VISAYAS STATE UNIVERSITY

DEPARTMENT OF PURE AND APPLIED CHEMISTRY
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OUTCOMES-BASED EDUCATION (OBE) COURSE SYLLABUS

Chem 150
Physical Chemistry

I. UNIVERSITY INFORMATION

1. Vision of the University

   A globally competitive university for science, technology, and environmental conservation

2. Mission of the University

   Development of a highly competitive human resource, cutting-edge scientific knowledge and innovative technologies for sustainable communities and environment.

3. VSU Quality Policy Statement

The Visayas State University (VSU), a globally competitive university of science and technology and environmental conservation, is created by law to develop highly competitive human resource, cutting- edge scientific knowledge and innovative technologies for sustainable communities and environment.

Towards this end, we, at the Visayas State University, commit to:

- Produce highly competent, quality and world-class manpower in science and technology, especially for agriculture, environmental management and industry who are proficient in communication skills, critical thinking and analytical abilities;
- Generate and disseminate relevant knowledge and technologies that lead to improved productivity, profitability and sustainability in agriculture, environment and industry; and
- Satisfy the needs and applicable requirements of the industry, the community and government sectors who are in need of quality graduates and technology ready for commercialization through the establishment, operation, maintenance and continual improvement of a Quality Management System (QMS) which is aligned with the requirements of ISO 9001:2015.

It shall be the policy of the university that the quality policies and procedures are communicated to and understood by all faculty, staff, students and other stakeholders and that the system be continually improved for its relevance and effectiveness.

EDGARDO E. TULIN
President
v0 07-16-2019

4. Quality Goals of the College of Agriculture and Food Science

World class education in agriculture and allied fields that builds empowered and resilient communities.

5. Quality Objectives of the Department of Food Science and Technology

a) To generate knowledge and technologies in food processing and utilization that are appropriate, acceptable, profitable, safe and ecologically sound;
b) To enhance transfer of food processing technologies and sustain development of integrated processing systems that generates employment and income especially in rural areas communication systems management;
c) To promote public awareness and advocacy on relevant issues affecting food quality and safety;
d) To establish linkages and cooperation with local, national and international private and government institutions and organizations involved in the pursuit of development in food science and technology; and
e) To establish and maintain development-oriented and income-generating projects as models in instruction and income generation

II. PROGRAM INFORMATION

1. Name of the Program	Bachelor of Science in Food Technology
2. CHED CMO Reference	CMO No. 7, series 2019
3. BOR Approval	BOR Resolution No. 84, series 2018

4. Program Educational Objectives and Relationship to Institution Mission

Program Educational Objectives	Mission*		
	a	b	c
1. To produce professionals who have the capacity to apply the science and technology and related fields of study in post-harvest handling, preparation, processing, packaging, storage and distribution of food to ensure food security and the well-being of individuals, families and communities. It also includes the social, cultural, economic, managerial and entrepreneurial and environmental aspects of food systems as well as the art of food preparation.	√	√	√
2. To promote continued excellence in food science education.	√	√	√

**a - development of a highly competitive human resource, b - cutting-edge scientific knowledge, c - innovative technologies for sustainable communities and environment*

III. COURSE INFORMATION

1. Course Code	Chem 150
2. Course Title	Physical Chemistry
3. Pre-requisite	
4. Co-requisite	Chem 150.1
5. Credit	2 units
6. Semester Offered	1st semester
7. Number of hours	2 hours a week
8. Course Description	Principles and applications of thermodynamic laws in physical and chemical equilibrium systems; colligative properties, colloids and chemical kinetics

9. Program Outcomes and Relationship to Program Educational Objectives			
Program Outcomes (POs)		Program Educational Objectives	
		1	2
A	Demonstrate communication skills (i.e. oral and written) that led to success in a food technology career including preparation of proposals, position papers, technical reports, communicating technical information to a nontechnical audience, making formal and informal presentations	√	√
B	Explain the functionality of different food ingredients and chemical changes occurring during post-harvest handling, preparation, processing, packaging and storage, including reactions involving carbohydrates, protein, and fats	√	
C	Apply the international and local regulations required for the manufacture, distribution and sale of food products, either fresh or processed	√	
D	Apply the role of microorganisms in postharvest handling, preparation, processing and preservation, packaging and storage with respect to pathogenic, spoilage, and fermentative microorganisms	√	
E	Apply the principles of engineering as they relate to converting agricultural commodities to the finished products	√	
F	Apply the principles and various facets of food technology, including sensory evaluation, in practical situations, problem solving and environmental sustainability	√	
G	Apply the basic elements of sanitation and quality assurance programs to assure food safety	√	
H	Analyse and evaluate the microbiological, physical, chemical, sensory and functional properties of food	√	
I	Plan and conceptualize new product ideas and procedures leading to innovative food technologies	√	
J	Generate and share knowledge relevant to agriculture	√	√
K	Formulate and implement plans and programs in food technology in support of agriculture	√	√

