



## OUTCOMES-BASED EDUCATION (OBE) COURSE SYLLABUS

Chem 231  
Carbohydrate and Lipid Metabolism

### 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.

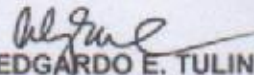
#### 3. VSU Quality Policy Statement

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 Office of the Graduate School

Produce high quality manpower in science and technology, especially for agriculture and its allied fields, environmental management and industry through graduate education to serve the development needs of the region.

#### 5. Quality Objectives of the Office of the Graduate School

- To offer graduate courses to teachers, researchers, extension workers, administrators, and other professionals;
- To train and guide graduate students in conducting productive and independent research studies relevant to agriculture and its allied fields, environmental management, and industry;
- To design and implement innovative strategies for the enhancement of managerial and leadership skills of professional and development workers; and,
- To strengthen personal discipline and moral character of graduate students to better serve their clientele.

## II. PROGRAM INFORMATION

1. Name of the Program	Master of Science in Chemistry
2. CHED CMO Reference	CMO 15 s. 2019
3. BOR Approval	BOR Resolution 118 s. 2017

#### 4. Program Educational Objectives and Relationship to Institution Mission

Program Educational Objectives	Mission*		
	a	b	c
1. Professional employment in industry, academe, and research institutions in local and international arena	✓	✓	✓
2. Participate in multi-disciplinary or cross-disciplinary and multi-cultural research teams	✓	✓	✓
3. Pursue more advanced studies and specialized training programs in chemistry and related fields.	✓	✓	✓
4. Professionally interpret and communicate research results through oral/written presentations in local and international fora	✓	✓	✓

\*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 231
2. Course Title	Carbohydrate and Lipid Metabolism
3. Pre-requisite	Undergraduate Biochemistry/Consent of Professor
4. Co-requisite	None
5. Credit	3 units
6. Semester Offered	First Semester
7. Number of hours	3 hours per week
8. Course Description	Properties, functions and metabolism of carbohydrates and lipids

**Vision:**  
**Mission:**

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V02 11-14-2022

No. 27-04



9. Program Outcomes (POs) in relation to the Program Educational Objectives (POEs)					
Program Outcomes (POs)		Program Educational Objectives			
		1	2	3	4
A	Display and articulate a broad and coherent knowledge and understanding in chemistry and its allied fields (PQF 7 descriptor)	✓	✓	✓	✓
B	Design and conduct experiments using various chemical instrumentation techniques	✓	✓	✓	✓
C	Work effectively and independently or in multi-disciplinary and multi-cultural teams	✓	✓	✓	✓
D	Demonstrate self-directed research work and/or leadership in specialized or multi-disciplinary field (PQF 7 descriptor)	✓	✓	✓	✓
E	Identify and solve societal problems involving chemistry independently or in multi-disciplinary/multi-cultural research groups	✓	✓	✓	✓

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
1. Review the laws of thermodynamics, the types of biochemical reactions and their regulation	E	D	D	D	D
2. Trace the anabolic and catabolic pathways of carbohydrate metabolism	E	D	D	D	D
3. Write the net reactions of each metabolic pathway and calculate the ATP yield	E	D	D	D	D
4. Trace the anabolic and catabolic pathways of lipid metabolism	E	D	D	D	D
5. Write the net reactions of each metabolic pathway and calculate the acetyl Co-A yield	E	D	D	D	D
6. Describe the interplay of hormones in the body in coordinating fuel metabolism	E	D	D	D	D

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	OBE Course Syllabus (including VSU Vision Mission, and Quality Policy Statement)  Class Policies  Course Requirements  Grading System and Activities  Submission of		Q & A for clarification  Setting of expectations, and getting-to-know-each other  Class interaction		



	requirements Values Integration		Sharing of Ideas Feedback VSUEE/VC : Familiarization of the virtual classroom		
<b>CO1</b> Review the laws of thermodynamics, the types of biochemical reactions and their regulation					
1-2	<b>1. Introduction to Metabolism</b> 1.1 Bioenergetics and Thermodynamics 1.2 Phosphoryl Group Transfers and ATP 1.3 Biological Oxidation-Reduction Reactions 1.4 Regulation of Metabolic Pathways	1. correlate biological energy transformation to thermodynamics 2. calculate the standard free energy of hydrolysis of some phosphorylated compounds 3. describe the structures and redox chemistry of the most common of the specialized electron carriers 4. integrate the metabolic pathways and their regulation	Powerpoint presentation  Interactive Discussion	Note-taking  Downloading resource materials  Problem Solving	Recitation  Quiz  Exam
<b>CO2</b> Trace the anabolic and catabolic pathways of carbohydrate metabolism					
<b>CO3</b> Write the net reactions of each metabolic pathway and calculate the ATP yield					
3-4	<b>2. Glycolysis</b> 2.1 Glycolysis 2.2 Feeder Pathways for Glycolysis 2.3 Fates of Pyruvate	5. write the 10 reactions of glycolysis and calculate the net yield of ATP 6. illustrate how the other sugars will enter glycolysis 7. consider the metabolic	Powerpoint presentation  Video clip  Interactive Discussion	Note-taking  Downloading resource materials  Writing overall and net reactions  Calculation	Recitation  Journal critiquing  Quiz



		pyruvate		yield	
				Flow diagrams	
<b>CO2</b> Trace the anabolic and catabolic pathways of carbohydrate metabolism					
<b>CO3</b> Write the net reactions of each metabolic pathway and calculate the ATP yield					
5	<b>3. Gluconeogenesis</b> 3.1 Reactions of Gluconeogenesis 3.2 Coordinated Regulation of Glycolysis and Gluconeogenesis	8. compare the gluconeogenic and glycolytic reactions 9. reflect on how glycolysis and gluconeogenesis are coordinately regulated 10. deduce why glycolysis and gluconeogenesis are not reversible pathways	Powerpoint presentation Video clip Interactive Discussion	Note-taking Downloading resource materials Writing net reactions Flow diagrams	Recitation Report
<b>CO2</b> Trace the anabolic and catabolic pathways of carbohydrate metabolism					
<b>CO3</b> Write the net reactions of each metabolic pathway and calculate the ATP yield					
6	<b>4. Pentose Phosphate Pathway (PPP)</b> 4.1 Oxidative Phase of PPP 4.2 Non-oxidative Phase of PPP 4.3 Important Products of PPP 4.4 Integrating glycolysis and PPP	11. write the reactions of the oxidative and non-oxidative phase of PPP 12. distinguish the important products of PPP and their subsequent roles in other metabolic pathways 12. determine the link between glycolysis and PPP	Powerpoint presentation Video clip Interactive Discussion	Note-taking Downloading resource materials Writing net reactions Flow diagrams	Recitation Quiz Exam
<b>CO2</b> Trace the anabolic and catabolic pathways of carbohydrate metabolism					
<b>CO3</b> Write the net reactions of each metabolic pathway and calculate the ATP yield					
7-8	<b>5. Metabolism of Glycogen</b> 5.1 Structure and Function of Glycogen 5.2 Breakdown and Synthesis of Glycogen 5.3 Coordinated Regulation of Glycogen Breakdown and Synthesis	13. review the structure and function of glycogen 14. contrast glycogenesis and glycogenolysis 15. reflect on the coordinated regulation of	Powerpoint presentation Video clip Interactive Discussion	Note-taking Downloading resource materials Flow diagrams	Recitation Quiz Report Journal Critiquing



		glycogenesis and glycogenolysis			
9	MIDTERM EXAMINATION				
CO2 Trace the anabolic and catabolic pathways of carbohydrate metabolism					
CO3 Write the net reactions of each metabolic pathway and calculate the ATP yield					
10-11	<b>6 Citric Acid Cycle (CAC)</b> 6.1 Production of Acetyl Co-A 6.2 Reactions of the Citric Acid Cycle 6.3 The Hub of Intermediary Metabolism 6.4 Regulation of the Citric Acid Cycle	16. examine how pyruvate is converted to acetyl Co-A 17. write the 8 reactions of the CAC 18. infer why the CAC is the hub of intermediary metabolism 19. point out the regulatory steps of the CAC	Powerpoint presentation  Video clip  Interactive Discussion	Note-taking  Downloading resource materials  Writing net reactions  Calculating ATP yield  Flow diagrams	Recitation  Quiz  Exam  Report
CO4 Trace the anabolic and catabolic pathways of lipid metabolism					
CO5 Write the net reactions of each metabolic pathway and calculate the acetyl Co-A yield					
12-13	<b>7 Fatty Acid Catabolism</b> 7.1 Digestion, Mobilization and Transport of Fats 7.2 Oxidation of Fatty Acids 7.3 Ketone Bodies	20. outline how lipids are digested, mobilized and transported in the body 21. calculate the yield of acetyl Co-A and number of cycles needed during $\beta$ -oxidation of fatty acids 22. illustrate when and how ketone bodies are formed	Powerpoint presentation  Video clip  Interactive Discussion	Note-taking  Downloading resource materials  Writing net reactions  Calculating the yield of acetyl Co-A  Flow diagrams	Recitation  Journal critiquing
CO4 Trace the anabolic and catabolic pathways of lipid metabolism					
CO5 Write the net reactions of each metabolic pathway and calculate the acetyl Co-A yield					
14-15	<b>8. Lipid Biosynthesis</b> 8.1 Biosynthesis of Fatty Acids and Eicosanoids 8.2 Biosynthesis of Triacylglycerols 8.3 Biosynthesis of Membrane Phospholipids	23. outline the biosynthesis of fatty acids, eicosanoids, triacylglycerols, membrane phospholipids, cholesterol,	Powerpoint presentation  Video clip  Interactive Discussion	Note-taking  Downloading resource materials  Flow	Recitation  Quiz  Exam  Journal Critiquing  Report



