PROGRAM ENGINEERING TECHNOLOGY:
BACHELOR OF CHEMICAL ENGINEERING TECHNOLOGY (Honours)

Programme Educational Objectives (PEO) for Bachelor of Chemical Engineering Technology (Hons.)(Food Technology)

<table>
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<tr>
<th>Code</th>
<th>Programme Educational Objectives (PEO)</th>
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<tbody>
<tr>
<td>PEO 1</td>
<td>Engineering technology graduates engaged in the field of chemical engineering as demonstrated through career advancement.</td>
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<tr>
<td>PEO 2</td>
<td>Engineering technology graduates who are members and contribute to professional society.</td>
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<tr>
<td>PEO 3</td>
<td>Engineering technology graduates embracing in life-long learning or pursuing continuing education opportunities</td>
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<tr>
<td>PEO 4</td>
<td>Engineering technology graduates who are technopreneurs.</td>
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Program Outcomes (PO) for Bachelor of Chemical Engineering Technology (Hons.) (Food Technology)

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<tr>
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<tbody>
<tr>
<td>PO 1</td>
<td>Apply knowledge of mathematics, science, engineering fundamentals and engineering specialization principles to define and applied engineering procedures, processes, systems or methodologies.</td>
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<td>PO 2</td>
<td>Solve broadly defined engineering problems systematically to reach substantiated conclusions, using tools and techniques appropriate to their disciplines or area of specialization.</td>
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<td>PO 3</td>
<td>Design solutions for broadly-defined engineering technology problems, and to design systems, components or processes to meet specified needs with appropriate consideration for public health and safety, as well as cultural, societal, environmental and sustainability concerns.</td>
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<td>PO 4</td>
<td>Plan and conduct experimental investigations of broadly defined problems, using data from relevant sources.</td>
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<td>PO 5</td>
<td>Select and apply appropriate techniques, resources and modern engineering tools with an understanding of their limitations.</td>
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<td>PO 6</td>
<td>Function effectively as individuals, and as members or leaders in diverse technical teams.</td>
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<td>PO 7</td>
<td>Communicate effectively with the engineering community and society at large.</td>
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<td>PO 8</td>
<td>Demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities.</td>
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<td>PO 9</td>
<td>Demonstrate an understanding of professional ethics, responsibilities and norms of engineering technology practices.</td>
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<td>PO 10</td>
<td>Demonstrate an understanding of the impact of engineering practices, taking into account the need for sustainable development.</td>
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<td>PO 11</td>
<td>Demonstrate an awareness of management, business practices and entrepreneurship.</td>
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<tr>
<td>PO 12</td>
<td>Recognise the need for professional development and to engage in independent and lifelong learning.</td>
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## CURRICULUM STRUCTURE FOR BACHELOR OF CHEMICAL ENGINEERING TECHNOLOGY (HONOURS) (FOOD TECHNOLOGY) – RY01

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST</th>
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<tr>
<td>SEM</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
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<td></td>
<td>PTT153/2 (3+0) Materials Engineering</td>
<td>PTT152/2 (2+0) Physical Chemistry</td>
<td>PTT251/3 (2+1) Thermodynamics for Chemical Engineering</td>
<td>PTT255/3 (2+1) Reaction Engineering</td>
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<td>PTT155/3 (2+1) Organic Chemistry</td>
<td>PTT158/3 (2+1) Analytical Chemistry</td>
<td>PTT252/3 (2+1) Fluid Mechanics</td>
<td>PTT254/3 (2+1) Mass Transfer for Chemical Engineering</td>
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<td>PTT157/2 (0+2) Engineering Graphics for Chemical Engineering</td>
<td>PTT156/4 (3+1) Principles of Chemical Process</td>
<td>PTT253/3 (2+1) Heat Transfer for Chemical Engineering</td>
<td>PTT272/3 (2+1) Food Science &amp; Biochemistry</td>
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<td>PTT151/3 (2+1) Electrical Technology</td>
<td>PTT154/2 (1+1) Introduction to Process Instrumentation</td>
<td>PTT271/3 (2+1) Food Microbiology</td>
<td>PTT273/3 (2+1) Postharvest Technology</td>
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<td>PQT 111/3 (3+0) Mathematics for Engineering Technology I</td>
<td>PQT 112/3 (3+0) Mathematics for Engineering Technology II</td>
<td>PQT 213/3 (3+0) Mathematics for Engineering Technology III</td>
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<td></td>
<td>UVW211/2 (2+0) English for General Purposes (MUET Band 1,2,3)</td>
<td>UVW312/2 (2+0) English for Technical Communication (MUET Band 1,2,3,4)</td>
<td>UUW XXX/2 (2+0) Option Subject (Foreign Subjects) (MUET Band 4)</td>
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<td></td>
<td>UUW 233/2 (2+0) Islamic Civilization &amp; Asian Civilization</td>
<td>UUW 240/2+0 University Malay Language</td>
<td>UUW 235/2+0 Ethnic Relation</td>
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<td>UUW XXX/1 Co-Curricular Activity</td>
<td>UUW XXX/1 Co-Curricular Activity</td>
<td>UUW XXX/1 Co-Curricular Activity</td>
<td>UUW 224/2 (2+0) Engineering Entrepreneurship</td>
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**Total Units for Graduation = 142**

