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**Department of Chemistry**

**College of Science**

**University of Salahaddin**

**Subject: Practical Physical Chemistry**

**Course Book – (2ndStage)**

**Lecturer's name :**

**Dr. Ropak A. Sheakh Mohamad**

**Academic Year: 2022/2023**

**Course Book**

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| **1. Course name** | **Theoretical & Practical Physical Chemistry** | |
| **2. Lecturer in charge** | **Ropak A. Sheakh Mohamad** | |
| **3. Department/ College** | **Department of Chemistry/College of Science** | |
| **4. Contact** | **e-mail: ropak.shekhmohamad@su.edu.krd** | |
| **5. Time (in hours) per week** | **Practical: 3hr/week. Theoretical: 3hr/week** | |
| **6. Office hours** | **To be return to the schedule on the office door** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | * **I received my B. Sc of Science in Chemistry from Salahaddin University-Erbil, Erbil -Iraq in 1993.** * **I received Master of Science in physical chemistry from Salahaddin University, Erbil-Iraq in 1997.** * **I received my PhD in physical chemistry from Salahaddin University, Erbil-Iraq in 2021** | |
| **9. Keywords** | **Thermochemistry, viscosity, Colligative properties of solution, Physical properties of liquid, chemical equilibrium and phase diagram for (one, two and three) component system.** | |
| **10. Course overview:**  The course is built around ten sets of experiments which are devoted to various aspects of chemical data collection and analysis. Laboratory reports will be required for all experiments. Reports are due no later than one week after completion of each module. Guidelines for preparation of reports will be covered in the first lab meeting. Students will work in the laboratory in pairs, but each student will be required to keep their own laboratory notebook, which will be graded periodically in class by the instructor. Although students will work in pairs, laboratory reports should be written independently. Occasionally a take-home exam will be given that will require independent reading and research to complete. Although resources may be shared for these take home exams, the writing of the exam should be done by each student independently. You are responsible for attending all laboratories, and you are expected to start all laboratories at the designated times. Any delays or absences must be approved by the instructor. Only excused absences may be made up. | | |
| **11. Course objective:**  This course is composed of ten modules or experiments. The six experiments will be performed simultaneously by rotating teams of two students each. Each team will rotate through the set of six experiments, with at least two weeks devoted to each of the labs. There will be occasional take home exams which will require independent study, web and literature searches for completion. These will be devoted to various topics important in experimental physical chemistry, such as temperature measurement, pressure measurement, voltage and current measurement, equipment design, computer interfacing and data logging, vacuum methods, high pressure methods, balances, pH meters, signal averaging, and timing. | | |
| **12. Student's obligation**  Your final grade will be derived as follows:   * *Quizzes:* About 10 quizzes will be given throughout the semester. They will be given at the beginning of the class period and last 10 minutes. * *Exams*: There will be three closed book exams given throughout the semester. Each test will be scheduled for 1.5 hr. * *Practical Exam*: This Exam is Comprehensive in all course outlines.   **The Practical grade of this semester distributed as follows?**  **Midterm exam (%10)**  **Quizzes (%5)**  **Weekly reports (%6)**  **Activities (%4)**  **The Theoretical grade of this semester distributed as follows?**  **Midterm exam %15**  **Quizzes (%5)**  **Activities (%5)** | | |
| **13. Forms of teaching**  Power point text, white board and lectures copied paper. | | |
| **14. Assessment scheme**  Although students will work in pairs, laboratory reports should be written independently. Occasionally a take-home exam will be given that will require independent reading and research to complete. Although resources may be shared for these take home exams, the writing of the exam should be done by each student independently.‌‌ | | |
