

# FNH 303 - Food Product Development

## Course Details

<b>Course</b>	FNH 303 [3-0-0] (3 hours/week of lecture)
<b>Prerequisites</b>	Introductory Statistics (LFS 252); Food Chemistry (FNH 301)
<b>Term/year</b>	Winter term 2 (January – April 2021)
<b>Class day/time</b>	Tuesday/ Thursday 9:30 – 11:00
<b>Class location</b>	P. A. Woodward Instructional Resources Centre Room 3. Some classes maybe held online via zoom, if required by UBC CoVID protocols.
<b>Instructor</b>	Anubhav Pratap-Singh
<b>Email</b>	anubhav.singh@ubc.ca
<b>Office</b>	FNH Room 213, 2205 East Mall
<b>Office hours</b>	I do not have office hours but I am happy to meet with you at a mutually convenient time. Please contact me to arrange a meeting.
<b>TAs</b>	Mithun Dey mithun85@mail.ubc.ca

**Syllabus version** Jan, 2022

## Instructor's Biographical Statement:

My name is Dr. Anubhav Pratap-Singh, and I am a chemical engineer by education (BTech+MTech in Chemical Engineering from IIT Kharagpur in 2011), a software engineer by interest (acquired as the founder of two tech-service startups: Orangified and EstuMart), and a food scientist by training & practice (PhD in 2015 from McGill University, postdoc from University of Toronto in 2016). I also worked with R&D division of Enwave Inc., a UBC-spinoff company by UBC Food Science Professor Emeritus Dr. Tim Durance. In 2017, I joined UBC and setup the UBC Food Process Engineering Laboratory.

My main research focus on exploring novel approaches that: a) minimize deleterious effect of food processing on food quality & nutrition, and b) overcome the biological barriers to absorption of nutritional components of food. Some of the major research directions in our laboratory include:

- developing non-thermal (pulsed light, ultrasound & cold plasma) technologies for decontamination food products,
- using extrusion & other plant-based meat development technologies,
- fortification of tea, salt & other food products with multiple nutrients (iron, zinc, vitamin B, folic acid etc.) together,
- developing buccal and sublingual sprays/tablets for delivery of insulin & other bioceuticals orally bypassing GI tract
- development of encapsulated rhACE2 for treating mild symptom CoVID-19 patients
- upcycling of food industry wastes into value-added products, biodegradable & packaging solutions for the food industry, etc.

In 2019, I received the Endowed Professorship in Food & Beverage Innovation from the BC Ministry of Agriculture, Food & Fisheries, as part of which I am coordinating the establishment of Food Hubs across the Province of British Columbia, with a central R&D hub at the proposed UBC Food & Beverage Innovation Center, that is expected to be operational by 2024. As part of my current responsibilities, I am

the Undergraduate Academic Advisor for the Food, Nutrition and Health program, LFS Representative Senator 2020-23 to the UBC Vancouver Senate, Member of the UBC Academic Policy Committee, and the UBC Research & Scholarship Committee, Privacy Officer of the St. James House Strata Council, UBC Representative to the Executive Board of the British Columbia Food Technologists (BCFT) Association, BC Representative to the Advisory Committee of the Canadian Institute of Food Science & Technology (CIFST) Association, and Editorial Board Members for Elsevier's journal 'Applied Food Research' and Nature Publishing Group's journal 'Scientific Reports'. I am also currently writing a book on "Application of Microwaves in Foods".

## Course Objectives

New product development is an integral part of the food industry. This course will introduce you to concepts in food product formulation and development. The function of various food additives, approaches to experimental design, and sensory evaluation will be addressed in lectures and applied in a theoretical case study.

## Course Format and Activities

The course will present lectures, activities and support materials that will introduce you to concepts used in food product development, with the overarching principle of food safety. These will be presented in 4 modules, and each module will be assessed with quizzes. The modules and concepts that will be covered are:

1. Introduction to Product Development
  - a. Concept development
  - b. Project management
  - c. Formulation
  - d. Shelf-life testing
  - e. Labelling
  - f. Sustainability
2. Design of Experiment
  - a. Factorial, response surface and mixture designs
  - b. Selection of an appropriate experimental design
  - c. Evaluation and interpretation of statistical data
3. Sensory Evaluation
  - a. Design of an appropriate evaluation - discriminative, descriptive, hedonic
  - b. Evaluation and interpretation of statistical data
4. Additive roles, mechanisms, and properties
  - a. Stabilizers
  - b. Antimicrobials
  - c. Flavours
  - d. Colours

All these concepts will be used to complete two group reports and a case study. Students, working in

teams, will apply the concepts to their own reports and product development case. Teams will be given class time to develop their case. *It is expected that all students will participate in all sessions set aside for the group work.*

The original format of the course is **in-person classes**, with the supporting materials for the course available on Canvas. In case some of the classes are moved on-line, recorded lectures will be made available online.

**Cameras during class time for Online Classes:** I strongly recommend that you remain visible on your camera during class time when there is group discussions or activities. This helps me to get to know you and remember you (in case you need a reference in the future!), and helps build a better sense of community with your class.

### Learning Outcomes

Students who successfully complete this course will be able to:

- Apply the steps involved in developing a food product in a safe and sustainable manner, including formulation, labeling, packaging, regulatory requirements, evaluation of shelf-life, and sensory evaluation.
- Differentiate between the characteristics of various food additives to select the additive appropriate for a specific application.
- Choose an appropriate experimental design for product development based on the objective of the study, number of factors, and other practical considerations
- Design and carry out an appropriate sensory evaluation of a product, with statistical analysis, to meet a specific objective.
- Work effectively as a group member and communicate information clearly and logically in oral and written formats.

