Nanyang Technological University
Division of Chemistry and Biological Chemistry

Academic Year	2022/23	**Semester**	1
Course Coordinator	Ken Lee		
Course Code	CM5101[1]		
Course Title	Food Chemistry and Nutrition		
Pre-requisites	(CM1031 and CM1051) or (CM1051 and CM9001/CM5000) or (BS1003 and CM1051) or (BS1005 and CM1031) or (BS1003 and BS1005) or CM1002 or CY1101 or by permission		
No of AUs	3 AUs		
Contact Hours	Lectures: 26 hours Experiments: 9 experiments taking a maximum of 3 hours for each experiment – total 27 hours		
Proposal Date	21 October 2021		

Course Aims

This course aims to introduce the basic knowledge on the chemical composition of food ingredients and the chemical transformation of the three major components in food: 1) Fats (oil); (2) Proteins and (3) Carbohydrates. It provides the basic laboratory skills related to food chemistry that are essential for food chemists working in industry and academia. Concepts and principles of food science and technology that are taught in lectures are closely link to the expertise of your daily life. In addition, problem-based learning will be utilized as an instructional strategy of active learning. Experience of the experimental techniques used in food chemistry will also be enhanced, and you will be trained in the safe handling of chemicals and instruments, and in the assessment of risks associated with experimental procedures.

Intended Learning Outcomes (ILO)

Upon the successful completion of this course, you (as a student) would be able to:

1. Identify the major chemical components of food
2. Evaluate the chemical changes in food that occur during processing and storages
3. Explain on the operation techniques commonly used in isolation and chemical analysis of food ingredients
4. Work independently and, where required, in collaboration with other students to safely perform experiments from the laboratory manual
5. Follow detailed instructions in the laboratory manual to obtain desired experimental results
6. Operate state-of-the-art scientific laboratory equipment that is often used in industry
7. Analyze the data from your experiments to fit a theoretical model
8. Explain and discuss your experimental results using scientific literature
9. Work independently to prepare a detailed written report of your experimental findings
10. Keep an accurate laboratory notebook of your experimental results in a form that is understandable by a third party
11. Assess the potential risks of an experimental procedure before the procedure is carried out

[1] Previously listed as CM9101

12. Review the experimental procedures after the experiments to see if there are more potential risks and propose how these can be alleviated
13. Connect the experiments conducted with the relevant theories

Course Content

Lectures

1. Introduction to food chemistry and nutrition
2. Water content and water activity
3. Fat and Oil Food Products
4. Carbohydrates in Food
5. Proteins in Food
6. Food Browning
7. Natural Food Colorants
8. Special Topics

Experiments

9. Determination of Moisture Content in Food
10. Fat Determination using Soxhlet extraction
11. Determination of Protein in Food by the Biuret Method and Coagulation of Protein
12. Fehling's Test for Reducing and Non-reducing Sugars
13. Ascorbic Acid in Cabbage
14. Non-Enzymatic Browning (The Maillard Reaction and Browning in Reconstituted Milk)
15. Enzymatic Discolouration of Fruit and Vegetable and Blanching Effectiveness in Vegetable
16. Oxidative Rancidity in Oil
17. Extraction and Identification of Artificial Colours

Assessment (includes both continuous and summative assessment)

This is a graded course. There is a checklist of ALL the components of the assessments, including both individual and team assessments.

Component	**Course LO Tested**	**Related Programme LO or Graduate Attributes**	**Weighting**	**Team/ Individual**	**Assessment rubrics**
Midterm Tests	1 - 8	Competence, communication	20%	Individual	Point-based marking (not rubrics based)
Final examination	1 - 8	Communication, Competence	50%	Individual	See Appendix 1
Experiments	1-13	Communication, Competence, Creativity	30%	Certain experiments may be performed as a team but	See Appendix 1

				reports must be prepared individually	
Total			100%		

Formative feedback

You will be given feedback in the following ways:
1. Through the marking of the midterm test
2. Feedback will be provided to the students following the final exam
3. Through consultation with the faculty member for the coursework section
4. Through the graded lab reports
5. Through consultation with the faculty member who designed the lab experiment

