Inter-American University of Puerto Rico
Enclosure _____
Department of _____
CHEMISTRY PROGRAM

SYLLLABUS

I. GENERAL INFORMATION

Course Title	**:**	Food Chemistry
Code and Course	**:**	CHEM 3360
Credits	**:**	3 credits
Academic Term	**:**	
Professor	**:**	
Place and hours of Office	**:**	
Office Phone	**:**	
Email	**:**	

II. DESCRIPTION

Study and state of dispersion of the components of foods: water, carbohydrates, proteins, lipids, enzymes, inorganic nutrients and those responsible for color and flavor. Study of the toxicology of compounds inherent to foods and those that are generated by means of their processing. Prerequisite: CHEM 2222. 3 credits .

III. OBJECTIVES

1. **General Aspects of water chemistry** – Study the properties of water and its influence on the processes for handling and transforming food.

    1.1. Identify water sources for humans
    1.2. Know the approximate water content in food
    1.3. Relate the properties of water with the processes of canning, sterilization, microwave heating
    1.4. Describe the water phase diagram
    1.5. Relate the changes of state with the processes of dehydration, lyophilization
    1.6. Describe the dissolution process
    1.7. Relate the properties of the solutions with the maintenance of freshness in plant foods
    1.8. Differentiate between free water and bound water in food
    1.9. Define water activity
    1.10. Describe the adsorption and desorption curves
    1.11. Relate adsorption and desertion curves to food preservation
    1.12. Relating water activity to food stability
    1.13. Explain the effects of freezing a food

2. **Carbohydrates** – Characterize carbohydrates, their properties and relationship with food

    2.1 Classify key carbohydrates in food
    2.2 Linking fruit ripening to the conversion of starch into sugar
    2.3 Review the chemical structure of the most common monosaccharides, including amino sugars, deoxy sugars, polyols
    2.4 Describe glycosides formation
    2.5 Describe the structure of common disaccharides such as sucrose, maltose, and lactose
    2.6 Describe the Maillard darkening reaction and the factors that affect it

2.7 Discuss the properties of sugars that are related to the preservation, hydration, and sweetening power of foods
2.8 Analyze the phenomenon of starch gelatinization
2.9 Identify starch products such as dextrin's
2.10 Interaction of starch with other substituents
2.11 Explain the effect of glycogen on meat quality
2.12 Description of the properties of gums and their properties as thickeners and gelling agents and their functional properties such as emulsification, cryoprotection and stabilization
2.13 Describe the composition of the fiber
2.14 Differentiate between raw fiber and dietary fiber

3. Lipids – Analyze the structures and properties of lipids

3.1 Classifying lipids
3.2 Characterizing lipids from the physical-chemical point of view
3.3 Describe the manufacture of fat and oils
3.4 Describe the processes of fat and oil modification
3.5 Distinguishing fatty systems in foods
3.6 Recognize the process of lipid deterioration
3.7 Determining lipid oxidation
3.8 Establish nutritional aspects

4. Proteins – Determine the fundamental characteristics of proteins, their structure and relationship with food

4.1 Identify the structure of amino acids
4.2 Recognize techniques for protein detection
4.3 Describe the primary structure of proteins
4.4 Describe the secondary structure of proteins
4.5 Describe the tertiary structure of proteins
4.6 Describe the quaternary structure of proteins
4.7 Comparing denaturation and proteolysis of proteins
4.8 Recognizing the functional properties of proteins
4.9 Describe the characteristics of important proteins in foods

5. Enzymes – Determine the fundamental characteristics of enzymes and their relationship tofood

5.1 Identify enzymes as biological catalysts
5.2 Recognize the active site of enzymes
5.3 Examine factors that affect the speed of enzyme reactions
5.4 Quantify enzyme activity
5.5 Review important enzymes in foods
5.6 Recognize enzymes as indicators of food quality
5.7 To establish the importance of recombinant DNA technology applied to the production and modification of enzymes of interest in food

6. Vitamins and inorganic nutrients – Examine the basis of the use of vitamins as nutrients.

6.1 Classify vitamins
6.2 Describe the chemical properties of vitamins
6.3 Analyze the stability of vitamins
6.4 Relate additives to vitamins when incorporated into different foods
6.5 Establish the importance of inorganic or mineral nutrients