### Institute of Food Technologists (IFT)

UBC's Food Science Program is one of few institutions in Canada that are approved by the Institute of Food Technologists (IFT), an internationally recognized leader in undergraduate education standards for degrees in Food Science. Programs with this approval badge are recognized as delivering a comprehensive Food Science education that covers 55 essential learning outcomes (ELOs) established by the IFT organization. For further information on IFT ELOs, click [here](#) (see page 5) The ELOs below are covered in this course.

### IFT Essential Learning Objectives Addressed in this Course

#### Food chemistry (FC)

FC.3. Apply food chemistry principles used to control reactions in foods.

FC.7. Evaluate the appropriate analytical technique when presented with a practical problem. FC.8. Design an appropriate analytical approach to solve a practical problem.

#### Food safety (FS)

FS.1. Identify potential hazards and food safety issues in specific foods.

#### Sensory science (SS)

SS.1. Discuss the physiological and psychological basis for sensory evaluation. SS.2. Apply experimental designs and statistical methods to sensory studies. SS.3. Select sensory methodologies to solve specific problems in food.

#### **Quality assurance (QA)**

QA.1. Define food quality and food safety terms.

#### **Food laws and regulations (FL)**

FL.3. Locate sources of food laws and regulations.

#### **Data and Statistical Analysis (DS)**

DS.1. Use statistical principles in food science applications.

DS.2. Employ appropriate data collection and analysis technologies. DS.3.

Construct visual representation of data.

#### **Critical thinking and problem solving (CT)**

CT.1. Locate evidence-based scientific information resources. CT.2.

Apply critical thinking skills to solve problems.

CT.3. Apply principles of food science in practical, real-world situations and problems.

CT.4. Select appropriate analytical techniques when presented with a practical problem.

CT.5. Evaluate scientific information.

#### **Food Science Communication (CM)**

CM.1. Write relevant technical documents.

CM.3. Assemble food science information for a variety of audiences.

#### **Professionalism and leadership (PL)**

PL.1. Demonstrate the ability to work independently and in teams.

PL.2. Discriminate tasks to achieve a given outcome.

PL.4. Discuss examples of ethical issues in food science

## **Course Resources**

**Course Software Resource:** You will be using **Minitab** for the Design of Experiments aspects of the course. There is a free 30 day trial of Minitab available on-line ( <https://www.minitab.com/en-us/products/minitab/free-trial/> ) . You may need to use Minitab for longer than 30 days. You can rent Minitab from <https://onthehub.com/minitab/> for ~ 44 CAD for a 6 month period if you wish. As the Minitab is required for group assignments, the above cost can either be distributed amongst ~7 group members, or each member can start their 1-month free license strategically, totaling upto ~4 months of coverage for the group.

**Readings:** The resources below are **optional** and can be accessed if you want additional material on the topics covered in this course. Other **required** resources are noted in the Course Schedule for each module, and available on Canvas.

- New Food Product Development: from concept to marketplace. Fuller, G. W. 2005 Boca Raton, CRC Press. Boston, New York, Washington
- Creating New Foods. The Product Developer's Guide. Mary D Earle and Richard L Earle. <https://nzifst.org.nz/resources/creatingnewfoods/index.htm>
- Case Studies in Food Product Development Edited by M Earle and R Earle, Massey University, New Zealand Woodhead Publishing Series in Food Science, Technology and Nutrition No. 153 (available on-line, <https://www.sciencedirect.com/book/9781845692605/case-studies-in-food-product-development>
- Experimental Design for Formulation by Wendel Smith (available via library.ubc.ca)
- StatSoft, Inc. (2013). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: <https://www.freetechbooks.com/electronic-statistics-textbook-t932.html>

- The chemistry of food additives and preservatives Titus A.M. Msagati. Oxford ; Ames, Iowa : Wiley-Blackwell, 2012 ([available via library.ubc.ca](http://library.ubc.ca))
- <https://foodinsight.org/category/ingredients/>
- Lawless, H.T. and Heymann, H. 1998 Sensory Evaluation of Food: Principles and Practices. Chapman and Hall, Toronto ([available via library.ubc.ca](http://library.ubc.ca))
- <https://support.hunterlab.com/hc/en-us/sections/200832645-Application-Notes>
- <https://www.brookfieldengineering.com/learning-center>

## Course Assessment

% Course Mark	Item	Description
5%	Course Participation	Tracked through in-class & on-canvas participation
5%	Quizzes	Individual, Open Book
10%	Assignments	Individual and group
20%	Case Studies	Group Report - Report 1 and 2* - final and draft + Critique of Assigned Case Report
30%	Mid-Term Exam 1	Individual
30%	Mid-Term Exam 2	Individual
100%		

\*Note: a peer factor of 20% will be used as for the case work component of the course. Each group member will distribute 200 points amongst group members, in proportion to their contribution to group work. The sum distributed to each group member will be used to compute 4% of the total 20% weightage assigned to case study

## Late Assignment Policy

Due dates for assignments are clearly noted in the syllabus and in the assignments posted on Canvas. Late assignments will be accepted up to 3 days late, with a 10% mark penalty per day (i.e. an assignment handed in one day late will have 10% subtracted from the grade). If you anticipate having a problem meeting a deadline, please contact me to discuss the situation.