**Elective 1**
1. PTT 373/3 (3+0) Fats & Oil Technology
2. PTT 374/3 (3+0) Food Ingredients

**Elective 2**
1. PTT 377/3 (3+0) Functional Foods & Nutraceuticals
2. PTT 378/3 (3+0) Dairy & Meat Technology

**Elective 3**
1. PTT 472/3 (3+0) Food Packaging Technology
2. PTT 473/3 (3+0) Poultry & Fish Technology
LIST OF COURSES FOR BACHELOR OF CHEMICAL ENGINEERING TECHNOLOGY (HONOURS)(FOOD TECHNOLOGY):

PTT 151/3 Electrical Technology
PTT 152/2 Physical Chemistry
PTT 153/3 Materials Engineering
PTT 154/2 Introduction to Process Instrumentation
PTT 155/2 Organic Chemistry
PTT 156/4 Principle of Chemical Processes
PTT 157/2 Engineering Graphics for Chemical Engineering
PTT 158/3 Analytical Chemistry
PTT 251/3 (Thermodynamics for Chemical Engineering)
PTT 252/3 (Fluid Mechanics)
PTT 253/3 (Heat Transfer For Chemical Engineering)
PTT 271 (Food Microbiology)
PTT 254/3 (Mass Transfer for Chemical Engineering)
PTT 255/3 (Reaction Engineering)
PTT 272 (Food Science & Biochemistry)
PTT 273 (Postharvest Technology)
PTT 351/2 (Safety & Loss Prevention)
PTT 355/3 (Process Control & Dynamic)
PTT 356/4 (Separation Engineering)
PTT 371 (Analysis & Instrumentation for Food Technology)
PTT 372 (Food Processing & Preservation)
PTT 373 (Fats and Oil Technology) (Elective)
PTT 374 (Food Ingredients) (Elective)
PTT 353/3 (Final Year Project 1)
PTT 354/3 (Plant Design Project 1)

PTT 375 (Food Waste Management & Utilization)

PTT 376 (Quality & Safety Management System in Food Production)

PTT 377 (Functional Foods & Nutraceuticals)(Elective)

PTT 378 (Dairy and Meat Technology)(Elective)

PTT 451/5 (Final Year Project II)

PTT 452/3 (Plant Design Project 2)

PTT 471 (Food Product Development & Commercialization)

PTT 472 (Food Packaging Technology) (Elective)

PTT 473 (Poultry and Fish Technology)(Elective)
COURSE SYLLABUS

PTT 151/3 Electrical Technology

Course Synopsis:
This course is offered to non-electrical engineering background. This course introduces the basic electrical circuit theory, DC and AC circuits, basic principles of 3-phase AC circuits and magnetic circuits. This course also covers the fundamental of electronic components such as semiconductors, diodes and transistors. The laboratory sessions cover the concepts being discussed in lectures.

Course Outcomes:
1. Ability to demonstrate the application of the principle elements of DC and AC circuits, principles of electricity including Kirchhoff's of currents and voltage.
2. Ability to explain parameters of three phase AC system for Wye and Delta connection, and also the basic concepts of electronic components.
3. Ability to explain the basic concept of magnetism and electromagnetism and its application in DC and AC machines.

References:

PTT 152/2 Physical Chemistry

Course Synopsis:
The course discusses the concept of equilibrium in terms of thermodynamics, particularly enthalpy and entropy. The course also covers the calculations of material equilibrium, reaction equilibrium, reaction kinetics, phase diagrams and equilibrium electrochemistry.

