



EQVEGAN
European Qualifications & Competences for the Vegan Food Industry
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Deliverable 2.1

Innovative training for the vegan food industry operator

Workpackage 2 Design of innovative trainings
Task 2.1 Design learning outcomes-based VET training using ECVET credits for EQF 4
Lead Beneficiary Malta College of Arts, Science & Technology (MCAST)

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Foreword

The work described in this guideline was developed under the project EQVEGAN: European Qualifications & Competences for the Vegan Food Industry (621581-EPP-1-2020-1-PT-EPPKA2-SS). If you wish any other information related to this report or the EQVEGAN project please visit the project web-site (www.eqvegan.eu) or contact:

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1. Summary

EQVEGAN project will provide updated trainings to vegan food industry professionals in order to improve their technical and soft skills in the fast-changing industry. The training materials are prepared for four European Qualifications Framework (EQF) levels, from level 4 to level 7. The occupational profiles tackled by EQVEGAN are the “Fruit, vegetable and related preserver” (EQF4, ISCO-08 code, ESCO 7514), “Food Production Operator” (EQF 4), the “Food technician” (EQF 5), the Food Technologist/Engineer (EQF 6 and 7).

Another level for the training materials is the trainer level which is the subject of this deliverable. The aim of this deliverable is to guide the trainers who will use the training materials prepared by EQVEGAN project on how they need to conduct the trainings and use the materials. It contains information about the trainings including modules, teaching topics, learning outcomes and the content of trainings.

2. Trainings in EQVEGAN

Trainings were designed into four modules:

- 1- Plant-based processing technology,
- 2- Green skills,
- 3- Digitalization and automation,
- 4- Soft skills

The modules are composed of units. In training materials, the aim and description of the units are provided, the teaching topics and learning outcomes are defined and the whole content is given. The assessment, reading list and resources for unit are explained as well.

The stakeholders of the EQVEGAN were identified and professional’s profiles were defined in the first work package of the projects, which constituted the objectives to the design of training. These results are available on the Food Skills portal (food-skills.eu).

The quality of trainings will be assessed for validation and further improvement. Learning outcomes, ECVET and ECTS credits will be validated across the different countries to facilitate the design of a reliable European certification scheme. The certification scheme will be designed to include recognition of prior non-formal and informal learning and guidelines will be issued for guidance by the training organizations.

3. Training for the vegan food industry technician

The trainings of food industry technician (EQF 4) should consist of lectures, and practicals and site visits.

The following sections identify the aim of the respective module in EQF 4, a short description of the module, the contents being explored, the suggested reading and link to training materials that the trainers can use.

3.1. Plant-Based Processing Technology

This module covers:

- Technologies
- Nutrition
- Food safety
- Analysis

3.1.1. Technologies

Aim of Unit: Design of innovative trainings

Unit aims to bring to students' knowledge of vegan food production.

Students will gain knowledge of the basic raw materials for vegan food production and the modern technological processes used in the food industry. Technologies for the production of food analogues of animal origin and the use of fermentation processes will be presented in detail. Special attention will be paid to the production of safe food and the potential for adulteration. It is suggested a module of 3 ECVET credits.

Description of Unit:

In the Technology unit, students will learn about methods and strategies used in vegan food production. The aim of the unit is to provide students with knowledge of the quality requirements of plant raw materials used in the production of vegan food, modern methods of producing plant protein as a substitute for animal protein in the vegan diet, technological processes and operations used in the production of plant analogues of animal products. Students will learn about food preservation methods and become familiar with current fermented food production strategies. The effects of thermal and non-thermal processes on the sensory quality of finished products will be presented.

Teaching Topics:

EQF4
Contact hours: 7.5 hours. Non-contact hours: 11 hours
1. Plants and microorganisms
2. Production of plant proteins
3. Thermal and non-thermal food processing
4. Technologies of meat analogues
5. Technologies of dairy analogues
6. Technologies of eggs analogues
7. Technologies of fermented and non-fermented beverages

Learning Outcomes:

1. V4EQL_K01 Recognize the differences between vegan and other vegetarian diets and the potential health benefit
2. V4EQL_K02 Recognize the main conservation/preservation technologies and identify the manufacturing phases of Vegan foods, Dairy & Meat substitute

3. V4EQL_K03 Handle the appropriate equipment for each method of preservation/processing of Vegan foods, Dairy & Meat substitutes respecting the standards of quality, hygiene and food safety and health and safety at work
4. V4EQL_K04 Identify the factors that influence the quality of vegan products from receipt of raw materials to dispatch.

Content of Unit:

1. Introduction
2. Plants and microorganisms as sources of vegan food – quality, production, properties, application
 - 2.1. Legume-based products
 - 2.2. Legumes as components of food products
 - 2.3. The meaning of allergens in vegan food production
 - 2.4. The use of fungi and yeast in the production of vegan food
 - 2.5. Technological treatment of fungi and yeasts
 - 2.6. Biotechnological treatment of fungi and yeast
3. Production of plant proteins
 - 3.1. Plant protein extraction methods
 - 3.2. Plant protein extrusion
 - 3.3. Comparison of plant based proteins from different sources
4. Thermal and non-thermal food processing
 - 4.1. Thermal food processing
 - 4.2. Non-thermal food processing
5. Meat analogues
 - 5.1. Basics of the production of meat analogues
 - 5.2. Technologies in the production of meat analogues
 - 5.3. Design and manufacture of meat analogues
6. Dairy analogues
 - 6.1. Liquid dairy analogues
 - 6.2. Fermented dairy analogues
 - 6.3. Quark analogues
 - 6.4. Cheese analogues
 - 6.5. Spread analogues
7. Egg analogues
 - 7.1. Basics of the production of egg analogues
 - 7.2. Ingredients and technologies in the production of egg analogues
 - 7.3. Design and manufacture of egg analogues
8. Alcoholic and non-alcoholic beverages
 - 8.1. Fermented beverages
 - 8.2. Non-fermented beverages

Assessment:

1. Know raw materials used for protein production
2. Compare technics used for protein production.
3. Show differences between proteins from different sources.
4. Know the main methods for meat analogues production
5. Know the main methods for dairy analogues production
6. Know the main methods for egg analogues production
7. Know the main methods for fermented food production

Reading List for Unit:

1. Abu-Ghannam, N., & Gowen, A. (2011). Pulse-based food products. *Pulse Foods: Processing, Quality and Nutraceutical Applications*, 249-278.
2. Chang, A. S., Sreedharan, A., & Schneider, K. R. (2013). Peanut and peanut products: A food safety perspective. *Food Control*, 32(1), 296-303.
3. Colletti, A., Attrovio, A., Boffa, L., Mantegna, S., & Cravotto, G. (2020). Valorisation of by-products from soybean (*Glycine max* (L.) Merr.) processing. *Molecules*, 25(9), 2129.
4. Duodu, K. G., & Minnaar, A. (2011). Legume composite flours and baked goods: Nutritional, functional, sensory, and phytochemical qualities. In *Flour and breads and their fortification in health and disease prevention* (pp. 193-203). Academic Press.
5. He, Y., Meda, V., Reaney, M. J., & Mustafa, R. (2021). Aquafaba, a new plant-based rheological additive for food applications. *Trends in Food Science & Technology*.
6. Jahreis, G., Brese, M., Leiterer, M., Schafer, U., & Bohm, V. (2016). Legume flours: nutritionally important sources of protein and dietary fiber. *Ernahrungs umschau*, 63(02), 36-42.
7. Kolapo, A. L., & Sanni, M. O. (2009). A comparative evaluation of the macronutrient and micronutrient profiles of soybean-fortified gari and tapioca. *Food and Nutrition Bulletin*, 30(1), 90-94.
8. Kaur, R., & Prasad, K. (2021). Technological, processing and nutritional aspects of chickpea (*Cicer arietinum*)-A review. *Trends in Food Science & Technology*.
9. Nawaz, M. A., Tan, M., Øiseth, S., & Buckow, R. (2020). An emerging segment of functional legume-based beverages: a review. *Food Reviews International*, 1-39
10. Pasqualone, A., Costantini, M., Coldea, T. E., & Summo, C. (2020). Use of legumes in extrusion cooking: A review. *Foods*, 9(7), 958.)
11. <https://www.foodnavigator-usa.com/News/Promotional-Features/Legume-based-snacks-a-great-alternative-to-industrial-products>
12. <https://www.shutterstock.com>
13. <https://www.dacsa.com/the-revolution-of-snacks-with-legume-flour/>
14. <https://www.nutraingredients-asia.com/Article/2019/06/20/Top-four-dietary-supplement-trends-in-New-Zealand-revealed-by-national-industry-organisation>