## Quizzes

Short (15 min) quizzes will be completed by each individual student on Canvas, online or in-class. These quizzes are **open book**, but must be completed without collaboration. The objective of this approach is to ensure that basic concepts are understood by all students.

Quizzes will be marked automatically and the marks posted on Canvas, but if you notice a problem with the marking, please contact your TA, who will review it.

Note – if you miss one quiz *for a valid reason*, the marks will be distributed to the remaining quizzes. A second missed quiz, without discussing with me **prior** to the quiz, will be given a mark of 0.

***If you run into a technical problem accessing a quiz on-line, please email me immediately***  
[anubhav.singh@ubc.ca](mailto:anubhav.singh@ubc.ca)

## Assignments

The assignments are posted on Canvas Assignments. The assignments are activities designed to help you understand course concepts and use the appropriate apps. You must complete and hand each of the assignments described. The 6 assignments and their due dates are indicated below:

1. Land Acknowledgement Activity (individual, 2% weightage, Due 13<sup>th</sup> Jan)
2. Module 1 Ed.Ted Activity (1 per group, 1% weightage, Due 18<sup>th</sup> Jan)
3. Module 1 Accelerated Shelf-Life Activity (1 per group, 1% weightage, Due 20<sup>th</sup> Jan)

4. Module 2 Design of Experiments Activity (1 per group, 2% weightage, Due 3<sup>rd</sup> Feb)
5. Module 3 Sensory Data Statistical Evaluation Activity (1 per group, 2% weightage, Due 3<sup>rd</sup> Mar)
6. Module 4 Additives Assignment (1 per group, 2% weightage, Due 17<sup>th</sup> Mar)

## Case Study

Each group must submit the following items for the case study:

- Group Work Contract – Due Jan 13<sup>th</sup>
- Product Selection Worksheet – Due Jan 20<sup>th</sup>
- 1st written report – Product Description and Experimental Design
  - (1%) Draft – Due Feb 10<sup>th</sup> (on Mid-Term 1 date)
  - (4%) Final copy - Feb 17<sup>th</sup>
- 2<sup>nd</sup> written report – Sensory Evaluation and Other Considerations
  - (1%) Draft – Due March 24<sup>th</sup> (on Mid-Term 2 date)
  - (4%) Final copy – Due Mar 31<sup>st</sup>
- Critique of an assigned group – Due April 8<sup>th</sup>

You will be assigned to groups of ~7 students. You will apply the information from the course content in a **THEORETICAL** food product development case to simulate some of the issues that can arise during product development, and to practice and demonstrate your mastery of the course content.

**The product must include upcycling of a waste material as a sustainability element.** Each group must select specific criteria for their product. The objective of the case study, may be:

- New product without a prototype in the market
- Expansion of an existing product line
- Match to a product already in the market
- Another objective – please confirm with your Teaching Assistant

Please get feedback on your ideas from me or your teaching assistant. You can consider recent nutritional trends/topics or other trends that could impact food products (e.g. lifestyle issues; demographics). You may check IFT top 10 food trends or <http://www.mintel.com/global-food-and-drink-trends/> for ideas.

Each group must complete the “Product Selection Worksheet” and submit on Canvas by Jan 20<sup>th</sup> 2022. The group needs to select their product and approach relatively quickly so that there will be enough time to research and develop the details of the case.

The group will write two reports for the case study. Details on what is required in each report are given below, and additional information is in the marking rubrics for each report posted on Canvas.

**A. Case Report #1: Draft (1%) + Final (4%):** The first written report will detail:

- i. **Executive Summary 10%**

- Brief summary of product description, target market, processing required, and experimental designs used
  - 500 word limit
- ii. **Product Characterization 40%:**
- Clearly list the objective of the product development (if appropriate, how and why it will be improved or changed)
  - Describe the target market for your new product (demographic characteristics)
  - Describe any specific regulatory requirements/standards of identity for this product if they exist in Canada. For example, if you are proposing a low-fat version of an existing product, you need to specify the change in fat content required by the Canadian Food and Drug regulations that allow a product to be denoted as “low fat”
  - Describe all the ingredients of the product, with the function of each. If you are proposing to use any new food additives / ingredients in the product, including the function and rationale for selection of specific components (e.g. why the specific emulsifier or colour is most appropriate)
  - Indicate sources of all additives/ingredients and standards required (quality, chemical, microbiological)
  - Consider the Canadian laws and regulations that pertain to food and your product specifically
  - Use appropriate literature to support the information presented.
- iii. **Experimental Design 40%:**
- **Step 1: Fractional factorial** as a screening method for selecting appropriate factors for further investigation in Step 2. You will justify select the factors and levels based on your knowledge, literature information, and from a logical ‘best guess’.
  - **Step 2:** Using factors and levels from Step 1, optimize your product using **response surface** and/or **mixture design** (simplex, centroid). The “optimum” from Step 2 will be used for the nutritional analysis of the ‘final’ theoretical product.
  - For each step in the experimental design, the group must select and provide justification for
    - the **factors** to be varied during the experiments
    - the upper and lower **limits** of each factor
    - the **responses** used to evaluate the experiments. You will likely have both analytical assays and sensory evaluations as responses. Do NOT include any details on the sensory evaluation that will be carried out in this report. These will be included in report #2. Simply indicate where/when you will be using sensory evaluation as a response for the experimental design.
    - Since you are not doing the actual experiments, you will justify select the ‘optimum’ based on your knowledge, literature information, and from a logical ‘best guess’.
  - Use Minitab to obtain output of the experimental designs. You will NOT have any data for responses. You are only required to present the design(s) you will use (factors, levels, type of responses, number of experiments/replication).
- iv. **Appropriate supporting references (5%)**
- The report will be in paragraph format, with a bibliography section formatted in the style of the “Journal of Agricultural and Food Chemistry” ( see <http://pubs.acs.org/page/jafcau/submission/reference-guidelines.html>)
- v. **Grammar, spelling, presentation (5%)**
- The report will be in paragraph format, with appropriate sections and headings.

