



OUTCOMES-BASED EDUCATION (OBE) COURSE SYLLABUS

Chem 195
PHYSICAL CHEMISTRY C³

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

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4. Quality Goals of the College of Arts and Sciences

- To produce quality manpower and graduates in biology, biotechnology, chemistry, english, liberal arts and behavioral sciences, mathematics, physics and statistics to serve the development needs of the region.
- To uplift the economic well-being of the region through relevant R and D and extension programs.
- Enhance regional development of the Visayas for regional competitiveness.

5. Quality Objectives of the Department of Pure and Applied Chemistry

- Produce highly qualified and skilled Chemists and Chemical technicians for the industry and the academia.
- Generate relevant knowledge and technologies through basic and applied multi- and inter-disciplinary researches.
- Achieve strong linkages and cooperation with domestic and international institutions and agencies involved in the pursuit of sustainable development.

II. PROGRAM INFORMATION

1. Name of the Program	Bachelor of Science in Chemistry
2. CHED CMO Reference	CMO No. 47 s. 2017
3. BOR Approval	BOR Resolution No. 63 s. 2018

4. Program Educational Objectives and Relationship to Institution Mission

Program Educational Objectives	Mission*		
	a	b	c
1. Occupy supervisory and managerial position and in educational, research institution and industries both local and international.	✓	✓	✓
2. Participate in multidisciplinary or cross-disciplinary research team.	✓	✓	✓
3. Establish own chemical-based business industries.	✓	✓	✓
4. Pursue graduate studies and specialized training program in chemistry and related field.	✓	✓	✓
5. Pursue other degree program.	✓	✓	✓

*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 195
2. Course Title	Physical Chemistry C ³
3. Pre-requisite	Chem 158
4. Co-requisite	None
5. Credit	3.0 (Lecture)
6. Semester Offered	2 nd Semester
7. Number of hours	3.0 hours/week
8. Course Description	This course is an integration of all the knowledge gained in the physical chemistry courses (Chem 157, 158, and 159 lecture and laboratory courses) and serves as a pre-review course in preparation for the chemist licensure examination (CLE)
9. Program Outcomes (POs) in relation to the Program Educational Objectives (POEs)	

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Program Outcomes (POs)		Program Educational Objectives				
		1	2	3	4	5
a	Demonstrate a broad and coherent knowledge and understanding in the core areas of chemistry: inorganic, organic, physical. Biological and analytical chemistry; and in addition, the necessary background in mathematics and physics.	✓	✓	✓	✓	✓
b	Gather data using standard laboratory equipment, modern instrumentation and classical techniques.	✓	✓	✓	✓	✓
c	Identify & solve problems involving chemistry, using current disciplinary and inter-disciplinary principles.	✓	✓	✓	✓	✓
d	Qualify for the study and/or for entry level professional employment in the general workplace.	✓	✓	✓	✓	✓
e	Work effectively and independently in multi-disciplinary and multi-cultural teams.	✓	✓	✓	✓	✓
f	Act in recognition of professional, social, and ethical responsibility.	✓	✓	✓	✓	✓
g	Effectively communicate orally and in writing using both English and Filipino.	✓	✓	✓	✓	✓
h	Articulate and discuss the latest developments in the specific field of practice (PQF level 6 descriptor).	✓	✓	✓	✓	✓
i	Interpret relevant scientific data and make judgments that include reflection on relevant scientific and ethical issues.	✓	✓	✓	✓	✓
j	Preserve and promote "Filipino historical and cultural heritage" (RA 7722).	✓	✓	✓	✓	✓

10. Course Outcomes (COs) and Relationship to Program Outcomes (POs)

After completing this course, the student must be able to perform the following COs:	Program Outcomes Code										
	a	b	c	d	e	f	g	h	i	j	
CO1: Integrate all knowledge gained about the laws of gases to solve problems in relation to gaseous systems	D		E						E		
CO2: Apply the various laws of thermodynamics and mnemonics in solving thermodynamic problems	D		E						E		
CO3: Analyze experimental data and apply chemical kinetics principles in solving problems	E		E						E		
CO4: Graphically and textually interpret phase equilibrium diagrams as well as recall the fundamental of chemical equilibrium	E		E						E		
CO5: Apply the laws of electricity and thermodynamics in analyzing and solving	E		E						E		

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chemical phenomena involving interactions between electricity and matter													
CO6: Apply the principles of quantum mechanics in analyzing and solving for the physical and chemical properties of systems in the atomic and molecular scale	E		E						E				
CO7: Apply the fundamental concepts of statistical thermodynamics to simple systems	E		E						E				

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					
1	<p>OBE Course Syllabus (including the mission and vision of VSU, and the Quality Policy Statement).</p> <p>Class Policies.</p> <p>Requirements for the course.</p> <p>Grading system and expected activities for the semester.</p> <p>Submission of course requirements.</p> <p>Introduction to the virtual classroom.</p>		<p>Class preliminaries, Q & A for any clarification, setting of expectations for the course, and getting-to-know-each other session.</p> <p>Class interaction.</p> <p>Sharing of ideas for the improvement of class delivery.</p> <p>Feedback from students.</p>		

