****

**Department of Food Technology**

**College of Agriculture**

**University of Salahaddin**

**Subject: Food Chemistry**

**Course Book – (Year 3)**

**Lecturer's name Dr. Nawal H. Sebo**

**Academic Year: 2021-2022**

**Course Book**

|  |  |  |
| --- | --- | --- |
| **1. Course name** | **Food Chemistry (Theory)** | |
| **2. Lecturer in charge** | **Nawal Hurmiz Sebo** | |
| **3. Department/ College** | **Agriculture/ Food Technology** | |
| **4. Contact** | **e-mail - nawal.sebo@su.edu.krd:**  **Tel: 07504451952** | |
| **5. Time (in hours) per week** | **Theory: 2 + Practical: 3** | |
| **6. Office hours** | **Sunday + Monday 9:30-12:00am** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | **M.Sc . 1987 , Ph.D. 2008 in food chemistry with excellent experience in**  **different area of food technology subjects , Lecturing different subjects in**  **food technology department for under graduate students, post graduate ,**  **assisting in laboratory sections teaching( Food Chemistry ,Dairy Chemistry**  **Industrial Enzymes ,Cheese and Dairy Fermented product Technology ,Food**  **and Dairy Science and Technology ,Biochemistry)and supervising many post**  **graduate thesis .**  **Participating in different activities in the college of Agriculture from**  **administrational point of view and supervising the implementation of some**  **dairy processing plants.** | |
| **9. Keywords** |  | |
| **10. Course overview:**  **-The course will cover water, carbohydrates, protein, lipids, minerals, vitamins and enzymes. In addition,**  **colour, flavour, and additives will be discussed.**  **-The lab component will cover the principles of chemical and instrumental methods for the qualitative and**  **quantitative analyses of moisture, protein, carbohydrate, lipids, minerals and vitamins. Students will perform**  **experiments to determine major food components using chemical and instrumental methods.**  **-This course deals with the chemical composition of food; physical, chemical and biochemical reactions**  **and the impact of these reactions on food quality during postharvest/ processing, storage and utilization.**  **-This course relates to chemical, physical and functional properties of food constituents and the variable**  **effects of processing on those constituents using an array of both basic and recently developed chemical,**  **biochemical and instrumental technologies in accordance with current food technology.** | | |
| **11. Course objective:**  **1- The course is intended to give students an overview of the chemical and physical properties of the major**  **and minor food components and their changes during processing, handling and storage and to establish a**  **connection between the chemical structure of food components and their roles in chemical reactions and**  **properties of food and food products.**  **2-Develop and understanding of how individual food components contributes to the overall quality of food**  **products.**  **3-Achieve an understanding of the chemical changes that take place with food components during**  **processing and storage.**  **4-Recognize reactions and mechanisms important in food chemistry.**  **5-Be capable of designing and conducting experiments.**  **6- Students will be able to identify the structure of food constituents and relate the structure to the**  **constituents function and importance in foods with respect to food quality, nutrition, safety, processing, etc.**  **7- Students will also distinguish chemical interactions and reactions of food components and their effect on**  **sensory, nutritional and functional properties of foods, and how processing influences these.**  **8- The student will explain how environmental factors such as temperature, pH, ionic characteristic and**  **strength, bonding, light, etc. affect chemical changes in food systems and judge how to adjust these**  **conditions to improve or minimize chemical and biochemical deterioration of food systems.**  **9- The student will integrate chemistry and biochemistry principles into real-world food science and**  **nutritional problems** | | |
| **12. Student's obligation**  **1- Attendance at lectures and labs is required.**  **2-The student will write notes on their notebook which are written on whiteboard besides the lecture on the**  **data show.**  **3-Every lecture have a quiz.** | | |
| **13. Forms of teaching**  **1- Data show, 2-Power point , 3- White board** | | |
| **14. Assessment scheme**  **Course content is assessed through two written examinations and class participation with an emphasis**  **on problem solving related to real life situations that one may encounter in the food industry and written report.**  **Teamwork is critical to the project and grading. Grades will count as below:**   |  |  |  | | --- | --- | --- | | **Time** | **theoretical** | **Practical** | | **During semester** | **10** | **35** | | **Participation Conservation and activity, quizzes** | **5** |  | | **Final** | **50** | **-** | | | |
