SEMESTER LEARNING PLAN
S-2 CHEMISTRY STUDY PROGRAM
FACULTY OF MATH AND SCIENCE
BENGKULU UNIVERSITY

Course Identity			**Identity of course tutor**		
Course Code	:	**MIK-312**	Lecturer Name	:	Prof. Dr. Irfan Gustian, M.Si/Dr. Charles Banon, M.Si
Course Name	:	Advanced Physical Chemistry	Field Group	:	Physical Chemistry
Course Weight (credits)	:	2 (2-0)			
Semester	:	1			
Prerequisite Course	:	-			

Program Learning Outcomes (PLO)

PLO Code		PLO Element
S-9	:	Demonstrate a responsible attitude towards work in their area of expertise independently;
KU-1		Able to develop logical, critical, systematic, and creative thinking through scientific research, creation of designs or works of art in the field of science and technology that pays attention to and applies humanities values according to their field of expertise, compiles scientific conceptions and study results based on rules, procedures, and scientific ethics in the form of a thesis or other equivalent form, and uploaded on the university's website, as well as papers that have been published in national scientific journals, or accepted in international journals;
KU-2	:	Able to carry out academic validation or studies according to their field of expertise in solving problems in the relevant community or industry through the development of their knowledge and expertise;
Scientific Study Materials	:	In this lecture discussed: 1. Macroscopic approach to understanding Microscopy. 2. Quantum mechanics trigger physics concepts, quantum mechanics principles 3. energy levels, thermodynamics, hydrogen atoms, spectroscopic theory, transition spectra, study of molecular vibrations and rotations. 4. Thermodynamic probabilities and entropy: Boltzmann equations. 5. Molecular partition functions (translation, rotation, vibration, and electronics). 6. Application of statistical thermodynamic methods to chemical equilibrium, real gases, adsorption, crystals, and other examples.
Course	:	1. Students are able to explain the concepts of quantum mechanics, quantum mechanics principles, energy levels, thermodynamics, hydrogen atoms, spectroscopic theory, transition spectra, vibration studies and molecular rotations. 2. Students are able to explain basic concepts of statistical thermodynamics such as the Boltzmann equation, microcanonical/canonical/grandcanonical probability distributions. 3. Students are able to apply statistical thermodynamic methods for monatomic, diatomic and polyatomic gases. 4. Students are able to apply statistical thermodynamic methods for chemical equilibrium, real gases, adsorption, crystals, and other examples.
Learning Experience	:	Students are given knowledge about the Macroscopic approach to understand Microscopy, quantum mechanics triggering physics concepts, quantum mechanics principles, energy levels, thermodynamics, hydrogen atom, spectroscopic theory, transition spectra, vibration studies and molecular rotation, thermodynamic probability and entropy: Boltzmann equation, Partition function molecular (translation, rotation, vibration, and electronics), Application of statistical thermodynamic methods for chemical equilibrium, real gases, adsorption, crystals, and other examples.
Reference list	:	1. Advanced Physical Chemistry, J. A Davis, McGraw hill 2. Atkins, PW, 1990, Physical Chemistry, 4th ed., Oxford University Press. 3. Castellan, GW, 1983, Physical Chemistry, third ed., Addison Wesley Publishing Company. 4. A. Maczek, Statistical Thermodynamics, Oxford University Press, Oxford, 2012.