10. Course Outcomes (COs) and Relationship to Program Outcomes (POs)											
Program Outcomes addressed by the Course Outcomes: After completing this course, the student must be able to:	PO Code										
	A	B	C	D	E	F	G	H	I	J	K

CO1. Describe, both qualitatively and quantitatively, and explain the behavior of gases as applied in food processing and preservation	I			D				I			
CO2. Discuss the four laws of thermodynamics, derive the relevant mathematical expressions and apply them in problem solving		E						I			
CO3. Explain the significance of the different thermodynamic functions and apply them in explaining the equilibrium properties of physical and chemical system								E			
CO4 Apply concepts of colligative properties of solution in food preparation and preservation techniques		I							I		

Legend: I – Introductory, E – Enabling, D – Demonstrative
Each letter indicates the expected level of competency that each CO should provide for each PO.

11. Course Content and Plan

Week	Topics	Learning Outcomes	Teaching and Learning Activities		Assessment Tasks
			Teaching Activities	Learning Activities	
Class Orientation					
W1	Faculty on-boarding Training General student orientation/ onboarding OBE Course Syllabus (including VSU Vision Mission, and Quality Policy Statement) Class Policies Requirements Grading System and Activities	Students relate their future career to the VMGO of the university	**Face to face:** Brainstorming Sharing of ideas	**Virtual:** Brainstorming Sharing of Ideas	Worksheet relating the VMGO of VSU to the student's intended
CO1. Describe, both qualitatively and quantitatively, and explain the behavior of gases as applied in food processing and preservation					

W2 -W3	**Module 1:** Review on Gas Laws **Lesson 1.1**: The Kinetic Molecular Theory of Gases and Ideal Gas Laws	**LO1.1.1** Define what an ideal gas (perfect gas) is. **LO1.1.2** Derive the ideal gas equation (IGE) from the postulates of KMT using particle-in-a-box approach. **LO1.1.3** Know the limitations on the use of IGE. **LO1.1.4** Show that the different ideal gas laws can be obtained from the IGE. **LO1.1.5** Solve problems relating to ideal gas properties and their applications in food processing and preservation	**Face to face:** Class discussion/ interaction Computer-aided instruction Consultation Video clips Developing problem solving skills	**Virtual Meeting:** Note-taking Independent study Video clips viewing Journal reading Internet research Practice problems	Learning Task Journal Report Worksheet /Problem Set Quiz 1
W3-W4	**Module 1:** Gas Laws	**LO1.2.1.** Compare and contrast ideal and real gas properties	**Face to face:** Class	**Virtual Meeting:** Independent study	Learning Task Workshe

	Lesson 1.2: Real Gas laws	**LO1.2.2.** Deduce the vdW EOS from the correction factors being introduced **LO 1.2.3.** Explain qualitatively what happens to a gas as the pressure is increased at constant temperature **LO 1.2.4.** Explain what is critical point and the meaning of each term: critical temperature, critical pressure and critical volume **LO1.2.5.** Show graphically the difference in the PV-diagram of a gas using IGL and vdW EOS **LO1.2.6.** solve problems relating to gas properties	discussion/ interaction Computer-aided instruction Consultation Video clips Developing problem solving skills	Video clips viewing Continue Journal Reading	et/Problem Set Group Journal Report (cont'n) E-portfolio (entire semester: submission 1 week before final examination) Quiz 2 Summative Exam 1

CO2. Discuss the four laws of thermodynamics, derive the relevant mathematical expressions and apply them in problem solving					
W5-W6	**Module 2:** Chemical Thermodynamics **Lesson 2.1**: Temperature to	**LO 2.2.1.** Explain the meaning(s) of the various concepts used in thermo-	**Face to face:** Class discussion/ interaction	**Virtual Meeting:**	Learning Task Worksheet/Proble