**B. Case Report #2: Draft (1%) + Final (4%):** The second written report will detail:

- i. **Executive Summary 10%**
  - Brief summary of how sensory evaluation is used, shelf-life determination, safety considerations, and any 'other' considerations.
  - 500 word limit
- ii. **Sensory Evaluation 40%** : Each product will require sensory evaluation as one of the approaches to evaluate the product formulations. There will likely be more than one type of sensory evaluation that is required, depending on the objectives of the case. Your approach should be realistic and do-able.
  - Describe the objective of each of the sensory evaluations used and how each will help achieve the product development
  - Describe details of each sensory evaluation
    - Recruitment and number of panelists that will be used, standards and training if necessary, and give examples of score cards that will be used.
  - Describe the appropriate statistical evaluation of the data collected. Note that it is not necessary to give the Ho and Ha for each experiment.
  - Actions to be followed based on outcome of the sensory evaluation
  - Appropriate literature used to support points.
- iii. **Shelf Life of the Final Product 30%**
  - Describe the required or expected shelf life of the product. This may be done on the final optimal formulation.
  - Describe the approach used to determine the shelf-life of the product
    - Times and temperatures used (as appropriate)
    - Number of samples / replication that will be needed
    - Analyses that will be used for assessment of the product
- iv. **Other considerations 10%**
  - Provide a Canadian **nutrition facts panel**, based on the "best" formulation from Step 2 Report #1. **You are required to select the "best" formulation, based on a rational evaluation of the literature and your own experience**
    - Include an appendix with the calculations used to calculate this
  - Describe specific **food safety considerations** for this product and how these will be addressed
  - Give an example of the **packaging and label** will be used for the product
  - **Waste management/environmental issues** that may be associated with manufacture of your product
  - Issues related to **scale up** of your product
- v. **Appropriate supporting references (5%)**
  - with a bibliography section formatted in the style of the "Journal of Agricultural and Food Chemistry" ( see <http://pubs.acs.org/page/jafcau/submission/reference-guidelines.html>)
- vi. **Grammar, spelling, presentation (5%)**
  - The report will be in paragraph format, with appropriate sections and headings.

**Case Report Presentation Guide** (1 per group): The details of the case reports to be followed are:

- Use a size 12 font (Times or Calibri); 1.5 line spacing; 1 inch margins on pages
- Title page:
  - Group members first and last names; Product objective, Commodity and Experimental Designs used; date report is submitted.



- Second page:
  - Signed by each group member, with a description of what their contribution was to the groupwork for the case and the written report
- Submit one electronic copy on Canvas
- Page limit for each report – 20 pages, not including the title page and second page. This includes references, figures, tables etc.
- See <https://pubs.acs.org/doi/full/10.1021/acsguide.40204> for tips on how to format an effective table
- See grading rubric on the Canvas assignment page for how each report will be evaluated.

### C. Critique (6%)

Each group will be assigned case, based on draft Report #1 and #2 submitted by your assigned group on March 31<sup>st</sup> 2022. The critique of the case should be presented as a report in paragraph format with appropriate section headings. The critique must include discussion of the positive aspects of the material presented as well as the areas that need to be improved. In all cases, you must provide **a clear justification** for each point in your assessment. *You will not get marks for length but for critical analysis.*

- Use a size 12 font (Times or Calibri); 1.5 spacing; minimum 1-inch margins on pages. Maximum words: 1500.
- Title page:
  - Group members who wrote the report - first and last names; Product objective, Commodity and Experimental Design used
  - Your Group members - first and last names
  - Date report is submitted
- **Examples of points to discuss in your critique:** Your critique can include but **should not be limited to**, the following:
  - Objective/ Product Description:
    - Was product concept clearly presented
    - Was the formulation and the additives used in the product appropriate? Will the product be legal to sell in Canada as described?
  - Experimental Design
    - Experiments presented in sufficient detail to understand?
    - Was the appropriate design selected for the objective?
    - Realistic approach to replication/ statistical evaluation?
  - Sensory Evaluation
    - Experiments presented in sufficient detail to understand?
    - Appropriate test selected for the objective?
  - Shelf-life
    - Was an appropriate approach used to obtain the shelf life?

- Other considerations
  - Was the nutritional label accurate and did it contain the required information? Were
  - appropriate safety aspects for the product addressed?
  - Was packaging and label appropriate

See grading rubric on the Canvas Rubric on Canvas for how the critique will be evaluated.

#### D. Peer Evaluation (6%)

You will distribute 200 points amongst your group members, except yourself. Total points should not be more than 200 and no one student can get more than 60 points, else your score will not be counted and all your group members will receive default  $200/(n-1)$  points (where  $n$  is the number of group members). You can allocate less than 200 points. Total score received by each group member will be divided by 5 to count towards 40 points (4% weightage of the course). Please note that over-contributors can get more than 100% marks in this scoring format, while those not contributing can get 0% marks.