| **15. Student learning outcome:**  **Students are expected to understand and be able to control the major chemical and biochemical (enzymatic)**  **reactions that influence food quality with emphasis on food industry applications. To**  **understand how the properties of different food components and interactions among these components**  **modulate the specific quality attributes of food systems, and to understand the principles**  **that underlies the biochemical/enzymatic techniques used in food analysis.** | | |
| **16. Course Reading List and References‌:**  **1-Fennema’s Food Chemistry, fourth edition, edited by S. Damodaran, K.L. Parkin, and O. R. Fennema,**  **2007, published by CRC Press may be used as a reference.**  **2-Principles of Food Chemistry, 1999. 3rd Edition.  J.M. deMan, Aspen Publishers, New York.**  **3-Food Chemistry, 3rd edition1996 . O.R. Fennema, Ed. Marcel and Dekker, Inc., New York, NY.**  **4- Students are responsible for reading articles**  **that are found in the library and on the Internet** | | |
| **17. The Topics:** | |  |
| |  |  |  | | --- | --- | --- | |  | **Title of the Subject** | **Lecture’s name** | | **1st** | **Introduction to Food Chemistry, Food Chemistry History, Food Elements** | **Dr.Nawal H. Sebo** | | **2nd** | **: Water in food. Structure of water and ice. Water solute interactions. Water activity and**  **relative vapour pressure (RVP). Moisture sorption isotherms. Aw and mallard, Oxidation, Enzymatic reactions and Aw and growth of microorganisms.** | **Dr.Nawal H. Sebo** | | **3rd** | **Proteins in Foods, Protein Chemistry: Amino acid Chemistry and its Role in Food Proteins Properties** | **Dr.Nawal H. Sebo** | | **4th** | **Peptides; Flavour Enhances; Hydrolysed vegetable protein; browning reactions, protein denaturation.** | **Dr.Nawal H. Sebo** | | **5th** | **Carbohydrate Chemistry: Monosaccharides, Disaccharides, Artificial Sweeteners, Carmalization.** | **Dr.Nawal H. Sebo** | | **6th** | **Polysaccharides** *:* **starch, vegetable, dietary fibre and their Role in Food Processing.** | **Dr.Nawal H. Sebo** | | **7th** | **Lipids in Foods, Lipid chemistry: Fatty Acid Chemistry; Commercially-Important Fats and Oils.** | **Dr.Nawal H. Sebo** | | **8th** | **Oxidation and Rancidity; Emulsions and Emulsifiers** | **Dr.Nawal H. Sebo** | | **9th** | **Food Enzymes** | **Dr.Nawal H. Sebo** | | **10th** | **The Roles of Food enzymes in food processing** | **Dr.Nawal H. Sebo** | | **11th** | **Food Vitamins****fat soluble and water soluble vitamins, dietary recommendations,**  **bioavailability, process-induced changes to vitamins in food, vitamin-like compounds,**  **optimisation of vitamin retention and vitamin supplementation. Methods of vitamin analysis.** | **Dr.Nawal H. Sebo** | | **12th** | **Mineral composition of foods Chemical and functional properties of minerals in foods Main and trace elements***.* | **Dr.Nawal H. Sebo** | | **13th** | **Food Pigments ,Effects of Food processing on Food Pigments** | **Dr.Nawal H. Sebo** | | **14th** | **Food Acids, Flavor Compounds** | **Dr.Nawal H. Sebo** | | **15th** | **Food Additives.** | **Dr.Nawal H. Sebo** | | | Lecturer's name  ex: (2 hrs)  ex: 14/10/2015 |
| **18. Practical Topics (If there is any)**   |  |  | | --- | --- | | **The Topics:** | **Lecturer's name** | | Introduction to food chemistry | Mrs. Rahela syamand  3 hrs | | Determination of water in different foods | Mrs. Rahela syamand  3 hrs | | pH and carboxylic acids in food | Mrs. Rahela syamand  3 hrs | | Kjeldhal and Protein determination | Mrs. Rahela syamand  3 hrs | | Fat determination by soxhlet | Mrs. Rahela syamand  3 hrs | | Sucrose determination in soft drinks  (Reducing sugars) | Mrs. Rahela syamand  3 hrs | | Enzymes in food | Mrs. Rahela syamand  3 hrs | | Enzymatic oxidative browning, of fruits and  vegetables | Mrs. Rahela syamand  3 hrs | | Extraction of pigments in food | Mrs. Rahela syamand | | Preparation of solution | Mrs. Rahela syamand  3hrs | | Gelatinization | Mrs. Rahela syamand  3hrs | | Foams in food | Mrs. Rahela syamand  3hrs | | Emulsions,in food | Mrs. Rahela syamand  3hrs | |  |  | |  |  | | |  |
| In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture | | Lecturer's name  ex: (3-4 hrs)  ex: 14/10/2015 |
| **19. Examinations:**  ­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­Q / Define the following:  Dialysis, Thixotropic Gel, Stachyose, Modified Starch, Polyglactouronase, Dextrose Equivalent, Volatile  fatty acids, Acid value ,BHA. Elaidic acid, Valin, Sved berg , Tyrosine , Lysozyme,protein denaturation.  Q/what are the differences between:-  Inuline and Cellulose  Amyloglucosidase, β –Amylase and α-Amylase-  Pectin and Pectic Acid  Fats and Oils  Q / Write chemical structure and significance of the following compounds:  Lecithin , Triolein , Octadecadienoic acid, Eicosanoic ,Stearic acid ,Vitamin A, Sphingosine,Tyrosine , Tochoferol,  Monoglyceride,EPA, Salting out, Tofu, Collagen, Prolamins. Nigerose, Moroctic , Un-conjugated fatty acids ,  Gliadin , Asparaginase , BHT, Tributyrin  Q/A/Explain the role of pectin in jelly production.  