7. **Aroma and flavor** – Analyze the characteristics of the molecules associated with aroma and flavor, the mechanisms in the generation of the same and the methods to analyze them

    7.1 Classify flavors
    7.2 Classify aromas
    7.3 Describe the phenomena of perception associated with tastes
    7.4 Recognize physico-chemical aspects in the perception of taste and aroma
    7.5 Examine the mechanisms of the generation of aromas and flavors
    7.6 Identify precursors and development of aroma and flavor in food
    7.7 Analyze aroma and flavor compounds

8. **Additives-** Evaluate common additives

    8.1 Classify additives
    8.2 Recognize legal aspects in the addition of additives
    8.3 Examining the properties of the most common additives

9. **States of Dispersion-** Formulate the basic mechanisms and factors that determine the stability of colloids

    9.1 Defining a colloid
    9.2 Classifying colloids
    9.3 Relate the stability of colloids with the application in the food industry
    9.4 Describing peptization
    9.5 Analyze the mechanisms of transformation from suns to gels
    9.6 Describe the structure of a foam
    9.7 Analyzing the characteristics of an emulsion

10. **Toxics present in food** – Characterize the toxic compounds present in food\

    10.1 Define the types of toxic substances present in food
    10.2 Characterizing toxic substances in food
    10.3 Linking toxicity to disease

11. **Transgenic foods –** Analyze the different types of transgenic foods.

    11.1 Describe the main methods for gene transfer.
    11.2 Describe genetically modified organisms of commercial interest
    11.3 Recognizing first-, second- and third generation genetically modified organisms
    11.4 Assess potential impacts on human health

IV. Thematic Content

UNIT	THEMATIC CONTENT		*Exam*	
Introduction and Syllabus	Syllabus			
Water	• Properties of water • Physical states of water • Effect of solutes on water • Distribution of water in food • Determination of adsorption and desorption curves	• Water activity and food stability • Intermediate moisture foods • Freezing of food • Water in the food industry	EXAM #1	EXAM #3 -FINAL (70% MATERIAL EXAMS #1 and #2, 30% units not evaluated in exams)-
Carbohydrates	• Classification and nomenclature • Monosaccharides • Amino sugars • Deoxy sugars • Sugars alcohols or polyols • Glycosides	• Oligosaccharides • Chemical reactions of monosaccharides • Sugar technology • Polysaccharides • Fibers		
Lipids	• Classification • Physical and chemical analyses • Manufacture of fat and oils • Fat and oil modification processes	• Fatty systems in food • Lipid deterioration • Determination of oxidation • Nutritional aspects		
Proteins	• Amino acids • Peptides and peptide bonds • Structural organization • Denaturation	• Functional properties of proteins • Nutritional properties • Proteins from some foods • Chemical modifications		
Enzymes	• Nomenclature • Enzymes as catalysts • Specificity • Active site • Factors affecting the speed of enzymatic reactions	• Industrial use of enzymes • Review of enzymes of interest in food • Chemical analysis by enzymes • Enzymes as indicators of food quality • Kinetics of enzymatic reactions	EXAM #2	
Vitamins and inorganic nutrients	• Vitamin content in food • Fat-soluble vitamins	• Water-soluble vitamins • Stability of vitamins • Inorganic nutrients		
Aroma and Taste	• Taste • perception phenomena associated with tastes • Aroma • Physico-chemical aspects in the perception of taste and aroma	• Mechanisms of the generation of aromas and flavors • Precursors and development of aromas and flavors in food • Analysis of aroma and flavor compounds		
Additives	• Legal aspects • Conservative • Emulsifiers • Flavor enhancers • Alkalizing acidulants and pH regulators • Chelating	• Sweeteners • Raising agents • Defoamers • Dyes • Nutrients • Other additives		
Dispersion States	• Classification of colloids • Stability of colloids • Soles	• Gels • Foams • Emulsions		
Toxics present in food	• Legumes • Cereals • Amylase inhibitors • Stimulant drinks • Toxic peptides, proteins and amino acids • Goiter-promoting substances	• Toxins in shellfish and fish • Process-generated toxics • Racemization of amino acids and formation of isopeptides • Fumigants and solvents		
Transgenic foods	• Main methods for gene transfer • Commercial genetically modified organisms for food • Second-generation genetically modified organisms	• Third generation genetically modified organisms • Modifications of interest to producers and consumers • Potential impacts on human health and risk analysis		

