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|  | **LAMPUNG UNIVERSITY**  **FACULTY OF MATHEMATICS AND NATURAL SCIENCES**  **DEPARTMENT OF CHEMISTRY / UNDERGRADUATE CHEMISTRY PROGRAM** | | | | | | |
| **TEACHING SCHEDULE (COURSE MODULE)** | | | | | | | |
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| **Course Title** | | | | **Course code** | **Credit** | **Semester** | **Date** |
| **Chemical Kinetics** | | | | **KIM622213** | 2 | 4 | 21st July 2022 |
| **Authorization** | | | | **PIC of Course Module Development** | **Peer Group Coordinator** | **Head of Department** | |
| Prof. Dr. John Hendri, M.S. | Prof. Dr. Rudy TMS | Mulyono, Ph.D | |
| **Learning Outcomes** | **Learning Outcomes (LO)** | | | | | | |
| 1. | | Be devoted to God Almighty as an educated human being and a responsible citizen and uphold national values.(S1) | | | | |
| 2. | | Mastering concepts related to the nature of natural science and mathematics to strengthen knowledge of chemistry and its applications. (P1) | | | | |
| 3. | | Explain the basic concepts of atomic and molecular structure, interaction of matter and energy, isolation and characterization, analysis, separation, and synthesis of materials, natural and synthetic materials, and metabolism of biomolecules.(P2) | | | | |
| 4.  5. | | Capable to communicate orally and in writing with various parties, both nationally and internationally, using modern information technology (KU1)  Demonstrate the ability to think constructively in applying and developing chemistry in society. (KK1) | | | | |
|  | **Courses Learning Outcomes (CLO)** | | | | | | |
| CLO-1  CLO-2  CLO-3  CLO-4 | Students are able to use the principles of natural science and mathematics to understand the structure, properties and changes of chemical compounds (C3);  Students are able to explain the theoretical concepts of atomic and molecular structures as well as the function of chemical compounds both biological and non-biological (C2);  Students are able to explain the theoretical concept of the interaction of matter and energy and its application to various fields of chemistry (C2);  Students are able to apply theoretical concepts of chemical calculations to explain the function and changes of chemical compounds (C3). | | | | | |
| **Course Description** | In this course, students are expected to be able to the experimental methods to major reaction rate of different types of chemical reaction; the derivations of rate equations for complex reactions; mechanisms within rates; basic concepts of elementary reactions; basic principle of polymerization reactions; different types of catalysis | | | | | | |
| **Syllabus** | * 1. The Experimental Methods to Major Reaction Rate of Different Types of Chemical Reaction   2. The Derivations of Rate Equations for Complex Reactions   3. Mechanisms Within Rates   4. Basic Concepts of Elementary Reactions   5. Basic Principle of Polymerization Reactions   6. Different Types of Catalysis | | | | | | |
| **References** | **Main:**  1. Atkins, P.W., de Paula, J., and Keeler, J. 2018. Physical Chemistry, Oxford University Press.  2. Chang, R. and Thomson, J.W., 2014. Physical Chemistry for the Chemical Silences, Royal Society of Chemistry | | | | | | |  |
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| **Supplementary:** | | |  | | | |
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| **Lecturer** | Physical Chemistry Team | | | | | | |
| **Prerequisite (if any)** | Basic Chemistry II | | | | | | |

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| **Week-** | **Lesson Learning Outcomes (LLO)** | **Topics** | **Teaching and Learning Methods and Resources** | **Allocated time** | **Student Learning Experience** | **Evaluation** | | |
| **Criteria and Category** | **Indicator** | **Weight (%)** |
| **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** |
| 1-2 | LLO 1  The student will be able to explain the forms the experimental methods (chemical methods, physical methods, rapid mixing, stopped-flow methods, continuous-flow method ). | Experimental methods to measure the chemical kinetics | Lectures, discussion, questions and answers, course works, problem-based learning  Media:  Computer, LCD and Zoom | Lecturing: 1 x 2 x 50 min  Course work: 1 x 2 x 60 min  Independent study:  1 x 2 x 60 min | 1. Learning of experimental methods to measure the chemical kinetics 2. Practicing to solve problems/exercise 3. Participating in class and group discussion. 4. Practicing to develop a scientific attitude. | 1. Answer to question during lecture 2. Exercise 3. Course works. 4. Questions for Formal Exam-1. | The accuracy to explain the experimental methods to measure the chemical kinetics | 6 |
