6. Acquire self and long life learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with property rights legally and ethically.
9. Exhibit the sense of beauty and neatness.

I.2. National Academic Reference Standards for Double Programs

1. National academic Reference Standards for Chemistry/Physics Program

1.1. The attributes of the Graduate

1.1.1 General Attributes of the graduates of basic sciences:

The graduate must be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities.
9. Deal with scientific data in Arabic, English or other languages.

1.1.2. General Attributes of the graduates of chemistry / physics program

In addition to the general attributes of the graduates, the graduates of the chemistry/ physics program should be able to:

1. Demonstrate a wide range of background knowledge related to the branches of chemistry and physics.
2. Design and conduct experimental work, critically evaluate the outcomes, review and report on practice.
3. Acquire the knowledge and experience of working with specialized laboratory techniques relevant to different disciplines of chemistry and physics.
4. Review quality control processes, conform to safety regulations, manage risks and organize time to finish jobs.

5. Apply theories and concepts of chemistry and physics to interpret the chemical and physical processes from an integrated point of view.
6. Employ theories and concepts of mathematics and statistics to understand the underlying mechanisms of the essential chemical and physical processes.
7. Abide by the legislations and ethics related to the environment preservation and human health and welfare.

1.2. National Academic Standards for Chemistry/Physics Program

National Academic Reference Standards (NARS) for Basic Science prepared by National Authority for Quality Assurance and Accreditation of Education (NAQAAE).

1.2.1. Knowledge and Understanding:

At the end of the program, graduates acquire knowledge and understanding of:

1. Acquire knowledge and understanding of the related basic scientific facts, concepts, principles and techniques.
2. Acquire knowledge and understanding of the relevant theories and their applications.
3. Acquire knowledge and understanding of the processes and mechanisms supporting the structure and function of the specific topics.
4. Acquire knowledge and understanding of the related terminology, nomenclature and classification systems.
5. Acquire knowledge and understanding of the theories and methods applied for interpreting and analyzing data related to discipline.
6. Acquire knowledge and understanding of the developmental progress of the program-related knowledge.
7. Acquire knowledge and understanding of the relation between the studied topics and the environment.

In addition to the knowledge and understanding acquired by basic sciences graduates, the graduates must acquire knowledge and understanding of:

8. Demonstrate a wide range of knowledge including the theories, facts, concepts, and techniques related to chemistry and physics.

9. Recognize the relationship and interactions among chemistry, physics and the environment.
10. Acquire the essential knowledge in mathematics, statistical analyses, computing, and other collateral subjects required to understand the advanced and contemporary topics of chemistry and physics.
11. Demonstrate knowledge of principles and procedures used in chemical analysis, as well as in characterization and structural investigations of compounds.
12. Characterize the nature and behavior of the functional groups in different types of molecules.
13. Adopt clear understanding of the physics of energy transfer, thermodynamics and nuclear energy.
14. Characterize the static and dynamic prosperities of the matter.

1.2.2. Intellectual Skills

At the end of this program, the graduates must able to:

1. Discuss subject- related theories of chemistry and physics and critically assess their concepts and principles.
2. Analyze, evaluate and interpret qualitative and quantitative scientific data relevant to the various subjects of chemistry and physics.
3. Develop lines of argument and appropriate judgment in accordance with scientific theories and concepts in the area of study .
4. Postulate and deduce mechanisms and procedures to handle scientific problems. Choose optimum solutions for physical and chemical problems based on critical thinking
5. Construct several related information to confirm, make evidence and test hypotheses.
6. Analyze and interpret quantitative data relevant to the fields of chemistry and physics in graphs, figures, tables and other sources of information.

1.2.3. Practical and Professional Skills

At the end of the program, graduates of basic science must be able to:

1. Identify and criticize the different methods used in addressing subject related issues.

In addition to the general skills acquired by basic sciences graduates, Graduates must be able to:

2. Plan and conduct investigations using appropriate techniques and write structural reports on the data in accordance with the standard scientific guide lines.
3. Apply techniques and tools in accordance with the guide lines of scientific ethics.
4. Solve problems using a range of formats and approaches that are widely applicable in the different areas of chemistry and physics.
5. Identify and employ the specific methodologies used in addressing subject related issues that involve working on the interface between chemistry and physics.
6. Handle research materials safely and conduct risk assessments taking into account their physical and chemical properties to avoid hazards associated with their use .
7. Demonstrate sound familiarity with laboratory instruments, procedures and techniques used in experimental applications in chemistry and physics.
8. Monitor, by observation and measurement, chemical properties, events or changes followed by systematic and reliable recording and documentation thereof.
9. Choose and apply appropriate computational tools to analyze and interpret experimental data in terms of theories relevant to chemistry and physics.
10. Search and evaluate the validity and relevance of literature in a critical thinking approach.

1.2.4. General and Transferable Skills

At the end of this program, the graduates must able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, delegate tasks, and set clear guidelines and performance indicators.
3. Think independently, and solve problems on scientific basis.
4. Work in groups effectively; manage time, collaborate and communicate with others positively.
5. Consider community linked problems, ethics and traditions.
6. Acquire self- and lifelong learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with property rights legally and ethically.
9. Exhibit the sense of beauty and neatness.

