

Bachelor of Technology (Honours)

FOOD

ACADEMIC HANDBOOK



School of Industrial Technology

Universiti Sains Malaysia

www.indtech.usm.my



**Academic Handbook
Bachelor of Technology (Honours) (Food)
Academic Calendar 2022/2023**

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Full version of the Academic Handbook

Vision and Mission

Universiti Sains Malaysia

Vision

Transforming Higher Education for a Sustainable Tomorrow

Mission

USM is a pioneering, transdisciplinary research intensive university that empowers future talents and enables the bottom billions to transform their socio-economic well-being

Vision and Mission

School of Industrial Technology

Vision

World class centre in technological innovation for a sustainable tomorrow

Mission

1. To be the prime education provider of technologists who are competent, capable of independent thinking, possess communication and analytical skills, and able to fulfil the needs in various industries and socio-economic development.
2. To pursue cutting-edge research in the fields of Food Technology, Bioresource Technology, Environmental Technology, and Bioprocess Engineering Technology.
3. To contribute to the well-being of the community through sustainability-led dynamic transdisciplinary academic programmes, research innovation, teamwork, and continuous improvement.

Niche Research Area

School of Industrial Technology

Sustainable Materials, Processing, and Energy Technologies

History

School of Industrial Technology

1973

The School of Industrial Technology commenced with the establishment of the School of Applied Sciences. The School offered the Bachelor of Applied Science programmes in Electronic Science and Technology, Food Science and Technology, and Polymer Science and Technology.

1984

The name of the School was changed to the School of Engineering Sciences and Industrial Technology. Hence, the curricula were amended to Bachelor of Engineering (B. Eng) and Bachelor of Technology (B. Tech) to meet the requirement of engineering and industrial technology courses.

1986

The School was split into :

- School of Electrical and Electronic Engineering
- School of Materials and Mineral Resources Engineering
- School of Industrial Technology

School of Industrial Technology offered Bachelor of Technology programmes in Food Technology, Polymer Science and Technology, Quality Control & Instrumentation, and Wood, Paper and Coatings Technology.

2001

Polymer Technology and Quality Control & Instrumentation programmes were upgraded into:

- Polymer Engineering programme
- Mechatronic Engineering programme

1999

Environmental Technology programme was introduced by School of Industrial Technology.

2002

Wood, Paper and Coatings Technology programme was renamed Bioresource, Paper and Coatings Technology programme.

2008

Bioprocess Technology programme was introduced by School of Industrial Technology.

2018

Master of Science (Environmental Science) programme was introduced by School of Industrial Technology.

2020

Bioresource, Paper and Coatings Technology programme was renamed Bioresource Technology programme.

2022

Bioprocess Technology programme was changed to Bioprocess Engineering Technology programme.

Management

School of Industrial Technology



- | | | |
|----|--|---|
| 1 | Dean | Prof. Datuk Ts. Dr. Abdul Khalil Shawkataly, D.S.P.N., D.P.S.M. |
| 2 | Deputy Dean (Academic, Career & International) | Assoc. Prof. Dr. Mardiana Idayu Ahmad |
| 3 | Deputy Dean (Research, Innovation & Industrial - Community Engagement) | Assoc. Prof. Dr. Husnul Azan Tajarudin |
| 4 | Deputy Dean (Resource Development & Branding) | Assoc. Prof. Dr. Leh Cheu Peng |
| 5 | Programme Chairman (Food Technology) | Assoc. Prof. Dr. Uthumporn Ultra @ Sapina Abdullah |
| 6 | Programme Chairman (Environmental Technology) | Assoc. Prof. Dr. Yusri Yusup |
| 7 | Programme Chairman (Bioresource Technology) | Ts. Dr. Nurul Fazita Mohammad Raw |
| 8 | Programme Chairman (Bioprocess Engineering Technology) | Dr. Mohamad Hafizi Abu Bakar |
| 9 | Senior Assistant Registrar (Academic & Administration) | Mdm. Rasslene Rass Rasalingam |
| 10 | Assistant Registrar (Postgraduate & Human Resource) | Ms. Nur 'Aqila Badrul Hisham |

Academic Programme

The School of Industrial Technology offers the following bachelor degrees:

- Bachelor of Technology (Honours) (Food)
- Bachelor of Technology (Honours) (Bioresource)
- Bachelor of Technology (Honours) (Environment)
- Bachelor of Bioprocess Engineering Technology with Honours

Acceptance to any of the above programmes is subjected to selection and entry qualification. Most of the first year courses consist of basic science courses in Chemistry, Mathematics, Physics, and Computer. From level 200, all students are required to enrol for courses relevant to their respective programmes up to level 300 (Bioresource and Environmental Technologies) or 400 (Food and Bioprocess Engineering Technologies), whereby they are required to conduct one final year research project.

Students are also required to undergo industrial training in various industries relevant to their study programme for 12 (Food, Bioresource, and Environment Technologies) or 24 (Bioprocess Engineering Technology) weeks. This training is aimed at exposing the students to actual working practice and atmosphere of the industry.