Although, you will be dividing the marks as per your own impressions of the work-ethics of your group members, a sample marking scheme is denoted below:

1. 1st Member Name - 51-60    most active and has the greatest contribution.
2. 2nd Member Name - 41-50    above average contribution
3. 3rd Member Name - 31-40    average contribution
4. 4th Member Name - 15-30    below average contribution
5. 5th Member Name - 1-14    very little contribution
6. 6th Member Name - 0    never showed up. Did not contribute at all

#### Final exam

Please note that there is NO final exam.

#### Mid-term exams I and II (30% each)

The course will have 2 in-person mid-terms (that may have to transition online for CoVID-protocol), each covering 2 modules and each having 30% weightage on Thursday 10th February 2022 and Thursday 24th March 2022 respectively from 9:30-11:00am. If for some reason these dates don't work for you, please notify the instructor before the course-drop deadline, in order to seek accommodation.

Mid-Term Exam 1 will cover Modules 1 and 2, while Mid-Term Exam 2 will cover Modules 3 and 4. If the exams are in-person, they will be closed-book. If the exams are forced online due to CoVID, we will discuss about this in the class, with a strong probability of an open-book time-stressed exam. **Failure to follow the expected guidelines with respect to academic honesty may result in disciplinary action.** Questions will mainly be short-answer type and will also include various types of questions (e.g. true/false, long and short-answer, match the following, fill in the blanks, short numericals, statistical data interpretation etc.). **You cannot copy and paste material from any source, or re-type material directly from source as an answer to an exam question.** You must compose answers in your own words. You will not need access to Minitab.

*I recommend reviewing the Learning Outcomes from each lecture as a way to prepare for the exam*

***If you run into a technical problem during the exam, please email me immediately [anubhav.singh@ubc.ca](mailto:anubhav.singh@ubc.ca)***

### Learning Analytics

Learning analytics includes the collection and analysis of data about learners to improve teaching and learning. This course will be using the following learning technologies: Canvas. This tool captures data about your activity and provide information that can be used to improve the quality of teaching and learning. In this course, I plan to use analytics data to:

- View overall class progress
- Review statistics on course content being accessed to support improvements in the course
- Monitor adherence to academic integrity by applying analytics on quizzes, assignments and on-line exams.

### Academic integrity

The academic enterprise is founded on honesty, civility, and integrity. All UBC students are expected to behave as honest and responsible members of an academic community. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work.

It is the student's obligation to learn, understand and follow the standards for academic honesty. Students must be aware that standards at the University of British Columbia may be different from those in secondary schools or at other institutions.

Violations of academic integrity lead to the breakdown of the academic enterprise, and therefore serious actions are taken. Plagiarism or cheating may result in a mark of zero on an assignment, exam, or course. More serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Academic misconduct may result in a one-year suspension from the University and a notation of academic discipline on the student's record.

The [UBC library](#) has a useful Academic Integrity website that explains what plagiarism is and how to avoid it. If a student is in any doubt as to the standard of academic honesty in a particular course or assignment, then the student must consult with the instructor as soon as possible. A more detailed description of academic integrity, including the University's policies and procedures, may be found in the [Academic Calendar](#). All course work may be submitted to Turnitin.com for review.

### University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on [the UBC Senate website](#).

## Course Schedule with Required Readings and Activities

Module 1	Food Product Development Concepts
<p><b>Required Reading/Watching</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://www.youtube.com/watch?v=q4wRyU-OyE0">https://www.youtube.com/watch?v=q4wRyU-OyE0</a> (3:58) Concept to Consumer -Leatherhead Food Research</li> <li>2. On-line assignment ED.TED <a href="https://ed.ted.com/on/l79EKPov">https://ed.ted.com/on/l79EKPov</a> (17:34)</li> <li>3. Food product innovation A background paper <a href="http://www.fao.org/docrep/016/j7193e/j7193e.pdf">www.fao.org/docrep/016/j7193e/j7193e.pdf</a> <ul style="list-style-type: none"> <li>▪ Pages 6 - 10 Product Development in the Food Industry</li> <li>▪ Pages 17 - 19 Case Studies – Flavored fruit pieces; Milk for lactose-intolerant</li> </ul> </li> <li>4. Guide to Project Management Body of Knowledge (PMBOK) 3<sup>rd</sup> Ed.           <ol style="list-style-type: none"> <li>a. Section 1.2 – What is a Project;</li> <li>b. 1.3 – What is Project Management;</li> <li>c. 3.2.1-5 – The Planning Process Group (Review the figures);</li> <li>d. Appendix F Summary of Project Management Knowledge Areas</li> </ol> </li> <li>5. Perchonok, M (2008) <i>Shelf-Life Considerations and Techniques</i>, in Food Product Development: Based on Experience (ed C. Side), Iowa State Press, Ames, Iowa, USA. doi: 10.1002/9780470376898.ch6           <ol style="list-style-type: none"> <li>a. 1.6.2 Raw Material Specifications</li> </ol> </li> </ol> <p><b>Review the following websites so you understand the information available on-line</b></p> <ul style="list-style-type: none"> <li>• <a href="http://www.usp.org/">http://www.usp.org/</a></li> <li>• <a href="http://www.fao.org/food/food-safety-quality/scientific-advice/jecfa/en/">http://www.fao.org/food/food-safety-quality/scientific-advice/jecfa/en/</a></li> <li>• <a href="http://www.inspection.gc.ca/food/labelling/guide-to-food-labelling-and-advertising/eng/1300118951990/1300118996556">http://www.inspection.gc.ca/food/labelling/guide-to-food-labelling-and-advertising/eng/1300118951990/1300118996556</a></li> <li>• <a href="http://www.inspection.gc.ca/food/labelling/reference-documents/interactive-food-label/eng/1302802599765/1302802702946">http://www.inspection.gc.ca/food/labelling/reference-documents/interactive-food-label/eng/1302802599765/1302802702946</a></li> <li>• <a href="http://www.inspection.gc.ca/food/labelling/food-labelling-for-industry/nutrition-labelling/nutrition-facts-table-formats/eng/1389209684841/1389210023155">http://www.inspection.gc.ca/food/labelling/food-labelling-for-industry/nutrition-labelling/nutrition-facts-table-formats/eng/1389209684841/1389210023155</a></li> <li>• Guide for preparing a preventive control plan           <ul style="list-style-type: none"> <li>• <a href="https://www.inspection.gc.ca/preventive-controls/preventive-control-plans/guide/eng/1427746591578/1427746679297">https://www.inspection.gc.ca/preventive-controls/preventive-control-plans/guide/eng/1427746591578/1427746679297</a></li> </ul> </li> <li>• ISO International Standards Organization           <ul style="list-style-type: none"> <li>• <a href="http://www.iso.org/iso/home/standards/management-standards/iso22000.htm">http://www.iso.org/iso/home/standards/management-standards/iso22000.htm</a></li> </ul> </li> <li>• GFSI – Global Food Safety Initiative           <ul style="list-style-type: none"> <li>• <a href="https://mygfsi.com/">https://mygfsi.com/</a></li> </ul> </li> </ul>	

