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**Department of Chemistry**

**College of Education**

**University of Salahaddin**

**Subject: Polymer**

**Course Book of Stage 4th**

**Lecturer's name: Azad S. sadraddin**

**Academic Year: 2023/2024**

**Course Book**

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| **1. Course name** | **Polymer Chemistry** | |
| **2. Lecturer in charge** | **Azad S. Sadraddin** | |
| **3. Department/ College** | **Chemistry/Education** | |
| **4. Contact** | **azad.sadraddin@su.edu.krd** | |
| **5. Time (in hours) per week** | **4 hours** | |
| **6. Office hours** | **Wednesday 9:30am-11:30am** | |
| **7. Course code** |  | |
| **8. Course overview:**  This subject is an exploratory and an important subject for the chemistry students, Chemistry students get information on Polymer Chemistry. They will learn about polymerization mechanism; stereospecific polymerization; copolymerization; phase system for polymerization; industrially important thermoplastic and thermosetting polymers; polyurethanes; rubber elasticity; mechanical properties of polymers; degradation of polymers; analysis and testing of polymers.  It gives information on the Economic importance of petrochemicals and derived products, for commercial, industrial and domestic uses are ready to delve into the polymer science world. Polymers and their manufacture play a very important part in our daily lives and the technologies that we use. Students will get in-depth understanding of chemistry and physics of polymers via interactive lab classes.  This course covers fundamental polymer chemistry, where types of polymers, reactions to form polymer, polymerization mechanisms, structures, properties and application of polymer ionic polymerisations and free radical polymerisation, and learn what strategies are at our disposal to generate simple and complex macromolecular architectures. The polymer physics segment of the course allows students to develop an understanding of the physical properties if polymers in relation to their chemical structure. | | |
| **9. Course objective:**  The objectives of this course are to:  • provides students with an opportunity to identify different types of polymers in our surrounding.  • introduces students to the practical application of polymers.  •Modern materials depend on large variety of properties available from polymers.  •Know common commercial polymers by their names, properties and syntheses.  • Relate properties and applications of polymers to methods of polymer processing.  •Know common polymer additives and their role in the control of desired properties.  •Classify polymer degradation and enumerate the factors that contribute to polymer  degradation. | | |
| **10. Student's obligation**  **Attendance:** All students are expected to attend every class meeting. Attendance will be taken. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible to any of the instructors, indicating the reason for the absence. **The student that attended all the classes will take 0.5 degree all over the total marks.**  **Electronic devices:** As described in lab Student rules, unwarranted disruption of classroom activities is not permissible. Accordingly, with the exception of calculators, ALL electronic devices, including cell phones must be TURNED OFF and stowed during class. The use of laptop, tablet, or other portable computers during class is strictly limited to recording notes or viewing course-related materials, such as on-line lecture notes or topic-related web sites. Prior to the start of examinations, all calculator memories must be cleared of any stored text or equations.  • Actively **participate** in class/group discussions.  • **Relate** knowledge gained in class which can be applied to “real-world” problems.  •Working in **groups** for support throughout the term. | | |
| **11. Forms of teaching**  All documents used in this year are copied, you have the right to copy all the documents for your personal academic use. Other forms of teaching are hand out and discussion. | | |