Details of Programme

Type of Programme	Structure of Programme
Bachelor of Technology with Elective	Students choose several elective courses to widen their specialisation area and their knowledge in industrial technology.
Bachelor of Technology with Minor	Students choose and complete one minor area offered by other schools. <ul style="list-style-type: none">● Starting in the second semester of Year I.

Food Technology

This program is the earliest program offered by the School of Industrial Technology. This programme has undergone continual curriculum evolution since it was offered and managed to obtain an approval as an accredited undergraduate food science programme by the Institute of Food Technologists (IFT) from 2015 until present. Our Food Technology programme covers all the 11 standards set by the IFT, i.e. food chemistry, food microbiology, food safety, food engineering and food processing, sensory science, quality assurance, food laws and regulations, data and statistical analysis, critical thinking and problem solving, food science communication, and professionalism and leadership.

The curriculum is designed in such a way to train and produce competent graduate equipped with the 21st century skills to serve and to lead food industries as well as the government sectors. Courses in the curriculum for Food Technology program are spread over four years of study, which emphasise the logical sequence of related course while ensuring that teaching – learning activities are equally distributed throughout the study period. Students have opportunities to advance knowledge and acquire lifelong learning skills beyond the four-wall through a variety of experiential education sub-programs such as the ASEAN International Mobility for Students (AIMS), the biennial MIFT National Food Science and Technology Competition, short-term certificate programs, etc.

Mentor-Mentee System & Counselling Service

The mentors are appointed among the academic staff of the school who provide assistance and guidance to students, mainly in academic matters. However, the school has established an open mentor system, whereby probation students are free to see any of the mentors. Nevertheless, probation students are recommended to discuss academic-related problems with mentors from their own programme.

The mentors appointed are as listed below:

No.	Name	Room No.	Phone Extension	E-mail Address
1.	Prof. Dato' Dr. Azhar Mat Easa	A606	6394	azhar@usm.my
2.	Assoc. Prof. Dr. Cheng Lai Hoong	238	5209	lhcheng@usm.my

Programme Educational Goal & Objectives

The goal of the Bachelor of Technology (Honours) (Food) degree programme is to produce graduates who have specialised expertise, solid knowledge, critical thinking, creative, research skills in the field of Food Technology to meet the employable needs of the country in various related industries or agencies and graduates and able to lead the community for sustainable national development.

Therefore, the Bachelor of Technology (Honours) (Food) degree programme is designed to produce graduates:

- who are competent, creative, innovative and capable of solving problems in Food Technology on the global and society level for sustainable development.
- who can communicate and work in interdisciplinary teams effectively in the Food Technology field.
- who have leadership skills, a positive attitude, and professional ethics in the Food Technology field.
- who can contribute to society's well-being and the sustainability of the environment.
- who have an interest in entrepreneurship and constantly strive to acquire new knowledge through research, continuing education and/or professional development activities.

Programme Learning Outcomes

At the end of the programme, students will be able to:

1. Acquire the advanced and comprehensive theoretical and technical knowledge and skills in the area of Food Technology specialised (Knowledge).
2. Apply extensive technical skills in the area of Food Technology specialisation (Practical Skills).
3. Identify and resolve issues and problems in a critical, creative, and innovative manner in the area of Food Technology specialisation (Cognitive Skills).
4. Acquire the skill to communicate effectively in a well-structured manner to a diversity of audiences (Communication Skills).
5. Display a sense of responsibility and master social skills in diverse learning and working communities locally and internationally (Interpersonal Skills).
6. Understand and manage to make decision in a professional and ethical manner within the varied social and professional environment and practice (Ethics and Professionalism).
7. Manage current information and recognise the importance of lifelong learning (Personal Skills).
8. Acquire entrepreneurial knowledge base for career development (Entrepreneurship Skills).
9. Function effectively as an individual and in a team with the ability to lead within broad organisational scales. (Leadership, Autonomy and Responsibility).
10. Demonstrate basic digital skills and technological application for living, learning and working in a society (Digital Skills).
11. Demonstrate numeracy skills in all aspects of life (Numeracy Skills).

IFT Approved Undergraduate Programme

Since 1939, the Institute of Food Technologists (IFT) has been a forum for passionate science of food professionals and technologists to collaborate, learn, and contribute all with the goal of inspiring and transforming collective scientific knowledge into innovative solutions for the benefit of all people around the world. As a scientific community grounded in purpose, IFT feeds the minds that feed the world.

IFT Vision

A world where science and innovation are connected and universally accepted as essential to improving food for everyone.

IFT Mission

Connecting global food system communities to promote and advance the science of food and its application

To support the IFT mission and vision, the IFT Higher Education Review Board (HERB) rigorously assesses undergraduate food science and technology programmes that meet its high IFT Undergraduate Education Standards for Degrees in Food Science and Technology. The Bachelor of Technology (Honours) (Food) programme offered by the School of Industrial Technology, USM is the first undergraduate programme in Malaysia that is IFT-approved, from 2015 until present. This means that the programme is internationally recognised and will provide graduates with many global career opportunities.

