****

**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 nameex: (2 hrs)ex: 14/10/2015 |
| **18. Practical Topics (If there is any)**

|  |  |
| --- | --- |
| **The Topics:** | **Lecturer's name** |
|  Introduction to food chemistry  | Mrs. Rahela syamand3 hrs |
| Determination of water in different foods | Mrs. Rahela syamand3 hrs  |
| pH and carboxylic acids in food |  Mrs. Rahela syamand3 hrs  |
|   Kjeldhal and Protein determination  | Mrs. Rahela syamand3 hrs  |
|   Fat determination by soxhlet | Mrs. Rahela syamand3 hrs  |
| Sucrose determination in soft drinks(Reducing sugars) | Mrs. Rahela syamand3 hrs  |
|  Enzymes in food | Mrs. Rahela syamand3 hrs  |
|   Enzymatic oxidative browning, of fruits and vegetables  | Mrs. Rahela syamand3 hrs  |
|  Extraction of pigments in food | Mrs. Rahela syamand |
| Preparation of solution  | Mrs. Rahela syamand3hrs |
| Gelatinization | Mrs. Rahela syamand3hrs |
| Foams in food | Mrs. Rahela syamand3hrs |
| Emulsions,in food | Mrs. Rahela syamand3hrs |
|  |  |
|  |  |

 |  |
| 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 nameex: (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 CelluloseAmyloglucosidase, β –Amylase and α-Amylase-Pectin and Pectic AcidFats 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, TributyrinQ/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 meatQ4/ 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.‌‌  |