Week - Lecture 1 -1	January 11	<p>Before Class: Complete the Course Introduction Module on Canvas &amp; preview the Ed.Ted video</p> <p>9:30-9:45: Course Introduction &amp; <b>Land Acknowledgement Assignment</b></p> <p>9:45-10:05: Module 1 Part 1 Lecture: Concept Development &amp; Project Management</p> <p>10:05-10:25: Watch the Ed.Ted Video and prepare to discuss the work questions during class time on Jan 13.</p> <p>10:25-11:00: Module 1 Part 2 Lecture: Product Formulation &amp; Shelf Life</p>
1-2	13	<p>Before Class: Read the paper '<i>Experimental accelerated shelf-life determination of a ready-to-eat processed food.</i>' available in the "Required Readings" for Module 1. Prepare to discuss &amp; work on the questions on the assignment during class time.</p> <p>9:30-9:45: Warm Up Activity</p> <p>9:45-10:05: Tutorial by TA on Module 1 Group Assignments</p> <p>Group work time (#1):</p> <p>10:05-10:30: Group Introductions &amp; Group Work: Wrap up of Ed.TED assignment (due Jan 18)</p> <p>10:30-11:00: Group Work: Shelf-life Activity Assignment (due Jan 20)</p> <p><b>DUE Land Acknowledgement Assignment</b></p> <p><b>DUE Group Work Contract</b></p>
2-3	18	<p>9:30-9:45: Warm Up Activity</p> <p>9:45-10:10: Module 1 Part 3 &amp; 4 Lecture: Ingredient Sourcing, Scale-up and Labelling</p> <p>10:15-10:40: Module 1 Part 5 Lecture: Production Costs, Sustainability/Environmental Issues &amp; Food Safety</p> <p>Group work time (#2)</p> <p>10:45-11:00: Group Work: work on Product Selection Form (due Jan 20)</p> <p><b>DUE Module 1 Ed.TED assignment</b></p>
2-4	20	<p>9:30-9:45: Warm Up Activity</p> <p>9:45-10:00: Quiz 1</p> <p>Group work time (#3)</p> <p>10:00-10:20: Group Work: Wrap up Product Selection Form (due Jan 20)</p> <p>10:20-11:00: Group Work: Wrap up Module 1 Shelf-life activity assignment (due Jan 20)</p> <p><b>DUE Accelerated Shelf-Life Activity assignment</b></p> <p><b>DUE Product Selection Form</b></p>