The IFT Programme Goals serve as an overarching expectation of an IFT-approved academic programme. The Standards encompass the academic content and skills under the four IFT Programme Goals. The Standards provide the framework to assess the Essential Learning Outcomes (ELOs). ELOs are measurable statements that describe the knowledge or skills students should acquire by the end of a particular assignment, class, course, or programme. The academic programme must require specific courses and learning activities that provide students with a deep understanding of the critical principles, concepts, and skills in the content areas of Food Science or Food Technology.

Under the IFT Approved Undergraduate Programme, the Bachelor of Technology (Honours) (Food) degree programme is designed to produce:

- Graduates are competent in core areas of food science.
- Graduates can integrate and apply their knowledge.
- Graduates are proficient communicators.
- Graduates demonstrate professionalism and leadership skills.

No.	Standards	Descriptions
1	Food Chemistry	The structure and properties of food components (water, carbohydrates, protein, lipids, other components and food additives); the chemistry of changes occurring during processing, storage, and utilisation.
2	Food Microbiology	Microorganisms in food including beneficial, pathogenic, and spoilage; the influence of the food system on their growth, survival, and control.
3	Food Safety	Hazards (physical, chemical, biological) associated with foods and the food system; their transmission and control.
4	Food Engineering and Processing	Food engineering principles; food preservation and processing; packaging materials and methods; cleaning and sanitation; water and waste management.
5	Sensory Science	Analytical and affective methods of assessing sensory properties of food.
6	Quality Assurance	Principles of food quality control and assurance.
7	Food Laws and Regulations	Government regulations required for the manufacture and sale of food products.
8	Data and Statistical Analysis	Collection, analysis, interpretation, and presentation of data.
9	Critical Thinking and Problem Solving	Scientific reasoning through uncertainty in scientific and technical situations.
10	Food Science Communication	Oral and written communication.
11	Professionalism and Leadership	Organisation and project management; skills necessary to work and interact with individuals from diverse backgrounds.

Programme Requirements

Course Code Classification	Normal Programme	Minor Programme	Min. Total Unit Requirements
T	78	78	
E	33	13	
M	0	20	131
U	20	20	

Notes:

T (core courses) – compulsory courses for a particular area of specialisation that must be taken and passed.

E (elective courses) – courses must be taken by students with elective programme to strengthen their technology specialisation courses.

M (minor courses) – minor specialisation offered by other schools.

U (university requirements) – courses to fulfil the university requirements.

Graduation Requirements

- ☑ Fulfil the minimum required (8 semesters) of the residential requirement for the programme of study and has not exceeded the maximum period of study (14 semesters).
- ☑ Fulfil all credit requirements of the courses for the programme of study required units such as the requirements for each component (core, elective/ minor, and university courses or option).
- ☑ Obtained a CGPA of 2.00 and above for core courses.
- ☑ Obtained a CGPA of 2.00 and above for the programme.
- ☑ Achieved a minimum of 'C' or a grade point of 2.00 for Bahasa Malaysia, English (4 units), Appreciation of Ethics and Civilisations, Philosophy and Current Issues, and Core Entrepreneurship courses.

University Requirements for Graduation

LOCAL STUDENTS		INTERNATIONAL STUDENTS	
Compulsory Courses	Units	Compulsory Courses	Units
<ul style="list-style-type: none"> ❖ LKM400/2 Bahasa Malaysia IV 	2	<ul style="list-style-type: none"> ❖ LKM100/2 Bahasa Malaysia I 	2
<p>English Language (MUET Band 6)</p> <ul style="list-style-type: none"> ❖ (LHP451/452/453/454/455/456/457/458/459) and/or ❖ Foreign language courses 		<ul style="list-style-type: none"> ❖ English Language courses 	4
<p>English Language (MUET Band 5)</p> <ul style="list-style-type: none"> ❖ LSP402/2 Scientific and Medical English and ❖ LHP451/452/453/454/455/456/457/458/459 	4	<p><i>* Students may obtain advice from the School of Languages, Literacies and Translation if they have different English Language Qualification.</i></p>	
<p>English Language (MUET Band 4)</p> <ul style="list-style-type: none"> ❖ LSP300/2 Academic English 			
<p>English Language (MUET Band 2 – 3)</p> <ul style="list-style-type: none"> ❖ LMT100/2 Preparatory English* or ❖ Re-sit MUET <p><i>* Prerequisite for LSP300/2 Academic English</i></p>			
<ul style="list-style-type: none"> ❖ HFE224/2 Appreciation of Ethics and Civilisations ❖ HFF225/2 Philosophy and Current Issues ❖ WUS101/2 Core Entrepreneurship 	2 2 2	<ul style="list-style-type: none"> ❖ HFF225/2 Philosophy and Current Issues ❖ SEA205E/4 Malaysian Studies ❖ Option/English Language 	2 4 2
<ul style="list-style-type: none"> ❖ Co-curricular 	2	<ul style="list-style-type: none"> ❖ Co-curricular 	2
Optional Courses	Units	Optional Courses	Units
<ul style="list-style-type: none"> ❖ Co-curricular/Skills Courses/Foreign Language Courses/Options ❖ WSU101/2 Sustainability: Issues, Challenges & Prospect ❖ HTV201/2 Thinking Techniques 	6	<ul style="list-style-type: none"> ❖ Co-curricular/Skills Courses/Foreign Language Courses/Options ❖ WSU101/2 Sustainability: Issues, Challenges & Prospect 	6
Minimum Requirements	20	Minimum Requirements	20

Note: Student must pass all University courses with the minimum grade of C.