2. National Academic Reference Standards for Chemistry/Biochemistry Program

2.1 The attributes of the graduates

The graduates of the Chemistry and Biochemistry program must be able to:

1. Recognize the role of basic sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret data of various sources.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Use effectively information technology relevant to the field.
7. Participate effectively as a member in a team, recognize and respect the views and opinions of the other members, and be flexible for adaptation to work conditions.
8. Develop the skills and attitude necessary for lifelong and independent learning and participate effectively in research activities.
9. Deal with scientific data and communicate about specific subjects appropriately in Arabic, English or other languages.

2.1.2. General Attributes of the graduates of Chemistry and Biochemistry program

In addition to the general attributes of the graduate of faculties of Sciences, the graduate of the Chemistry and Biochemistry program should be able to:

1. Demonstrate wide background knowledge related to the different branches of chemistry / biochemistry
2. Acquire the knowledge and experience of principles and procedures employed in standard chemical and biochemical analyses using specialized laboratory techniques.
3. Review and evaluate quality control processes, safety regulations, manage risks and organize time to finish jobs.
4. Plan and conduct experimental work, critically evaluate the outcomes, review and report on practice.
5. Demonstrate knowledge, from an integrated point of view, of theories, facts, concepts and essentials of chemistry and biochemistry.

6. Recognize the relationship and interactions among chemistry, bio-chemistry and the environment and abide by the legislations and ethics related to the environment preservation and human health and welfare.
7. Apply theories and concepts of mathematics and statistics to understand the underlying mechanisms of the essential chemical and biochemical processes.

2.2. National Academic Reference Standards for Chemistry and Biochemistry Program

National Academic Reference Standards (NARS) for Basic Science prepared by National Authority for Quality Assurance and Accreditation of Education (NAQAAE).

2.2.1. Knowledge and understanding

At the end of the program, graduates acquire knowledge and understanding of:

1. Acquire knowledge and understanding of the related basic scientific facts, concepts, principles and techniques.
2. Acquire knowledge and understanding of the relevant theories and their applications.
3. Acquire knowledge and understanding of the processes and mechanisms supporting the structure and function of the specific topics.
4. Acquire knowledge and understanding of the related terminology, nomenclature and classification systems.
5. Acquire knowledge and understanding of the theories and methods applied for interpreting and analyzing data related to discipline.
6. Acquire knowledge and understanding of the developmental progress of the program-related knowledge.
7. Acquire knowledge and understanding of the relation between the studied topics and the environment.

In addition to the knowledge and understanding acquired by basic sciences graduates, the graduates must acquire knowledge and understanding of:

8. Demonstrate knowledge and comprehension of theories, facts, concepts, fundamentals and techniques related to the fields of chemistry and biochemistry.

9. Acquire the essential knowledge in mathematics, physics, biology, statistics and other subjects in order to understand the advanced and contemporary topics of chemistry and biochemistry.
10. Exhibit familiarity with the principles and procedures used in chemical analyses as well as in characterization and structural investigation of compounds.
11. Characterize the chemical nature and behavior of the functional groups in different types of molecules.
12. Appreciate the concepts of bio-diversity and maintaining of natural resources.

2.2.2. Intellectual skills

At the end of the program, the graduates must be able to:

1. Discuss subject – related theories and assess their concepts and principles.
2. Analyze, evaluate and interpret qualitative and quantitative scientific data relevant to the various subjects of chemistry and biochemistry.
3. Develop lines of argument and appropriate judgment in accordance with scientific theories and concepts in the area of study.
4. Postulate and deduce mechanisms and procedures to handle scientific problems and choose optimum solutions for chemical and biochemical problems based on critical thinking.
5. Construct several related and integrated information to confirm, make evidence and test hypotheses.
6. Analyze and interpret quantitative data in graphs, figures, tables, equations, and other resources of information.

2.2.3. Professional and practical skills

At the end of the program, graduates of basic science must be able to:

1. Identify and criticize the different methods used in addressing subject related issues.

In addition to the general skills acquired by basic sciences graduates, graduates must be able to:

2. Plan and conduct investigations using appropriate techniques relevant to the fields of chemistry and biochemistry and write structural reports on the data in accordance with the standard scientific guide lines.

3. Solve problems related to the fields of chemistry and biochemistry using a range of formats and approaches and employ appropriate techniques and tools in accordance with scientific ethics.
4. Handle chemical materials safely and conduct risk assessments taking into account their physical and chemical properties to avoid hazards associated with their use.
5. Employ standard laboratory instruments, procedures, and techniques used in the chemical and biochemical investigations.
6. Apply mathematical and computational tools to analyze and interpret experimental data in terms of theories relevant to chemistry and biochemistry.
7. Read, scrutinize, and evaluate the validity and relevance of literature in a critical thinking approach.
8. Consider variations inherent in dealing with biological materials such as sample size, accuracy, precision and calibration.