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			Instructions for ease of access to the virtual classroom and what it will be used for.		
CO1: Integrate all knowledge gained about the laws of gases to solve problems in relation to gaseous systems					
2-3	<ul style="list-style-type: none"> Gas laws: Ideal and Real Gases 	1. Textually and graphically differentiate ideal gases from real gases 2. Solve problems involving gaseous properties	Class interaction and lecture discussion Sharing of ideas Readings from journal articles and reference books	Group work/discussions (peer learning) Note-taking Board work (wherever applicable)	Problem sets or worksheets Examination #1
CO2: Apply the various laws of thermodynamics and mnemonics in solving thermodynamic problems					
4-6	Chemical thermodynamics	1. Recall the laws of the thermodynamics and their conceptual implications 2. Solving simple problems in thermodynamics (work-heat, entropy, etc.)	Class interaction and lecture discussion Sharing of ideas Readings from journal articles and reference books	Group work/discussions (peer learning) Note-taking Board work (wherever applicable)	Problem sets or worksheets Examination #2
CO3: Analyze experimental data and apply chemical kinetics principles in solving problems					
7-8	Chemical kinetics	1. Apply chemical kinetics principles in solving kinetics problems	Class interaction and lecture discussion Sharing of ideas Readings from journal articles and reference books	Group work/discussions (peer learning) Note-taking Board work (wherever applicable)	Problem sets or worksheets Examination #3

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9	Midterm Examination				
CO4: Graphically and textually interpret phase equilibrium diagrams as well as recall the fundamental of chemical equilibrium					
10-11	Chemical and physical equilibria	1. Analyze and interpret phase equilibria plots and diagrams 2. Explain the fundamental concepts of chemical equilibrium (equilibrium expressions and constants, related problems, etc.)	Class interaction and lecture discussion Sharing of ideas Readings from journal articles and reference books	Group work/discussions (peer learning) Note-taking Board work (wherever applicable)	Problem sets or worksheets Examination #4
CO5: Apply the laws of electricity and thermodynamics in analyzing and solving chemical phenomena involving interactions between electricity and matter					
12-13	Electrochemistry	1. Apply thermodynamics and electrochemical principles in solving these kinds of problems 2. Recall the fundamentals of electrochemistry	Class interaction and lecture discussion Sharing of ideas Readings from journal articles and reference books	Group work/discussions (peer learning) Note-taking Board work (wherever applicable)	Problem sets or worksheets Examination #5
CO6: Apply the principles of quantum mechanics in analyzing and solving for the physical and chemical properties of systems in the atomic and molecular scale					
14-15	Quantum chemistry	1. Analyze and interpret properties of chemical systems at the atomic scale, and how the quantum scale dictates these properties.	Class interaction and lecture discussion Sharing of ideas Readings from journal articles and reference books	Group work/discussions (peer learning) Note-taking Board work (wherever applicable)	Problem sets or worksheets Examination #6
CO7: Apply the fundamental concepts of statistical thermodynamics to simple systems					
16-17	Statistical thermodynamics	1. Apply statistical principles in linking	Class interaction and lecture discussion	Group work/discussions (peer learning)	Problem sets or worksheets Examination

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		molecular properties to macroscopic properties of chemical systems	Sharing of ideas Readings from journal articles and reference books	learning) Note-taking Board work (wherever applicable)	on #7
18	Final Examination (Mock Board Style Examination)				
* VSUEE/VC – VSU E-Learning Environment/ Virtual Classroom https://elearning.vsu.edu.ph/course/view.php?id=2676					
12. Life-long Learning Opportunities This particular component of the C ³ series will be instrumental in having Chemistry majors remember the fundamental concepts of Physical Chemistry. In turn, this will have the added advantage of serving as a pre-review in preparation for the chemist licensure examination (CLE).					
13. Contribution of Course to Meeting the Professional Component (%) General Education: % Basic Education (Foundation): % Professional Education (Major Field): 100 %					
14. References and Other Learning Resources A. Textbook(s)/ E-Books <ul style="list-style-type: none">Silbey, R. J., Alberty, R. A., Papadantonakis, G. A., & Bawendi, M. G. (2022). <i>Physical chemistry</i>. John Wiley & Sons.Atkins, P., Atkins, P. W., & de Paula, J. (2014). <i>Atkins' physical chemistry</i>. Oxford university press.Atkins, P., & De Paula, J. (2013). <i>Elements of physical chemistry</i>. Oxford University Press, USA.Ball, D. W. (2014). <i>Physical chemistry</i>. Cengage Learning.McQuarrie, D. A., & Simon, J. D. (1997). <i>Physical chemistry: a molecular approach</i> (Vol. 1). Sausalito, CA: University science books.Piela, L. (2006). <i>Ideas of quantum chemistry</i>. Elsevier.Monk, P. M. (2008). <i>Physical chemistry: understanding our chemical world</i>. John Wiley and Sons.Chang, R. (2000). <i>Physical chemistry for the chemical and biological sciences</i>. University Science Books.Moelwyn-Hughes, E. A. (2015). <i>Physical chemistry</i>. Cambridge University Press.Kuhn, H., Försterling, H. D., & Waldeck, D. H. (2009). <i>Principles of physical chemistry</i>. John Wiley & Sons.Mortimer, R. G. (2000). <i>Physical chemistry</i>. Academic Press.					
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	No. of Times in the Semester	Individual Task % Contribution	