15. Wood, J. A., & Malcolmson, L. J. (2011). Pulse milling technologies. *Pulse foods: Processing, quality and nutraceutical applications*, 193-221.
16. Rahman M.M., Lamsal B.P. (2020) Ultrasound-assisted extraction and modification of plant-based proteins: Impact on physicochemical, functional, and nutritional properties. *Compr Rev Food Sci Food Saf* 20:1457-1480.
17. Wittek P., Zeiler N., Karbstein H.P., Emin M.A. (2021) High moisture extrusion of soy protein: investigations on the formation of anisotropic product structure. *Foods* 10:102.
18. Cornet S.H.V., Snel S.J.E., Schreuders F.K.G., van der Sman R.G.M., Beyrer M., van der Goot A.J. (2020) Thermo-mechanical processing of plant proteins using shear cell and high-moisture extrusion cooking. *Crit Rev Food Sci* DOI: 10.1080/10408398.2020.1864618
19. Zhu H.-G., Tang H.Q. Cheng Y.-Q., Li Z.-G. Tong L.T. (2021) Electrostatic separation technology for obtaining plant protein concentrates: A review. *Trends Food Sci Tech* 113:66-76.
20. Erdogdu, F., Karatas, O. and Sarghini, F. 2018. A short update on heat transfer modelling for computational food processing in conventional and innovative processing. *Current Opinion in Food Science*. 23: 113-119.
21. Erdogdu, F., Sarghini, F. and Marra, F. 2017. Mathematical modeling for virtualization in food processing. *Food Engineering Reviews*. 9: 295-313.
22. Kirit, B., Erdogdu, F. and Ozdemir, Y. (2013). Accumulation of 5-hydroxymethyl-2-furfural during toasting of white bread slices. *Journal of Food Process Engineering*. 36: 241-246.
23. Boz, Z. and Erdogdu, F., "Thermal processing: aseptic processing and canning", *Handbook of Vegetable Preservation and Processing*, 2nd ed., ed. by Hui, Y. H. and Evranuz, O., chpt.-7, CRC Press –Taylor & Francis Group, Boca Raton, FL, USA, 2016.
24. Filho P.F.S., Nair R.B., Andersson D., Lennartsson P.R., Taherzadeh M.J. (2018) Vegan-mycoprotein concentrate from pea-processing industry byproduct using edible filamentous fungi. *Fungal Biol Biotechnol* 5:5. DOI: 10.1186/s40694-018-0050-9
25. Scientists create vegan ice-cream from genetically modified yeasts. (2019) *Asian News International*.
26. Ghifari A.M.A. (2021) Acceptability and nutrients content (vitamin B12 and Folic acid) of substituted snack bar with purple sweet potato (*Ipomoea batatas* L.) enriched with nutritional yeast as healthy vegan food. *Ghifari. Media Gizi Indonesia (National Nutrition Journal)* 16(1): 79–85.
27. Monteyne A.J., Dunlop M.V., Machin D.J., Coelho M.O.C., Pavis G.F., Porter C., Murton A.J., Abdelrahman D.R., Dirks M.L., Stephens F.B., Wall B.T. (2021) A mycoprotein-based high-protein vegan diet supports equivalent daily myofibrillar protein synthesis rates compared with an isonitrogenous omnivorous diet in older adults: a randomised controlled trial. *Brit J Nutr* 126:674-684.
28. Samard S., Ryu G.H. (2019) Physicochemical and functional characteristics of plant protein-based meat analogues. *J Food Process Preserv* 43:e14123

29. Schreuders F.K.G., Schlangen M., Kyriakopoulou K., Boom R., van der Goot A.J. (2021) Texture methods for evaluating meat and meat analogue structures: A review. *Food Control* 127:108103.
30. Kim T., Riaz M.N., Awika J., Teferra T.T. (2021) The effect of cooling and rehydration methods in high moisture meat analogs with pulse proteins-peas, lentils, and faba beans. *J Food Sci* 86:1322-1334.
31. Kumar S. (2016) Meat Analogs “Plant based alternatives to meat products: Their production technology and applications” *Crit Rev Food Sci* DOI: 10.1080/10408398.2016.1196162
32. Dekkers B.L., Boom R.M., van der Goot A.J. (2018) Structuring processes for meat analogues. *Trends Food Sci Tech* 81:25-36.
33. Jeewanthi R.K.C., Paik H.D. (2018) Modifications of nutritional, structural, and sensory characteristics of non-dairy soy cheese analogs to improve their quality attributes. *J Food Sci Technol* 55 (11):4384-4394.
34. Tangyu M., Muller J., Bolten C.J., Wittmann C. (2019) Fermentation of plant-based milk alternatives for improved flavour and nutritional value. *Appl Microbiol Biot* 103:9263-9275.
35. Grossmann L., McClemens D.J. (2021) The science of plant-based foods: Approaches to create nutritious and sustainable plant-based cheese analogs. *Trends Food Sci* 118:207-229.
36. Laaksonen O., Kahala M., Marsol-Vall A., Blasco L., Järvenpää E., Rosenvald S., Virtanen M., Tarvainen M., Yang B. (2021) Impact of lactic acid fermentation on sensory and chemical quality of dairy analogues prepared from lupine (*Lupinus angustifolius* L.) seeds. *Food Chem* 346:128852.
37. McClements D.J., Grossmann L. (2021) The science of plant-based foods: Constructing next-generation meat, fish, milk, and egg analogs. *Compr Rev Food Sci F* 20:4049-4100.
38. Yazici G.N., Ozer M.S. (2021) A review of egg replacement in cake production: Effects on batter and cake properties. *Trends Food Sci Technol* 111:346-359.
39. Lafarga T. Alvarez C., Villaro S. Bobo G., Aguilo-Aguayo I. (2020) Potential of pulse-derived proteins for developing novel vegan edible foams and emulsions. *Int J Food Sci Technol* 55:475-481.
40. Raikos V., Hayes H., Ni H. (2019) Aquafaba from commercially canned chickpeas as potential egg replacer for the development of vegan mayonnaise: recipe optimisation and storage stability. *Int J Food Sci Technol* 55:1935-1942.

Resources for Unit:

- A fully equipped classroom
- Hardware and software for online teaching
- Whiteboard
- Projector

3.1.2. Nutrition

Aim of Unit:

This topic aims at highlighting the different types of plant-based diets available and the sources of macro and micronutrients from different forms of vegetarian beverages and food. The importance of accessibility of proteins in different plant-based foods will also be discussed.

Description of Unit:

In unit Nutrition, students will become familiar with vegetarian diets categorization. The unit aims to deliver to students knowledge concerning nutritional value of vegan diets in relation to type/restrictiveness. Students will learn how to distinguish/analyse deficiencies, identify and avoid them on vegetarian diets in human nutrition. They get acquainted with the bioavailability and bioaccessibility evaluation and modifications on plant diets. Liebig law development in relation to proteins complementation in vegan nutrition will be presented and discussed.

Methods of the diet supplementation and complementation of vegan diet will be presented (training will be performed).

Health-related benefits and threats of plant diets consumption will be analysed basing on population studies.

Teaching Topics:

EQF4
Contact hours: 7.5 hours. Non-contact hours: 11 hours
1. Plant diets – categorization and definition
2. Macro- and micronutrients in vegetarian diets (Nutritional value)
3. Nutrient's bioavailability and bioaccessibility of vegan diets
4. Protein complementation in vegan diets
5. Health-related benefits and threats of plant diets consumption

Learning Outcomes:

- Name and explain basic types of vegetarian diets, definitions, and rules of their application.
- Define the primary categorization of nutritional value vegan diets.
- Name and understand the general rules of bioavailability and bio accessibility nutrients in plant diets.
- Understand the basics roles of protein's complementation on vegetarian's dietary patterns.
- Understand the risks and benefits in terms of health and moncommunicable diseases.