2.2.4. General and transferable skills

At the end of the program, the graduates must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, and their performing manner.
3. Think independently, set tasks and solve problems on scientific basis.
4. Work in groups effectively; manage time, collaborate and communicate with others positively.
5. Consider community linked problems, ethics and traditions.
6. Acquire self- and long life-learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with scientific patents considering property right.
9. Exhibit the sense of beauty and neatness.

3. National Academic Reference Standards for Geology/Chemistry Program

3.1. The Attributes of the graduate

3.1.1. General attributes of the graduates of basic sciences

The graduate should be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities.
9. Deal with scientific data in Arabic, English or other languages.

3.1.2. General Attributes of the graduates of Geology/Chemistry program

In addition to the general attributes of the basic sciences graduates, the graduate of the Geology/Chemistry program should be able to:

1. Demonstrate a wide range of integrated knowledge related to different branches of chemistry and geology.
2. Review and evaluate quality control processes, manage risks and organize time to finish jobs.
3. Plan and conduct experimental work, critically evaluate the outcomes, and report on practice.
4. Employ concepts and theories of chemistry to interpret geological processes taking place in and on the Earth.
5. Apply essential theories and concepts of mathematics and statistics to comprehend contemporary geological and chemical subjects.

6. Employ effectively the principles, procedures and techniques used in the chemical and geological investigations in accordance with the safety regulations and good practices in the laboratory and the field.
7. Recognize the relationship and interactions among chemistry, geology and the environment and abide by the legislations and ethics related to the environment preservation and human health and welfare.

3.2. National Academic Reference Standards for Geology/Chemistry program:

The academic references standards considered in the development of this program are the National Academic Reference Standards (NARS) published by the National Authority for Quality Assurance and Accreditation of Education for double major of Geology/Chemistry program; strengthened by the National Academic Reference Standards for Basic Sciences.

3.2.1. Knowledge and understanding:

In respect of the knowledge and understanding, the National Academic Reference Standards (NARS) for double major of Geology/Chemistry program were precisely studied and correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Geology/Chemistry program must be able to:

1. Demonstrate integrated knowledge and comprehension of the theories, facts, concepts, fundamentals and techniques related to the fields of chemistry and geology.
2. Employ mathematics, physics, and other collateral subjects in order to understand the major processes of chemistry and geology.
3. Exhibit familiarity with the principles and procedures used in chemical analyses as well as in characterization and structural investigation of compounds.
4. Develop coherent knowledge of the physical, chemical and biological processes operating on and within the Earth.
5. Enumerate the structure and composition of the Earth and other planets and the history of the Earth over geological time scales.
6. Demonstrate familiarity and comprehension of classification systems used for animals and plants and the chemical processes causing their fossilization.
7. Enumerate the concepts of bio-diversity and maintaining of natural resources.

8. Know and understand the processes and mechanisms supporting the structure and function of the specific topics.
9. Know the theories and methods applied for interpreting and analyzing data related to discipline.
10. Understand the relation between the studied topics and the environment.

3.2.2. Intellectual skills:

In respect of the intellectual skills, the National Academic Reference Standards (NARS) for double major of Geology/Chemistry program were precisely studied and correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Geology/Chemistry program must be able to:

1. Discuss subject-related theories and assess their concepts and principles.
2. Analyze, evaluate and interpret qualitative and quantitative scientific data relevant to various subjects of chemistry and geology.
3. Develop lines of argument and appropriate judgment in accordance with scientific theories and concepts in the geological and chemical fields.
4. Develop an integrated and systematic understanding of the present and past interactions between the processes operating in the Earth's core, mantle, crust, hydrosphere, atmosphere and biosphere.
5. Monitor and manage natural and human-induced environmental changes and evaluate the implications of sustainable development.
6. Combine and construct integrated information to choose optimum solutions for geological problems based on critical thinking
7. Analyze and interpret quantitative data from maps, graphs, figures, tables and other sources of information.

3.2.3. Professional and practical skills:

In respect of the professional and practical skills, the National Academic Reference Standards (NARS) for double major of Geology/Chemistry program were precisely studied and

correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Geology/Chemistry program must be able to:

1. Plan and conduct investigations using appropriate techniques and write structural reports in accordance with the standard scientific guide lines.
2. Handle chemical materials and geological samples safely and conduct risk assessments taking into account their physical and chemical properties to avoid hazards associated with their use.
3. Employ recent laboratory equipment and procedures used in standard experimental applications in chemistry and geology in accordance with ethical guidelines.
4. Monitor; by observation and measurement; chemical properties, events or changes followed by systematic and reliable recording and documentation thereof.
5. Apply mathematical and computational tools to analyze and interpret experimental data in terms of theories relevant to chemistry and geology.
6. Exploit the geographical information system (GIS) in interpreting the different geological phenomena.
7. Apply exploration and exploitation strategies for natural resources such as hydrocarbons, minerals and water.
8. Solve problems using a range of formats and approaches.
9. Identify and criticize the different methods used in addressing subject related issues.