| **15. Student learning outcome:**  To convey the joys of experimental physical chemistry and the satisfaction obtained from doing quality work. You should obtain an appreciation and understanding of experimental methods and equipment used in chemical thermodynamics, kinetics, and spectroscopy, including data collection methods, instrumentation, data reduction, error analysis, and report writing. | | |
| **16. Course Reading List and References‌:**  ▪ "Mathematics for Physical Chemistry, 3rd Edition" by Robert Mortimer, Elsevier, Academic Press, Boston, 2005.  ▪ "Data Reduction and Error Analysis for the Physical Sciences, 3rd Edition" by Philip Bevington, McGraw Hill, 2002.  ▪ F. Daniels, J. W. Williams, P. Bender, R. A. Alberty, C. D. Cornwell and J. E. Harriman, Experimental Physical Chemistry, 7th ed., McGraw-Hill, 1970. QD457.D21.  ▪ (http://pubs.acs.org/journals/jpcafh/index.html) | | |
| **17. The Topics:** | | **Lecturer's name** |
| **18. Practical Topics (If there is any) only for first course**  **1st Semester Thermodynamic Chemistry**  **1-Determination of liquid mixture composition by Refractive Index.**  **2- Determination of M.wt by depression of freezing point.**  **3-M.wt Determination by Victore Meyer method.**  **4- Determination of M.wt by elevation of boiling point.**  **5- Determination of surface tention of a liquid.**  **6- Determination of heat of ionization**  **7- Determination of heat of neutralization.**  **8-Temperature dependence of viscosity**  **9-The density of a liquid as a function of temperature**  **10- Determination heat of solution from solubility**  **2nd Semester: Chemical Equilibrium &Solution (Practical part)**  **1-Determination of equilibrium constant by distribution method.**  **2-Homogeneous equilibrium in liquid system.**  **3-Determination of molecular weight by steam distillation method.**  **4-Determination of the ''Boiling point-composition curve'' for azotropic solution (liquid- vapour equilibrium in a mixture of two miscible liquids).**  **5-Liquid and solid phase diagram for two compositions.**  **6-Determination of phase diagram for water-phenol binary system (Mutual solubility).**  **7-Determination of phase diagram for three component system.**  **8-Particle size measurement by viscosity method.**  **2nd Semester: Chemical Equilibrium&** **Solution (Theoretical part)**  **1)States of Matter**  **2) Physical &** **Chemical Properties of Matter**  **3) Phase & Gibbs Phase Rule**  **4) Water Phase Diagram**  **5) Carbon Dioxide Phase Diagram**  **6) Sulphur Phase Diagram**  **7) Two Components System**  **(Binary Eutectic Phase Diagram)**  **8) Liquid binary system mutual solubility**  **9) Ternary Phase Diagram**  **10) Chemical equilibrium**  **(Determination of equilibrium constants)**  **11) KP and KC for gaseous reaction and solution**  **12) Le Chatelier's principle**  **13) Ammonia equilibrium**  **14) Phosgene equilibrium**  **15) Effect of inert gases on equilibrium**  **16) The equilibrium constant for Heterogeneous reactions**  **17) solutions (definition and type of solution)**  **18) Solubility and miscibility**  **19) Ideal and non-ideal solutions**  **20) Vapor pressure Composition Phase Diagram**  **21) Raoult’s Law**  **22) Solution Separation**  **23) Colligative Properties of solutions** | | **Ropak A. Sheakh Mohamad**  (12 hrs) 1st Semester  (10 hrs) 2nd Semester  **Ropak A. Sheakh Mohamad** |
| In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture | | **Ropak A. Sheakh Mohamad** |
| **19. Examinations:**  *1. Compositional:*  What are the factors affect viscosity?  *2.True or false type of exams:*  Is Velocity of light is less in dielectric material than it is in vacuum?  answer: True  *3. Multiple choices:*  Is angle øv increase, the angle øm increase, and reach its maximum value øm when the angle øv becomes equal to a/45 b/90 c/180 angle. | | |
| **20. Extra notes:**  I will try to do my best to cover the course very well. | | |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**  This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.  *(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).*  ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.  هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌ | | |