Diponegoro University
Faculty of Science and Mathematics
Undergraduate Program Of Chemistry

Module designation	**Polymer Physical Chemistry (KFP)**
Semester(s) in which the module is taught	5
Person responsible for the module	Dr. Parsaoran Siahaan, MS
Language	Indonesian
Relation to curriculum	~~Compulsory /~~ elective ~~/ specialisation~~
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	Face to face : 1 x (2 x 50 min); Structured study: 1 x (2 x 60 min); Self study: 1 x (2 x 60 min)
Credit points	2
Required and recommended prerequisites for joining the module	KRX

Module objectives/intended learning outcomes	1. S9 Demonstrates an attitude of being responsible for work in his field of expertise independently. 2. PP1 Mastering the theoretical concepts of structure, properties, changes, kinetics, and energetics of molecules and chemical systems, identification, separation, characterization, transformation, synthesis of micromolecular chemicals, and their application. 3. PP3 Mastering the basic principles of software for analysis, synthesis, and molecular modeling in general or more specific chemical fields. 4. KU1 Able to apply logical, critical, systematic, and innovative thinking in the development or implementation of science and technology that pays attention to and uses humanities values by their field of expertise. 5. KU2 Able to demonstrate independent, quality, and measurable performance. 6. KU5 Able to make decisions regularly in the context of solving problems in their area of expertise, based on the results of analysis of information and data. 7. KK2 Able to solve science and technology problems in general and straightforward chemical fields such as identification, analysis, isolation, transformation, and synthesis of micro-molecules through the application of knowledge of structure, properties, kinetics, and energetics of molecules and chemical systems, with analytical methods and synthesis in specific chemical fields, as well as the application of relevant technologies. 8. KK4 Able to use software to determine the structure and energy of micromolecules, software to assist analysis and synthesis in general or more specific chemical fields (organic, biochemical, or inorganic), and for data processing (analytical chemistry)

Content	1. Definition and molecular structure of polymers: Monomers, Natural and synthetic polymers, Homopolymers, Heteropolymers (copolymers), Size and shape, Average polymer weight, average weight, Polydispersity, Intermolecular interactions in polymers, Experimental methods for determining size and polymer form, Molecular weight relationship and interactions with polymer physical properties 2. Reaction kinetics and energetics of addition polymerization, condensation polymerization, copolymerization: Mechanism and steps of addition polymerization, Kinetics of addition polymerization, Thermochemistry of addition polymerization, Mechanism and stages of condensation polymerization, Condensation polymerization kinetics, Thermochemistry of condensation polymerization, Relative permittivity., Molecular structure and geometry. 3. The relationship between the structure and the physical properties of polymers: variations in intermolecular interaction forces and temperature, modulus, polymer dissolution process, polymer dissolution thermochemistry. 4. Types of polymer transformation: degradation, cross-link formation, a reaction between functional groups, intramolecular rearrangement formation, polymer stabilization, Changes in polymer physical properties after modification: polymer weight, solubility, other physical properties. 5. • Preliminary evaluation includes: thermal characteristics (thermosets and thermoplastics), solubility with Solubility (solvent type) = f(polymer chemical structure, BM, crystallinity, cross-linking), stability to chemical substances or the environment (acids, bases, radiation), mechanical properties (hard, brittle, lunal), UV and IR spectra. • Determination of molecular weight (BM) and molecular size using viscosity, distribution of BM by GPC chromatography. • Polymer morphology • Thermal properties (glass transition temperature with TGA, etc.) 6. Characterization of polymer structure by the spectroscopic method : Infrared (IR) spectroscopy method • NMR spectroscopic method • Relationship of structure and molecular weight with optical properties of polymers. 7. • X-ray Diffraction Method • Data interpretation: crystalline and amorphous • Relationship of structure and molecular weight with polymer crystallinity. 8. • Tensile Strength Method; Data interpretation: firm, soft, etc. • SEM (Scanning Electron Microscopy) method. • Conductivity method.

	• Relationship of structure and molecular weight with polymer strength, polymer porosity, and polymer conductivity.
Exams and assessment formats	Mid-Semester Exam and Final Exam
Study and examination requirements	Participatory Activities 20% Project Results 30% Task 10% Quiz 10% Mid-semester 15% Final exams 15%
Reading list	1. Billmeyer, F.W., 1984, Textbook of Polymer Science, 3rd ed. 2. Atkins dan de Paula, 2014, Physical Chemistry, 10th ed., W. H. Freeman and Company, New York 3. Anslyn, E.V. dan Dougherty, D.A., 2006, "Modern Physical Organic Chemistry", University Science Books. 4. Atkins, P. dan De Paula, J., 2006, "Physical Chemistry for the Life Sciences", Oxford University Press, Oxford. 5. Benedect, I. (editor), 2006, Developments in Pressure-Sensitive Product, 2nd ed., Taylor & Francis. 6. Journal.