Assessment:

1. Distinguish and categorize type of animal protein restrictions in dietary patterns.
2. Explain and discuss levels of restrictiveness.
3. List how to increase nutritional value of vegan diets.
4. Plan meals to include higher bioavailability of nutrients
5. Plan meals to include protein complementary mechanism.
6. List the potential risks and benefits of vegan nutrition and the benefit in non-communicable diseases epidemic

Reading List for Unit:

1. Rizzo, N. S., Jaceldo-Siegl, K., Sabate, J., & Fraser, G. E. (2013). Nutrient profiles of vegetarian and nonvegetarian dietary patterns. *Journal of the Academy of Nutrition and Dietetics*, 113(12), 1610–1619.
<https://doi.org/10.1016/j.jand.2013.06.349>
2. Clarys, P., Deliens, T., Huybrechts, I., Deriemaeker, P., Vanaelst, B., De Keyzer, W., Hebbelinck, M., & Mullie, P. (2014). Comparison of nutritional quality of the vegan, vegetarian, semi-vegetarian, pesco-vegetarian and omnivorous diet. *Nutrients*, 6(3), 1318–1332. <https://doi.org/10.3390/nu6031318>
3. Dinu, M., et al. (2017). Vegetarian, vegan diets and multiple health outcomes: A systematic review with meta-analysis of observational studies [Abstract].
<https://www.tandfonline.com/doi/abs/10.1080/10408398.2016.1138447?journalCode=bfsn20>
4. Kim, H., et al. (2019). Plant-based diets are associated with a lower risk of incident cardiovascular disease, cardiovascular disease mortality, and all-cause mortality in a general population of middle-aged adults.
<https://www.ahajournals.org/doi/10.1161/JAHA.119.012865>
5. Qian, F., et al. (2019). Association between plant-based dietary patterns and risk of type 2 diabetes: A systematic review and meta-analysis [Abstract].
[https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2738784?guestAccessKey=5e8aaedb-e77d-4bc1-9d52-b626e406138e&utm_source=For The Media&utm_medium=referral&utm_campaign=ftm links&utm_content=tf1&utm_term=072219](https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2738784?guestAccessKey=5e8aaedb-e77d-4bc1-9d52-b626e406138e&utm_source=For%20The%20Media&utm_medium=referral&utm_campaign=ftm_links&utm_content=tf1&utm_term=072219)
6. Reinhart, R. J. (2018). Snapshot: Few Americans vegetarian or vegan.
<https://news.gallup.com/poll/238328/snapshot-few-americans-vegetarian-vegan.aspx>
7. Saturated fat. (n.d.). <https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/saturated-fats>
8. Turner-McGrievy, G. M., et al. (2015). Comparative effectiveness of plant-based diets for weight loss: A randomized controlled trial of five different diets [Abstract].
<https://www.sciencedirect.com/science/article/abs/pii/S0899900714004237>
9. Whole grains, refined grains, and dietary fiber. (2016).
<https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/nutrition-basics/whole-grains-refined-grains-and-dietary-fiber>

10. World Health Organization. (2015). IARC Monographs evaluate consumption of red meat and processed meat [Press release]. https://www.iarc.fr/wp-content/uploads/2018/07/pr240_E.pdf
11. <https://www.eatrightpro.org/-/media/eatrightpro-files/practice/position-and-practice-papers/position-papers/vegetarian-diet.pdf>
12. Mariotti, François, and Christopher D. Gardner 2019. "Dietary Protein and Amino Acids in Vegetarian Diets—A Review" *Nutrients* 11, no. 11: 2661. <https://doi.org/10.3390/nu11112661>
13. Janet R Hunt, Bioavailability of iron, zinc, and other trace minerals from vegetarian diets, *The American Journal of Clinical Nutrition*, Volume 78, Issue 3, September 2003, Pages 633S–639S, <https://doi.org/10.1093/ajcn/78.3.633S>
14. <https://openbiotechnologyjournal.com/VOLUME/13/PAGE/68/FULLTEXT/>
15. <https://academic.oup.com/nutritionreviews/article/76/11/793/5053734>
16. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7600777/>
17. <https://www.tandfonline.com/doi/abs/10.1080/10408398.2013.781011?tab=permissions&scroll=top>
18. <https://academic.oup.com/ajcn/article/78/3/633S/4690005>
19. *Am J Clin Nutr*, Volume 78, Issue 3, September 2003, Pages 633S–639S, <https://doi.org/10.1093/ajcn/78.3.633S>
20. <https://academic.oup.com/ajcn/article/89/5/1627S/4596952>
21. Petroski, W., & Minich, D. M. (2020). Is There Such a Thing as "Anti-Nutrients"? A Narrative Review of Perceived Problematic Plant Compounds. *Nutrients*, 12(10), 2929. <https://doi.org/10.3390/nu12102929>
22. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7600777/>
23. Dinu M, Abbate R, Gensini GF, Casini A, Sofi F. Vegetarian, vegan diets and multiple health outcomes: A systematic review with meta-analysis of observational studies. *Crit Rev Food Sci Nutr*. 2017 Nov 22;57(17):3640-3649. doi: 10.1080/10408398.2016.1138447. PMID: 26853923.
24. <https://www.vegansociety.com/resources/nutrition-and-health/nutrients/iron>
25. https://www.vegansociety.com/sites/default/files/uploads/downloads/Zinc%20PDF_0.pdf
26. Meybeck A, Gitz V. Sustainable diets within sustainable food systems. *Proc Nutr Soc*. 2017 Feb;76(1):1-11. doi: 10.1017/S0029665116000653. PMID: 28195528.

Resources for Unit:

- A fully equipped classroom
- hardware and software for online teaching
- Whiteboard
- Projector

3.1.3. Food Safety

Aim of Unit:

The students will be exposed to the food safety system that is part of the EU legislation. Food safety hazards will be covered along with the prerequisite's programs and HACCP.

Description of Unit:

The unit Safety is practice oriented unit where students will get acquainted with the hygiene requirements for the food premises (outer and inner building requirements); water, air, equipment and surfaces; temperature control; food handling and health of food operators; control of raw materials and food suppliers as well as sanitation protocols, and will learn how to design and complete the mandatory checklists. The topic on HACCP will include concrete information and practical assignments how to perform necessary steps to develop a HACCP plan in vegan food industry.

EQF4
Contact hours: 7.5 hours. Non-contact hours: 11 hours
1. EU food safety systems
2. Food safety hazards
3. Prerequisite programs and HACCP

Learning Outcomes:

- Define the components of the EU food safety system
- State physical, chemical and physical hazards
- Name prerequisites for safe vegan food processing, principles, and steps of the HACCP system

Content of Unit:

1. EU food safety systems
2. Food safety hazards
3. Prerequisite programs and HACCP

Assessment:

Project presentation

Reading List for Unit:

1. Regulation (EC) No 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32002R0178>
2. Regulation (EC) No 852/2004 on the hygiene of foodstuffs <https://eur-lex.europa.eu/eli/reg/2004/852/oj>
3. Australian Institute of Food Safety. 2022. Can Vegans Get Food Poisoning? Retrieved from <https://www.foodsafety.com.au/blog/can-vegans-get-food-poisoning> on January 28, 2022.
4. COMMISSION REGULATION (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs. 2005. Official Journal of the European Union L 338, 26 p.
5. Hadi, J.; Brightwell, G. Safety of Alternative Proteins: Technological, Environmental and Regulatory Aspects of Cultured Meat, Plant-Based Meat, Insect Protein and Single-Cell Protein. *Foods* 2021, 10, 1226. <https://doi.org/10.3390/foods10061226>
6. Heiskanen, S. 2006. Elintarviketeollisuuden HACCP-pohjainen omavalvontaohje. Kasvis- ja marjateollisuus. Versio 5/2006. Helsinki: ETL, Evira & Laatuketju. 35 p. (in Finnish)
7. The Royal Borough of Kensington and Chelsea. 2019. Vegetarian guide to food hygiene. Retrieved from <https://www.rbkc.gov.uk/business-and-enterprise/food-safety/vegetarian-guide-food-hygiene> on January 28, 2022.
8. Regulation (EC) No 852/2004 on the hygiene of foodstuffs <https://eur-lex.europa.eu/eli/reg/2004/852/oj>
9. Implementation of HACCP plan for blue-mould tofu with focus on microbial hazards https://stud.epsilon.slu.se/10477/1/sapieja_a_171019.pdf

Resources for Unit:

- A fully equipped classroom
- Hardware and software for online teaching
- Whiteboard
- Projector

3.1.4. Analysis

Aim of Unit:

The purpose of the unit is to provide students with knowledge of food analysis at the operator level. Students learn about sampling and basic analytical methods in vegan food production. They will gain basic knowledge of food allergens and gluten determination methods.

Description of Unit:

In unit Analysis, students will become familiar with basic methods used in vegan food analysis. The unit aims to deliver to students' knowledge concerning sampling procedures, simple tests for the detection of basic food components (sugars, starch, protein) and determination of water, sodium chloride, vitamin C, pH and titratable acidity as well as Brix degree measurements. Students get acquainted with analysis of food allergens and gluten content.

Teaching Topics:

EQF4
Contact hours: 7.5 hours. Non-contact hours: 11 hours
1. Sampling and basic analytical methods in vegan food production
2. Analysis of food allergens and gluten content

Learning Outcomes:

- Understand the principles of sampling and basic analytical methods in vegan food production
- Identify gluten content materials and main food allergens. Understand the principles of allergen and gluten cross-contact prevention

Content of Unit:

- Sampling in vegan food production
- Qualitative analysis of carbohydrates: reducing sugar detection, starch detection
- Protein detection
- pH and titratable acidity
- Determination of sodium chloride
- Determination of vitamin C
- Determination of water/moisture/dry mass
- Brix degree measurements
- Analysis of food allergens and gluten content

Assessment:

1. Explain principles of sampling and basic analytical methods in vegan food production
2. Name gluten content materials and main food allergens
3. Explain the principles of allergen and gluten cross-contact prevention

Reading List for Unit:

1. ISO 6540 (Determination of moisture in maize)
2. AOAC Method 9.32.14C for solids in syrups
3. AOAC 932.12 (soluble solids by refractometer)
4. AACC 02-52, AOAC 943.02 and 981.12 (pH tests)
5. AOAC 960.29 (Determination of chloride, expressed as sodium chloride)
6. AOAC 939.05 (Acidity determination)
7. Kareem, Mohanad & Sadiq, J & Baqir, Saadon & Aowda, Fatima & Hussein, Fatimah & Alasedi, Muhammed. (2020). Determination of Vitamin C (Ascorbic acid) concentration in some of Commercial Products, by Redox Titration.
8. Tiwari A. (2015). Practical Biochemistry. LAP Lambert Academic Publishing.
9. <https://inspection.canada.ca/preventive-controls/sampling-procedures/eng/1518033335104/1528203403149>
10. S. Suzanne Nielsen (2017) Food Analysis Laboratory Manual, Springer, ISBN 978-3-319-44125-2

Resources for Unit:

- A fully equipped classroom
- hardware and software for online teaching
- Laboratory and materials for microbial surface testing/allergen testing

3.2. Green Skills

Even though food waste is primarily the responsibility of agriculture and consumers, the food industry seeks to improve its performance in order to minimize food waste even further, both for sustainability and profitability. Therefore, 'GREEN SKILLS' assists in building skills in energy and water management.

With suggested 4 ECVET credits, it covers:

- Sustainability,
- Vegan food processing,
- Economy and marketing,
- Society and visibility.

3.2.1. Sustainability

Aim of Unit:

Unit aims to bring to students' knowledge of topics about sustainability, general definition and parameters that stand in terms of sustainable development. The unit aims to deliver to students what sustainable vegan processing and plant-based processing is. Another is to explain energy/water/waste critical points in processing and how food waste in processing can be reduced. Also, observations regarding food waste, would be oriented towards, how to educate consumers how to treat plant-based products, how to reduce, reuse and recycle plant-based products. Through the unit, there will be focus on food by-products and effective usage of by-products in extraction processing and further incorporation of output products. In waste management, it is necessary to establish critical thinking and skills toward future lead in vegan food processing technology.

Description of Unit:

In unit Sustainability, students will become familiar with general definitions and parameters that stand in terms of sustainable development. The unit aims to deliver to students what sustainable vegan processing and plant-based processing is. Another is to explain energy/water/waste critical points in processing and how food waste in processing can be reduced. Students will compare conventional and vegan food processing technologies. Also, students will be trained to prepare plans for food waste reduction in vegan food processing. There will be education regarding food waste, how to educate consumers how to treat plant-based products, how to reduce, reuse and recycle plant-based products. Through the unit, there will be focus on food by-products and effective usage of by-products in extraction processing and further incorporation of output products. In waste management, it is necessary to establish critical thinking and skills toward future lead in vegan food processing technology. There will be usage of software to understand, collect and analyze data from vegan food processing plants and analyze data in terms of sustainable parameters.

Teaching Topics:

EQF4

Contact hours: 7.5 hours. Non-contact hours: 17 hours

1. Introduction to sustainability

- Sustainable food production
- Sustainable food sources
- Protein sources
- Traditional and emerging technologies and approaches used along the food chain
- Challenges for sustainable food value chains
- Strategies for improving the sustainability of food systems
- Sustainable development goals
- Food technology sustainable techniques
- Nutrition
- Future Efforts

2. Energy/water/waste critical points

- Mapping of Energy/water/waste critical points
- Sustainable production
- Carbon cycle
- Actions to make food production more sustainable
- Food classification systems
- Footprint

3. Food waste – targeting consumers

- Vegan food processing and waste
- Comparison with standard technologies information on waste generation
- Comparison of available technologies and waste generation
- Waste utilization

4. Food by-products

- Visit to processing plant (3h)
- Sustainable Development Goals
- Sustainable Food Systems
- Plant food by – products and reusage
- Lean, green and digitalization towards smart, sustainable and energy efficient processing with low emission technologies

5. Waste management

- Visit to processing plant (2h)
- Food waste
- Footprints
- Life cycle assessment and digitalization- waste prevention
- Climate Protection

Learning Outcomes:

- List sustainable parameters
- Name conventional technologies and VFP (vegan food processing) and energy/water/ waste critical points in VFP
- Relate food waste reduction in VFP with consumers
- Underline possible by-products in VFP
- Discuss data that should be obtained to perform sustainability evaluation in VFP

Content of Unit:

1. List sustainable parameters
2. Name conventional technologies and VFP and energy/water/ waste critical points in VFP
3. Relate food waste reduction in VFP with consumers
4. Underline possible by-products in VFP
5. Discuss data that should be obtained to perform sustainability evaluation in VFP

Assessment for unit:

State possible ways of reporting sustainability evaluation that should be present in VFP.

Reading List for Unit:

1. Sustainable Food Processing 1st Edition; by Brijesh K. Tiwari (Editor), Tomas Norton (Editor); Nicholas M. Holden (Editor); Elsevier (2013)
2. Sustainable Food Processing and Engineering Challenges; by Charis Michel Galanakis (Editor); Academic Press; 2021
3. Sustainable Food Systems from Agriculture to Industry, by Charis M. Galanakis (Editor); Academic Press; 2018
4. Sustainable Food Waste Management: Concepts and Innovations, by Monika Thakur, V. K. Modi, Renu Khedkar (Editors); Springer; 2021
5. Valorization of Food Processing By-Products; by M. Chandrasekaran (Editor), CRC, 2012
6. Sustainability of the Food System, by Noelia Betoret, Ester Betoret (Editors); Academic Press; 2020
7. Sustainable Production in Food and Agriculture, by Jolanta B. Królczyk, Pawel Sobczak, Wioletta Żukiewicz-Sobczak (Editors), MDPI Books; 2020

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching;
Whiteboard; Projector, Software for calculations of sustainable parameters.
Special time and organization for on-site visit to vegan food processing plants.

3.2.2. Vegan Food Processing

Aim of Unit:

Unit aims to bring to students knowledge of topics about vegan processing technology, critical points in sustainable vegan food production. The unit aims to deliver to students knowledge about basics vegan processes in no waste philosophy. Another is to explain how sustainable vegan production is.