		(1)	(2)	(1/2)
1	Long Examinations	40	7	5.7%
2	Term Examinations	40	2	20%
3	Problem Sets and Worksheets	20	7	2.9%
...		100%		

COs	Assessment Tasks	Weight in Percent	Minimum Average for Satisfactory Rating	Target and Standards
COs 1 - 7	Long Examinations	40%	70%	At least 90% of the students have at least 70% score
	Term Examinations	40%	70%	
	Problem Sets and Worksheets	20%	70%	
TOTAL		100%		

Grading System (% Passing: 60%)			
Range	Grade	Range	Grade
97-100	1.00	65 – 69	2.75
93-96	1.25	60 – 64	3.00
89-92	1.50	55 – 59	3.25
85-88	1.75	50 – 54	3.50
80-84	2.00	45 – 49	3.75
75-79	2.25	40 – 44	4.00
70-74	2.50	01 – 39	5.00

16. Course Policies

- 1) The official virtual classroom can be found in the VSU E-Learning Environment (VSUEE) (<https://elearning.vsu.edu.ph>). A class orientation will be done in relation to the use and navigation of the platform. The link to the virtual classroom is provided in this course syllabus, you may refer to it.
- 2) Since this is a major subject for the Chemistry majors, all the sessions for the semester will be held face-to-face. If there are any emergencies or cancellations of classes, the instructor may opt to convene with the class synchronously through either ZOOM or Google Meet to facilitate announcements and continuous discussion, or through the group chat in Facebook Messenger.
- 3) Attendance is a must for all sessions in the semester and will be checked every meeting. Marks will be deducted for tardiness. For absences, you will be dropped from the course if you satisfy any of the following:
 - 3 consecutive unexplained absences
 - Non-consecutive unexcused absences amounting to 20% of the total class hours in the semester (For this class, it will **4 meetings**).

- 4) Unless otherwise state by your instructor, all requirements are to be personally passed by the student. Any instructions regarding formatting of online submissions will be addressed and clarified by the instructor handling the subject.
- 5) Worksheets and problem sets are to be submitted on any stated deadlines. Deductions will be handed out for late submissions.
- 6) Cheating and plagiarism will be severely punished. NO EXCEPTIONS. Cheating during examinations, if caught, will automatically net you a zero (0) for that examination. Plagiarism will be dealt with by reduction of marks (AI-assisted output, direct copying from internet sources, etc.)
- 7) For any additional clarifications regarding policies or the subject matter, you may visit the instructor during their consultation hours.
- 8) All students are reminded to observe all policies, regulations, and rules of the university and other related laws of the land and are advised to read, understand, and practice the provisions of the VSU Student Manual.

This class policy serves as our written agreement for the whole semester. If there are any changes to enhance the class learning opportunity within the semester, it will be communicated accordingly.

17. Course Materials and Facilities Available

1. Learning Guides (Powerpoint Presentations)
2. Journal Publications
3. Books
4. Laptop/Cellular phone
5. Internet

18. Revision History

Revision number	Date of Revision	Date of implementation	Highlights of Revision	Revised by
1	February, 2023	February, 2023	OBE compliant CMO no 47 s. 2017; ISO format compliant; conversion to v2 format; updating of learning outcomes and tasks, class policies, requirements, references, corrections	Mark Ryan R. Tripole

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0	December, 2020	January, 2021	OBE compliant CMO no 47 s. 2017; ISO format compliant;	Jacob Glenn F. Jansalin
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19. Preparation

Prepared by	Name	Signature	Date Signed
	MARK RYAN R. TRIPOLE		

IV. INSTRUCTOR/PROFESSOR INFORMATION

1. Name of Instructor/Professor	Mark Ryan R. Tripole, RCh, MSc
2. Office and Department	Department of Pure and Applied Chemistry
3. Telephone/Mobile Numbers	+63 920 119 6784
4. Email Address	mark.tripole@vsu.edu.ph
5. Consultation Time	TBA

20. Department Instructional Materials Review Committee:

Committee	Name	Signature	Date Signed
Member:	VIVIAN P. LINA		
Member:	MARIA ROBELYN A. INSIK		
Chairperson:	ELIZABETH S. QUEVEDO		

	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.

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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