Curriculum Structure

COURSE TYPE	LEVEL 100 (2022/2023)		LEVEL 200 (2023/2024)		LEVEL 300 (2024/2025)		LEVEL 400 (2025/2026)		TOTAL UNIT
	SEMESTER 1	SEMESTER 2	SEMESTER 1	SEMESTER 2	SEMESTER 1	SEMESTER 2	SEMESTER 1	SEMESTER 2	
CORE (T)	IMK 103/2 IMK 114/3 IUK 108/4 IUK 191/4 KOT 122/4	IMA 116/2 IMA 117/2 IMG 103/3 IMG 111/3 IMK 106/3	IMG 203/3 IMG 222/3 IMK 225/3 IMK 227/3	IMG 204/3 IMG 223/4	IMG 324/4 IMG 329/3 IMK 316/3 IMK 327/3	IMA 325/3 IMK 326/3	IMA 422/4	IMA 423/6*	78
	17	13	12	7	13	6	4	6	
ELECTIVE (E)		IMK 113/3 KAT 145/4	IBK 104/3 IMK 221/3 KFT 133/4	IMK 209/2 IMK 226/3 IMK 228/2 IUK 208/3	IBK 316/3 IBG 214/4	IMG 328/3 IMK 320/3 IUK 303/3	IMK 410/3 IMK 424/2 IMK 425/2		33
		7	10	10	7	9	7		
UNIVERSITY (U)	WUS 101/2 Ko-K/2	LKM 400/2 Ko-K/Skill Courses/ Foreign Languages/Option/2	HFF 225/2	WSU 101/2 LMT 100/2 or LSP 300/2 HFE 224/2	HTV201/2 LSP 300/2 or LSP 402/2		LSP 300/2 or LSP 402/2		20
	4	4	2	6	4		2		
TOTAL MINIMUM CREDIT FOR GRADUATION									131

* Students must register for this course online during their internship.

List and Synopsis of Courses

Level 100

1. IBK 104/3 Fundamentals of Bioprocess Technology

This course encompasses the definition of Bioprocess Technology, discussions of similarities and differences with the disciplines of Bioprocess Engineering and Biotechnology. The course also describes the existence of disciplines of Bioprocess Technology, a string of history of penicillin discovery, bioprocessing advantages over chemical processing, various bioprocessing products, and basic knowledge as bioprocess technologists (cell diversity as catalyst agent, cell growth requirements, cell composition, enzymes, and metabolic pathways). The diversification of cell growth reactors, monitoring and measurement of kinetic growth, multiple stages of processing of bioprocess product, Bioprocess Technology application in the treatment of animal and plant cell waste and culture. Students are also exposed to research areas in Bioprocess Technology.

2. IMA 116/2 Persuasive Oral Presentation for Food Technology

Course Prerequisites: s IMK 103/3

The course is a basic requirement for a modern food technologist. It will include preparation and presentation of informative and persuasive speeches. Other topics include: selection and organisation of material, methods of securing interest and attention, and the elements of delivery. The course will use food products as materials for presentation assignments.

3. IMA 117/2 Basic Scientific Communication for Food Technology

Course Prerequisites: s IMK 103/3

This course teaches students to read, extract and write research-based articles for professional communication of food sciences. The learning outcomes are designed to incorporate the overarching skills of critical thinking, effective communication, and the understanding of food science written communications.

4. IMG 103/3 Food Chemistry

This course discussed the structure-function relationship of major food constituents such as water, carbohydrate, lipid, protein, vitamins, minerals and pigments. This course also will cover the effect of processing and preservation on the functional properties of the said constituents.

5. IMG 111/3 Food Microbiology I

This course begins with an overview and history of microbiology. Topics discussed include prokaryotic and eukaryotic structure & function, criteria used in classification, physiology of microorganisms (including reproduction, growth and metabolism), genetics (classical and molecular), physical and chemical control of microorganisms. The laboratory component of this course will cover techniques of microbiology such as microscopy, various culture techniques, isolation, identification, and enumeration.

6. IMK 103/2 Introduction to Food Science and Technology

The course gives a comprehensive overview of food science and technology. The course introduces basic concepts relating to food composition, food deterioration, food safety, and food processing. Topics covered include food processing and preservation techniques, chemical and biochemical changes, food spoilage and safety, food regulations, and nutritional aspects. Ethical issues in food science and technology are briefly covered.

7. IMK 106/3 Introduction to Food Engineering

This course introduces the fundamental of engineering principles and theory in food processing unit operations. This course covers introduction to the significance of food engineering in food processing operation, units and dimensions, basic thermodynamics, material and energy balance, heat and mass transfer, fluid flow, and kinetics of chemical reactions.

8. IMK 113/3 Management of Halal Food

This course introduces basic principles of Halal Haram and sources of food according to Syariah. This course also covers slaughtering method, hygiene, and sanitation in the preparation of food for Muslims and processing of halal ingredients and additives including packaging, storage, and transportation. In addition, this course will elaborate on the method and implementation of halal system in food industry.