V. ACTIVITIES

Forums
Video
Exams

Quizzes
Practice exercises

VI. EVALUATION

a. The course evaluation consists of:

Evaluation Criteria	Points	% of final grade
Partial Exam #1	100	25
Partial Exam #2	100	25
Final Exam	100	25
Quizzes	100	20
Forum participation	25	5
Total	**525**	**100**

b. The Chemical Evaluation Scale will be applied

100-85 A
84-75 B
74- 65 C
64- 55 D
54- 0 F

VII. EDUCATIONAL RESOURCES:

Textbook: Química de los Alimentos. Salvador Badui **Dergal. Pearson/ Addison Wesley,** Fifth **edition, 2013. ISBN 978-607-32-1508-4**

VIII. BIBLIOGRAPHY

Books

Introduction to the Chemistry of Food, Zeece M., 1st Edition Academic Press, 2020, ISBN 978-0128094341

Fennema's Food Chemistry, 2017. 5 th Edition, S. Damordaran, K. Parkin, O. Fennema Eds. CRC Press. **ISBN-13** 978-1482208122

Principles of Food Chemistry, John de Man Springer; 4th ed. 2018 edition., 978-3319636054

Introductory Food Chemistry, Brady J.: Comstock Publishing Associates; Illustrated edition 2013, ISBN-13: 978-0801450754

Food: The Chemistry of its Components, Coultate, T., Royal Society of Chemistry; 6th edition 2016, ISBN-13: 978-1849738804

Chemistry and Biochemistry of Food, Perez-Castineira, J., De Gruyter Textbook, 2020, ISBN-13 : 978-3110595475

Química de los alimentos 3ªED (Spanish Edition) Belitz H-D., Grosch W., Schieberle, P., Editorial Acribia, S.A.; 1st edition, 2012, ISBN-13 : 978-8420011622

Food Chemistry, Belitz H. D. y Grosch W. 2009. 4 Ed. Springer-Verlag, Alemania ISBN-13: 978-3540699354

Audiovisual Resources

List of links to videos

Videos related to water activity topic:

https://www.youtube.com/watch?v=mIlTDQKVIvo - Water activity
https://www.youtube.com/watch?v=3Y8qnzxZka0 - Water activity and Isotherms I
https://www.youtube.com/watch?v=iM7iea9WTys - Water activity and Isotherms II
https://www.youtube.com/watch?v=fKIUbBdXZZ8 - Water activity and Isotherms III
https://www.youtube.com/watch?v=_tOt0ZOjxeI - Water activity and Isotherms IV

Videos related to periodic table of foods

https://www.youtube.com/watch?x-yt-cl=84503534&v=gbmw-TFGnM4&x-yt-ts=1421914688 - Periodic Table of Foods 1/4
https://www.youtube.com/watch?v=ZyrfHx1-3fo -Periodic Table of Foods 2/4
https://www.youtube.com/watch?v=KNt2DNaVOcw- Periodic Table of Foods 3/4

Videos related to the topic of carbohydrates

https://www.youtube.com/watch?v=XIfVSMaGSKc - Maillard reaction
https://www.youtube.com/watch?v=z2xKlwhh9fA - Darkening Reaction
https://www.youtube.com/watch?v=jvjRFwL0aek - Non-enzymatic darkening
https://www.youtube.com/watch?v=25VOaenld8k - Starch Gelling Capacity
https://www.youtube.com/watch?v=E0vBrTS9npU - (fibers) The value of fibers in food