3.2.4. General and transferable skills:

Graduates of Geology/Chemistry program must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, delegate tasks, and set clear guidelines and performance indicators.
3. Think independently, and solve problems on scientific basis.
4. Work in a team effectively, manage time, collaborate and communicate with others positively.
5. Address community linked problems with considerable attention to the community ethics and traditions.
6. Acquire self and long life learning.
7. Apply scientific models, systems, and tools effectively.

8. Deal with property rights legally and ethically.
9. Exhibit the sense of beauty and neatness.

4. Academic Reference Standards for Zoology/Chemistry Program

4.1. General Attributes of the Graduate

4.1.1. General Attributes of the graduates of basic sciences

The graduates should be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on the scientific basis.
6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities. Apply theories and concepts of mathematics and statistics to understand the underlying mechanisms related to the essential processes in chemistry and zoology.
9. Deal with scientific data in Arabic, English or other languages.

4.1.2. General Attributes of the graduates of Zoology/Chemistry program

In addition to the general attributes of the graduate of faculties of Sciences, the graduate of the zoology/chemistry program should be able to:

1. Demonstrate wide integrated knowledge related to different branches of chemistry and zoology.
2. Develop knowledge and experience of working with contemporary laboratory techniques relevant to different disciplines in chemistry and zoology.
3. Plan and conduct experimental work using appropriate instruments, review safety regulations and quality control processes, assess and manage risks, report on practice, and critically evaluate the outcomes.
4. Apply concepts and theories of chemistry to interpret life's basic processes from cell to organism to ecosystems.
5. Recognize the relationship and interactions among chemistry, zoology and the environment.
6. Employ theories and concepts in mathematics and statistics to interpret the underlying mechanisms of the essential processes in chemistry and zoology.

7. Abide by the legislations and ethics related to the environment preservation and human health and welfare.

4.2. National Academic Reference Standards for Zoology/Chemistry Program

The academic references standards considered in the development of this program are the National Academic Reference Standards (NARS) published by the National Authority for Quality Assurance and Accreditation of Education for double major of Zoology/Chemistry program; strengthened by the National Academic Reference Standards for Basic Sciences.

4.2.1. Knowledge and Understanding

In respect of the knowledge and understanding, the National Academic Reference Standards (NARS) for double major of Zoology/Chemistry program were precisely studied and correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Zoology/Chemistry program must be able to:

1. Demonstrate wide knowledge and comprehension of the theories, facts, concepts, fundamentals and techniques related to the fields of chemistry and zoology.
2. Acquire the essential knowledge in mathematics, physics, biology and other collateral subjects in order to understand the recent advances in chemistry and zoology.
3. Exhibit knowledge of the principles and procedures used in chemical analyses as well as in characterization and structural investigation of compounds.
4. Demonstrate familiarity and comprehension of terminology, nomenclature and contemporary tools used for the classification systems of animals.
5. Acquire knowledge and understanding of the structure and function of various types of animal cells and cell organelles in unicellular and multicellular organisms.
6. Demonstrate a profound understanding of how the chemistry of biological molecules determines their biological functions with a special consideration to the major metabolic pathways and their interactions in living organisms.
7. Appreciate the concepts of biodiversity and maintaining of natural resources.
8. The relevant theories and their applications.
9. The processes and mechanisms supporting the structure and function of the specific topics.
10. The theories and methods applied for interpreting and analyzing data related to discipline.
11. The developmental progress of the program-related knowledge.

12. The relation between the studied topics and the environment.

4.2.2. Intellectual Skills

In respect of the intellectual skills, the National Academic Reference Standards (NARS) for double major of Zoology/Chemistry program were precisely studied and correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Zoology/Chemistry program must be able to:

1. Test, evaluate and criticize an existing piece of information in the light of the evidence provided by recent advances in zoology.
2. Analyze, evaluate and interpret qualitative and quantitative scientific data relevant to various subjects of chemistry and zoology.
3. Construct several lines of related information to confirm, make evidence and test hypotheses related to recent progress in research such as stem cell and applications of Nano-technology in biology.
4. Breakdown, synthesizes, reconstruct and reformulate a bulk of information such as pathways for biosynthesis of biologically active compounds or macromolecules.
5. Analyze and interpret quantitative data in graphs, figures, tables and other sources of information.
6. Postulate, deduce mechanisms and procedures to deal with scientific problems relevant to advanced approaches in zoology and chemistry.
7. Link and integrate subject-specific theories, concepts and principles such as the relationship between genes and their products, interactions and modulation of the actions of different types of physiological regulators in animals.
8. Combine knowledge gained from different sources to postulate the role of various cell signaling mechanisms in regulating cellular functions and growth.
9. Differentiate between the different states of the matter, elements and compounds based on the recognition and quantification of the properties.
10. Differentiate between subject-related theories and assess their concepts and principles.
11. Analyze, synthesize, assess and interpret qualitatively and quantitatively science relevant data.

12. Develop lines of argument and appropriate judgments in accordance with scientific theories and concepts.
13. Postulate and deduce mechanisms and procedures to handle scientific problems.
14. Construct several related and integrated information to confirm, make evidence and test hypotheses.