9. IMK 114/3 Introduction to Food Physics

This course covers the basic principles and measurement in food physics which can be applied in food technology courses. Topics discussed in this course covered basic Physics such as units and dimensions, vectors, Newton's Laws and its application in food technology, work and energy, conservation of energy and momentum, gravitational force, mass and density, geometric properties of foods, particle size and distribution, fluxes and pressure, thermal properties and phase transitions in food systems, optical properties and colour measurements. Acoustical and radioactivity properties and their applications in food systems are also included in this course. Examples of case studies and problems involving Physics in food systems will be discussed throughout this course.

10. IUK 108/4 Statistic with Computer Applications

This course discusses on probability models for quality control of discrete random variation: random variation, cumulative distribution function, mean, variance and standard deviation. The course also discusses Discrete distribution: hypergeometric distribution, Binomial distribution, Poisson distribution, Continuous distribution, Normal distribution, exponential distribution and uses in reliability modelling.

11. IUK 191/4 Mathematics I

This course introduces the concepts of functions and limits of single variable. Linear, polynomial, logarithmic, exponential and trigonometry functions will be discussed. The focus will be on the understanding of concept and solving of differentiation and integration with applications. Students are then introduced to differential equations focusing on separable differential equation and first-order linear equations. Matrices and determinants are taught in solving systems of linear equations by using Gauss and Cramer methods.

12. KAT 145/4 Analytical Chemistry I

Course Prerequisites: s KOT 122/4

Stoichiometry calculations, statistical data treatment, concepts of equilibrium, gravimetric analysis, acid-base equilibria, acid-base titrations, complexometric titrations, precipitation reactions and titrations, electrochemical cells, and redox titrations.

13. KFT 133/4 Physical Chemistry I

Course Prerequisites: s KOT 122 or s KTT 112

Properties of gases: gas laws, van der Waals equation, kinetic theory of gases, principle of the corresponding states, Maxwell-Boltzman distribution, effusion, diffusion, viscosity, and thermal conductivity. Chemical kinetics: rate laws, temperature effect, experimental methods, complex reactions. First law of thermodynamics: work, heat, energy, enthalpy change, heat capacity, adiabatic and isothermal processes, reversible and irreversible processes and thermochemistry.

14. KOT 122/4 Organic Chemistry I

Electronic structure and bonding. Acids and bases. An introduction to organic compounds and functional groups. Nomenclature and representation of structure. Reactions of alkanes, alkenes and alkynes. Stereochemistry: the arrangement of atoms in space, The stereochemistry of addition reactions. Nucleophilic substitution reactions of alkyl halides, Elimination reactions of alkyl halides and compounds with leaving groups other than halogen. Structure, synthesis and reactions of alcohols, ethers and epoxides.

Level 200

15. IBG 214/4 Enzyme Technology

This course covers properties and characteristics of enzyme, mode of reaction, reaction specificity. Source of enzyme, purification and characterisation. Factors affecting enzyme reaction: temperature, pH, enzyme concentration, substrate concentration, end-product concentration, activator, inhibitor. Quantitation of enzyme reaction, enzyme kinetics. Enzyme immobilisation techniques; immobilisation mechanism; advantage and disadvantage of immobilised enzyme. Application of enzyme in food and non-food industries: milk industry, detergent.

16. IMG 203/3 Chemical Food Analysis

Course Prerequisites: p IMG 103/3

The course introduces the basic principles and procedures commonly used for the analysis of major food components. The concepts involved in sampling protocols and the preparation, reporting and analysis of data to achieve valid measurement are emphasised. The course covers topics on proximate analysis of the major food components (moisture, ash, nitrogen or protein, lipid, carbohydrate) and analysis methods for other food components, such as vitamin C and preservatives, such as benzoic acid and sulphur dioxide. Practical experience of relevant experimental procedures will be conducted.

17. IMG 204/3 Instrumental Food Analysis

Course Prerequisites: p IMG 103/3

This course introduces the principles and applications of instrumental methods in food analysis. The covers spectrochemical analysis methods that use absorption of electromagnetic radiation (molecular ultraviolet-visible spectroscopy, fluorescence, infrared spectroscopy, atomic absorption/emission spectroscopy); chromatographic methods, such as HPLC and GC; thermal analysis, and electrophoresis methods. In all instrumental methods of food analysis discussed, aspects of instrumentation parts and practical considerations for qualitative and quantitative analysis such as sample preparation and sources of error will be discussed.

18. IMG222/3 Food Microbiology II**Course Prerequisites: p IMG 111/3**

This course covers factors (intrinsic, extrinsic and implicit) responsible for the selection of specific spoilage organism of different food commodities; microbiology of various food commodities, indicator organisms microbiological criteria, and sampling plans. Various food-borne pathogens are also discussed. The laboratory component of this course covers microbiological examination of foods for both indicator and pathogenic organisms.