| **12. Assessment scheme**  The main components of the course are: The course guide, objectives, study units, self-assessment, exercises, and tutor marked assignments and references/further reading.  **Quizzes:** the course lesson include a number of quizzes.  **Mid -term exam:** the students will take mid exam during this course.  **Activity and participate** in class discussions and home works preparation. | | |
| **13. Student learning outcome:**  Upon successful completion of this course, the student will be able to:  Polymer chemistry  1. Differentiate between natural and man-made polymers.  2. Explain polymerization methods.  3. Understand polymerization kinetics.  4. Uses of polymers.  5. Modern materials depend on large variety of properties available from polymers. | | |
| **14. Course Reading List and References‌:**  • Malcolm P. Stevens (1990). An Introduction to Polymer Chemistry. 2nd Edition. Oxford  University Press, New York. Pp 3-43, 189-485.  • Hall C. M. (1981). Polymer materials: An introduction for technologist and scientists.  •Industrial Chemistry Textbook, 4th Edition. Sharma Lee, publisher Wiley &Co, copy right 2010.  **•**Principles of Polymer Chemistry, A. Ravve, Niles, IL, USA, 3rd edition: Springer Science 2012  •PRINCIPLES OF POLYMERIZATION, GEORGE ODIAN,4th edition, 2004 by John Wiley & Sons, | | |
| **15.Theorytical Topics** | | **Week no.** |
| * 1. Introduction to polymer science   2. Historical development | | 1 |
| * 1. Classification of polymers      1. Natural vs. Synthetic      2. Polymer Structure   1.4 Nomenclature of Polymers | | 2 |
| 1.5 Methods of polymerisation  1.6 Condensation (Step) polymerization  1.6.1 Mechanism of condensation polymerization  1.6.2 Typical Step-Growth Polymerizations  1. Polyesters  2. Polyamides | | 3 |
| 1.7 Addition (Chain) polymerization  1.7.1 Free radical polymerization  1.7.2 Ionic and coordination polymerizations  1.7.3 Anionic polymerization | | 4 |
| 1.7.4 Cationic polymerization  1.7.5 Coordination polymerization | | 5 |
| 1.8 Polymerization Techniques  1.8.1 Bulk Polymerization  1.8.2 Suspension Polymerization  1.8.3 Solution Polymerization  1.8.4 Emulsion Polymerization | | 6 |
| 1.9 Polymer molecular weight | | 7 |
| 2.0 Copolymerization | | 8 |
| 2.1Polymer Structure (Morphology)  2.2 Stereochemistry of Polymers  2.3Molecular Interactions  2.4 Polymer Crystals  2.5 Amorphous Bulk State  2.6 Polymer Structure–Property Relationships  2.7 Cross-Linking | | 9 |
| 3.1 Mechanical Properties of Polymers | | 10 |
| 4.1 Testing and Analysis of Polymers | | 11 |
| 5.1 Polymer Degradation | | 12 |
| 6.1 Polymer Additives | | 13 |
| 7.1 Polymeric Materials for Special Applications | | 14 |
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| **16. Practical Topics** | |  |
| **Polymer chemistry practical session**  Experiment 1: Urea-Formaldehyde [Methanal] polymerization.  Experiment 2: The Condensation Polymerization of Phenol and Formaldehyde: Bakelite.  Experiment 3: Preparation of Polystyrene by Bulk polymerization.  Experiment 4: Determination of the Molecular Weight of a polystyrene sample by Viscometer.  Experiment 5: Preparation of Nylon 6, 6 and Nylon 6, 10 by Interfacial Polycondensation.  Experiment 6: Preparation of phthalic alkyde resin.  Experiment 7: Bulk Photopolymerization of Methyl Methacrylate.  Experiment 8: Preparation of Poly Cellulose Acetate.  Experiment 9: Poly [alkylene Sulfide].  Experiment 10: Making a Plastic from Potato Starch. | | (week1)  (week2)  (week3)  (week4)  (week5)  (week 6)  (week7)  (week 8)  (week9)  (week10) |
| **17. Examinations:**  ***1. Compositional:***  Explain the significant of Urea-formaldehyde resin.  ***2.******True or false type of exams:***  \*The polymer which is used in a production of blared ball is nitro cellulous.  ***3. Multiple choices:***  .  \*The first synthetic organic polymer was…….  a**.** Novolac b. polystyrene c. Bakelite d. Nylon 6,6 | | Answer: Knowledge of the water content of petroleum products is important in the refin ing, purchase, sale, and transfer of products.  The amount of water as determined by this test method may be used to correct the volume involved in the custody transfer of petroleum products and bituminous materials, also it is specified in the contracts. |
| **18. Extra notes:** | |  |
| **19. Peer reviewپێداچوونه‌وه‌ی هاوه‌ڵ** | |  |