4.2.3. Practical and Professional Skills

In respect of the professional and practical skills, the National Academic Reference Standards (NARS) for double major of Zoology/Chemistry program were precisely studied and correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Zoology/Chemistry program must be able to:

1. Plan, and conduct investigations using appropriate procedures and techniques. Write structural reports on the data in accordance with the standard scientific guidelines.
2. Use contemporary laboratory equipment, instruments, and tools efficiently in a safe, ethical and responsible manner to investigate living organisms and biological systems.
3. Solve problems using a range of formats and approaches.
4. Handle chemical materials and biological samples safely taking into consideration their physical and chemical properties to avoid hazards associated with their use.
5. Employ appropriate statistical and computational tools to analyze and interpret experimental data in terms of theories relevant to chemistry and zoology.
6. Search and evaluate the validity, credibility, and relevance of literature in a critical thinking approach.
7. Consider variations inherent in dealing with biological materials such as sample size, accuracy, precision and calibration.
8. Employ contemporary information retrieval, modeling approaches, taxonomic keys, bioassays and tools of molecular biology.
9. Collect and preserve animal samples and prepare sections for microscopic examination and identification of different types of cells and tissues.
10. Apply techniques and tools considering scientific ethics.
11. Identify and criticize the different methods used in addressing subject related issues.

4.2.4. General and transferable skills

The Graduates of Zoology / Chemistry Program must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, and their performing manner.
3. Think independently, set tasks and solve problems on the scientific basis.
4. Work in groups effectively; manage time, collaborate and communicate with others positively.
5. Consider community linked problems, ethics and traditions.
6. Acquire self- and long life-learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with scientific patents considering property right.
9. Exhibit the sense of beauty and neatness

5. Academic Reference Standards for Botany / Chemistry Program

5.1 Attributes of a Botany / Chemistry Program

5.1.1. General Attributes of the graduates of basic sciences programs

The graduates should be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities.
9. Deal with scientific data in Arabic, English or other languages.

5.1.2. General Attributes of the graduates of Botany / Chemistry program

In addition to the general attributes of the graduate of faculties of Sciences, the graduate of the Botany / Chemistry program should be able to:

1. Recognize the role of basic sciences in the development of society.
2. Use effectively IT technology relevant to botany/chemistry.
3. Recognize and assess different levels of organization of plants.
4. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
5. Utilize scientific facts and theories to analyze and interpret experimental data.
6. Collect, analyze, and present data using appropriate formats and techniques and use information technology relevant to the field efficiently.
7. Participate in multidisciplinary teamwork and be flexible for adaptation and working under contradictory conditions.

8. Evaluate the life's basic processes from genes to organisms
9. Search for required information and adopt self- learning
10. Show leadership and decision making capabilities.
11. Deal with scientific data and communicate about specific subjects appropriately in Arabic, English or other languages.
12. Demonstrate a wide range of knowledge related to the theories, facts, concepts and essentials of chemistry and botany.
13. Acquire knowledge and experience of working with recent laboratory techniques relevant to different disciplines of chemistry and botany
14. Plan and conduct experimental work, review safety and quality control processes, report on practice, and critically evaluate the outcomes.
15. Apply concepts and theories of chemistry to interpret life's basic processes at the level of the cell, organism, and the ecosystem.
16. Recognize the relationship and interactions among chemistry, botany and the environment.
17. Apply theories and concepts of mathematics and statistics to understand the underlying mechanisms related to the essential processes in chemistry and botany.
18. Abide by the legislations and ethics related to the environment preservation and human health and welfare.

5.2. National Academic Standards for Botany/chemistry program

The academic references standards considered in the development of this program are the National Academic Reference Standards (NARS) published by the National Authority for Quality Assurance and Accreditation of Education for double major of Botany/chemistry program; strengthened by the National Academic Reference Standards of Basic Sciences.

5.2.1 Knowledge and Understanding

In respect of the knowledge and understanding, the National Academic Reference Standards (NARS) for double major of Botany/Chemistry program were precisely studied and correlated along with National Academic Reference Standards of Basic Sciences. It was optimized the graduates of the Botany/Chemistry program must be able to:

1. Demonstrate integrated knowledge and comprehension of the theories, facts, concepts, and fundamentals related to the fields of chemistry and botany.
2. Acquire the essential knowledge in mathematics, physics, biology and other collateral subjects in order to understand the recent advances in chemistry and botany.
3. Exhibit familiarity with the principles and procedures used in chemical analyses as well as in characterization and structural investigation of chemical compounds.
4. Illustrate the nutrients and energy flow through plant organisms, populations, and ecosystems.
5. Acquire the necessary knowledge related to patterns of plant distribution, population processes, dynamics, and biodiversity.
6. Demonstrate familiarity with the major metabolic pathways and their interactions on the cellular level and in the living organisms.
7. Acquire knowledge and understanding of the structure and functions of various types of plant cells and cell organelles in unicellular and multicellular organisms.
8. Demonstrate familiarity and comprehension of terminology nomenclature and contemporary tools used in classification systems of plants.
9. Appreciate concepts of bio-diversity and maintaining of natural resources.

5.2.2 Intellectual Skills

In respect of the intellectual skills, the National Academic Reference Standards (NARS) for double major of Botany/Chemistry program were precisely studied and correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Botany/Chemistry program must be able to:

1. Test, evaluate and criticize an existing piece of information in the light of evidence provided by recent advances in botany.
2. Analyze, evaluate and, interpret scientific data relevant to the various subjects of chemistry and botany.
3. Breakdown, synthesize, reconstruct and reformulate a bulk of information such as pathways for biosynthesis of biologically active compounds or macromolecules.
4. Construct several related and integrated information to confirm, make evidence and test hypotheses and employ this information in problem solving.

5. Link and integrate subject-specific theories, concepts and principles such as relationship between genes and their products, interactions and modulation of the actions of different types of physiological regulators in plants.
6. Analyze and interpret quantitative data related to the fields of botany and chemistry from graphs, figures, tables and other sources of information.

5.2.3 Practical and Professional skills

In respect of the professional and practical skills, the National Academic Reference Standards (NARS) for double major of Botany/Chemistry program were precisely studied and correlated along with the National Academic Reference Standards for Basic Sciences. It is epitomized that the graduates of Botany/Chemistry program must be able to:

1. Plan and conduct investigations using recent equipment and instruments. Write structural reports on the data in accordance with the standard scientific guide lines.
2. Use appropriate and contemporary laboratory equipment and tools efficiently in a safe, ethical and responsible manner to investigate living organisms and systems.
3. Identify and criticize the different methods used in addressing subject related issues in botany and chemistry.
4. Handle chemical materials safely taking into account their physical and chemical properties to avoid hazards associated with their use.
5. Employ statistical analyses and computational tools to analyze and interpret experimental data in terms of theories relevant to chemistry and botany.
6. Consider variations inherent in dealing with biological materials such as sample size, accuracy, precision and calibration.
7. Employ research techniques, information retrieval, modeling, taxonomic keys, bioassays and tools of molecular biology.
8. Collect and preserve plant samples and prepare sections for microscopic examination and identification of different types of cells and tissues.
9. Carry out experiments on plant material at a variety of levels of the biological organization; cells, tissues, up to a whole plant.

5.2.4. General Skills

Graduates of Botany/Chemistry program must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, delegate tasks, and set clear guidelines and performance indicators.
3. Think independently, and solve problems on scientific basis.
4. Work in a team effectively; manage time, collaborate and communicate with others positively.
5. Address the community linked problems with considerable attention to the community ethics and traditions.
6. Acquire self- and life-long learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with property rights legally and ethically.
9. Exhibit the sense of beauty and neatness.

II. Academic Reference Standards (ARS) for Double Programs

1. Academic Reference Standards for Mathematics and Computer Science Program

1.1. The Attributes of a Mathematics and Computer Science Program

1.1.1 General attributes of the graduates of basic sciences

The graduates of the Mathematics and Computer Science program in basic sciences must be able to:

1. Recognize the role of basic sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret data of various sources.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Use effectively information technology relevant to the field.
7. Participate effectively as a member in a team, recognize and respect the views and opinions of the other members, and be flexible for adaptation to work conditions.
8. Develop the skills and attitude necessary for lifelong and independent learning and participate effectively in research activities.
9. Deal with scientific data and communicate about specific subjects appropriately in Arabic, English or other languages.

1.1.2. The Attributes of the graduates of Mathematics and Computer Science

In addition to the general attributes of a basic sciences graduate, the Mathematics and Computer Science graduates must be able to:

1. Recognize a wide-ranging of the basic concepts and theories in the different branches of mathematics and computer science.
2. Use such knowledge and necessary skills to develop mathematical and computer science processes in modeling and designing of computer based systems.
3. Awareness and use various types of reasoning and methods of proof to find true statements
4. Create and use representations to model and interpret mathematical ideas.
5. Enhance the student's ability to apply their mathematical and computer knowledge and skills in solving problems.

6. Provide students' with mathematical and computer data about specific subjects appropriately in English and improve him students' self and life-long learning skills in research activities.
7. Use effectively IT relevant to the field of mathematics and computer science.
8. Offer students opportunities to develop analytical and practical transferable skills and prepare them to play a creative role in the community

1.2. Academic reference standards (ARS) for mathematics and computer science program

1.2.1. Knowledge and Understanding:

The graduates of the Mathematics and Computer Science program in basic science must acquire the knowledge and understanding of:

1. The related basic scientific facts, concepts, principles and techniques.
2. The relevant theories and their applications.
3. The processes and mechanisms supporting the structure and function of the specific topics.
4. The related terminology, nomenclature and classification systems.
5. The theories and methods applied for interpreting and analyzing data related to discipline.
6. The developmental progress of the program-related knowledge.
7. The relation between the studied topics and the environment.

