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**Department of Food Technology**

**College of Agricultural Engineering Sciences**

**University of Salahaddin**

**Subject:** **Food Plant Engineering**

**Course Book – *3RD* Stage (First semester)**

**Lecturer's name: Assist prof. Dr. Seerwan Ahmed Abdullah & Mrs. Darun Hawar Jabar**

**Academic Year: 2022/2023**

**Course Book**

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| **1. Course name** | Food Plant Engineering  |
| **2. Lecturer in charge** | Assist prof. Dr Seerwan Ahmed Abdullah  |
| **3. Department/ College** | Food Technology- College of Agricultural Engineering Sciences |
| **4. Contact** | e-mail: serwan.abdullah@su.edu.krdTel: +964-7501199223 |
| **5. Time (in hours) per week**  | Theory and Practice ( 2 x 3 hrs)  |
| **6. Office hours** | 30 hrs |
| **7. Course code** | N. |
| **8. Teacher's academic profile**  | * Researched the **New Techniques** for pasteurization of liquid foods, **Ohmic heating, Continuous Flow Microwave Heating** and **Solar Collector** application and performance in medium **Plate Heat Exchanger.**
* Assisted researcher in laboratory for students at University-College of Agriculture- Food Technology Department.
* Counselled to implement **Iso-17025** to provide the **accreditation** to Central Food Laboratory in Erbil, Kurdistan Region-Iraq.
* Recommended to committee members of food safety and quality at Ministry of Health to control of food quality and safety.
* **Lectured, and assist lectured in Laboratory** of cereal chemistry and technology, Principle of food industry, food processing, Food Plant Engineering and Sugar and Confectionery as well as post- harvest.
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| **9. Keywords** | Units and dimensions, Force, Density, Temperature, Pressure, work and energy, Heat Exchanger, Fouling, Refrigerator system, Fluid flow, Mass balance, Psychometrics,Evaporation,Enthalpy, Thermodynamics, Curing and Extrusion, Mass and Energy Balance, Evaporative Drying. Psychometric |
| **10. Course overview:**Food engineering is usually a difficult discipline for food science students because they are more used to **qualitative rather than to quantitative** descriptions of food processing operations. The flow of food fluids, in which the importance of laminar or turbulent flow in food processing is emphasized, mass transfer, which is often perceived as a difficult topic and indeed is poorly treated in many food texts as well as the principles of psychometric will be explained.In addition, the principal preservation operations are including coverage of the principles of the refrigeration cycle and; evaporation, freezing, drying and familiar with extrusion process for foods and pumps.  Finally, Nanotechnology, mixing and physical separation processes, including the increasingly important area of separation using ultrafiltration and reverse osmosis.This course is intended to be a step-by-step workbook that will help the students to practice solving food engineering problems. It presumes that the students have already studied the theory of each subject from their textbook. |
| **11. Course objective:*** To be familiar with charts and calculation
* To understand fundamental principles of mass and energy conservation
* To understand and to apply basic engineering charts
* To use physical properties of foods in process design
* To comprehend basics of fluid flow, as well as role of laminar and turbulent flow
* To predict pressure drops, power and to select pump and extrusion process
* To be familiar with thermal and non-thermal techniques for pasteurization and/or sterilization of foods
* Knowledge about nanotechnology
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| **12. Student's obligation**1. Attendance is required and will influence course grade.
2. **Silent your mobile or turned off will be better** in class
3. All graded assignments, quizzes, and exams will be returned to students.
4. The course is graded on an absolute grading policy.
5. **Quizzes:** In-class quizzes (typically10-15 minutes) will be one problem or several conceptual questions given at the beginning of the lecture. The material covered on the quiz will come from the previous lectures, homework. The quiz will be closed books and notes. Every week in previous class
6. **Exams:** One Mid-term and Final exams will be given during the semester. The exams will be closed books and notes.
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| **13. Forms of teaching**White board, Data show, Youtube and visit the food manufacture in Erbil  |
| **14. Assessment scheme**1. Mid-term exam 100 points (10 +5)
2. Mid-term exam (Practice) 100 points (35)
3. Final exam 100 points (50)
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| **15. Student learning outcome:**1. The basic principles of mass and energy balances and able to apply them in food processing.
2. The basic concepts of psychometrics and types of evaporation
3. How to deal with the charts of enthalpy or refrigeration cycle system.
4. Principles of refrigeration. Be able to identify the major components of a refrigeration system and conduct refrigeration calculations.
5. Different freezing systems and predict freezing time.