19. IMG223/4 Processing Technology of Animal-Based Food Products**Course Prerequisites: p IMG 103/3**

This course discusses structure and composition of animal based-product, such as fish, meat, poultry, egg, and dairy. This course will also discuss the biochemical changes during post-harvest and its effects on the product quality. Processing technologies of animal-based product, such as freezing, drying, and canning, will be discussed. Effects of processing on product quality will also be discussed.

20. IMK 209/2 Physical Properties of Food

This course covers the study of the principles and measurement of various physical properties of foods that are important in handling, preparing, processing, preserving, packaging, storing and distribution of foods. The application of the underlying physical principles in food formulation and production will also be discussed.

21. IMK 221/3 Food Ingredients

This course covers aspects of food ingredients and additives usually used in food products. Different categories of these ingredients and additives will be discussed based on their specific functional properties. Examples will be given such as chemical and trade name, E-number, properties, toxicology, and suitable level of usage in food.

22. IMK 225/3 Unit Operation in Food Processing**Course Prerequisites: p IMK 106/2**

This course exposed the students to the main topics in food process engineering operations. Topics covered include thermal processing, refrigeration, freezing, evaporation, drying, physical separation, size reduction, mixing, and non-thermal processing. Topic on food industry waste and wastewater treatment will also be discussed.

23. IMK 226/3 Post Harvest Technology of Fruits and Vegetables

This is an advanced course of learning wherein, various aspects covering the “farm to table” theme will be discussed. Students will be taught comprehensively on various changes occurring during the post-harvest stages after harvesting of fruits and vegetables. The studying theme will include understanding post-harvest physiology and biochemical changes in fruits and vegetables, handling, transportation and preservation/storage of the fresh harvest with emphasis laid on safety and quality evaluation (Good Agricultural Practices, Good Manufacturing Practices, Good Handling Practices, etc). The course will be of immense help to students to have a better understanding on the harvesting systems (traditional and modern), post harvest biology (microbes and insect pests) as well as the physiology and chemistry of horticultural crops. The course will also be of use, wherein students will learn more about the importance of quality, safety and marketability of the fresh horticultural produce, all of which are directly dependent on the consumers’ attitude.

24. IMK 227/3 Biochemistry

This course includes acid-bass chemistry, structural and function of organelles cells, bio-energetic of cells (enzyme and kinetic, resistance and regulations, various metabolic roads). This course also includes replication transcription, DNA translation, gene expression and biochemical applications in the industry.

25. IMK 228/2 Primary Products Technology

This course covers the chemistry and technology of two important commodities in Malaysia, namely, starch (with emphasis on sago starch) and commercial oils/fats (with emphasis on oil palm). Applications of relevant chemical and physical principles in food formulation and processing will be discussed.

26. IUK 208/3 Experimental Design with Computer Applications

This course discusses on the Replication, Randomisation, Blocking, and Definitions in Experimental Design (Experiment, Treatment, Factor, Level, Experimental unit, Experimental design, Random, Replicate).

Completely Randomised Design: Randomisation, Analysis of variance, equal replication and unequal replication, Estimation of the model Parameters, Comparison of Individual Treatment Means: Comparing of pair Treatment Means, Comparing with a control, orthogonal contrast.

Randomised Block Design: blocking, Randomised block design, Model and Assumptions, Missing values, Relative efficiency. Latin Square design Incomplete Block design: balanced incomplete block designs, Partially Balanced incomplete block designs.

Factorial Experiments (Designs): General factorial experiments, 2k Factorial experiment, 3k factorial experiment, Confounding, regression analysis, Response surface: Method of steepest ascent, Analysis of second-order model, Location of stationary point, Designs for fitting the first-Order and second-order models. Mixture experiments.

Level 300

27. IBK 316/3 Food Bioprocess Technology

This course covers the processing of food commodities (plants and animals) via the usage of enzymes, tissue cultures and microorganisms, with the aim of increasing quality and the production of value-added products. The production of food ingredients and additives, as well as food processing aids through bioprocessing will also be discussed (e.g. probiotics, enzymes, monosodium glutamate) The use of foods from genetically modified microbial sources will also be studied and issues on regulation and acceptance of the community/ masses will also be discussed.

28. IMA 325/3 Food Product Development

This course covers main factors, such as market survey, marketing strategy, development process, consumer behaviour, and others, in new food product development and also outlines methodologies for their management. Students will be required to work in groups to develop a prototype food product, to present a final report and to exhibit the final product to the public.

29. IMG 324/4 Processing Technology of Plant-Based Food Products

This course provides an overview of various aspects and technologies involved in producing plant-based food products. This course will focus on the importance of various ingredients and processing steps on product safety and quality.

30. IMG 328/3 Food Packaging

This course is designed to help students identify and consider major requirements of packages for a range of food products that require shelf life extension. The key focus in this subject is on knowledge and application of the properties of commonly used packaging materials such as paper, plastic, metal and glass. The physical and chemical properties of these food packaging materials are studied in relation to their use in food-packaging applications. This coupled with an understanding of the compatibility requirements of food products and container which form the basis for the choice and selection of packaging material for a specific product. Modern food packaging practices related to meats, beverages, fruits, vegetables, bakery products, and snack foods will also be covered in this course. This course comprises of 2 units of lectures and 1 unit of laboratory work on related topics.

31. IMG 329/3 Sensory Science

Course Prerequisites: p IUK 108/4

This course introduce methodology used in sensory evaluation of food product. Students will be exposed to the ability of humans to use their senses to evaluate the quality attributes of food product using sensory evaluation methods such as analytical and affective methods. This course will also cover the use of relevant statistics in analysing sensorial evaluation data.

32. IMK 316/3 Food Quality Management and Food Regulations

This course introduces quality management system that is widely practiced in the food industry. This course covers food assurance, control, evaluation, and audit. The course is made complete with basic exposure to food laws and regulation.

33. IMK 320/3 Functional Foods

This course covers the science, technology, regulatory aspects and consumerism towards a class of foodstuffs referred to as 'functional foods' (foods rendering health benefits). Students will be taught in detail on various aspects relevant to plant and animal based functional foods and their economic importance.

34. IMK 326/3 Food Safety

Course Prerequisites: p IMG 111/3 & p IMG 222/3

This course focuses on practices that will ensure production, processing and preparation of safe foods. Topics covered are type of contaminants, types of soils and their interaction with contact surfaces; various cleaning operations; election, application and safety of detergents and sanitisers; Code of Food Hygiene; Food safety management tools such as GMPs/GAPs/SSOP/HACCP, risk management, food toxicology and food allergens will also be covered in this course.

35. IMK327/3 Human Nutrition

This course discusses the sources of nutrient in food, functions of nutrient in metabolic processes, nutritional deficiencies and its relationship to health. This course will also introduce the fundamental of nutritional status assessment, energy requirements, and nutrition and disease.

36. IUK 303/3 Industrial Waste Management

This course exposes students to various industrial waste management practices in terms of philosophy and practical technology. Among practical philosophies are "Just-in-time", Lean Manufacturing, "5R", and zero waste management. Students will also be introduced to technologies used in sustainable industrial waste processing. This course also includes laws, regulations and protocols implemented in industrial waste management. In addition, students will conduct case studies and journals review as exposure to industrial waste management practices in developed and developing countries as well as recent research in sustainable industrial waste management.

Level 400

37. IMA422/4 Food Technology Research Project

Course Prerequisites:

- (i) Students must take all core courses of levels 100, 200, and 300.
- (ii) Students have collected at least 50 credit units of core courses.

This course will introduce the student problems relating to Food Technology. Through research, the student will be tasked to solve the problem. Lecturers will supervise the students in carrying out research proposal writing, literature search, laboratory work, thesis/dissertation writing, and viva voce. The student will also attend a series of lectures on experimental design, laboratory safety, thesis/dissertation, presentation etc.

38. IMA423/6 Food Industrial Training

Course Prerequisites: Students have completed SEVEN (7) semesters of study, regardless of the accumulated units.

This course involves placement of students to undertake internship at industries. During the internship, students are able to gain an insight into industrial practices and appreciate how principles of science, technology and management are applied in the actual workplace.

39. IMK410/3 Food Borne Pathogens

Course Prerequisites: p IMG 111/3 & p IMG 222/3

The course covers incidence, trends, epidemiology, nature of illness, growth characteristics and current detection, prevention and control methods of both traditional, and emerging food borne pathogens (bacteria and their toxins, viruses, and parasites). Outbreaks of recent food borne illness and their investigations will also be discussed.

40. IMK 424/2 Food Defence

This course provides an introduction to food defense guidelines and legal requirements. It also highlights the importance of ensuring the right food defense plans are in place. Topics covered in this course include vulnerability assessment, operational risk management (ORM), and mitigation strategies. Information from these topics will be useful in building a food defense plan that will become the tool to identify vulnerabilities and implement strategies to mitigate risks identified. Students will be exposed to the requirements, guidelines, and tools to develop a food defense plan.

41. IMK 425/2 Food Structure

This course covers the relationship of food structure with molecular composition, processing and macroscopic properties. It includes description of the macromolecular food structures including emulsions, gels, foams and colloids. It reveals the effects of various factors involved in the stability of food structure, techniques for detecting and measuring structure of food such as rheological properties, physical properties, microscopic imaging of the food and relations between structure and sensory experience. Additionally, students are also given the opportunity to design and conduct their own projects to enhance their understanding of the theory of food structure that they have learned.

“Tell me and I forget. Teach me and I remember. Involve me and I learn.”

–Benjamin Franklin–

Minor Programmes

All students that choose to take a Minor programme must choose one minor programme and commence the programme in the second semester of the first year of their studies. These students must complete 20 units of the courses in the minor package.

