Arab Academy for Science, Technology & Maritime Transport
College of Engineering & Technology
Department of Basic and Applied Science

University/Academy: Arab Academy for Science, Technology & Maritime Transport
Faculty/Institute: College of Engineering & Technology
Program: B.Sc. Mechanical Engineering

Form No. (12)
Course Specification

1- Course Data

Course Code: **BA 118**	Course Title: **Chemistry**		Academic Year/Level: **1st** year / **1st** semester
Specialization: **All Programs**	No. of Instructional Units	Lecture	Practical
	3 Credits	**2hrs.**	**2hrs.**

2-Course Aim

1- Apply knowledge of chemistry independently and among other disciplines to design and conduct experiments, and analyze and interpret data to meet desired needs within realistic economic, regulatory, ethical, social or other constraints
2- Function on teams, including those with members from different disciplines
3- Identify, formulate, and solve chemical and engineering problems associated with their professional position
4- Use practical techniques, skills, and modern tools necessary for chemical and engineering practice
5- Possess an ability to engage in life-long learning

3- Intended Learning Outcome (ILO's)

a- Knowledge and Understanding	K3) Characteristics of engineering materials related to the discipline. K5) Methodologies of solving engineering problems, data collection and interpretation K8) Current engineering technologies as related to disciplines. K12) Contemporary engineering topics. (K.3) Define atoms, molecules, compounds, and the science of chemistry (K.8) Define and understand the methods of separating mixtures: decantation, distillation, filtration, extraction, and chromatography. (K.3) Define, and recognize physical and chemical change; qualitative and quantitative properties of matter (K.3) Differentiate between various forms of energy. i- (K.3) Define pressure and its unit of measurement j- (K.5) Recall gas laws (Boyle's, Charles's, Avogadro's, Gay-Lussac's, ideal gas law, kinetic molecular theory and Graham's law of effusion) (K.3) Define and understand the difference between various intramolecular types of bonding (ionic, covalent, coordinate and metallic bonds) (K.3) Define solution, solvent, solute, aqueous solution, and molarity (K.3) Define acids and bases in terms of Arrhenius, Bronsted and Lewis theories (K.3) Recognize mono-, di-, and poly- protic acids from their formula k- (K.3) Define lubricants and their function (K.12) Define various terms related to corrosion including: oxidation and reduction, voltaic (Galvanic) cell, electrolytic cell, half-cell, electrode, spontaneous reaction non-spontaneous reaction, potential difference, cell potential, standard cell potential, and standard electrode potential (K.3) List requirements and conditions promoting corrosion (K.8) List characteristics of dry cell, lead storage, Ni-Cd, Ni-metal hydride and Li-ion

	batteries (K.3) Define air pollutants, ozone depletion, and green-house effect (K.3) List types of gaseous and particulate pollutants (K.12) Define ceramics and composite materials, liquid crystals, biomedical materials, nanotechnology, carbon nanotubes, grapheme, semiconductors, superconductors and evaluate their applications
b- Intellectual Skills	I1) Select appropriate mathematical and computer-based methods for modeling and analyzing problems. I2) Select appropriate solutions for engineering problems based on analytical thinking. I3) Think in a creative and innovative way in problem solving and design. I4) Combine, exchange, and assess different ideas, views, and knowledge from a range of sources. I6) Investigate the failure of components, systems, and processes. I11) Analyze results of numerical models and assess their limitations. (I.2) Calculate conversions on various temperature scales: Fahrenheit, Celsius, and Kelvin. (I.3) Perform calculations with the aid of dimensional analysis, conversion factors, prefixes and derived units (I.2) Differentiate between various forms of matter; pure substance, element, compound, heterogeneous mixture, and homogeneous mixture l- (I.6) Explain the origin of deviations from ideal gas behavior m- (I.2) Apply Van der Waals equation to solve real gas problems n- (I.2) Use mathematical relationships of gas laws (I.1) Explain theories of metallic bonding (I.2) Differentiate between various types of intermolecular forces (I.6) Explain the effects of intermolecular forces on various properties of liquids including surface tension and capillary action, viscosity, boiling point, vaporization and vapor pressure (I.2) Explain acid-base properties of salts (I.1) Explain the uses of buffers, common ion effect and Le Châtelier's principle. (I.2) Calculate the pH/pOH of weak acid, weak bas and buffer systems (I.2) Calculate pH and pOH of simple liquid o- (I.1) Predict titration curves, (I.2) Explain chemical aspects of lubricants that are pertinent to engineering (I.1) Calculate standard cell potential from standard electrode potential (I.6) Differentiate between various types of corrosion and their origin (I.6) Explain common methods of corrosion protection (I.4) Differentiate between batteries and fuel cells (I.3) Enumerate types and sources of water pollutants and methods of water and waste-water treatment and recycling (I.11) Explain chemical aspects of ceramics, liquid crystals, biomedical materials, nanotechnology, semiconductors and superconductors that are pertinent to engineering