Description of Unit:

In unit Introduction to vegan processing technology, students will become familiar with general information about basic processes useful in vegan food production and try to implement no waste philosophy in VFP. Another is to explain how sustainable vegan food production is and how to prepare to plan for mapping in sustainable production of vegan food. Students will compare conventional and vegan food processing technologies.

Teaching Topics:

EQF4

Contact hours: 7.5 hours. Non-contact hours: 17 hours

1. Introduction to vegan processing technology (6h)

- Why veganism is key to zero-waste eating ?
- What is veganism?
- What is zero waste?
- Why is veganism the key to zero-waste eating?
- Is veganism healthy?
- What Are Vegan Meat Alternatives Made Of?
- Meat Alternatives, their economical and environmental effects
- Meat Alternative Technology
- Ingredients for Plant-Based Meats and Seafood
- Good Manufacturing guidelines for Vegan Products
- Industry Standards
- Prerequisite Programmes

2. Mapping of critical points in sustainable vegan food production (raw material, processing, packaging) (12h)

- The relationship between health and diet
- The relationship between environment and plant-based diet

Learning Outcomes:

- Implement “no waste” philosophy in VFP.

- Create a plan for mapping in sustainable production of vegan food.

Content of Unit:

1. Implement “no waste” philosophy in VFP.
2. Create a plan for mapping in sustainable production of vegan food.

Reading List for Unit:

1. Agnoli, C., Baroni, L., Bertini, I., Ciappellano, S., Fabbri, A., Papa, M., & Sieri, S. (2017). Position paper on vegetarian diets from the working group of the Italian Society of Human Nutrition. *Nutrition, Metabolism, and Cardiovascular Diseases*, 27(12), 1037–1052.
2. Banis, D. (2018). Everything is ready to make 2019 the "year of the vegan". Are you? *Forbes*, 31 Dec, 2018.
3. Pojic, M., Misan, A., & Tiwari, B. (2018). Eco-innovative technologies for extraction of proteins for human consumption from renewable protein sources of plant origin. *Trends in Food Science & Technology*, 75, 93–104.
4. Dagevos, H., & Voordouw, J. (2013). Sustainability and meat consumption: Is reduction realistic? *Sustainability: Science, Practice and Policy*, 9(2), 60–69
5. Ulla A. Saari, U. A. Saari, Cornelius Herstatt, C. Herstatt, Rajnish Tiwari, R. Tiwari, Ozgur Dedehayir, O. Dedehayir, & Saku J. Mäkinen, S. J. Mäkinen. (2021). The vegan trend and the microfoundations of institutional change: A commentary on food producers’ sustainable innovation journeys in Europe. *Trends in food science & technology*, 107, 161-167.

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector.

3.2.3. Economy and Marketing

Aim of Unit:

This unit is aimed to explore the interwinding principles of economy and marketing. Throughout this unit the learner should be guided to foster the ability to turn ideas into actionable business plans. Encouraging learners to be creative, innovative and take calculated risks is essential. This should be in support of their ability to plan and manage projects to achieve objectives.

Being in touch with today's essential requirements dictates that any process embarked upon should rely on a circular economy concept. It is not enough to produce without taking into consideration the future outcomes of such production. Learners should not only be familiar with the concepts of the green economy, but also be able to implement them accordingly.

Traceability is of paramount importance and reflecting this reality, the learners will be able to analyse a production supply chain identifying its hazards and to design a traceability system for the management of food safety problems.

Description of Unit:

In this unit learners will become intrinsically familiar with assessing formal economic approaches and translate them into circular designs, based on concepts of sustainability and productivity. Learners will be exposed to theories that are proved to assist in shifting from linear to circular economy. Importance should also be given to the concepts of green economy. Learners should be familiar with the concept of global environmental concerns, that is, serious environmental issues of immediate global relevance and therefore considered to be of common interest; both in national and international scales.

In traceability the learners are required to master the correct terminology to express concepts relating to traceability, food safety and food quality. Learners must know principles of food safety legislation, food traceability and labeling. Moreover learners are to be exposed to blockchain technologies in order to be able to understand how such technologies can assist in food traceability. Blockchain's properties are to be discussed and applied to a food traceability scenario.

Teaching Topics:

EQF4

Contact hours: 7.5 hours. Non-contact hours: 17 hours

1. Circular economy

- Understand role and objectives of business organisations within the economy
- Understand the difference between linear and circular economy

2. Green economy

- Understand an economy based on low carbon, resource efficiency and social inclusiveness

- Recognise the impact that economic environments leave on the business community

3. Traceability

- Identify the traceability regulations applicable to a specific food industry
- Understand the principles of food traceability

Learning Outcomes:

- Understand role and objectives of business organisations within the economy
- Understand the difference between linear and circular economy
- Understand an economy based on low carbon, resource efficiency and social inclusiveness
- Recognise the impact that economic environments leave on the business community
- Identify the traceability regulations applicable to a specific food industry
- Understand the principles of food traceability

Content of Unit:

1. Understand role and objectives of business organisations within the economy
2. Understand the difference between linear and circular economy
3. Understand an economy based on low carbon, resource efficiency and social inclusiveness
4. Recognise the impact that economic environments leave on the business community
5. Identify the traceability regulations applicable to a specific food industry
6. Understand the principles of food traceability
7. Examine what it takes to be an entrepreneur and the scope of entrepreneurial ventures
8. Explore the concept of the entrepreneurial mindset

Reading List for Unit:

1. Tay, F. (2015), Turning Good Ideas Into Small Businesses)
2. Hudson, K (2007), The Idea Generator: Tools for Business Growth
3. Barrow C., Barrow P., Brow R. (2012) The Business Plan Workbook
4. Svane, M., Adler, C. (2015) Startupland: How Three Guys Risked Everything to Turn an Idea into a Global Business
5. Evans, V., Tracy, B. (2014) The Standout Business Plan: Make It Irresistible and Get the Funds You Need for Your Startup or Growing Business
6. Griffin, M.P., (2015), How to Write a Business Plan: A Step-by-Step Guide to Creating a Plan That Gets Results, Fifth Edition

7. BURNS, P (2011) Entrepreneurship and Small Business. 3rd Ed. Basingstoke: Palgrave MacMillan.
8. DOWN, S. (2010) Enterprise, Entrepreneurship and Small Business. London: Sage.
9. CARTER, S. and JONES-EVANS, D. (2012) Enterprise and Small Business: Principles, Practice and Policy. London: Pearson.
10. NEWTON, A. (2014) An Introduction to the Green Economy: Science, Systems and Sustainability
11. DRESCHER, D. (2017) Blockchain Basics: A Non-Technical Introduction in 25 Steps
12. WEETMAN, C. (2020) A Circular Economy Handbook: How to Build a More Resilient, Competitive and Sustainable Business
13. CHARTER, M. (2018) Designing for the Circular Economy

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector.

3.2.4. Society and Visibility

Aim of Society and Visibility Unit:

This unit aims to explore the links between the environment and food systems. Students should be guided to develop concern with the protection of natural resources and ecosystem services. Food systems and also food processing should contribute to the preservation and enhancement of environmental integrity, and contribute more broadly to the Sustainable Development Goals. They also must discuss the cause-effect relationships between environmental and food systems and to know which are the environmental performance indicators and tools to analyze the environmental impacts of different dietary options. It is also important to know how to communicate environmental issues to consumers. They should identify opportunities for rationalization of resources and new practices to improve environmental performance and formulate critical environmental thinking associated with processing and vegan diets.

Description of Unit:

In this unit, students will become familiar with the definition of food systems, with their contributions to the Sustainable Development Goals. The unit aims to develop students' understanding of the environmental impacts associated with food systems and diets in a context of respect for sustainability principles. It aims to lead students to understand and compare the effects of environmental changes, such as climate change, biodiversity loss, depending on the various food systems and diets, including vegan. It will permit to understand the importance of approaches to help integrate environmental concerns into food systems and diets and develop simple consumer information tools. Students will be engaged with the concept of the environment footprint and associated tools. They will compare the environmental performance of conventional and vegan food systems. They also will analyse and interpret data, synthesize information to validate conclusions and propose actions for environmental improvement in vegan processing.

