MODULE HANDBOOK

Module Name	Thermodynamics of Chemistry
Module level	Bachelor
Abbreviation, if applicable	3074213030
Sub-heading, if applicable	-
Course included in the module, if applicable	-
Semester/term	3rd/Second Year
Module coordinator(s)	Dian Novita, ST., M.Pd.
Lecturer(s)	Prof. Dr. Harun Nasrudin, M.Pd. Dian Novita, ST., M.Pd. Findiyani Ernawati Asih, S.Pd., M.Pd.
Language	Indonesian
Classification within the curriculum	Compulsory/ ~~Elective~~
Teaching format/class hours per week during the semester:	3 contact hours of lectures and lab activity (Indonesia credit semester or sks*)
Workload:	a. Lecture: 2 x 50 minutes lectures, 2 x 60 minutes structured activity, 2 x 60 minutes individual activity, 14 weeks per semester, 79.33 total hours per semester ~ 3.18 ECTS b. Lab activity: 1x170 minutes lab activity, 14 weeks per semester 39.67 total hours of lab activity per semester ~ 1.59 ECTS Total of lecture and lab activity= 119 total hours per semester ~ 4.77 ECTS**
Credit points:	3 CU x 1.59 = 4.77 ECTS
Prerequisites course(s):	Quantum chemistry

Targeted learning outcomes:	1. Understand the basic principles of thermodynamics and their application: the nature and behavior of gasses; 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 the general field of chemistry and in a simple scope such as through the application of knowledge of the nature and behavior of gasses; gas, energy, heat and work kinetics; inner energy and enthalpy; process direction and the concept of entropy; free energy and its relationship to 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 their field of expertise independently.
Content:	1. Ideal gas properties and real gas properties 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 and 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

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<tr><td>Study / exam achievements:</td><td>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>
</table>

Grade Conversion of 0-100 scale into 0-4 scale is set as below:

<table>
<tr><td>Letter</td><td>Number</td><td>Grade interval</td></tr>
<tr><td>A</td><td>4.00</td><td>$85 \leq A \leq 100$</td></tr>
<tr><td>A-</td><td>3.75</td><td>$80 \leq A- < 85$</td></tr>
<tr><td>B+</td><td>3.50</td><td>$75 \leq B+ < 80$</td></tr>
<tr><td>B</td><td>3.00</td><td>$70 \leq B < 75$</td></tr>
<tr><td>B-</td><td>2.75</td><td>$65 \leq B- < 70$</td></tr>
<tr><td>C+</td><td>2.50</td><td>$60 \leq C+ < 65$</td></tr>
<tr><td>C</td><td>2.00</td><td>$55 \leq C < 60$</td></tr>
<tr><td>D</td><td>1.00</td><td>$40 \leq D < 55$</td></tr>
<tr><td>E</td><td>0.00</td><td>$0 \leq E < 40$</td></tr>
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<tr><td>Media:</td><td>Computer, LCD, White board</td></tr>
<tr><td>Learning Methods</td><td>Lectures, individuals assignment, group assignment, discussion, presentation, and laboratory activity</td></tr>
<tr><td>Literature:</td><td>

Rankin, WJ. 2019. Chemical Thermodynamics Theory and Applications. US: CRC Press.
Atkins, PW. 1996. Physical Chemistry. Oxford: ELBS Oxford University Press.
Argon Sembiring, 2000, Kimia Fisika I, Universitas Terbuka.
Bahl, BS. 2002. Essential of Physical Chemistry. New Delhi: S.Chand and Company Ltd.
Levine, I.N., 2005, Physical Chemistry, 4th edition, Singapore, McGraw-Hill

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Notes:	*1 sks in learning process = three periods consist of: (a) scheduled instruction in a classroom (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. For lab activity: 1 sks in learning process = two periods consist of: (a) scheduled lab activity (100 minutes); (b) structured lab activity (70 minutes);
	**1 sks = 1.59 ECTS according to Rector Decree Of Universitas Negeri Surabaya No. 598/Un38/Hk/Ak/2019