c- Professional Skills	P1) Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve engineering problems. P2) Professionally merge the engineering knowledge, understanding, and feedback to improve design, products and/or services. (P.1) Correlate number of moles, Avogadro's number, number of atoms/molecules and mass. (P.1) correlate chemical symbols, atomic mass and atomic numbers of common elements of the periodic table (P.1) Differentiate between the common sets of units: English system, metric system and international System (SI). (P.2) Report correct units with measurements p- (P.2) Apply Ideal Gas Law: Molar Volume, density, molar mass of a gas, mole fraction and Dalton's law of partial pressure to solve day life and engineering problems (P.1) Differentiate between intrinsic and extrinsic semi-conductors and n- and p-type semi-conductors (P.1) Express auto-ionization of water (P.1) Compare acid strength and degree of dissociation (P.1) Differentiate between strong electrolyte, weak electrolyte, and nonelectrolyte. (P.2) Apply acids/bases to manufacturing of invisible inks, manufacturing of antacids, and industrial pollution control. q- (P.1) Report end points r- (P.1) Propose suitable indicators (P.1) Predict the direction of spontaneity of redox reactions (P.2) Apply Nernst equation to calculate cell potential under non-standard conditions (P.1) Write balanced electrochemical reactions describing corrosion (P.1) Explain methods of water desalination (P.1) Explain the origin of acid rains, photochemical smog and indoor air pollutants
d- General Skills	G3) Communicate effectively. (G.3) Criticize the effects of Freon and NOx on ozone layer

4- Course Content

Lecture		
Wk	Hrs	Description
1-2	4	Matter, elements, substances and mixtures, chemical & physical changes, measurements and units, dimensional analysis
3-4	4	Gases: ideal gas laws, density of gas, Dalton's law of partial pressures, graham's law of effusion, real gas equation and deviation from ideal behaviour.
5-6	4	Intra- and Inter-molecular forces, properties of liquids
7-8	4	*Aqueous ionic equilibria, acids & bases, ion product of water, pH scale, weak acids & bases, acid-base properties of salts, buffers, acid base titrations*
9	2	Lubricants: function, treatment, additives and testing of lubricating oils; greases, solid lubricants
10-11	4	Electrochemical cells and corrosion: oxidation & reduction, electrode potential, electrochemical series, polarization, over-potential, cell potential, batteries, fuel cells, corrosion, elements of corrosion, types of corrosion, corrosion protection
12-13	4	Environmental engineering, air & water pollution: types of gaseous and particulate air pollutants, air pollution control, types and sources of water pollutants, testing and analysis of water, water and waste-water treatment and recycling, water desalination
14-15	4	Modern materials: Ceramics and composite materials, liquid crystals, biomedical materials, nanotechnology, semiconductors, superconductors
16	2	Final Exam

5-Teaching and Learning Methods

1. Lectures
2. Tutorials
3. Individual and group coursework
4. Project group technical reports
5. Individual and group projects

6-Teaching and Learning Methods for Students with Special Needs

1. Consulting with lecturer during office hours
2. Consulting with teaching assistant during office hours
3. Private sessions for redelivering the lecture contents
4. An academic supervisor is appointed for handicapped students. Constant follow ups are done for handicapped students after each assessment to evaluate their academic level of achievement.

7-Student Assessment

a- Procedures used:	1. Written examinations to assess the ILO's. 2. Continuous assessment (reports, discussions, etc……) to assess the Intellectual skills.
b- Schedule:	Assessment 1: 7th Week Written Exam Assessment 2: 12th Week Written Exam Assessment 3: Continuous Assessments Assessment 4: 16th Week Final Written Exam
c- Weighing of Assessment:	7th Week Examination : 30 % 12th Week Examination: 20 % Final-term Examination: 40 % Oral Examination : 0 % Practical Examination : 10 % Total : 100%

8- List of References:

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a- Course Notes	Non
b- Required Books (Textbooks)	Chemistry, 10th edn., R. Chang, McGraw-Hill, New York, 2010.
c- Recommended Books	* Chemistry, 9th edn., S. S. Zumdahl, S. A. Zumdahl, Brooks Cole, Belmont, 2014 * General Chemistry: Principles and Modern Applications, 10th edn., R. H. Petrucci, Pearson Canada Inc., Toronto, Ontario, 2011.
d- Periodicals, Web Sites, ..., etc.	

Course coordinator: **Program Manager:**