Module 2	Design of Experiment
<p><b>Required reading</b></p> <ol style="list-style-type: none"> <li>1. The use and importance of design of experiments (DOE) in process modelling in food science and technology D Granato and VM de Araujo Calado In “Mathematical and statistical methods in food science and technology” John Wiley &amp; Sons, Ltd ISBN: 1-118-43368-8, 978-1-118-43368-3 Page: 1-18DOI: 10.1002/9781118434635.ch01 (Available from UBC Library)</li> <li>2. Video lecture: Using Minitab</li> <li>3. <a href="https://www.scribd.com/document/251747760/How-to-Use-Minitab-4-Design-of-Experiments-pdf">https://www.scribd.com/document/251747760/How-to-Use-Minitab-4-Design-of-Experiments-pdf</a></li> </ol> <p><b>Optional Reading</b></p> <ol style="list-style-type: none"> <li>4. ANOVA and multiple comparisons for Food Science</li> <li>5. Video lecture: Review Statistical Concepts (30min)</li> <li>6. A tutorial on how to use Minitab for Design of Experiment (to enter and analyze data) is at <a href="https://www.minitab.com/en-us/products/minitab/quick-start/">https://www.minitab.com/en-us/products/minitab/quick-start/</a> which requires free registration. There is also a 5 minute video tutorial at <a href="https://www.youtube.com/watch?v=ysTUF15S93w">https://www.youtube.com/watch?v=ysTUF15S93w</a></li> </ol> <p><b>Papers covered in-class lectures</b></p> <ol style="list-style-type: none"> <li>7. Quick and reliable screening of compatible ingredients for the formulation of extended meat cubes using Plackett–Burman design V.K. Modi, M. Prakash / LWT 41 (2008) 878–882</li> <li>8. Optimization of Enzymatic Production Process of Oat Milk Using Response Surface Methodology Aastha Deswal et al., (H. N. Mishra Food Bioprocess Technol (2014) 7:610–618 DOI 10.1007/s11947-013-1144-2</li> <li>9. Optimization of a fermented soy product formulation with a kefir culture and fiber using a simplex-centroid mixture design. 2013). <i>International journal of food sciences and nutrition</i>, 64(8), 929–935. <a href="https://doi.org/10.3109/09637486.2013.816935">https://doi.org/10.3109/09637486.2013.816935</a></li> </ol> <p><b>Papers required for assignments:</b></p> <ol style="list-style-type: none"> <li>10. Improving Knowledge of Garlic Paste Greening through the Design of an Experimental Strategy M. AGUILAR, F RINCÓN J. Agric. Food Chem. 2007, 55, 10266–10274</li> <li>11. Optimization of Fruit Punch Using Mixture Design Kumar et al. 2010 Journal of Food Science. S. BHARATH KUMAR et al., Vol. 75, Nr. 1, 2010 S1-S7</li> </ol>	
3-5	<p>January 25</p> <p>9:30-9:45: Warm Up Activity 9:45-10:05: Module 2 Part 1 Lecture: Introduction to Design of Experiment Group work time (#4) 10:05-10:25: Group Work: Start working on the draft case report #1 (due on Feb 10). 10:25-11:00: Module 2 Part 2 Lecture: Fractional and Full Factorial Designs (21:30 min)</p>
3-6	<p>28</p> <p>9:30-9:45: Warm Up Activity 9:45-10:15: Tutorial by TA on Using Minitab &amp; ANOVA Group work time (#5): 10:15-11:00: Group Work: Work on Q1 and Q2 of the Module 2 DOE assignment on fractional &amp; full-factorial design (due Feb 3)</p>
4-7	<p>February 1</p> <p>9:30-9:45: Warm Up Activity 9:45-10:30: Module 2 Part 3 &amp; 4 Lecture - Response Surface &amp; Mixture Design Group work time (#6): 10:30-11:00: Group Work: Work on Q3 and Q4 of the Module 2 DOE assignment on response-surface &amp; mixture design (due Feb 3)</p>
4-8	<p>3</p> <p>9:30-9:45: Warm Up Activity 9:45-10:00: Quiz 2 Group work time (#7) 10:00-10:30: Group Work: Wrap up Module 2 DOE assignment (due Feb 3)</p>

		10:30-11:00: Group Work: Continue working on draft case report #1 (due Feb 10) <b>DUE Module 2 DOE Assignment</b>
5-9	5	9:30-9:45: <i>Warm Up Activity</i> 9:45-10:15: <i>Mid-Term 1 Review: Format, Doubts, Q&amp;A</i> <i>Group Work time (#8)</i> 10:15-11:00: Group Work: Continue working on draft case report #1 (due Feb 10)
5-10	10	<b>Mid-Term Exam 1</b> <b>DUE Draft Case report #1</b>

Module 3		Sensory Evaluation
<p><b>Required reading:</b></p> <ol style="list-style-type: none"> <li><a href="https://archive.org/details/laboratorymethod00otta">https://archive.org/details/laboratorymethod00otta</a> Laboratory Methods for Sensory Analysis of Food LM Poste, DA Mackie, G Butler, E. Larmond Agriculture Canada Publication 1864/E 1991</li> <li>IFST Guidelines for Ethical and Professional Practices for the Sensory Analysis of Foods</li> </ol> <p><b>Optional Reading:</b></p> <ol style="list-style-type: none"> <li>Video lecture: Review Statistical Concepts (30 min)</li> </ol> <p><b>Papers covered in-class lecture – Examples</b></p> <ol style="list-style-type: none"> <li>Shelf-Life Estimation of Apple-Baby Food. GÁMBARO, A., ARES, G. and GIMÉNEZ, A. (2006), Journal of Sensory Studies, 21: 101-111. <a href="https://doi.org/10.1111/j.1745-459X.2006.00053.x">https://doi.org/10.1111/j.1745-459X.2006.00053.x</a></li> <li>Advanced Analytical Sensory Correlation – Towards a Better Molecular Understanding of Coffee Flavor Josef Kerlera et al., <i>Flavour Science</i> Proceedings from XIII Weurman Flavour Research Symposium 2014, Pages 39-44 <a href="https://doi.org/10.1016/B978-0-12-398549-1.00007-6">https://doi.org/10.1016/B978-0-12-398549-1.00007-6</a></li> <li>Sensory evaluation of "dulce de leche" with coffee and whey using different affective data analysis methods. Ferreira et al (2011). <i>Food Science and Technology</i>, 31(4), 998-1005. <a href="https://doi.org/10.1590/S0101-20612011000400028">https://doi.org/10.1590/S0101-20612011000400028</a></li> <li>Passion fruit juice with different sweeteners: sensory profile by descriptive analysis and acceptance. Izabela Furtado et al. <i>Food Sci Nutr</i>. 2015 Mar; 3(2): 129–139. doi: <a href="https://doi.org/10.1002/fsn3.195">10.1002/fsn3.195</a></li> </ol>		
6-11	February 15	9:30-9:45: Warm Up Activity 9:45-10:05: Module 3 Part 1 Lecture: Introduction to Sensory Evaluation Group work time (#9) 10:05-10:25: Group Work: Start working on the Final Case Report #1 (due on Feb 17). 10:25-11:00: Module 3 Part 2 Lecture: Discriminative tests
6-12	17	9:30-9:45: Warm Up Activity Group work time (#10) 9:45-11:00: Group Work: Wrap up Final Case Report #1 (due Feb 17) <b><i>DUE: Final Case Report #1</i></b>
-	21-25	<i>Reading Break</i>
7-13	March 1	9:30-9:45: Warm Up Activity 9:45-10:05: Module 3 Part 3 Lecture: Descriptive tests 10:05-10:40: Module 3 Part 4 Lecture: Affective evaluation 10:40-11:00: Quiz 3
7-14	3	9:30-9:45: <i>Warm Up Activity</i> 9:45-10:00: Tutorial by TA on Module 3 Sensory Data Assignment Group work time (#11) 10:00-10:30: Group Work: Start working on Module 3 Sensory Data assignment (due Mar 10) 10:30-11:00: Group Work: Start working on draft case report #2 (due Mar 24)