Among the minor programmes offered are:

School	Minor Package	Code
School of Biological Sciences	Biology	oB01
School of Physics	Physics	oZ01
School of Chemical Sciences	Chemistry	oK01
School of Mathematical Sciences	Mathematics	oM01
School of Humanities	English Language	oH01
	Malay Linguistics	oH02
	Geography	oH03
	Literature	oH04
	Islamic Studies	oH05
	History	oH06
	Japanese Studies	oH11
	Philosophy and Civilisations	oH15
	Translation and Interpretation	oH14
	School of Language, Literacies, & Translation	Japanese Language Studies
Chinese Language Studies		oL02
Communicational Arabic		oL06
School of Art	Fine Arts	oH07
	Performing Arts	oH08
	Musics	oH09
	Drama and Theatre	oH10
	Communicational Graphics	oH12
	Acting and Directing	oH13
	Music Technology	oV01
School of Communication	Communication Studies	oY05
	Science and Environment Journalism	oY06
School of Management	Management	oA03
Centre for Global Archeological Research	Archeology	oU01

School	Minor Package	Code
School of Social Science	Anthropology and Sociology	oS01
	Economics	oS02
	Social Development and Administration	oS04
	Political Science Development	oS05
	Planning and Management	oS07
	Industrial Relation Public	oS08
	Policy and Administration	oS09
	International Relation	oS10
	South-East Asian Studies	oS11
	Psychology	oS12

The following minor programmes are popular among students of the School of Industrial Technology:

(a) Communication Studies (oY05)

No. Code/Units/Course Title

A. Compulsory (9 credits)

i) Choose any 1 course (3 credits)

1. YKT101/3 Introduction to Human Communication
2. YKT102/3 Introduction to Mass Communication
3. YKT104/3 Introduction to Communication Studies

ii) Choose any 2 courses (6 credits)

4. YKT218/3 Communication Theory 1
5. YKT220/3 Communication Theory 2
6. YBP201/3 Communication for Sustainable Development

B. Choose (11 credits)

7. YFP324/3 Cinema Studies
8. YFP321/3 Television Studies
9. YBP224/3 Public Relations
10. YBP326/3 Corporate Communication
11. YBP300/3 Integrated Marketing Communication
12. YWP223/3 Feature Writing
13. YKT221/3 Media Laws and Ethics
14. YWP315/3 Media and Gender

(b) Psychology (oS12)**No. Code/Units/Course Title**

1. STU231/4 Foundation in Psychology (Compulsory)
Choose any 3 courses (12 credits)
2. STU241/4 Health Psychology
3. STU242/4 Social Psychology
4. STU243/4 Development Psychology
5. STU244/4 Abnormal Psychology
6. STU337/4 Counselling

(c) Management (oA03)**No. Code/Units/Course Title****Title Semester**

- | No. | Code/Units/Course Title | Title Semester |
|-----|-------------------------------------|----------------|
| 1. | AKW103/4 Introduction to Management | I & II |
| 2. | AKW104/4 Accounting and Finance | I & II |
| 3. | AKP201/4 Marketing | I & II |
| 4. | AKP202/4 Organisational Behaviour | I & II |
| 5. | AKP302/4 Operation Management | I & II |

Course 1 and 2 are compulsory and pre-requisites to other courses.

(d) Economics (oS04)**No. Code/Units/Course Title**

1. SKE109/3 Principles to Economics Issues (Compulsory) - Sem. II
2. SEW101/3 Microeconomics (Compulsory) - Sem. II
3. SEW103/3 Macroeconomics (Compulsory) - Sem. II
Choose any 3 courses (11 credits)
4. SEU226/4 Labour Economics
5. SEU228/4 Malaysian Economy
6. SEU333/3 Industrial Organisation
7. SEU334/3 Money, Banking and Financial Markets
8. SEU336/3 Environmental and Natural Resources Economics
9. SEU339/3 Economic Planning and Project Analysis

(e) Islamic Studies (oH05)

No. Code/Units/Course Title

Package A (12 credits)

1. HIA101/4 Introduction to Islamic Studies (Compulsory Grade C)
2. HIU123/4 The Islamic Creed: Concept and Realisation
3. HIS213/4 Sources and Principles of Islamic Laws

Package B (8 credits)

4. HIS224/4 The Islamic Family Institution
5. HIU226/4 Akhlaq and Islamic Spiritual
6. HIS311/4 Zakat and Wakaf
7. HIS315/4 Mu'amalat: Concept and Application
8. HIU321/4 Al-Quran, Tawhid, and Science

For students wishing to register for the minor programme, please make sure that time-tabling and course scheduling allow you to graduate in the stipulated period. See the Minor Programmes Handbook for further information on Minor Specialisations.

“At the intersection of food science and technology, food replacement startups are creating substitutes for the basic components of meals as well as replacements for complete meals.”

–Steve Blank–

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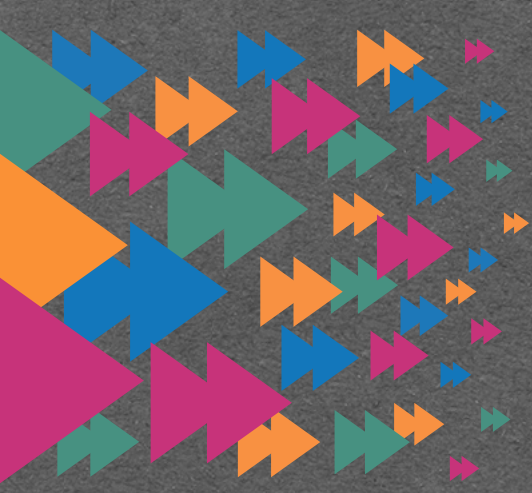
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