	Thermochemistry	dynamics: system, surrounding, work, heat, energy, enthalpy, internal energy, kinetic energy, potential energy, entropy, free energies and the following processes; isothermal, isobaric, isochoric, adiabatic, reversible, irreversible and free expansion **LO 2.1.2.** Differentiate path functions from state functions **LO 2.1.3.** Illustrate using 2-D diagrams of systems experiencing PV changes and interprets the same **LO 2.1.4.** Calculate the magnitude of energy released or absorbed during physical or chemical changes **LO2.1.5.** Solve problems involving energy interconversions through chemical and	Computer-aided instruction Consultation Video clips Developing problem solving skills Seat works	Participation in class activity Internet research Independent study Consultation with the instructor Journal Report	m set Quiz 3 Summative Exam 2

		physical processes			
W7-W8	**Lesson 2.2**: Spontaneity of a process and absolute entropy	**LO 2.2.1** Apply Legendre Transformation to generate the necessary thermodynamic property relationships and the accompanying Maxwell equations **LO 2.2.2** Predict whether the entropy change of the system in a given process is positive or negative **LO 2.2.3.** Calculate efficiencies of heat engine and other types of engines **LO 2.2.4.** Predict whether a process or reaction occurs spontaneously or not **LO 2.2.5.** apply thermodynamic concepts to solve/explain practical and real problems	**Face to face:** Class discussion/ interaction Computer-aided instruction Consultation Video clips Developing problem solving skills Seat works	**Virtual Meeting:** Participation in class activity Independent study Consultation with the instructor	Learning Task Worksheet/Problem set Quiz 4
W9	Midterm Assessment [Coverage Modules 1 and 2]				
CO3. Explain the significance of the different thermodynamic functions and apply them in explaining the equilibrium properties of physical and chemical system					
W10-W11	**Module 3.** Chemical and physical equilibria	**LO 3.1.1** Classify the type of chemical equilibrium **LO 3.1.2.** Write the appropriate equilibrium	**Face to face:** Class discussion/ interaction	**Virtual Meeting:** Participation in class activity	Learning Task Worksheet/Problem set

	Lesson 3.1 Chemical Equilibria	constant expression **LO 3.1.3** relate equilibrium constant to thermodynamic properties **LO 3.1.4** Solve equilibrium problems	Computer-aided instruction Consultation Video clips Developing problem solving skills Seat works	Internet search Independent study Consultation with the instructor Video clip viewing	Quiz 5
W12-W13	**Module 3.** Chemical and physical equilibria **Lesson 3.2** Physical equilibria and Gibbs Phase Rule	**LO 3.2.1.** Apply Gibbs Phase Rule to simple chemical systems **LO 3.2.2.** Interpret phase diagrams of unary – ternary systems **LO 3.2.3.** Construct phase diagrams from cooling curve data **LO 3.2.4.** Differentiate the utility of the Clapeyron and the Clausius – Clapeyron equation **LO3.2.5.** Discuss application of phase equilibria in food processing and preservation	**Face to face:** Class discussion/ interaction Computer-aided instruction Consultation Video clips Developing problem solving skills Seat works	**Virtual Meeting:** Participation in class activity Internet search Worksheet/Problem Set Independent study Consultation with the instructor	Learning Task Worksheet /Problem Set Summative Exam 3
CO4. Apply concepts of colligative properties of solution, colloids and kinetics in food design and preparation					

	Lesson 4.1: Colligative properties	**LO 4.1.1** Define what are colligative properties **LO 4.1.2** Explain the concepts/ principles responsible for the colligative properties of solution **LO 4.1.2** Solve problems pertaining to colligative properties **LO 4.1.3** Utilize the concepts of colligative properties in the design of foods and food processes	**Face to face:** Class discussion/ interaction Computer-aided instruction Consultation Video clips Developing problem solving skills Seat works	**Virtual Meeting:** Participation in class activity Actual observation Individual Journal Reading Independent study Consultation with the instructor	Learning Task Individual Journal Report
W14					Learning Task
W15	**Lesson 4.2 Colloids**	**LO 4.2.1** Compare and contrast properties of true solutions and colloids **LO 4.2.2** Identify the types of colloids **LO 4.2.3** Explain properties of colloids **LO 4.2.4** Utilize knowledge of colloids in food design and preparation **LO 4.3.1** Derive the rate law equations: Zero, first, and second order LO 4.3.2 Explain the factors that	**Face to face:** Class discussion/ interaction Computer-aided instruction Consultation Video clips Developing problem solving skills Seat works Group reporting	**Virtual Meeting:** Participation in class activity Actual observation Individual Journal Reading Independent study Consultation with the instructor	Worksheet/Problem Set Quiz 7 Summative Exam 4