Lipid-related videos

https://www.youtube.com/watch?v=bxCX2u8KhKw Butter
https://www.youtube.com/watch?v=qG-dKoXqJD4 -Power of metabolism
https://www.youtube.com/watch?v=VmzzsvwPjOw - Ice Cream
https://www.youtube.com/watch?v=msBPRY-2MyU - Ice Cream
https://www.youtube.com/watch?v=3RlKsEdwpC4 - Mayonnaise
https://www.youtube.com/watch?v=BgjTvqkYpAI - Dressing

Protein-related videos

https://www.youtube.com/watch?v=2IWSYOHNUpA - Protein classification
https://www.youtube.com/watch?v=iTFy11MUiP4 - Protein Denaturation

Enzyme-related videos

https://www.youtube.com/watch?v=tI69AVRW0DU - Enzymes - What Are They And How Do They Work?
https://www.youtube.com/watch?v=XUn64HY5bug - Enzymes and... Pac-Man?
https://www.youtube.com/watch?v=WOAcp15VLJ0 - Enzymes
https://www.youtube.com/watch?v=6MbfBLbhmfs - Enzymes: Structure, Characteristics and Functions
https://www.youtube.com/watch?v=0Jr7gxy3bKI - Enzymes
https://www.youtube.com/watch?v=6vEQ3o2b1wU - Enzymes: Classification
https://www.youtube.com/watch?v=xtI8OuspHBY - Scald the swing)
https://www.youtube.com/watch?v=s56_C7qs4qk - Food Thermal Process: Cooking - Scalding - Pasteurization - Commercial Sterilization

Videos related to Vitamins

Soluble

https://www.youtube.com/watch?v=8365jRcKd6o - Vitamins: History, Structure and Classification
https://www.youtube.com/watch?v=uF5vRljZQw8 -Fat-soluble Vitamins: Vitamin A
https://www.youtube.com/watch?v=1oCodcCmLyI -Fat-soluble vitamins: Vitamin D
https://www.youtube.com/watch?v=Ql58f1CsV18 -Fat-soluble vitamins: Vitamin E
https://www.youtube.com/watch?v=8EF0m33pXMs -Fat-soluble vitamins: Vitamin K

Soluble

https://www.youtube.com/watch?v=yP2-AZnH4gY -Water-soluble vitamins: Vitamin B1 or Thiamine
https://www.youtube.com/watch?v=sS2ZLAS_09o - Water-soluble vitamins: Vitamin B2 or Riboflavin
https://www.youtube.com/watch?v=si40U7Dshgg -Hydrosolubles vitamins: Vitamin B3 or Niacin nicotinic acid)
https://www.youtube.com/watch?v=pangp1_26xY -Water-soluble vitamins: Vitamin B5 or Pantothenic acid
https://www.youtube.com/watch?v=decuC34omzI -Water-soluble vitamins: Vitamin B6 or Pyridoxine
https://www.youtube.com/watch?v=FqlAsblFcwA -Water-soluble vitamins: Vitamin B9 or Folic acid
https://www.youtube.com/watch?v=9bz-LqwtSbk -Water-soluble vitamins: Vitamin B12 or Cobalamin
https://www.youtube.com/watch?v=jRkCifj-Twc -Water-soluble vitamins: Biotin)
https://www.youtube.com/watch?v=aZduSrt6Cxc -(Water-soluble vitamins: Vitamin C or Ascorbic acid

Related Videos Smell and Taste

https://www.youtube.com/watch?v=TgRYxO5-VXQ -Is taste the same as taste?
https://www.youtube.com/watch?v=q7e1-Mm5QAQ - Didactic video: taste
https://www.youtube.com/watch?v=Vy87llSAqro - Sense of taste (Animated)
https://www.youtube.com/watch?v=cWQV82bpwbc - SENSE OF TASTE
https://www.youtube.com/watch?v=hQgtF_bsYw4 - SENSE OF SMELL

Videos related to Additives

https://www.youtube.com/watch?v=sFgzxQ74U8A - food additives
https://www.youtube.com/watch?v=ILfU6fXRzcQ - Additives and Preservatives-
https://www.youtube.com/watch?v=7Se1vVOMXKg - Additives in food

Videos related to Dispersal Statusn

https://www.youtube.com/watch?v=q96ljVMHYLo
https://www.youtube.com/watch?v=Ti0QroYDta8 - Chemistry 9.4 Solutions, Colloids and Suspensions
https://www.youtube.com/watch?v=GG8i5D9U4DI - Chemistry in Action: Properties and Stability of Colloids
https://www.youtube.com/watch?v=u2JSiyolnwo - What Is An Emulsion & How Does It Work?

Related Videos Toxics in Food

http://www.youtube.com/watch?v=Jz20OsV8Wg4 - The 10 most dangerous toxic substances present in food
http://www.youtube.com/watch?v=vSw_HTnghTY - How to protect ourselves from toxics in food. 10 tips.
http://www.youtube.com/watch?v=qYld_DMFkSQ - The 10 most toxic foods in the world

Videos related to Transgenic Foods

https://www.youtube.com/watch?v=Bvpl5Wccd9w -life cycle of agrobacterium tumefaciens
https://www.youtube.com/watch?v=nxjIbBiudp0 -Biobalística
https://www.youtube.com/watch?v=VqklR_8YRfA -How a gene gun works
https://www.youtube.com/watch?v=2G-yUuiqIZ0 -How Are GMOs Created?
https://www.youtube.com/watch?v=riCQ8R3EG9U - What is a GMO? Let us quickly explain...

Electronic Resources

- Vegetarian Resource Group; www.vrg.org
- Food and Drug Administration; www.fda.gov
- FDA Food Ingredients and Colors http://www.fda.gov/Food/FoodIngredientsPackaging/ucm094211.htm
- Summary of Color Additives for Use in in Foods, Drugs, Cosmetics, and Medical DevicesUnited States
- http://www.fda.gov/ForIndustry/ColorAdditives/ColorAdditiveInventories/ucm115641.htm
- United States Department of Agriculture; www.usda.gov/cnpp
- Centers for Disease Control and Prevention; www.cdc.gov
- Environmental Protection Agency; www.epa.gov/safewater
- WebMD; www.webmd.com
- Tufts Nutrition and Health; www.healthletter.tufts.edu
- USDA National Nutrient Database for Standard Reference http://www.nal.usda.gov/fnic/foodcomp/search
- http://www.quimicaorganica.net
- http://www.food-info.net
- http://www.fitnasio.com
- http://www.uco.es/master_nutricion/
- http://www.alimentacion-sana.org/
- http://www.biologia.edu.ar
- http://www.bionova.org.es/
- http://quimica.laguia2000.com
- http://www.foodadditives.org

IX. Special Notes

1. Auxiliary services or special needs

Any student who requires auxiliary services or special assistance must request them at the beginning of the course or as soon as he becomes aware that he needs them, through the corresponding registration, in the office of the in the Office of Orientation with

_____

2. Honesty, fraud and plagiarism

Dishonesty, fraud, plagiarism and any other inappropriate behavior in relation to academic work constitute major infractions sanctioned by the General Regulations of Students. Major infractions, as provided for in the General Regulations of Students, may result in the suspension of the University

for a defined period of more than one year or the permanent expulsion from the University, among other sanctions.

3. Use of electronic devices

Cell phones and any other electronic devices that could disrupt teaching and learning processes or alter the environment conducive to academic excellence will be disabled. Pressing situations will be addressed, as appropriate. The use of electronic devices that allow access, storage or sending data during evaluations or exams is prohibited.

4. Compliance with the provisions of Title IX

The Federal Higher Education Act, as amended, prohibits discrimination on the basis of sex in any academic, educational, extracurricular, athletic, or any other program or employment, sponsored or controlled by an institution of higher education regardless of whether it is performed on or off the premises of the institution, if the institution receives federal funds.

As provided by applicable federal regulations, our academic unit has appointed a Title IX Assistant Coordinator to provide assistance and guidance in connection with any alleged incident constituting sex or gender discrimination, sexual harassment or sexual assault. You can contact the Assistant Coordinator _____,extension _____, or email _____.

The Normative Document entitled **Rules and Procedures for Dealing with Alleged Violations of the Provisions of Title IX** is the document that contains the institutional rules for channeling any complaint that is filed based on this type of allegation. This document is available on the portal of the Inter-American University of Puerto Rico (www.inter.edu).

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