	8.4 Cholesterol, Steroids and Isoprenoids: Biosynthesis, Regulation and Transport	steroids and isoprenoids 24. point out the regulatory steps in cholesterol, steroids and isoprenoids biosynthesis and their transport in the body		diagrams  Writing net reactions  Calculating the yield of acetyl Co-A	
CO6 Describe the interplay of hormones in the body in coordinating fuel metabolism					
16-17	<b>9 Hormonal Regulation and Integration of Mammalian Metabolism</b> 9.1 Hormone Structure and Action 9.2 Tissue-Specific Metabolism 9.3 Hormonal Regulation of Fuel Metabolism 9.4 Obesity and the Regulation of Body Mass 9.5 Diabetes Mellitus	25. examine how hormones play an important role in mammalian metabolism  26. explain the involvement of hormones in the occurrence of obesity and diabetes mellitus	Powerpoint presentation  Video clip  Interactive Discussion	Note-taking  Downloading resource materials  Flow diagrams	Recitation  Report  Exam
18	FINAL EXAMINATION				
<b>12. Life-long Learning Opportunities</b> Students will be able to explain the practical applications of the metabolism of carbohydrates and lipids in chemistry, food science, agriculture, medicine and related fields.					
<b>13. Contribution of Course to Meeting the Professional Component (%)</b>  General Education: 0 % Basic Education ( <i>Foundation</i> ): 0 % Professional Education ( <i>Major Field</i> ): 100 %					
<b>14. References and Other Learning Resources</b> <b>A. Textbook(s)/ E-Books</b> 1. Garrett, R.H. and C.M. Grisham. 2017. Biochemistry, 6 <sup>th</sup> edition. Cengage Learning 2. Rodwell, V.W., Bender, D.A., Botham, K.M., Kennelly, P.J. and P.A. Weil. 2018. Harper's Illustrated Biochemistry, 31 <sup>st</sup> edition. McGraw-Hill Education 3. Nelson, D.L. and M. M. Cox. 2017. Lehninger Principles of Biochemistry, 7 <sup>th</sup> edition, W.H. Freeman and Company  <b>B. Other Learning Resources</b> Scientific Journals					
<b>15. Course Assessment and Evaluation</b> The performance of students will be assessed and evaluated based on the following					
Item No,	Assessment Tasks	Percentage Contribution (1)	No. of Times in the Semester (2)	Individual Task % Contribution (1/2)	
1	Quizzes	15	6	2.50	
2	Exams	50	5	10.00	



3	Report	20	4	5.00
4	Journal critiquing	15	4	3.75
		100%		
COs	Assessment Tasks	Weight in Percent	Minimum Average for Satisfactory Rating	Target and Standards
Cos 1-5	Quiz	15	80%	At least 70% of the students will obtain a passing mark of 80%
	Exam	50		
	Report	20		
	Journal Critiquing	15		
TOTAL		100%		

Grading System (% Passing: 60)			
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	below 60	5.00

#### 16. Course Policies

- Keep up with the lessons and do all the necessary assignments required of you.
- Questions about the lessons and other related concerns in the subject will be done during class hours.
- Handouts will be uploaded in the VSUEE.
- Submissions will be done during class hours.
- Chapter exams and Term Exams will be given during class hours. Special exams will be given for those who have valid reasons for not taking the exams during the agreed schedule.
- University policies on class attendance will be strictly followed.
- Be HONEST: even if others are not, even if others will not, even if others cannot.

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

- Lecture notes
- Video clips
- Laptop
- LCD Projector
- VSUEE

#### 18. Revision History

Revision number	Date of Revision	Date of Implementation	Highlights of Revision
00		August 2023	

#### 19. Preparation

Prepared by	Name	Signature	Date Signed
	MA. THERESA P. LORETO	<i>mtpln</i>	23 Feb 2023

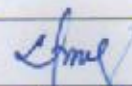
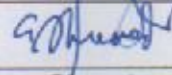

#### IV. INSTRUCTOR/PROFESSOR INFORMATION

1. Name of Instructor/Professor	MA. THERESA P. LORETO
2. Office and Department	Department of Pure and Applied Chemistry



3. Telephone/Mobile Numbers	09194191915
4. Email Address	mtploreto@vsu.edu.ph
5. Consultation Time	TBA

**20. Department Instructional Materials Review Committee:**

Committee	Name	Signature	Date Signed
Member:	FELIX M. SALAS		
Member	ALLAN A. RAMAL		2/23/2023
Chairperson/ Department Head:	ELIZABETH S. QUEVEDO		2/23/2023 
	Name	Signature	Date Signed
Verified by:	ANABELLA B. TULIN College Dean		2/23/2023
Validated by:	NANCY D. ABUNDA Head, IMD		