W16 – W17	**Lesson 4.3 Chemical Kinetics**	affect rate of reaction LO 4.3.3 Interprets kinetic data from experiment LO 4.3.4 Utilize kinetic concepts in the design and preparation of foods			
W18	**FINAL ASSESSMENT [Coverage: Modules 3 & 4]**				

* *VSUEE/VC – VSU E-Learning Environment/ Virtual Classroom*

12. Life-long Learning Opportunities

The learners' gained knowledge in this course would enable them to analyze what principles/concepts are being used in the current food technology products available in the market and help them design food products and appropriate food processing technologies to produce them.

13. Contribution of Course to Meeting the Professional Component (%)

General Education: 0 %
Basic Education *(Foundation)*: 0 %
Professional Education (*Major Field*): *100 %*

14. References and Other Learning Resources

A. Textbook(s)/ E-Books

1. ATKINS, P. and J. de Paula. 2002. Physical Chemistry (7th ed.). W.H. Freeman and Co.
2. ATKINS, P. 1998. Physical Chemistry, 6th edition. W.H. Freeman and Co.
3. BALL, D. W. 2003. Physical Chemistry. Brooks/Cole
4. CASTELLAN, G. W. 1983. Physical Chemistry, 3rd edition. The Benjamin/Cummings Publishing Company, Inc.
5. COUPLAND, J.N. 2014. Introduction to the Physical Chemistry of Food (A Food Science Text Series), Springer, New York
6. JAIN, D. V. S. and S. P. JAUHAR. 1990. Physical Chemistry: Principles and Problems. Tata McGraw-Hill Publishing company Limited

7. RITZOULIS, C. 2013. Introduction to the Physical Chemistry of Foods, CRC Press, New York
8. WALSTRA, P. 2003. Physical Chemistry of Foods, Marcel and Dekker, Inc. New York

B. Other Learning Resources
Youtube videos
Journal Publications

15. Course Assessment and Evaluation

The performance of students will be assessed and evaluated based on the following:

50 % Midterm + 50 % Final Term = 100% (Overall Final)

Item No.	Assessment Tasks	Percentage Contribution (1)	No. of Times in the Semester (2)	Individual Task % Contribution (1/2)
1	Formative Assessments (LT, WS, PS,Q)	20 %	30	
2	Eportfolio	10 %	1	
3	Journal Reports	10 %	2	
4	Summative Assessments	60%	4	
	TOTAL	100%		

COs	Assessment Tasks	Weight in Percent	Minimum Average for Satisfactory Rating	Target and Standards
CO1	Worksheet/Problem Set, Learning Task	25	60 %	At least 70% of the students have at least 60% score
CO2	Worksheet/Problem Set, Learning Task, Group Journal Report	25		
CO3	Worksheet/Problem Set, Learning Task, Individual Journal Report	25		
CO4	Learning Task, Eportfolio	25		
	TOTAL	**100%**		

Grading System (60% Passing)			
Range	Grade	Range	Grade
97 – 100	1.00	75 - 79	2.25
93 – 96	1.25	70 - 74	2.50
89 – 92	1.50	65 - 69	2.75
85 – 88	1.75	60 - 64	3.00
80 – 84	2.00	< 60	5.00

18. Preparation			
Prepared by	Name	Signature	Date Signed

16. Course Materials and Facilities Available
• Learning Guide • Laptop and internet connection (for online classes) • Smartphone (for online classes) • Headphones • Videos on the lecture conducted during online classes

17. Revision History

Revision number	Date of Revision	Date of implementation	Highlights of Revision
00	August 2020	1st semester 2020 - 2021	
01	August 10, 2021	1st Semester 2021-2022	Change in the points distribution
02	August 23, 2022	St Semester 2022-2023	Incorporation of face to face instruction and redistribution of time allotment
	JACOB GLENN F. JANSALIN		

INSTRUCTOR/PROFESSOR INFORMATION

1. Name of Instructor/Professor	Jacob Glenn F. Jansalin
2. Office and Department	Department of Pure and applied Chemistry
3. Telephone/Mobile Numbers	09614645485
4. Email Address	jgfjansalin57@vsu.edu.ph/jacob.jansalin@vsu.edu.ph
5. Consultation Time	Any time during weekdays; discussion meeting (as scheduled)