		5. NM Laurendea, Statistical Thermodynamics-Fundamentals and Applications, Cambridge University Press, Cambridge, 2005

Stage	Final ability	Subject matter	Reference	Learning methods	Time (minutes)	Evaluation*	
						Indicator/ CPL code	Assessment technique /weight
1	2	3	4	5		6	7
1	Applying lecture rules and course assessment componentspundersta nding and insight about Advanced Physical Chemistry	1. Lecture Contract 2. Study rules 3. Assessment components 4. Reference/ literature/ reference book	Ref No :-	Lecture Class discussion	2x50	Knowing the components of assessment and references	
2	Macroscopic Approach to understand Microscopy	Concepts: Newtonian, Lagrangian, Hamiltonian	Ref No : 1,2,3	Literature search, Student discussions, Assignment of materials related to meetings		Concepts: Newtonian, Lagrangian, Hamiltonian,	7.5%
3	Able to understand quantum mechanics trigger physics concepts, quantum mechanics principles, energy levels	Concepts Quantum mechanics trigger physics concepts, quantum mechanical principles, energy levels	Ref No : 1,2	Literature search, Student discussions, Assignment of materials related to meetings	2x50	Understand the concepts of quantum mechanics trigger physics, quantum mechanical principles, energy levels	5%
4-5	Understand energy, thermodynamics, hydrogen atom, spectroscopic theory, transition spectra, study of molecular vibration and rotation.	Thermodynamics, the hydrogen atom, spectroscopic theory, transition spectra, the study of molecular vibrations and rotations. about	Ref No : 1,2	Literature search, Student discussions, Assignment of materials related to meetings	4x50	Can explain the concepts of Thermodynamics, hydrogen atoms, spectroscopic theory, transition spectra, vibration studies and molecular rotation. about	7.5 %
6	Understanding Thermodynamic Probability and Entropy:	Thermodynamic probability and entropy	Ref No: 3,4	Literature search, Student discussions, Assignment of materials related to meetings	4x50	UnderstandReaction Order (0,Thermodynamic probability and entropy	5 %
7	Understandthe concept of the Boltzmann equation.	Boltzmann Persamaan Equation	Ref No: 3,4	Literature search, Student discussions, Assignment of materials related to meetings	2x50	Understanding the Boltzmann persamaan equation	5 %
8	Mid-semester Evaluation	MIDTERM EXAM			2x50		20 %
9-10	Understand about the molecular partition function	Molecular partition function	Ref No: 3,4	Literature search, Student discussions, Assignment of materials related to meetings	4x50	Can explain about the molecular partition function	5 %
11-12	Students can understand the canonical partition function.	Canonical partition function.	Ref No: 3,4	Literature search, Student discussions, Assignment of materials related to meetings	4x50	Can explain Canonical partition function.	7.5 %
13	Students can understand about internal energy and entropy	Internal energy and entropy	Ref No: 3,4	Literature search, Student discussions, Assignment of materials related to meetings	2x50	Can explain about internal energy and entropy	5%

14-15	Students can understand the application of statistical thermodynamic methods for chemical equilibrium, real gases, adsorption, crystals,	Application of statistical thermodynamic methods for chemical equilibrium, real gases, adsorption, crystals,	Ref No : 1,2	Literature search, Student discussions, Assignment of materials related to meetings	4x50	Students can explain the application of statistical thermodynamic methods for chemical equilibrium, real gases, adsorption, crystals,	7.5%
16	End of Semester Evaluation	FINAL EXAMS			2x50		25%

Appendix 1. Learning Outcomes of Graduates for Master of Chemistry
According to the Attachment of Permenristekdikti No. 44 of 2015 concerning the National Standard of Higher Education

1/A1	Faithful to God Almighty and able to demonstrate a religious attitude;
S2/A2	Upholding human values in carrying out duties based on religion, morals and ethics;
S3/A3	Contribute to improving the quality of life in society, nation, state, and civilization based on Pancasila;
S4/A4	To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the state and nation;
S5/A5	Appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others;
S6/A6	Cooperate and have social sensitivity and concern for society and the environment;
S7/A7	Obey the law and discipline in the life of society and the state;
S8/A8	Internalize academic values, norms, and ethics;
S9/A9	Demonstrate a responsible attitude towards work in their area of expertise independently;

General Skills (KU) / Psychomotor (PU):
see LAMP-PERMENRISTEKDIKTI-NO 44-2015-SNPT

KU1/PU1	Able to develop logical, critical, systematic, and creative thinking through scientific research, creation of designs or works of art in the field of science and technology that pays attention to and applies humanities values according to their field of expertise, compiles scientific conceptions and study results based on rules, procedures, and scientific ethics in the form of a thesis or other equivalent form, and uploaded on the university website, as well as papers that have been published in accredited scientific journals, or accepted in international journals;
KU2/PU2	Able to carry out academic validation or studies according to their field of expertise in solving problems in the relevant community or industry through the development of their knowledge and expertise;
KU3/PU3	Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and communicate them through the media to the academic community or the wider community;
KU4/PU4	Able to identify the scientific field that is the object of his research and position it into a research map developed through an interdisciplinary or multidisciplinary approach;
KU5/PU5	Able to identify scientific fields that are able to make decisions in the context of solving problems in the development of science and technology that pay attention to and apply humanities values based on analytical or experimental studies of information and data;

KU6/PU6	Able to manage, develop and maintain networks with colleagues, peers within the institution and the wider research community;
KU7/PU7	Able to increase learning capacity independently;
KU8/PU8	Able to document, store, secure, and rediscover research data in order to ensure validity and prevent plagiarism.