Course Outcomes:
1. Ability to apply the basic concepts, laws and principles in physical chemistry.
2. Ability to calculate problems concerning material equilibrium, standard thermodynamic function and reaction equilibrium in ideal gas mixture.
3. Ability to analyze problems concerning chemical kinetics, phase diagrams and electrochemistry.

References:

PTT 153/3 Materials Engineering

Course Synopsis:
This course covers introduction to material science and engineering which emphasizes on material properties and structures. The course encompasses the fundamental of material structure, class of material properties, and measurement of the properties. The common micro-structural characteristics of different material classes as well as some features of biomaterials also embedded in the course.

**Course Outcome:**
1. Ability to describe types of material families, material structures, and material characteristics.
2. Ability to demonstrate the behavior of structural materials, the phases in material and material reliability.
3. Ability to analyze the suitability of material in engineering-related projects.

**References:**

PTT 154/2 Introduction to Process Instrumentation

**Course Synopsis**
The course begins with an introduction to process instruments involved in the process industries, followed by introduction to fundamentals of industrial valves which consists of many type of valves. This is complemented with the ability to employ and analyse the ISA (The Instrumentation Systems and Automation Society) symbology and tagging systems. This course also discusses the design and development of the process flow diagram as well as the piping and instrumentation diagram of a simple and complex system.

**Course Outcomes:**
1. Ability to interpret the operational aspects of different types of valves.
2. Ability to apply the appropriate ISA Symbology for the process flow diagram (PFD) and sketch the process flow diagram.
3. Ability to differentiate appropriate ISA Symbology for Piping & Instrumentation Diagram (P & ID).

**References:**
PTT 155/2 Organic Chemistry

Course Synopsis
This course introduces the fundamental theories of alkanes, alkenes and alkynes and their related reactions. Then, focusing on conformational analysis of alkanes and emphasizing on the nucleophilic substitution reaction of alkyl halides. The course also covers on physical and chemical properties as well as chemical reactions involving alcohol and ether, aldehyde and ketone, carboxylic acid and aromatic compound. The application of organic chemical process in chemical and biotechnological industry is discussed.

Course Outcomes:
1. Ability to explain the chemical and physical properties of each functional group.
2. Ability to distinguish the chemical reaction and reaction mechanism of functional group.
3. Ability to analyze the knowledge of organic chemical process in biotechnology and chemical industries.

References:

PTT 156/4 Principle of Chemical Processes

Course Synopsis:
This course highlights the basic concept of chemical processes involving material and energy balances in various processing systems. Exposure on the fundamental of material and energy balances are emphasized through the knowledge of process types, process variables and evaluation of the different chemical systems involving single and multiple systems as well as the nonreactive and reactive processes.

Course Outcome:
1. Ability to apply knowledge of engineering fundamentals to define chemical process methodologies and solve the basic calculations in chemical process engineering.
2. Ability to analyze information broadly and calculate material balances in chemical systems theoretically and practically using appropriate tools and techniques.
3. Ability to calculate energy balances of chemical processes and analyze the combination of material and energy balances for chemical systems theoretically and practically using appropriate tools and techniques.

References:

PTT 157/2 Engineering Graphics for Chemical Engineering

Course Synopsis:
This course introduces the techniques of engineering graphics to visualize, understand engineering drawings and to develop skill and accuracy in producing drawings. The application of computer graphics using AutoCAD software package is integrated part of the course.

Course Outcome:
1. Ability to use geometric construction, multiview, sectional view, 2D and 3D modelings in engineering drawings.
2. Ability to use dimensioning and tolerance in engineering drawings.
3. Ability to apply drawing techniques in engineering drawing.

References:

PTT158/3 Analytical Chemistry

Course Synopsis:
The first part of the course covers the basic principle of analytical chemistry which includes data analysis and its interpretation. The second part provides an introduction and application of classical analytical methods such as gravimetry and titrimetry as well as modern methods in analytical chemistry such as chromatographic and spectroscopic technique.

Course Outcomes:
1. Ability to understand and apply the basic chemical concepts that are particularly important to analytical chemistry.
2. Ability to understand and apply basic principle of different analytical techniques and to calculate and solve analytical problems by integrating different analytical techniques.
3. Ability to propose the use of different analytical techniques.