 Principles of psychometrics’. Be able to use a psychrometric chart and mathematical equations to identify and calculate different properties of air-water vapor mixtures. |
| **16. Course Reading List and References‌:*** Singh, R. P., and Heldman, D. R. (2001). Introduction to Food Engineering.
* Smith Je M. Van Ness H. C. Abbott M. M. (2001). Introduction to chemical engineering and thermodynamics, six edition

▪**Useful References**: 1- Toledo, R. T. (2007). Fundamentals of Food Process Engineering. 3rd ed. Springer Inc. USA2- Valentas, K. J. ; Rotstein, E. and Singh, R. P. (1997). Handbook of food engineering practice. CRC Press LLC Boca Raton New York USA.3- Berk, Zeki (2009). Food Process Engineering and Technology. 1st ed. Elsevier Inc. USA.4- Fellows, P. (2000). Food Processing Technology principle and practice.2nd ed. CRC Press LLC Boca Raton New York USA.▪Magazines and review (internet): Food engineeringjournals  |
| **17**. **The Topics will be covered (Theory)**

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| **Weeks** | **Modules** |
| **Week - 1** | Introduction , Syllabus and instructor policy |
| **Week - 2** | Engineering Units |
| **Week - 3** | Fluid flow in Food processing |
| **Week – 4**  |  Heat Transfer in Food processing |
| **Week – 5**  | Thermal properties of Food |
| **Week – 6**  | First Mid-Term Exam |
| **Week - 7** | Systems for heating and cooling Food Products |
| **Week – 8**  | Fouling |
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| **Week – 9**  | Refrigeration, Pressure –Enthalpy Charts |
| **Week - 10** | Evaporation and Types of Evaporation |
| **Week - 11** | Nanotechnology |
| **Week - 12**  | Curing and Extrusion |
| **Week – 13**  | Psychometric |
| **Week - 14** | Review and wrap-up |
| **Week -15**  |  |
|  | **18. Practical Topics will be covered** |

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| **No.** | **Title of the Subjects** |
| **Week 1** | Introduction to food Plant engineering and course book  |
| **Week 2** | Heat resistant and over all heat transfer cofficient |
| **Week 3** | Heat exchanger performance and efficiency, NTU method |
| **Week 4** | Energy equation for steady flow of fluid |
| **Week 5** | Exam |
| **Week 6** | Visit Factory |
| **Week 7-8** | Refrigeration  |
| **Week 9-10** | Mathematical expressions useful in analysis vapour- compression in refrigeration  |
| **Week 11** | Visit factory  |
| **Week 12** | Evaporation |
| **Week 13** |  Review and wrap-up |
| **Week 14** |  Final Exam  |

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| **19. Examinations:** **Q1:A.** Match the words in list A with appropriates words in list B, by phrase or equation  **(15 M)**

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| No. | A | B |
| 1 | Cooling | Steady state |
| 2 | Heat content | Thermodynamic |
| 3 | Created energy | Plane angle |
| 4 | Radian | Luminous intensity |
| 5 | Accumulation | Crystallizer |
| 6 | Candela | Enthalpy |
| Q2:  | Numerate each of the followings |  |
| Q3: | Describe each of the followings |  |

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| **20. Extra notes****Students activity, Report, Quiz, and share in class**  |
| **21. Peer review** .‌‌  |