In addition to the general knowledge acquired by basic sciences graduates, the Mathematics and Computer Science graduates in subject-specific must know and understand the:

8. Demonstrate knowledge and understanding of the core ideas of mathematics and computer science.
9. Numerical mathematics, and the different ways in which numerical information is used.
10. Brief algebraic structures and their roles in solving problems expressed with symbols and in developing mathematical and computer sciences theories and techniques.
11. Mathematical and computer sciences methods and techniques that deal with differential equations and their applications analytically and numerically.
12. Programming concepts for various branches of mathematics.
13. Appropriate theory, practices, and tools for the specification, design, implementation, and evaluation of a computer-based system.

14. Hardware and software used in creation of computer systems and distinguish between selected forms of hardware architecture, and operating system technology.
15. The techniques and principles of a number of application areas informed by the directions of the subject such as artificial intelligence, databases and image processing.

1.2.2. Intellectual Skills

The graduates of the Mathematics and Computer Science program in basic science must be able to:

1. Differentiate between subject-related theories and assess their concepts and principles.
2. Develop lines of argument and appropriate judgments in accordance with scientific theories and concepts.
3. Analyze, synthesize, assess and interpret qualitatively and quantitatively science relevant data.
4. Postulate and deduce mechanisms and procedures to handle scientific problems.
5. Construct several related and integrated information to confirm, make evidence and test hypotheses

In addition to the basic sciences graduates, the Mathematics and Computer Science graduates in subject-specific must be able to:

6. Use symbolic forms for modeling real-world situations based on provided knowledge of mathematical and computer science processes and use the models to make predictions and informed decisions.
7. Apply the appropriate scientific procedures and mathematical ideas and notations to construct a clearly and accurately lab report.
8. Develop appropriate knowledge and awareness of the importance and applications of mathematical and computer science assumptions.
9. Apply appropriate mathematical techniques to the development of software solutions.
10. Improve computational mathematical and computer science skills.
11. Manage information effectively to various types of information systems.

1.2.3. Practical and Professional Skills

The graduates of the Mathematics and Computer Science program in basic science must be able to:

1. Solve problems using a range of formats and approaches.
2. Apply techniques and tools considering scientific ethics.

3. Plan, design, process and report on the investigated data, using appropriate techniques and considering scientific guidance.
4. Identify and criticize the different methods used in addressing subject related issues.

In addition to the basic sciences graduates, the Mathematics and Computer Science graduates in subject-specific must be able to:

5. Identify required mathematical, computer sciences and other technical information independently.
6. Apply reasoning techniques to build convincing mathematical argument.
7. Apply essential concepts, principles of computer science in the context of well-defined scenarios, showing judgment in the selection and application of tools and techniques.
8. Design computerized interfaces to implement programming problems based on upgraded packages.
9. Identify clearly, design, interpret and upgrade computer-based systems.
10. Manipulate in a professional way with computer sciences and mathematical methods when solving and modeling problems.
11. Develop and reinforce tenacity and confidence in their abilities to use mathematics and computer sciences.
12. Relate the studied topics of mathematics and computer science to the real world.
13. Recognize and be guided by the social, professional, and ethical issues involved in the use of computer technology.

1.2.4. General and Transferable Skills

The graduates of the Mathematics and Computer Science program in basic science must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, and their performing manner.
3. Think independently, set tasks and solve problems on scientific basis.
4. Work in groups effectively; manage time, collaborate and communicate with others positively.
5. Consider community linked problems, ethics and traditions.
6. Acquire self- and long life-learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with scientific patents considering property right.
9. Exhibit the sense of beauty and neatness.

2. Academic Reference Standards for Mathematics and Physics Program

2.1. Attributes of a Mathematics and Physics Program

2.1.1. General Attributes of the graduates of basic sciences

The graduates of basic sciences must be able to:

1. Recognize the role of Basic Sciences in the development of society.
2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
3. Utilize scientific facts and theories to analyze and interpret practical data.
4. Collect, analyze, and present data using appropriate formats and techniques.
5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
6. Apply effectively information technology relevant to the field.
7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
8. Adopt self and long life-learning and participate effectively in research activities.
9. Deal with scientific data in Arabic, English or other languages.

2.1.2. Attributes of the Mathematics and Physics Program

In addition to the general attributes of a basic sciences graduate, graduates of mathematics and physics program must be able to:

1. Understand, recognize, and describe patterns and make abstractions about them.
2. Draw conclusions about the real world using mathematical concepts.
3. Find true statements that can be made about mathematical objects.
4. Recognize and use various types of reasoning and methods of proof.
5. Recognize and understand how mathematical ideas interconnect and build on one another.
6. Demonstrate a good basic knowledge of structural and functional aspects of physical systems at many spatial scales, from single molecule to the whole system.

