**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**Course Instructor: Asst. prof. Dr. Jathwa Abdul Karime Ibrahim**

**COURSE SPECIFICATION**

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| The course offers specialization in selected areas of analytical chemistry. It addresses classification and evaluation of analytical data with advanced normality and molarity volumetric calculation, back- titration, ionic equilibrium in aqueous solutions, equilibrium constants for dissociation, weak electrolytes and precipitate, precipitation equilibrium: the solubility product. Acid- base, Equilibrium: pH of solutions, buffer solution, sampling, planning and sampling protocols, detection limit and quantization limit and finally standard calibration curves. |

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| University of Baghdad /College of Engineering | 1. Teaching Institution |
| Environmental Engineering Department | 2. University Department/Centre |
| Analytical Chemistry EnE | 3. Course title/code |
| Annual System: They attend in face to face mode 2 hrs. a Week. | 4. Modes of Attendance offered |
| Annual | 5. Semester/Year |
| 60 hrs./ 2 hrs per week | 6. Number of hours tuition (total) |
| 2021-2022 | 7. Date of production/revision of this specification |
| **8. Aims of the Course** | |
| The main objectives of the course are:  1. To understand chemistry fundamentals,  2. To understand the principles, instrumentation and applications of chemical.  3. To perform analysis and calculations with ease. | |

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| **9· Learning Outcomes, Teaching ,Learning and Assessment Method**   1. **Cognitive goals.**   **At the end of the year the students should gain:**  A1. Essential analytical techniques and skills in calculation of solution concentration, and expression of analytical results  A2. Studying ion equilibrium in aqueous solutions.  A3. Measuring pH of solutions.  A4. Learning acid-base equilibrium.  A5. Solubility Product and Solubility of gases  A6. Attract and welcome undergraduate students to our Bachelor of Science program in Environmental Engineering, and to graduate B.S. students who are innovative problem solvers, who become leaders in their organizations, and who possess the knowledge and skills required for a wide range of careers and career changes. |
| **B. The skills goals special to the course**  **B1.**  Essential analytical techniques and skills in calculation of solution concentration, and expression of analytical results**.**  **B2.** Concentrating on scientific research and its leading role in helping to serve the society and solving its problems through conducting application researches  **Teaching and Learning Methods**  1- Lectures.  2- Homework and Assignments.  3- Tests and Exams.  4- In-Class Questions and Discussions.  5- Connection between Theory and Application.  6- In- and Out-Class oral conservations. |
| **Assessment Methods**  1. Examinations, Tests, and Quizzes.  2. Student Engagement during Lectures.  3. Responses Obtained from Students, Questionnaire about curriculum and faculty member (Instructor)***.***  4***.*** Home work related to problem solving. |
| C. Affective and value goals  C1.Applicable skills to learn calculation of solution concentration.  C2. Stoichiometry calculation.  C3. Research and analytical techniques**.**  C4. Prepare students for successful careers in environmental engineering. |
| Teaching and Learning Methods  Intensive studies of regulations |
| Assessment methods |
| Case studies |
| D. General and rehabilitative transferred skills(other skills relevant to employability and personal development) |
| D1. Become more effective, independent and confident self-directed learners  D2. Improve their general skills for study and career management  D3. Articulate personal goals and evaluate progress towards their achievement  D4. An ability to identify, formulate, and solve engineering problems. |

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| **10. Course Structure** | | | | | |
| Assessment Method | Teaching  Method | Unit/Module or Topic Title | ILOs | Hours | Week |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Review of fundamental concepts | 1&2 | 2 (Theo.) | 1 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Good lab. practice | 1 &2 | 2 (Theo.) | 2 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Stoichiometric calculations  Concentrations of solutions | 1 &2 | 2 (Theo.) | 3 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Stoichiometric calculations  Concentrations of solutions | 1 &2 | 2 (Theo.) | 4 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Stoichiometric calculations  Concentrations of solutions | 1 &2 | 2 (Theo.) | 5 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Analytical and equilibrium concentrations, Expressions of analytical results | 1,2,&3 | 2 (Theo.) | 6 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Analytical and equilibrium concentrations, Expressions of analytical results | 1,2,&3 | 2 (Theo.) | 7 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Titration principles,  Molarity volumetric calculation | 2,3 &4 | 2 (Theo.) | 8 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Normality volumetric calculation | 2,3 &4 | 2 (Theo.) | 9 |
| ------------- |  | Examination | -------- | 2 (Theo.) | 10 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Acid-Base Equilibria pH of solutions | 2,3 &4 | 2 (Theo.) | 11 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Acid-Base Equilibria pH of solutions | 2,3 &4 | 2 (Theo.) | 12 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Acid-Base Equilibria pH of solutions | 2,3 &4 | 2 (Theo.) | 13 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Gravimetric analysis and precipitation equilibria | 2,3 &4 | 2 (Theo.) | 14 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Gravimetric analysis and precipitation equilibria | 2,3 &4 | 2 (Theo.) | 15 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Gravimetric analysis and precipitation equilibria | 2,3 &4 | 2 (Theo.) | 16 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Precipitation and Titration | 2,3 &4 | 2 (Theo.) | 17 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Precipitation and Titration | 2,3 &4 | 2 (Theo.) | 18 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Redox Reaction | 2,3 &4 | 2 (Theo.) | 19 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Redox Reaction | 2,3 &4 | 2 (Theo.) | 20 |
| ------------------ |  | Examination | ------- | 2 (Theo.) | 21 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Solubility Product | 5 | 2 (Theo.) | 22 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Solubility Product | 5 | 2 (Theo.) | 23 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Solubility of gases in water | 5 | 2 (Theo.) | 24 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Solubility of gases in water | 5 | 2 (Theo.) | 25 |
| ---------------------- |  | Examination | --------- | 2 (Theo.) | 26 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Environmental sampling | 5 | 2 (Theo.) | 27 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Environmental sampling | 5 | 2 (Theo.) | 28 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Applications | 1,2,3,4&5 | 2 (Theo.) | 29 |
| Questions during the lectures ,quiz, exam, present in the class | 1-6 of  article (11) | Applications | 1,2,3,4&5 | 2 (Theo.) | 30 |

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| 11. Infrastructure | |
| 1. Simplified procedures for water examination, Awwa manual of water supply practices 2. Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch , “Fundamentals of Analytical Chemistry”, eighth edition, 2001 3. Dean, John R. Methods for Environmental Trace Analysis, John Wiley & Sons Ltd, 2003 | 1. Books required reading: |
| Gary D. Christian (2014) “Analytical Chemistry”, 7th ed. | 1. Main references (sources) |
| 1. Simplified procedures for water examination, Awwa manual of water supply practices 2. Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch , “Fundamentals of Analytical Chemistry”, eighth edition, 2001 3. Dean, John R. Methods for Environmental Trace Analysis, John Wiley & Sons Ltd, 2003 | A- Recommended books and references (scientific journals, reports…). |
| <https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Book%3A_A>  <https://www.sciencedirect.com/book/9780125551601/analytical-chemistry>  https://www.nature.com/articles/062292b0 | B-Electronic references, Internet  sites |

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| 12. The development of the curriculum plan  Not to relay on traditional examinations but the creation of reports following the reading of textbooks. These reports are validated and transformed into academic credits for graduation purposes. |