Learning and Teaching approach

Approach	**How does this approach support students in achieving the learning outcomes?**
Lectures	Present the key ideas and important information which will be used to solve different types of problems.
Lab experiments	You will receive hands-on experience with necessary equipment during experiment sessions. The experiments will be conducted in a mixture of individually as well as part of a team. Proforma for the experiments are expected to be done individually so that you have complete knowledge of all theoretical aspects of the experiments. These experiments develop proficiency in problem solving skills and reinforce concepts that are covered in the lectures.

Reading and References

1. Food Science & Nutrition
   Author: Sunetra Roday
   Publisher: Oxford Higher Education
   ISBN 978-0-19-568911-2

2. Essentials of Food Science 3rd
   Author: Elizabeth W. Christian; PH.D. Vaclavik Vickie A
   Publisher: Springer
   ISBN 978-0-387-69939-4

Course Policies and Student Responsibilities

Absence Due to Medical or Other Reasons

If you are sick and unable to attend your class, you have to:

1. Send an email to the instructor regarding the absence and the requests for a replacement class if necessary.
2. Submit the original Medical Certificate‖ to administrator.
3. Attend the assigned replacement class (***subject to availability***).

‖ The medical certificate mentioned above should be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.

Laboratory safety and punctuality

The instructors and chief TA of this module take a very serious stance on laboratory safety, punctuality and academic integrity.
(i) Students who flaunt safety rules spelt out in the CM9101 laboratory manual will be barred from entering the laboratory.
(ii) The laboratory sessions begin promptly at 2.30pm. A significant amount of marks (up to 50%) will be deducted for students who are late for any of the laboratory sessions without a valid excuse. Students who arrive 20 minutes after the start of the lab session will **not** be allowed to enter the lab and will receive a grade of zero for that day's experiment.
(iii) Hand-in your lab reports/pro-formas in time.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Ken LEE	SPMS-CBC-04-02	6513 2178	ken.lee@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Introduction to food chemistry and nutrition; Water content and water activity	1-3	Lecture
2	Fat and Oil Food Products: Basic information about fatty acids; Saturated fatty acids Lab: Determination of Moisture Content in Food	1-3 4-13	Lecture Laboratory experiment; Proforma provided
3	Fat and Oil Food Products: Monounsaturated and Polyunsaturated fatty acids and Essential fatty acids Lab: Fat Determination using Soxhlet extraction	1-3 4-13	Lecture Laboratory experiment; Proforma provided
4	Carbohydrates in Food: Introduction and Monosaccharides Lab: Determination of Protein in Food by the Biuret Method and Coagulation of Protein	1-3 4-13	Lecture Laboratory experiment; Proforma provided
5	Carbohydrates in Food: Disaccharides and Polysaccharides Lab: Fehling's Test for Reducing and Non-reducing Sugars	1-3 4-13	Lecture Laboratory experiment; Proforma provided
6	Carbohydrates in Food: Selected examples of carbohydrates in food Lab: Ascorbic Acid in Cabbage	1-3 4-13	Lecture Laboratory experiment; Proforma provided
7	Midterm Assessment Lab: Non-Enzymatic Browning (The Maillard Reaction and Browning in Reconstituted Milk)	1-3 4-13	Assessment Laboratory experiment; Proforma provided
8	Proteins in Food: Essential amino acids, limiting amino acids and examples of protein-rich foods	1-3 4-13	Lecture

	Lab: Enzymatic Discolouration of Fruit and Vegetable and Blanching Effectiveness in Vegetable		Laboratory experiment; Proforma provided
9	Proteins in Food: Tofu production; Cheese Production; Particular Examples of Proteins in Food Lab: Oxidative Rancidity in Oil	1-3 4-13	Lecture Laboratory experiment; Proforma provided
10	Midterm Assessment Lab: Extraction and Identification of Artificial Colours	1-3 4-13	Assesment Laboratory experiment; Proforma provided
11	Food Browning and Natural Food Colorants	1-3	Lecture
12	Special Topics	1-3	Consultation
13	Review on course contents	1-3	Consultation