References:

PTT 251/3 (Thermodynamics for Chemical Engineering)

Course Synopsis:
This course introduces students to the basic thermodynamics for chemical engineering application and problem solving which covers first and second laws of thermodynamics. The course also highlights substances properties, mass and energy analysis, entropy, refrigeration cycles as well as thermodynamic property relation and solution, and chemical and phase equilibrium.

Course Outcomes:
1. Ability to apply the fundamentals properties and law of thermodynamics in engineering system.
2. Ability to analyze heat, work and energy of the system and thermodynamic property relations.
3. Ability to synthesize the theory of the solution of thermodynamics, gas mixtures and chemical and phase equilibrium.

References:

PTT 252/3 (Fluid Mechanics)

Course Synopsis:
This course emphasizes fundamental concepts and problem-solving techniques. It covers properties of fluid, pressure, mass, Bernoulli and energy equations, momentum analysis of flow system, dimensional analysis and modelling and fluid flows (internal flows, differential analysis of fluid flow, external flows and compressible flow)

Course Outcomes:
1. Ability to classify fluid flows and analyze essential parameters describing them.
2. Ability to analyze pressures, forces and stability in fluid systems (closed and open systems) and the link between conserved quantities and the equations of fluid mechanics.
3. Ability to classify common devices for measuring pressure, flow rates and turbo macheneris

References:

PTT 253/3 (Heat Transfer For Chemical Engineering)
(Pre-requisite: PTT 156/4 Principle of Chemical Processes)

Course Synopsis:
This course emphasizes the fundamental concepts and problem-solving techniques related to heat transfer in process engineering. The fundamental theoretical concepts and mechanisms of conduction, convection and radiation of heat transfer and the design fundamentals of basic industrial heat exchangers are analyzed. The use of various equations to estimate total heat capacity and overall heat transfer coefficient, subsequently to be applied to calculate the duty of heat transfer equipment are also presented and discussed.

Course Outcomes:
1. Ability to demonstrate the principles of conduction, convection, and radiation heat transfer.
2. Ability to analyze the problems related to heat transfer process.
3. Ability to analyze the heat exchanger systems related to industries.

References:

PTT 271 (Food Microbiology)

Course Synopsis:
The subject covers a broad spectrum of food microbiology in food industry. The emphasis is on discussion of the history, habitats, taxonomy, and growth parameters of microorganisms in food; interpret types of microorganisms and/or their products in foods. Food preservation and some properties of psychrotrophs, thermophiles, and radiation-resistant bacteria and distinguish indicators of food safety and quality, principles of quality control, microbial criteria and foodborne diseases.
Course Outcomes:
1. Ability to describe the characteristics of foodborne, waterborne, and spoilage microorganisms, as well as methods of their isolation, detection, and identification.
2. Ability to analyze the intrinsic and extrinsic conditions affecting the growth, survival and death of microorganisms in foods.
3. Ability to assess indicators of food safety and quality, principles of quality control, microbial criteria and foodborne diseases.

References:

PTT 254/3 (Mass Transfer for Chemical Engineering)

Course Synopsis:
This course emphasizes the fundamental concepts and problem-solving techniques on mass transfer operations and principles. This course provides the knowledge on mass transfer operations at basic to an intermediate level that covers with the theoretical and analytical background to solve the mass transfer operations problems. Topics to be covered include mass transfer mechanism which is diffusion, Ficks Law, Maxwell Law, and principles of absorption, evaporation and drying.

Course Outcomes:
1. Ability to demonstrate the diffusion mass transfer principles.
2. Ability to calculate the mass transfer coefficient.
3. Ability to analyze mass transfer systems related to industry.

References:

PTT 255/3 (Reaction Engineering)

Course Synopsis:
This course highlights the principles of chemical reactions engineering involving knowledge exploitation of industrial scale reactor design. Fundamental concepts are emphasized through the knowledge of mole balance, conversion and reactor sizing as well as rate law and stoichiometry. Problem-solving techniques are also applied in solving
various problem related to isothermal reactor design, collection and analysis of rate data, multiple reaction, catalysis and catalytic reaction mechanism.

Course Outcomes:
1. Ability to demonstrate the principles of chemical reaction engineering design for industrial reactors.
2. Ability to analyze and solve various problem related to reactor design and reaction process.
3. Ability to classify catalyst and develop the catalytic reaction mechanism in a heterogeneous reaction.