Teaching Topics:

EQF4

Contact hours: 7.5 hours. Non-contact hours: 17 hours

1. Food systems concepts

- Defining a 'food system'
- Food systems and their outcomes
- Changing Food Systems

2. Environment and food systems

- Distribution of global biomass across all mammals and birds

- Global land 'foodprint'
- The 'cheaper food' paradigm and food and nutrition security
- The food system and its impacts on biodiversity
- Key levers for food system redesign
- Dietary change
- Setting aside land for biodiversity
- Adapting the way we farm the land
- Sustainable and unsustainable intensification
- Recognize the interdependencies of demand and supply in designing food system reform
- Ensure the UN Food Systems Summit embeds a 'food systems approach' across key international policy processes
- Strengthen coherence between global agreements and national-level action
- Making nature-based solutions work for biodiversity

3. Environmental footprints

- Introduction
- EU Environment footprint methods
- 2020 Circular Economy Action plan

Learning Outcomes:

- Distinguish between sustainable and vegan food systems
- Discuss the relationship between the different components in the food system with environmental goals and with SDG 2030
- Explain the environmental impacts of food industry and vegan food processing
- Explain how vegan food processing is impacted by environmental threats
- Discuss the factors that may influence the environmental footprint of food systems
- Identify environmental performance indicators
- Identify appropriate measures of environmental performance of the vegan food processing
- Propose and discuss changes on diet to reduce the carbon footprint and the water footprint
- Discuss of diet changes to reduce carbon footprint and water footprint

Content of Unit:

1. Distinguish between sustainable and vegan food systems
2. Discuss the relationship between the different components in the food system with environmental goals and with SDG 2030
3. Explain the environmental impacts of food industry and vegan food processing
4. Explain how vegan food processing is impacted by environmental threats
5. Discuss the factors that may influence the environmental footprint of food systems
6. Identify environmental performance indicators
7. Identify appropriate measures of environmental performance of the vegan food processing
8. Propose and discuss changes on diet to reduce the carbon footprint and the water footprint

9. Discuss of diet changes to reduce carbon footprint and water footprint

Reading List for Unit:

1. Tim G. Benton et al, 2021. Food system impacts on biodiversity loss, Energy, Environment and Resources Programme.
2. McLaren, S., et al., 2021. Integration of environment and nutrition in life cycle assessment of food items: opportunities and challenges. Rome, FAO.
3. Dury, S., et al. eds. 2019. Food Systems at risk: new trends and challenges. Rome, Montpellier, Brussels, FAO, CIRAD and European Commission.
4. Environmental Footprints, by Kai Fang (Editor); Springer (2021)
5. Environmental Water Footprints; by Subramanian Senthilkannan Muthu (Editor); Springer (2019)

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector, Software for calculations of environmental footprints. Special time and organization for on-site visit to a vegan food processing plant.

3.3. Digitalization and Automatization

Digitalization and automatization are important in food industry to keep advanced, safe, high technology processing. With the introduction of Industry 4.0, smart factories, there are new opportunities to implement elements of industry 4.0 in vegan food processing.

This module provides detailed information about digitalization and automatization under below topics with suggested 3 ECVET credits:

- Automation
- ICT
- Robotics

3.3.1. Automation

Aim of Unit:

Students will be able to differentiate between various automation systems and identify the components used in them. They will understand how automation systems work. Students will be knowledgeable of the structure, function and connections of relays and PLC drivers and the more common types of sensors and actuators. They will learn the idea behind the logic needed in automation technology.

Description of Unit:

In the Automation course, students will become familiar with automated systems. Unit is composed of teaching topics:

1. Introduction to Automation
2. Effective cooperation with automation specialists
3. Manual controlling of machines and processes
4. Programmable Logic Controllers (PLC)
5. Assessments
- 6.

Teaching Topics:

EQF4
Contact hours: 4.5 hours. Non-contact hours: 22 hours
1. Introduction to Automation
2. Effective cooperation with automation specialists
3. Manual controlling of machines and processes
4. Programmable Logic Controllers (PLC)

5. Vegan Food Process Sensoring

6. Thermal Processing Control

Learning Outcomes:

- Operate effective cooperation with automation specialists
- Recognize manual controlling of machines and processes
- Explain basic understanding of automated systems
- Identify common sensors in the automation of components and use cases for sensors
- Discuss PLC and how it can be used in systems control units

Content of Unit:

1. Introduction to Automation
2. Effective cooperation with automation specialists
3. Manual controlling of machines and processes
4. Programmable Logic Controllers (PLC)
5. Vegan Food Process Sensoring
6. Thermal Processing Control

Assessment:

Project and exam

Reading List for Unit:

EN 1672-2:2020 Food processing machinery – Basic concepts – Part 2: Hygiene and cleanability requirements.

1. Edgar, T. F., Smith, C. L., Shinsky, F. G., Gassman, G. W., Waite A. W. R., McAvoy, T. J. & Seborg, D. E. (2007). Process control, in Perry's Chemical Engineers' Handbook 8th ed. R. H. Perry, and D. W. Green, eds. McGraw-Hill, New York, NY, US.
2. Fellows, P. J. (2017). Food Processing Technology: Principles and Practice. 4th edition. London: Woodhead Publishing Group.
3. Habib, Maki K.. (2020). Advanced Robotics and Intelligent Automation in Manufacturing. IGI Global. Retrieved from
4. <https://app.knovel.com/hotlink/toc/id:kpARIAM001/advanced-robotics-intelligent/advanced-robotics-intelligent>
5. Kress-Rogers, E. Brimelow, C.J.B.. (2001). Instrumentation and Sensors for the Food Industry (2nd Edition). Woodhead Publishing. Retrieved from

6. <https://app.knovel.com/hotlink/toc/id:kpISFIE008/instrumentation-sensors/instrumentation-sensors>
7. Morgan, M. T. & Haley, T. A. (2019). Design of food process controls system. In M. Kutz (ed.) Handbook of Farm, Dairy and Food Machinery Engineering. 3rd ed. Amsterdam: Academic Press. <https://doi.org/10.1016/B978-0-12-814803-7.00022-1>

Thermal Processing Control

1. J. Castleman, in Coal Combustion Products (CCP's), 2017
2. Gregory W. O'Neil, ... Christopher M. Reddy, in Biofuels from Algae (Second Edition), 2019
3. Z. Boz, ... F. Erdoğan, in Encyclopedia of Food Microbiology (Second Edition), 2014
4. Petr Stehlík, in Handbook of Process Integration (PI), 2013
5. P.E.D. Augusto, ... M. Cristianini, in Encyclopedia of Food Microbiology (Second E)

Resources for Unit:

1. A fully equipped classroom; hardware and software for online teaching;
2. Suggestions on software:
 - a. <https://factoryio.com/> 30 day free trial available
 - b. <https://www.plcfiddle.com/> ladder logic simulator - free.
 - c. Siemens Tia Portal - Siemens software
 - d. others

3.3.2. ICT

Aim of Unit:

The students are familiar with the digital transformation that faces the vegan food industry. They can use the current software, different online services, and online learning environment. The student can apply basic information technology skills in new hardware and software environments.

Description of Unit:

In ICT courses, students will become familiar with information technology systems. Unit is composed of 4 teaching topics below.