B/How jelly special for diabetic people is produce.  Q / Write chemical structure for each of the following amino acids and explain its role in physical and chemical  properties of foods:  1-Proline 2-Serine 3-Alanine 4-Glutamic acid  Q/write the chemical equation of initiation step of food lipids oxidative rancidity.    Q/write the chemical equation of food lipids hydolysis rancidity.  Q/Name the following:-  1- Two essential amino acids found in food proteins.  2- Two non-essential amino acids founded in food proteins.  3- Phospho-protein founded in food.  4- Enzyme used for food processing.  5-Enzyme responsible for food deterioration  6- Main sugar found in fruits.  7- Can sugar.  8-Homotriglyceride.  9-Heterotriglyceride.  10-Natural Antioxidant found in food.  11-Artifitial Antioxidant found in food.  12-Pigment found in meat  Q4/ Answer with (Yes) or (No) and correct the wrong:-  1- all enzymes are proteins.  2-Maltose in non-reducing monosaccharide’s.  3-glucose is sweeter than fructose.  4- Denaturation of this protein leads to converting of the sulfahydral bonds to disulfide groups which are responsible  for the cooked flavor in food.  5-melting point of oleic acid is higher than stearic acid.  6-tartaric acid is the main acid found in citrus.  Q/Conjugate suitable word in list A with list B.  A- BHA, Salting out ,,Ultracentrifugation, Phospholipid, Tyrosine, Rancidity , saturated fatty acid , Svedberg,  B-Lipase, Antioxidant, Emulsifier, Ammonium Sulphate, Aromatic Agent,Caprylic acid, Bioactive protein.  Q/Discuss the following:-  1-Melting point of stearic acid is higher than melting point of lenolenic acid.  2-Proline called imino-acid.  3-Cellulose is not digested in human digestive tract.  4-Fat are solid at room temperatures.  5-Oils are liquid at room temperatures.  6- Electrical behavior of hydrophilic suspended colloids.  7-Mutarotation of carbohydrates.  8- The existence of various sugars with differences viscosity in aqueous solutions.  Q/Fill the following blanks:-  1- ------ is the major carbohydrate fraction in cereal, It is made up of ----- building block. **Q2\Complete the following: (27 Marks)**  **1- The main importance of colostrum includes -------------&------------&------------.**  **3- The presence of pro-oxidants such as-----------&----------increase the rate of milk**  **fat auto-oxidation.**  **4- The fat globule membrane material consists of lipids such as -------------25% &--------- 3% & ------- 2%.**  **The remaining 70% of the membrane material are -------------- .**  **5-The ---------&---------are examples for volatile fatty acids.**  **6- Reichert Meissl Number measure the present of -------------&------------fatty acids in milk fat and it is**  **value in milk fat is about--------------.**  **7- The main disease that affects milk yield and composition of dairy cows is --------------which**  **caused by ------------&----------------bacteria.**  **8- The saturated and unsaturated fatty acids found in high quantity in milk are-----------&--------**  **respectively.**  **9-** **The concentration of antibodies in colostrum averages -----------% (and in whole milk is about -------.**  **10-The ------------------& -----------------are example for natural anti-oxidants.**  **11-1-By definition, only the secretion of the ---------milking after calving should be referred to as colostrum.**  **12- In general, the SN1 position binds mostly ------- fatty acids, and the SN3 position binds mostly ------- & ------------.**  **Q5\**  **Complete the following table:**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Parameter** | **Casein αs-1** | **Casein αs-2** | **Casein- β** | **Casein-K** | | **Cysteine residues** |  |  |  |  | | **Group of Phosphate** |  |  |  |  | | **Carbohydrates** |  |  |  |  | | **Calcium sensitivity** |  |  |  |  | | **Sensitivity chymosin** |  |  |  |  |   **Q\ Explain the effects of seasonal variation on milk composition.**  Q\ List \1- The reactions that occur during caramelization process. 2- Lipid quality analyses.  B- What is the importance of three of the following enzymes in food industry?  Microbial transglutaminase , Glucose oxidase , Lipoxygenase , Invertase  Q\A-Write the chemical structure of the following fatty acid then rearrange them from lower to higher melting point & classify them according to omega system.  Oleic , Eladic , Linoleic ,Linolinic .  Q\ Write the chemical the chemical equation of apple browning reaction by PPO enzyme  Q\ What are the differences between the LM & HM pectin. | | |
| **20. Extra notes:**  Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich  the course book with his/her valuable remarks. | | |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**  This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by  writing few sentences in this section.  *(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor,*  *assistant professor, a lecturer or an expert in the field of your subject).*  ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.  هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌ | | |