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Module designation	*Physical Chemistry*
Module level, if applicable	*Bachelor (Undergraduate)*
Code, if applicable	
Semester(s) in which the module is taught	*3rd Semester*
Person responsible for the module	*Miftahul Jannah, S.Si., M.Si.*
Lecturer	*Prof. Ms. J. Rampe, M.C.* *Dr. Johny Z. Lombok, M.Si.* *Soenandar Millian Tengker, S.Si., M.Si.* *Miftahul Jannah, S.Si., M.Si.*
Language	*Indonesian*
Relation to curriculum	*Compulsory course in the Chemistry Study Program*
Teaching methods	*Lecture, discussion, oral presentation, collaborative learning, project-based learning, independent learning, LMS-based assignments.*
Workload	*Estimated total workload: 150 hours* *• Contact hours (lecture, discussion, demonstration): 42 hours* *• Structured assignments (projects, presentations, essays): 36 hours* *• Independent study & exam preparation: 72 hours*
Credit points	*3 credits (T=3, P=0)*
Required and recommended prerequisites for joining the module	*Basic Chemistry, Basic Physics, and Mathematics for Chemists*
Module objectives/intended learning outcomes	*Upon completion of this course, students are able to:* *• Explain the equations of state for ideal and real gases.* *• Understand the basic concepts and laws of thermodynamics.* *• Apply the First and Second Laws of Thermodynamics in chemical systems.* *• Explain thermodynamic functions (internal energy, enthalpy, entropy, Gibbs and Helmholtz free energy).* *• Evaluate the spontaneity of reactions based on free energy and entropy changes.*

Content	*This course covers:* *1. Gas equations (ideal and real gases).* *2. Concepts and laws of thermodynamics.* *3. First Law of Thermodynamics and related concepts (internal energy, enthalpy, thermochemistry).* *4. Second Law of Thermodynamics, entropy, and spontaneity.* *5. Gibbs and Helmholtz free energies and their applications.*
Examination forms	*Written exams (mid-term and final), oral presentations, individual and group assignments, reports, and project-based assessments.*
Study and examination requirements	*To successfully pass the module, students must:* *• Attend at least 80% of lectures.* *• Complete all assignments and project reports.* *• Pass mid-term and final examinations with a minimum cumulative score of 60 (out of 100).*
Reading list	*• Ijang Rohman & Sri Mulyani (2000), Physical Chemistry I.* *• Atkins, P.W. (1986), Physical Chemistry, W.H. Freeman & Co.* *• Alberty, R.A. (1987), Physical Chemistry, John Wiley & Sons.* *• Castellan, G. (1983), Physical Chemistry, 3rd ed., Addison Wesley.* *• Levine, I.N. (1978), Physical Chemistry, McGraw Hill.* *• Maron, S.H. & Lando, J.B. (1974), Fundamentals of Physical Chemistry, McMillan.*