7. Connect fundamental ideas about the physical behavior of matter and energy to system's structure and function.
8. Plan, execute and report the results of an experiment or investigation. These skills may be acquired as part of a course in a laboratory.
9. Find effective and realistic solutions for work problems through analysis of inputs and right anticipation.
10. Identify the role of basic concepts and theories in the different branches of mathematics and physics
11. Use scientific facts and theories to analyze and interpret data of various sources
12. Use physical and mathematical abilities in choosing appropriate solutions to solve problems on scientific basis
13. Use effectively information technology relevant to the field of mathematics and physics
14. Develop the skills and attitudes necessary for working with specialized laboratory techniques, especially in applied physics area.
15. Become investigators in industrial or research institutions, scientific reporters, technical consultants, employed in information technology companies, educational institutions and health care organizations.
16. Classify and identify materials or physical phenomena according to physics guidelines using mathematical ideas.
17. Develop communication, writing and scientific presentation skills in Arabic and English languages.
18. React positively with the society problems on scientific basis.

2.2. Academic Reference standards (ARS) for the mathematics and physics program

2.2.1. Knowledge and understanding:

The graduates of the mathematics and physics program in basic science must acquire the knowledge and understanding of:

1. The related basic scientific facts, concepts, principles and techniques.
2. The relevant theories and their applications.
3. The processes and mechanisms supporting the structure and function of the specific topics

4. The related terminology, nomenclature and classification systems.
5. The theories and methods applied for interpreting and analyzing data related to discipline
6. The developmental progress of the program-related knowledge.
7. The relation between the studied topics and the environment.

In addition to the previous general knowledge and understanding acquired by basic sciences graduates, the graduates must know and understand the:

8. Use the concept of functions, numerical mathematics and its role in mathematical analysis.
9. Identify Mathematical methods and techniques that deal with differential equations and their applications analytically and numerically.
10. Abstract algebraic structures, Geometric concepts and their roles in solving problems
11. Use, effectively, theories and applications of mathematical trends, applied mathematics and statistics.
12. Acquire an appreciation of the role of mathematical modeling of physical phenomena in producing testable predictions through studying subjects like mathematical, quantum particle and statistical physics.
13. Recognize the essential facts, major concepts, principles, and theories in physics and mathematics branches to understand the recent advances in physics.
14. Identify the basic principles and the relevant technical applications of electromagnetic, thermodynamic, material science, atomic, and nuclear physics.
15. Identify the foundations and principles of classical and quantum mechanics and other branches of applied mathematics.
16. Outline the principles and basic computing applications of computer science and technology.
17. Use English language for the related terminology and in their scientific study.
18. Acquire an awareness of the importance and influence of the accuracy and precision in physical measurements and data analysis.

2.2.2. Intellectual skills

The graduates of the mathematics and physics program in basic science must be able to:

1. Differentiate between subject-related theories and assess their concepts and principles.

2. Analyze, synthesize, assess and interpret qualitatively and quantitatively science relevant data.
3. Develop lines of argument and appropriate judgments in accordance with scientific theories and concepts.
4. Postulate and deduce mechanisms and procedures to handle scientific problems.
5. Construct several related and integrated information to confirm, make evidence and test hypotheses.

In addition to the basic sciences graduates, the graduates must be able to:

6. Connect the basic principles and methodology of mathematical analysis to solve problems of physics.
7. Develop the interface relationships between various branches of mathematics and physics.
8. Discuss the basic principles and relevant technical applications of mathematics and physics.
9. Relate special function, equation, models and programs for the examination of the validity of the physical phenomena and analyze system components.
10. Evaluate information and data from variety of sources.
11. Utilize theories of physics to interpret physical phenomena.
12. Analyze experimental data relevant to the physics topics.
13. Differentiate between different states of matter, elements and compounds based on the recognition and quantification of the properties.
14. Sketch and prepare the physical systems, techniques and data considering physical and mathematical guidance.
15. Apply technology to enhance mathematical and physical thinking and understanding.
16. Use the scientific literature effectively to write essays and do individual projects.

2.2.3. Professional and practical skills

The graduates of the mathematics and physics program in basic science must be able to:

1. Plan, design, process and report on the investigated data, using appropriate techniques and considering scientific guidance
2. Apply techniques and tools considering scientific ethics
3. Solve problems using a range of formats and approaches.
4. Identify and criticize the different methods used in addressing subject related issues

In addition to the basic sciences graduates, the graduates must be able to:

5. Apply technology to enhance mathematical and physical thinking and understanding
6. Judge to apply physics principles and mathematical tools to modern area of research.
7. Apply the theories and principles of physics and mathematical science to evaluate and interpret data in other branch of science.
8. Plan, execute and report the results of an experiment or investigation.
9. Employ computational software and data processing skills in handling physical information and analysis of physical data.
10. Able to conduct experiments, techniques and report the theoretical and experimental results in the understandable forms such as tables and graphs.

2.2.4. General and transferable skills

The graduates of mathematics and physics program must be able to:

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, and their performing manner.
3. Think independently, set tasks and solve problems on scientific basis.
4. Work in groups effectively, manage time, collaborate and communicate with other positively.
5. Consider community linked problems, ethics and traditions.
6. Acquire self-and long life-learning.
7. Apply scientific models, systems, and tools effectively.
8. Deal with scientific patents considering property right.
9. Exhibit the sense of beauty and neatness.