19. Department Instructional Materials Review Committee:

Committee	Name	Signature	Date Signed
Member:	ATOZ A. VASQUEZ		Sept. 26, 2022
Member:	MARIA ROBELYN A. INSIK		Sept. 26, 2022
Chairperson	ELIZABETH S. QUEVEDO		October 4, 2022

	Name	Signature	Date Signed
Verified by:	**MA. THERESA P. LORETO** Dean, CAS		
Validated by:			

	NANCY D. ABUNDA Head, IMD		

Note:

1) The number of POs will depend on each degree program offered
2) COs and Relationship to POs
   a. (I) - **Introductory** – an Introductory Course to an outcome
   b. (E) - **Enabling** – an Enabling Course or a course that strengthens the outcome
   c. (D) - **Demonstrated** – a Demonstrative Course or a course demonstrating an outcome.

*Distribution of copies: OIMD, College, Department, Facu*REMINDER:

1. *The author should not be part of the DIMRC.*
2. **If the author is the Department Head, he/she will be replaced by another chairperson from among the senior faculty members.*
3. ***If the author is the College Dean, the Head of Instructional Materials Development will approve.*
4. *Follow the next higher supervisor, no same person*
5. *For the component campuses, if the author is the College Dean, the Director for Academic Affairs will approve.*
6. *If the author is the Department Head and at the same time the College Dean, the Director for Academic Affairs will be the Chairperson of the DIMRC, and the Chancellor will approve it.*

(3) Distribution of copies: OHIMD, Department, Faculty

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EVALUATION OF OUTCOMES-BASED EDUCATION (OBE) COURSE SYLLABUS

Course No.: Chem 150 and Course Title: Physical Chemistry
1st Semester and A.Y. 2022-2023

Name of faculty : Jacob Glenn F. Jansalin
Department/Institute : Department of Pure and Applied Chemistry
College : College of Arts and Sciences

CRITERIA	Complied	Partially Complied	Not Complied	Remarks
FORMAT				
1) The OBE course syllabus follows the university-prescribed format	✓			
2) The course syllabus covers the required number of weeks in one academic term	✓			
3) Course policies and grading system are clearly defined	✓			
4) The syllabus is designed to align with the CMO-prescribed curriculum in relation to:				
a. Program Educational Objectives to VSU Vision, Mission, and Quality Policy Statement	✓			
b. Program Outcomes to Program Educational Objectives	✓			
c. Course Outcomes to Program Outcomes	✓			
CONTENT				
1) Learning outcomes are clearly articulated *(Specific, Measurable, Attainable, Realistic, Time-bounded (SMART) and anchored on Bloom's Taxonomy of Objectives)*	✓			
2) Course coverage completely follows the course description	✓			
3) Topics/lessons are arranged in a logical – sequence	✓			
4) Gender-sensitivity and values education are integrated in the syllabus whenever applicable	✓			
5) References are relevant, varied and updated. Contains at least five book titles copyrighted within the last 5 years as prescribed by CHED	✓			

TEACHING-LEARNING				
1) Teaching-learning activities are:				
a. varied and relevant	✓			
b. outcomes-based	✓			
c. encourage active learning	✓			
d. develop the students' critical – thinking skills and reflective judgment	✓			
LEARNING ASSESSMENT				
1) Learning outcomes and methods of assessment are aligned	✓			
2) Assessment methods used are varied and relevant	✓			
3) Schedule and frequency of assessment, and expected outputs are clearly defined	✓			

General Recommendation (Pls. check):

✓	APPROVED for use
	Needs to be REVISED *(please see comments)*

Department Instructional Materials Review Committee:

Committee	Name	Signature	Date Signed
Member:	ATOZ A. VAQUEZ		Sept. 26, 2022
Member:	MARIA ROBELYN A. INSIK		Sept 26, 2022
Chairperson	ELIZABETH S. QUEVEDO		October 4, 2022

	Name	Signature	Date Signed
Verified by 1/:	**MA. THERESA P. LORETO** Dean, CAS		
Validated by 2/:	**NANCY D. ABUNDA** Head, IMD		

1/ Means of Verification: Ratings on Individual evaluation sheets of the DIMRC members
2/ Means of Validation: Final action of the College Dean

(3) Distribution of copies: OHIMD, Department, Faculty,