MODULE HANDBOOK

Module Name	Thermodynamics of Chemistry
Module level	Bachelor
Abbreviation, if applicable	8420403140
Sub-heading, if applicable	-
Course included in the module, if applicable	-
Semester/term	4nd/Second Year
Module coordinator(s)	Dian Novita, ST., M.Pd.
Lecturer(s)	1. Prof. Dr. Harun Nasrudin, M.Pd. 2. Dian Novita, ST., M.Pd. 3. Findiyani Ernawati Asih, S.Pd., M.Pd.
Language	Indonesian
Classification within the curriculum	Compulsory Course
Teaching format/class hours per week during the semester:	3 hours lecturers (50 min per hours)
Workload:	3 x 50 minutes lectures, 3 x 60 minutes structured activity, 3 x 60 minutes individual activity, 14 weeks per semester, 119 total hours per semester ~ 4.77 ECTS**
Credit points:	3 CU = 3 x 1.59 = 4.77 ECTS
Prerequisite course(s):	-
Targeted learning outcomes:	1. Understand the basic principles of thermodynamics and their application: the nature and behavior of gases; gas, energy, heat and work kinetics; inner energy and enthalpy; process direction and the concept of entropy; free energy and its relation to system stability, chemical equilibrium, electrochemical cell thermodynamics, solution thermodynamics, phase equilibrium 2. Able to solve science and technology problems in general and in simple scope such as through the application of knowledge of the properties and behavior of gases; gas, energy, heat and work kinetics; inner energy and enthalpy; process direction and the concept of entropy; free energy and its relationship with system stability, chemical equilibrium, electrochemical cell thermodynamics, solution thermodynamics, phase equilibrium, and the application of relevant technologies 3. Having the ability to take advantage of ICT-based learning resources and learning media in understanding energetic concepts. 4. Make decisions about the relationship between basic chemical concepts and laboratory activities, research results, and the existence of chemistry in everyday life. 5. Demonstrate an attitude of responsibility for work in his field of expertise independently.
Content:	1. Ideal gas properties and real gas properties

<table>
<tr><td></td><td>2. Basic understanding and concepts of thermodynamics
3. The first law of thermodynamics.
4. Enthalpy function, enthalpy change and heat capacity.
5. Basic understanding and concepts of thermodynamics
6. The first law of thermodynamics.
7. Enthalpy function, enthalpy change and heat capacity.
8. Carnot loop process
9. Second law of thermodynamics
10. The change in entropy in a closed system
11. Third law of thermodynamics
12. Helmholtz free energy function
13. Gibbs free energy function
14. Fundamental equations and Maxwell's relationships
15. Chemical potential of open systems in mixtures
16. Equilibrium in the gas phase
17. Equilibrium in chemical reactions
18. Shifting equilibrium
19. Thermodynamics of solutions.
20. Thermodynamics of electrochemical cells</td></tr>
<tr><td>Study / exam achievements:</td><td>Students are considered to complete the course and pass if they obtain at least 40% of maximum final grade. The final grade (NA) is calculated based on the following ratio:
<table>
<tr><td>Assessment Components</td><td>Percentage of contribution</td></tr>
<tr><td>Participation</td><td>20%</td></tr>
<tr><td>Assignment</td><td>30%</td></tr>
<tr><td>Mid-semester test</td><td>20%</td></tr>
<tr><td>Final semester test</td><td>30%</td></tr>
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<tr><td>Media:</td><td>Computer, LCD, White board</td></tr>
<tr><td>Learning Methods</td><td>Individuals assignment, group assignment, discussion, presentation, and practicum</td></tr>
<tr><td>Literature:</td><td>1. Atkins, Peter, and De Paula, Julio. 2010. Physical Chemistry. 9th edition. Oxford: ELBS Oxford University Press.
2. Nasrudin, H., Novita, D., dan Tjahjani, S., 2018. Termodinamika Kimia. Surabaya: Unesa University Press.
3. Bahl, A., Bahl, B.S., and Tuli, G.D. 2012. Essential of Physical Chemistry. 4th edition. New Delhi: S.Chand and Company Ltd.
4. Levine, N. Ira, 2009, Physical Chemistry, 6th edition, Singapore, McGraw-Hill.</td></tr>
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Notes:	*1 CU in learning process = three periods consist of: (a) scheduled instruction in a classroom or laboratory (50 minutes); (b) structured activity (60 minutes); and (c) individual activity (60 minutes) according to the Regulation of Indonesia Ministry of Research, Technology, and Higher Education No. 44 Year 2015 jo. the Regulation of Indonesia Ministry of Research, Technology, and Higher Education No. 50 Year 2018.
	**1 CU = 1,59 ECTS according to Rector Decree Of Universitas Negeri Surabaya No. 598/Un38/Hk/Ak/2019