Module 4		Additives
<b>Optional Reading:</b> <ol style="list-style-type: none"> <li>Carocho, M., Barreiro, M.F., Morales, P. and Ferreira, I.C. (2014), Adding Molecules to Food, Pros and Cons: A Review on Synthetic and Natural Food Additives. <i>Comprehensive Reviews in Food Science and Food Safety</i>, 13: 377-399. <a href="https://doi.org/10.1111/1541-4337.12065">https://doi.org/10.1111/1541-4337.12065</a></li> <li>Chapter 7 Food Emulsifiers and Stabilizers N. Garti In <i>Food Shelf Life Stability: Chemical, Biochemical, and Microbiological Changes</i> Edited by David S. Robinson, N. A. Michael Eskin 2001.</li> <li>Video Lecture: Emulsifiers (23:11 min)</li> <li>Chemical Leaveners Lallemande Baking Update Vol 1, Number 12</li> <li>Lück E., Jager M. (1997) Antimicrobial Action of Preservatives. In: <i>Antimicrobial Food Additives</i>. Springer, Berlin, Heidelberg</li> <li>Food Additives Edited by JH. Thorngate III, S Salminen, LA. Branen, MP. Davidson CRC Press 2001 <ul style="list-style-type: none"> <li>Chapter 16 JH Thorngate III 2002 Synthetic Food Colorants. (focus mainly from section III. INTERNATIONAL GOVERNMENT REGULATION onward Note: colours permitted in Canada listed in Table 7 is not accurate</li> <li>Chapter 17 YK Lee, HP Khng 2002 Natural Color Additives</li> </ul> </li> <li>Flavour compounds in foods. B Sun-Pan, J-M Kuo, and C-M Wu Chapter 11 In <i>Chemical and Functional Properties of Food Components</i>, 3<sup>rd</sup> ed ZE Sikorski (Ed) CRC Press 2006</li> </ol>		
8-15	March 8	9:30-9:45: Warm Up Activity 9:45-10:05: Module 4 Part 1 Lecture: Introduction to Food Additives 10:05-10:30: Module 4 Part 2 Lecture: Stabilizers 10:30-11:00: Module 4 Part 3 Lecture: Flavors
8-16	10	9:30-9:45: Warm Up Activity 9:45-10:00: Tutorial by TA on Module 4 Additives Assignment Group work time (#12) 10:00-10:30: Group Work: Start working on Module 4 Additives Assignment (due Mar 17) 10:30-11:00: Group Work: Wrap up Module 3 Sensory Data assignment (due Mar 10) <i>DUE: Module 3 Sensory Evaluation Assignment</i>
9-17	15	9:30-9:45: Warm Up Activity 9:45-10:00: Quiz 4 10:05-10:30: Module 4 Part 4 Lecture: Color 10:30-11:00: Module 4 Part 5 Lecture: Anti-microbials
9-18	17	9:30-9:45: Warm Up Activity 9:45-10:00: Quiz 5 Group work time (#13) 10:00-10:30: Group Work: Wrap up Module 4 Additives assignment (due Feb 3) 10:30-11:00: Group Work: Continue working on draft case report #2 (due Mar 24) <i>DUE: Module 4 Additives Assignment</i>
10-19	22	9:30-9:45: Warm Up Activity 9:45-10:15: Mid-Term 2 Review: Format, Doubts, Q&A Group Work time (#14) 10:15-11:00: Group Work: Continue working on draft case report #2 (due Mar 24)
10-20	24	<b>Mid-Term Exam 2</b> <i>DUE Draft Case report #2</i>
11-21	29	9:30-9:45: Warm Up Activity Group Work Time (#15) 9:45-11:00: Group Work: Start working on Final Case Report #2 (due Mar 31)

11-22	31	9:30-9:45: Warm Up Activity <i>Group Work Time (#16)</i> 9:45-11:00: Group Work: Wrap up Final Case Report #2 (due Mar 31) <i>DUE Final Case Report #2</i> <i>REPORTS TO CRITIQUE SENT OUT TO GROUPS on 1<sup>st</sup> April 2022</i>
12-23	April 5	9:30-9:45: Warm Up Activity <i>Group Work Time (#17)</i> 9:45-11:00: Group Work: Start working on the Case Critique (due Apr 8) <i>DUE: Final Report #2 by 11:59 pm– one per group</i>