Appendix 1:

Grading Criteria for Final Examination – Short Answer Questions

Performance Level	**Criteria**
Fail standard	Answers demonstrate the ability to repeat factual knowledge but not to apply it outside of the lecture context. Answers do not have a strong logical underpinning or maybe attempts to answer both ways at the same time.
Pass standard	Answers to the standard level question are correct and show the ability to apply concepts from the course, but a high level of critical thinking is absent. Answers are reasonably logical, but with gaps.
High standard	Answers to all questions show a high and consistent level of critical analysis of the information presented and creative solutions to the problems. Answers are highly logical and demonstrate strong reasoning. Answers are concise and to the point.

Grading Criteria for Lab experiments and Proforma

The following guideline describes the criteria expected of the different levels of performance in this course.

	Exceptional (81 – 100)	Good (61 – 80)	Acceptable (41 – 60)	Poor (0 – 40)
Safety	Performed safety checks, followed the safety instructions carefully and supported others to do so.	Performed safety checks and followed the safety instructions carefully.	Performed safety checks but did not follow the safety instructions carefully.	Did not conduct safety checks. Did not realise the potential threats and hazards.
Overall presentation	Appropriate as a piece of scientific writing. Words were chosen carefully and appropriately. Sentence structure was clear and easy to follow. The proforma is free of spelling, punctuation, and grammatical errors .	Minimal awkward phrasing or word choices. Report is easy to read and constructed properly. Evidence of editing with less than three grammatical and/or spelling errors.	Many passages are phrased poorly, contained awkward word choices, or many long sentences. Narrative is disorganized in many places. Multiple grammatical and/or spelling errors.	Poorly organized narrative with frequent awkward phrases and poor word choices. Sentences are too long or short. Lacks cohesion, style and fluidity. Frequent spelling and grammatical errors.
Results	All figures, graphs, and tables are labelled with appropriate captions. All tables, figures, etc. are explicitly discussed when required. Relevant experimental data are referred to in answer to specific questions. Some scientific literature were referenced.	All figures, graphs, and tables are correctly drawn, but some have minor problems that could be still be improved. All data and associated figures, etc. are mentioned when required. Most relevant data are presented in answer to specific questions.	Most figures, graphs, and tables are included, but some important or required features are missing. Certain obtained data are not mentioned when specifically required in answering questions. Captions are not descriptive or incomplete.	Figures, graphs, and tables are poorly constructed; have missing titles, captions or numbers. Certain obtained data are not mentioned when specifically required in answering questions. Important data missing or incorrectly interpreted.

CBC Programme Learning Outcome

The Division of Chemistry and Biological Chemistry (CBC) offers an undergraduate degree major in Chemistry that satisfies the American Chemical Society (ACS) curricular guidelines and equips students with knowledge relevant to the industry. Graduates of the Division of Chemistry and Biological Chemistry should have the following key attributes:

1. Competence

Graduates should be well-versed in the foundational and advanced concepts of chemical science, be able to evaluate chemistry-related information critically and independently, and be able to use complex reasoning to solve emergent chemical problems.

2. Creativity

Graduates should be able to synthesize and integrate multiple ideas across the curriculum, and propose innovative solutions to emergent chemistry-related problems based on their training in chemistry.

3. Communication

Graduates should be able to demonstrate clarity of thought, independent thinking, and sound scientific analysis and reasoning through written and oral reports to audiences with varying technical backgrounds. They should also be able to effectively engage other professional chemists in collaborative endeavours.

4. Character

Graduates should be able to act in responsible ways and uphold the high ethical standards that the society expects of professional chemists.

5. Civic-mindedness

Graduates should be aware of the impact of chemistry on society, and how chemistry can be applied to benefit mankind. They should also be aware of and uphold the best chemical safety practices.