Academic Reference Standards (ARS)

for

Petrochemicals and their Applications

B. Sc. Program

Faculty of Science, Mansoura University

November 2015

1st Edition

Contents

Introduction

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.

Petrochemicals are those chemicals derived from petroleum. The two most common petrochemical classes are olefins (including ethylene and propylene) and aromatics (including benzene, toluene and xylene isomers). Oil refineries produce olefins and aromatics by fluid catalytic cracking of petroleum fractions. Chemical plants

produce olefins by steam cracking of natural gas liquids like ethane and propane. Aromatics are produced by catalytic reforming of naphtha. Olefins and aromatics are the building-blocks for a wide range of materials such as solvents, detergents, and adhesives. Olefins are the basis for polymers and oligomers used in plastics, resins, fibers, elastomers, lubricants, and gels. Petrochemicals have had a dramatic impact on our food, clothing, shelter and leisure. Some synthetics, tailored for particular uses, actually perform better than products made by nature because of their unique properties.

The B.Sc. in Petrochemicals and their applications aims to provide a graduate able to recognize the role of Petrochemicals in the development of society, develop Petrochemical approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements, utilize scientific facts and theories to analyze and interpret practical Petrochemical data, collect, analyze, and present Petrochemical data using appropriate formats and techniques, postulate concepts and choose appropriate solutions to solve Petrochemical problems on scientific basis, apply effectively information technology relevant to Petrochemicals, 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, and adopt self and long life-learning and participate effectively in research activities, and deal with scientific data in Arabic, English or other languages.

National Academic Reference Standards (NARS)

for **Basic Sciences**

Attributes of the Graduates

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.

1. Knowledge and Understanding

The graduates must acquire knowledge and understanding of:
1.1. The related basic scientific facts, concepts, principles and techniques.
1.2. The relevant theories and their applications.
1.3. The processes and mechanisms supporting the structure and function of the specific topics.
1.4. The related terminology, nomenclature and classification systems.
1.5. The theories and methods applied for interpreting and analyzing data related to discipline.
1.6. The developmental progress of the program-related knowledge.
1.7. The relation between the studied topics and the environment.

2. Intellectual Skills

The graduates should be able to:

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

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

3. Practical and Professional Skills

The graduates should be able to:

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

4. General and Transferable Skills

The graduates should be able to:

4.1. Use information and communication technology effectively.
4.2. Identify roles and responsibilities, and their performing manner.
4.3. Think independently, set tasks and solve problems on scientific basis.
4.4. Work in groups effectively; manage time, collaborate and communicate with others positively.
4.5. Consider community linked problems, ethics and traditions.

4.6. Acquire self- and long life–learning.
4.7. Apply scientific models, systems, and tools effectively.
4.8. Deal with scientific patents considering property right.
4.9. Exhibit the sense of beauty and neatness.

Curriculum Structure

Subject Areas	Percentage	Tolerance
Basic Science	28 %	27 – 29 %
Humanities (including language)	6 %	5 – 7 %
Specialty (professional)	50 %	48 – 52 %
Computer and IT	6 %	5 – 7 %
Research and graduation project	2 %	1 – 3 %
Others (Discretionary)	8 %	7 – 9 %
Total	**100 %**	**100 %**

Academic Reference Standards (ARS) for Petrochemicals and their Applications

The Attributes of Petrochemicals and their Applications Graduates

In addition to the attributes of Basic Sciences graduates, the Petrochemicals and their Applications graduates should be able to:

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

In addition to the knowledge and understanding acquired by Basic Sciences graduates, the Biotechnology and its Applications graduates should demonstrate knowledge and understanding of:

1.1. The basic scientific facts, concepts, principles and techniques related to Petrochemicals.
1.2. The Petrochemicals relevant theories and their applications.
1.3. The processes and mechanisms supporting the structure and function of Petrochemicals topics.
1.4. The terminology, nomenclature and classification systems related to Petrochemicals.
1.5. The theories and methods applied for interpreting and analyzing data related to Petrochemicals.
1.6. The developmental progress of Petrochemicals-related knowledge.
1.7. The relation between Petrochemicals and the environment.