| 3-4 | LLO 2  The student will be able to explain the derivations of rate equations for complex reactions (rate equations and constants, calculating rates, steady state and equilibrium approximations). | The derivations of rate equations for complex reactions | Lectures, discussion, questions and answers, course works, Problem-based learning  Media:  Computer, LCD and Zoom | Lecturing: 2 x 2 x 50 min  Course work: 2 x 2 x 60 min  Independent study:  2 x 2 x 60 min | 1. Learning of the derivations of rate equations for complex reactions 2. Practicing to solve problems/exercise. 3. Participating in class and group discussion. 4. Practicing to develop a scientific attitude. | 1. Answer to question during lecture 2. Exercise 3. Course works. 4. Questions for Formal Exam-1. | The accuracy to explain the derivations of rate equations for complex reactions | 10 |
| 5 | **Formal Exam-1** | | | | | | | |
| 6-7 | LLO 3  The student will be able to understand Mechanisms within rates (precursor states in adsorption process, common mechanisms, transition state theory, chain reactions). | Mechanisms of the chemical kinetics. | Lectures, discussion, questions and answers, course works, Problem-based learning  Media:  Computer, LCD and Zoom | Lecturing: 2 x 2 x 50 min  Course work: 2 x 2 x 60 min  Independent study:  2 x 2 x 60 min | 1. Learning of mechanisms of the chemical kinetics. 2. Practicing to solve problems/exercise 3. Participating in class and group discussion. 4. Practicing to develop a scientific attitude. | 1. Answer to question during lecture 2. Exercise 3. Course works. 4. Questions for Formal Exam-2 | The accuracy to explain the mechanisms of the chemical kinetics. | 8 |
| 8 | **(Formal Exam-2 (Midterm Exam)** | | | | | | |  |
| 9-10 | LLO-4  The student will be able to explain Basic concepts of elementary reactions ( sequential elementary reactions, mechanism of elementary reactions with a steady state approximation, rate-determining step of the reaction using a steady state approximation, the reaction before equilibrium, kinetic and thermodynamic control). | Basic concepts of elementary reactions | Lectures, discussion, questions and answers, course works, Problem-based learning  Media:  Computer, LCD and Zoom | Lecturing: 2 x 2 x 50 min  Course work: 2 x 2 x 60 min  Independent study:  2 x 2 x 60 min | 1. Learning of basic concepts of elementary reactions 2. Practicing to solve problems/exercise 3. Participating in class and group discussion. 4. Practicing to develop a scientific attitude. | 1. Answer to question during lecture 2. Exercise 3. Course works. 4. Questions for Formal Exam-3. | The accuracy to explain the basic concepts of elementary reactions | 25 |
| 11 | **Formal Exam-3** | | | | | | | |
| 12-13 | LLO-5  The student will be able to explain Basic principle of polymerization reactions (general types of polymerization reactions, steps of polymerization, extent of reaction, degree of polymerization, rate of initiation, rate of propagation, rate of termination). | Basic principle of polymerization reactions | Lectures, discussion, questions and answers, course works, Problem-based learning  Media:  Computer, LCD and Zoom | Lecturing: 2 x 2 x 50 min  Course work: 2 x 2 x 60 min  Independent study:  2 x 2 x 60 min | 1. Learning of basic principle of polymerization reactions 2. Practicing to solve problems/exercise 3. Participating in class and group discussion. 4. Practicing to develop a scientific attitude. | 1. Answer to question during lecture 2. Exercise 3. Course works. 4. Questions for Formal Exam-4. | The accuracy to explain basic principle of polymerization reactions | 10 |
| 14-15 | Different Types of Catalysis | The different types of catalysis | Lectures, discussion, questions and answers, course works, Problem-based learning  Media:  Computer, LCD and Zoom | Lecturing: 2 x 2 x 50 min  Course work: 2 x 2 x 60 min  Independent study:  2 x 2 x 60 min | 1. Learning of the different types of catalysis 2. Practicing to solve problems/exercise 3. Participating in class and group discussion. 4. Practicing to develop a scientific attitude. | 1. Answer to question during lecture 2. Exercise 3. Course works. 4. Questions for Formal Exam-1. | The accuracy to explain the different types of catalysis | 7 |
| 16 | **Formal Exam-4 (Final Exam)** | | | | | | | |