Teaching Topics:

1. Industry 4.0
2. ICT unit

EQF4
Contact hours: 7.5 hours. Non-contact hours: 18 hours
1. Industry 4.0
2. ICT unit

Learning Outcomes:

Operate with basic ICT (working with human-machine interface; use different software, like traceability, IoT)

Content of Unit:

1. Industry 4.0
 - a. Internet of Things (IoT) and cloud computing
 - b. Additive production and 3D printing
 - c. Big Data
 - d. Visual technologies (augmented reality / virtual reality / computer vision)
 - e. Automation and intelligent robotics
 - f. Cybersecurity
2. ICT unit
 - a. Human-Machine Interface
 - b. IoT Remote Monitoring
 - c. AI

d. Traceability Software

Assessment:

Project and exam

Reading List for Unit:

1. Bai, C., P. Dallasega, G. Orzes, and J. Sarkis. 2020. Industry 4.0 technologies assessment: A sustainability perspective. *International Journal of Production Economics* 229:107776. doi: 10.1016/j.ijpe.2020.107776.
2. Barbut, S. 2020. Meat industry 4.0: A distant future? *Animal Frontiers: The Review Magazine of Animal Agriculture* 10 (4):38–47. doi: 10.1093/af/vfaa038.
3. Bottani, E., Vignali, G., & Carlo Tancredi, G. P. (2020). A digital twin model of a pasteurization system for food beverages: Tools and architecture. 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), 1–8. <https://doi.org/10.1109/ICE/ITMC49519.2020.9198625>
4. Da, X. L., E. L. Xu, and L. Li. 2018. Industry 4.0: State of the art and future trends. *International Journal of Production Research* 56 (8):2941–2962. doi: 10.1080/00207543.2018.1444806
5. Dalzochio, J., R. Kunst, E. Pignaton, A. Binotto, S. Sanyal, J. Favilla, and J. Barbosa. 2020. Machine learning and reasoning for predictive maintenance in Industry 4.0: Current status and challenges. *Computers in Industry* 123:103298. doi: 10.1016/j.compind.2020.103298.
6. Garg, D., Luthra, S., & Mangla, S. K. (ei pvm.). 9.3 Functional Roles of it in SCM. *Teoksessa Supply Chain and Logistics Management*. New Academic Science. <https://app.knovel.com/hotlink/pdf/id:kt012NVIU1/supply-chain-logistics/functional-roles-it-in>
7. Hassoun, A., Aït-Kaddour, A., Abu-Mahfouz, A. M., Rathod, N. B., Bader, F., Barba, F. J., Biancolillo, A., Cropotova, J., Galanakis, C. M., Jambrak, A. R., Lorenzo, J. M., Måge, I., Ozogul, F., & Regenstein, J. (2022). The fourth industrial revolution in the food industry—Part I: Industry 4.0 technologies. *Critical Reviews in Food Science and Nutrition*, 0(0), 1–17. <https://doi.org/10.1080/10408398.2022.2034735>
8. Hugos, M. (ei pvm.). 4.2.5 Enterprise Resource Planning (ERP). *Teoksessa Essentials of Supply Chain Management (4th Edition)*. John Wiley & Sons. <https://app.knovel.com/hotlink/pdf/id:kt0127YA81/essentials-supply-chain/enterprise-resource-planning>
9. Jambrak, A. R., M. Nutrizio, I. Djekić, S. Pleslić, and F. Chemat. 2021. Internet of nonthermal food processing technologies (Iontp): Food industry 4.0 and sustainability. *Applied Sciences* 11:1–20.
10. Kayikci, Y., N. Subramanian, M. Dora, and M. S. Bhatia. 2020. Food supply chain in the era of Industry 4.0: Blockchain technology implementation opportunities and impediments from the perspective of people, process, performance, and technology. *Prod Plan Control* 33:301–321. doi: 10.1080/09537287.2020.1810757.

11. Khan, P. W., Y. C. Byun, and N. Park. 2020. IoT-blockchain enabled optimized provenance system for Food Industry 4.0 using advanced deep learning. *Sensors* 20 (10):2990. doi: 10.3390/s20102990.
12. Lee, J., B. Bagheri, and H. A. Kao. 2015. A cyber-physical systems architecture for Industry 4.0-based manufacturing systems. *Manufacturing Letters* 3:18–23. doi: 10.1016/j.mfglet.2014.12.001.
13. Lennon Olsen, T., and B. Tomlin. 2020. Industry 4.0: Opportunities and challenges for operations management. *Manufacturing & Service Operations Management* 22 (1):113–122. doi: 10.1287/msom.2019.0796.
14. Scholten, B. (ei pvm.). *MES Guide for Executives—Why and How to Select, Implement, and Maintain a Manufacturing Execution System*. <https://app.knovel.com/hotlink/toc/id:kpMESGEWH2/mes-guide-executives/mes-guide-executives>
15. Soroush, M., Baldea, M., & Edgar, T. F. (ei pvm.). *Smart Manufacturing—Concepts and Methods*. <https://app.knovel.com/hotlink/toc/id:kpSMCM0003/smart-manufacturing-concepts/smart-manufacturing-concepts>

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching;

3.3.3. Robotics

Aim of Unit:

Students will learn about various types of robots and examine robots and how to use them in factory automation and other areas where robots are needed. They will know the structure, features, and coordinate systems of robots as well as the periphery devices used in robotics. The course provides fundamental knowledge of robotics.

Description of Unit:

In the Robotics course, students will become familiar with robotic systems. Unit is composed of teaching topics:

1. Introduction to Robotic Systems
2. Industrial Manipulator Robots
3. Robot Programming Languages and Techniques
4. Collaborative Robotic Systems

Teaching Topics:

EQF4
Contact hours: 7.5 hours. Non-contact hours: 18 hours
Introduction to Robotic Systems
Industrial Manipulator Robots Robot Programming Languages and Techniques
Collaborative Robotic Systems

Learning Outcomes:

- Identify various types of robots
- identify how to use robots in factory automation and other areas where robotics are used
- Recognise the structure, properties, co-ordinations of robots, as well as the additional devices used in robots

Content of Unit:

1. Introduction to Robotic Systems
2. Industrial Manipulator Robots
3. Robot Programming Languages and Techniques

4. Collaborative Robotic Systems

Assessment:

Exam

Reading List for Unit:

1. Gupta, A.K. Arora, S.K. Westcott, Jean Riescher. (2017). Industrial Automation and Robotics. Mercury Learning and Information. Retrieved from <https://app.knovel.com/hotlink/toc/id:kpIAR00001/industrial-automation/industrial-automation>
2. Habib, Maki K.. (2020). Advanced Robotics and Intelligent Automation in Manufacturing. IGI Global. Retrieved from <https://app.knovel.com/hotlink/toc/id:kpARIAM001/advanced-robotics-intelligent/advanced-robotics-intelligent>
3. Jaulin, Luc. (2019). Mobile Robotics (2nd Edition). John Wiley & Sons. Retrieved from <https://app.knovel.com/hotlink/toc/id:kpMRE00014/mobile-robotics-2nd-edition/mobile-robotics-2nd-edition>
4. Mullakara, Nandan Asokan, Arun Kumar. (2020). Robotic Process Automation Projects. Packt Publishing. Retrieved from <https://app.knovel.com/hotlink/toc/id:kpRPAP0001/robotic-process-automation/robotic-process-automation>

Resources for Unit:

- A fully equipped classroom;
- hardware and software for online teaching; RokoDK, KUKA, Yaskawa...

<https://robodk.com/>

3.4. Soft Skills

On a total of 2 ECVET credits, this training covers:

- Critical and innovative thinking,
- Ethical understanding,
- Active listening
- Teamwork and leadership

The Soft Skills trainings are presented differently from the trainings on Plant-based Processing, Green Skills and Digital and Automatization Skills.

They are described here as suggested to be delivered on EQF 4 to 7 trainings. The duration of activities is the suggested duration for trainings with the students. It is recommended that at the implementation of trainings on EQF 4 to 7, the Soft Skills trainings are embedded in the other modules.

3.4.1. Critical and Innovative Thinking

Aim of Unit:

After this unit, students will recognize that decision-making and problem solving are competences that can and should be trained and developed; they will have gathered a few strategies to develop their mental plasticity and ability to decide and solve problems in various personal and professional domains.

Description of Unit:

In this unit students will become familiar with a range of strategies used for wise decision making and effective problem solving. The aims are to be accomplished through group dynamics; case studies; readings; metacognition and video watching.

Teaching Topics:

EQF4
Contact hours: 7.5 hours. Non-contact hours: 11 hours
1. Strategies used for wise decision making and effective problem solving
2. Learning from failure, thinking out of the box
3. Innovative solutions, thinking out of the box
4. Cooperative problem solving: The marshmallow challenge
5. Reflection and metacognition

Learning Outcomes:

- Understand the problem before making decisions and taking action.

- Evaluate available information for problem solving.
- Identify the reasonableness of the decision and find out alternatives.
- Take into account the consequences of the decision.
- Choose problem solving methods and procedure
- Apply relevant knowledge
- Evaluate the results of the decision.