2. Intellectual Skills

In addition to the intellectual skills acquired by Basic Sciences graduates, the graduates of Biotechnology and its Applications program should be able to:

2.1. Differentiate between Petrochemicals-related theories and assess their concepts and principles.
2.2. Analyze, synthesize, assess and interpret qualitatively and quantitatively Petrochemicals relevant data.
2.3. Develop lines of argument and appropriate judgments in accordance with Petrochemicals theories and concepts.
2.4. Postulate and deduce mechanisms and procedures to handle Petrochemical problems.
2.5. Construct several related and integrated information to confirm, make evidence and test hypotheses.

3. Practical and Professional Skills

In addition to the practical and professional skills acquired by Basic Sciences graduates, the graduates of the Biotechnology and its Applications program should be able to:

3.1. Plan, design, process and report on the investigated Petrochemical data, using appropriate techniques and considering scientific guidance.
3.2. Apply Petrochemical techniques and tools considering scientific ethics.
3.3. Solve Petrochemical problems using a range of formats and approaches.
3.4. Identify and criticize the different methods used in addressing Petrochemicals related issues.

4. General and Transferable Skills

In addition to the general and transferable skills acquired by Basic Sciences graduates, the graduates of the Biotechnology and its Applications program should be able to:

4.1. Use information and communication technology effectively.
4.2. Identify roles and responsibilities, and their performing manner.
4.3. Think independently, set tasks and solve problems on scientific basis.
4.4. Work in groups effectively; manage time, collaborate and communicate with others positively.
4.5. Consider community linked problems, ethics and traditions.
4.6. Acquire self- and long life–learning.
4.7. Apply scientific models, systems, and tools effectively.
4.8. Deal with scientific patents considering property right.
4.9. Exhibit the sense of beauty and neatness.

Glossary

1. **Institution**

   A University, Faculty or higher institute providing education programs leading to a first university degree or a higher degree (Master's or Doctorate).

2. **Attributes of the Graduates**

   Competencies expected from the graduates based on the acquired knowledge and skills gained upon completion of a particular program.

3. **National Academic Reference Standards (NARS)**

   Reference points designed by NAQAAE to outline/describe the expected minimum knowledge and skills necessary to fulfill the requirements of a program of study.

4. **Academic Standards**

   Reference points defined by an institution comprising the collective knowledge and skills to be gained by the graduates of a particular program.. The academic standards should surpass the NARS, and be approved by NAQAAE.

5. Subject Benchmark Statements

Guideline statements that detail what can be expected of a graduates in terms of the learning outcomes to satisfy the standards set for the program.. They enable the outcomes to be compared, reviewed and evaluated against agreed upon standards.

6. The Program

A set of educational courses and activities designed by the institution to determine the systematic learning progress.. The program also imparts the intended competencies required for the award of an academic degree.

7. Intended Learning Outcomes (ILOs)

Subject-specific knowledge, understanding and skills intended by the institution to be gained by the learners completing a particular educational activity. The ILOs emphasize what is expected that learners will be able to do as a result of a learning activity.

8. Knowledge and Understanding

Knowledge is the intended information to be gained from an educational activity including facts, terms, theories and basic concepts. Understanding involves comprehending and grasping the meaning or the underlying explanation of scientific objects.

9. Intellectual Skills

Learning and cognitive capabilities that involve critical thinking and creativity. These include application, analysis, synthesis and evaluation of information.

10. Professional and Practical Skills

Application of specialized knowledge, training and proficiency in a subject or field to attain successful career development and personal advancement.

11. General and Transferable Skills

Skills that are not subject-specific and commonly needed in education, employment, life-long learning and self development. These skills include communication, team work, numeracy, independent learning, interpersonal relationship, and problem solving... etc.