Content of Unit:

- Strategies used for wise decision making and effective problem solving
- Learning from failure
- Innovative solutions, thinking out of the box
- Cooperative problem solving: The marshmallow challenge
- Reflection and metacognition

Assessment for unit:

Student written essay and debate

Reading List for Unit:

1. <https://www.itseducation.asia/article/the-road-to-a-solution-generating-ideas>
2. <https://www.itseducation.asia/article/finding-possible-solutions>
3. <https://simplicable.com/new/decision-making>
4. <https://simplicable.com/new/problem-solving>
5. <https://www.marshmallowchallenge.com/>
6. https://www.youtube.com/watch?v=H0_yKBitO8M ted talk by Tom Wujec 'Build a tower, build a team'

Resources for Unit:

A fully equipped classroom; hardware and software for online teaching; Whiteboard; Projector.

3.4.2. Ethical Understanding

Aim of Unit:

To support student to develop an understanding of the breadth of ethical judgements and factors that affect it.

Description of Unit:

In this unit the student will review the ethics principles, ethical judgment development and which factors can affect ethics judgments. Food ethics issues will be analyzed and discussed in a role play so students can understand the different possible ethical views on a single issue. Students will learn how to use the ethical matrix for decision making on ethics issues.

Teaching Topics:

EQF4

Contact hours: 7.5 hours. Non-contact hours: 11 hours

1. Ethics principles

2. Stages of moral development

3. Factors that affects moral judgements

Overview of ethics issues (food fraud, etc.) and what affects moral judgements (ethics principles, stages of moral development, factors that affect moral judgements).

Give an overview to students of ethics issues in food (2h)

1. Food ethics issues

Divide students in groups, assign to each group an issue and to each student a role according to the stakeholders (representatives of food industry, consumers association, policy maker, animal protection association, etc.). (1.5h)

5. Ethical matrix of Ben Mephram

Explain the ethical matrix of Ben Mephram.

Divide students in groups and assign an issue to each group. (0.5h)

Learning Outcomes:

After this unit, students will be recognizing the breadth of ethical judgements and factors that affect it; they will be able to reflect on an ethical issue and to produce sound decisions considering the judgements of different stakeholders.

Content of Unit:

1. Ethics principles
2. Stages of moral development
3. Factors that affect moral judgements
4. Food ethics issues
5. Ethical matrix of Ben Mephram

Assessment:

- Role playing (1.5 h)
- Presentation of the ethical matrix (0.5 h)

Reading List for Unit:

1. Costa, R., Pittia, P. eds: Food ethics education. Springer International Publishing (2017)
2. Behave: The biology of humans at our best and worst, Sapolsky, Robert M. Penguin Press: New York, NY. 2017
3. FAO. 2021. Food fraud – Intention, detection and management. Food safety technical toolkit for Asia and the Pacific No. 5. Bangkok, <https://www.fao.org/3/cb2863en/cb2863en.pdf>

Resources for Unit:

- Classroom with projector
- Students with access to WWW.

3.4.3. Active Listening

Aim of Unit:

The aim of this unit is to call students attention to the importance of practicing active listening, give them the opportunity to learn a few techniques to improve it and use it to gain control over their teaching-learning process.

Description of Unit:

Active Listening is probably the most critical of interpersonal communication skills because it reinforces open communication, being an effective way for the students to gain self-understanding, feel understood, make the learning-teaching process easier, which is indeed basic and critical for any kind of apprenticeship. Thus, this Unit aims at making students understand that and help them in learning a few techniques to improve active listening in a way that will contribute to their successful autonomous learning.

Teaching Topics:

EQF4 to 7
Contact hours: 7.5 hours. Non-contact hours: 11 hours
<u>1. The meaning of Active Listening</u> List situations when active listening is very important – classroom, workplace, interaction with professors, colleagues, clients, team leaders, etc. It is the most critical of interpersonal communication skills because it reinforces open communication, being an effective way for the students to gain self-understanding, feel understood, make the learning-teaching process easier.
<u>2. Paying attention</u> Paying attention Learn some techniques to improve active listening.
<u>3. Show attentiveness and provide feedback</u> Learn ways of showing they are listening by using body language and by providing feedback.
<u>4. Appropriate responsiveness</u> Learn how to respond appropriately through practice.

Learning Outcomes:

By the end of the unit, students will be able to:

- Understand what it takes to be a good listener.

- Understand the importance of paying attention.
- Know a few techniques to practice and improve active listening.
- Use body language (non-verbal communication through gestures, tone of voice, etc.).
- Provide feedback by questioning or asking for clarification.
- Show appropriate responsiveness.
- Show assertiveness with respect.
- Hold judgement.
- Paraphrase.

Content of Unit:

1. The meaning of Active Listening
2. Paying attention
3. Show attentiveness and provide feedback
4. Appropriate responsiveness

Assessment:

Continuous assessment is carried out throughout the delivery sessions.

Reading List for Unit:

1. <https://www.youtube.com/watch?app=desktop&v=t2z9mdX1j4A&feature=youtu.be>
2. http://files.teachingjedi.webnode.com/200000004-6f61f705bf/ActiveListening_RogersFarson.pdf
3. <http://www.elanica.com/collaboratory/ActiveListening2020-spreads.pdf>

Resources for Unit:

- Classroom with projector and speakers
- Access to internet
- Two texts, pen and paper

3.4.4. Teamwork and Leadership

Aim of Unit:

The aim of this unit is to introduce the students to teamwork i.e. how to build up a team and how to empower employee based on the employees' competencies.

Description of Unit:

In this unit, a systematic team-building training is drawn up to teach the students to fill the skill gaps based on various cases. This action prepares the students to better understanding the need of various skills to enable employees to learn new skills needed in the team and to engage new workers employed. The teambuilding skills also enable the student how to act when applying for employment in a company and how to act as a team member in his/her tasks in the future. The team-building training will be based on theoretical classes and improvising in class in which the students are trained in various phases in the team development process. Here the teamwork skills are developed.

Teaching Topics:

EQF4
Contact hours: 7.5 hours. Non-contact hours: 11 hours
- Understanding of teamwork principles
- Usage of the diversity of members' knowledge in building a team
- Information on steps how to advance jointly, persuade and manage changes in the team

Learning Outcomes:

By the end of the unit, students will be able to:

- is able to learn proper team habits
- is aware of the team structure
- understands how to create a team
- knows how to manage a team
- is able to empower both already available and new members in the team

Content of Unit:

1. Understanding of teamwork principles
2. Usage of the diversity of members' knowledge in building a team
3. Information on steps how to advance jointly, persuade and manage changes in the team

Assessment:

- team-building exercise on a given case
- evaluation of the above-mentioned case performed in a group of 3-4 students
- oral exam on theory (2-3 tasks to explain individually)

Reading List for Unit:

1. Bird, A., Mendenhall, M., Stevens, M.J. & Oddou, G. 2010. Defining the content domain of intercultural competence for global leaders. *Journal of Managerial Psychology*, 25, 810-828. DOI 10.1108/02683941011089107.
2. Brinck, L & Tanggaard., L. 2016. Embracing the unpredictable. *Leadership, learning, changing practice. Human Resource Development International*, 19, 374–387, <http://dx.doi.org/10.1080/13678868.2016.1141607>.
3. Bartel, j. 2018. Teaching soft skills for employability. *ESL Canada Journal*, 2018, 35, 78–92, <http://dx.doi.org/10.18806/tesl.v35i1.1285>.
4. Marasi, S. 2019. Team-building: Developing teamwork skills in college students using experiential activities in a classroom setting. *Organization Management Journal*, 16, 324-337, DOI: 10.1080/15416518.2019.1662761.
5. Paros, A., Taylor, M. & Yawson, R.M. 2020. Enhancing student understanding of networks using experiential learning. *Organization Management Journal*, 17, 173-183, DOI 10.1108/OMJ-05-2020-0930
6. Volkova, N., Lebid, O., Hrom, O., Zinukova, N. & Korobeinikova, T. 2021. Teamwork as an interactive educational technology at pedagogical universities. *SHS Web of Conferences*, 104, 03003. <https://doi.org/10.1051/shsconf/202110403003>.

Resources for Unit:

- Classroom with projector and speakers
- Access to internet
- Two texts, pen and paper