References:

PTT 272 (Food Science & Biochemistry)

Course Synopsis:
This course focuses on the fundamental concepts of food science with emphasis on quality and deteriorative factors in food. This course also highlighted on chemical/biochemical reaction of carbohydrate, lipids, proteins, vitamins, water and minerals in fresh and processed foods with respect to food quality and health. It also covers on how biochemical and functional properties, enzymes and food additives (emulsifiers, pigments, colours, flavours, sweeteners, preservatives, etc). Metabolism and processes of nutritive aspect of food constituents are also emphasized.

Course Outcomes:
1. Ability to apply the basic principles of food science and biochemistry into real-world food science and nutritional studies.
2. Ability to differentiate the chemical structure of food components including proteins, carbohydrates, fats and vitamins; and how these structures determines functional behaviour of these food components with respect to food quality, nutrition and safety.
3. Ability to proporse the chemical interactions with food components and their effects on the sensory, nutrition composition and functional properties of foods.

References:
PTT 273 (Postharvest Technology)

Course Synopsis:
This course provides the overview on postharvest handling technology of agricultural produce. The course emphasizes the basic of postharvest handling technology, pre-harvest and harvesting factors affecting the postharvest quality, postharvest operations in the packinghouse and appropriate equipment or chemicals that relates to postharvest treatments and storage of agricultural products, quality assurance and preparation of fresh-cuts, and postharvest socio-economics.

Course Outcomes:
1. Ability to analyze the chemical and physical properties of agricultural products in order to apply the appropriate post-harvest handling technology.
2. Ability to manage the factors during pre-harvest, harvesting and postharvest handlings that affect the quality of the produces.
3. Ability to assess the socio-economic factors and impact to prevent losses in post-harvest operation.

References:

PTT 351/2 (Safety & Loss Prevention)

Course Synopsis:
The course emphasizes the technical fundamentals of process safety. Students are exposed to the issues in safety associated with toxicology, industrial hygiene, source and dispersion models. Students are then taught about characteristics and possible prevention steps of fires and explosions. Subsequently, they are also exposed to the concept and design of relief system, hazard identification as well as risk assessment. The course is concluded with the lesson in accident investigation.

Course Outcomes:
1. Ability to analyze the type of hazards and dispersion models in chemical engineering processes.
2. Ability to recommend suitable methods to prevent fires and explosion and to design relief system for process vessels.
3. Ability to evaluate safety procedures and designs using proper hazard identification and accident investigation techniques.

References:

PTT 355/3 (Process Control & Dynamic)

Course Synopsis:
The course aims to introduce the concept of process control by applying theoretical models of chemical processes for steady and unsteady-state models (dynamic model) of chemical processes. Topics to be covered such as dynamic behavior of processes including Laplace transform, transfer function models, dynamic behavior of first-order and second-order processes. Introduction to feedback control also will be learned in this course including feedback controllers, control system instrumentation, overview of control system design and dynamic behavior of closed-loop control system, PID controller design, tuning, and troubleshooting. The theories are supported by performing laboratory experiments.

Course Outcomes:
1. Ability to analyze basic concepts of process control and theoretical model of chemical processes.
2. Ability to develop dynamic behavior of process control.
3. Ability to evaluate the feedback and feedforward control system for chemical processes.

References:

PTT 356/4 (Separation Engineering)

Course Synopsis:
This course emphasizes the theory and basic principles of separation processes based on equilibrium stage concepts and mass transfer rate control. This course provides the knowledge of basic design criteria required for binary and multi component separations processes. Topics to be covered include liquid-liquid extraction, vapour-liquid extraction (distillation), solid-fluid extraction (leaching, crystallization and adsorption), mechanical-physical separation process (filtration and centrifugation), and membrane separation technology.

Course Outcomes:
1. Ability to apply principles and theory to examine basic design/operation of liquid-liquid extraction, leaching and crystallization equipment.
2. Ability to apply and calculate based on principles of mechanical-physical separation process and membrane separation process.
3. Ability to apply principles and theory to develop basic design/operation of adsorption tower, and distillation column.

References:

PTT 371 (Analysis & Instrumentation for Food Technology)

Course Synopsis:
This course dealing with the development, application and study of analytical procedures for characterizing the properties of foods such as its structure, physicochemical properties, sensory attributes and their constituents. Analysis and specific instrumentation techniques involve are chromatography (HPLC, GC and TLC), spectrometry (UV vis Spectrophometer, Mass Spectrometry, FTIR, AAS and NMR) electroanalytical (Potentiometry), electrophoresis, microscopy (Compound, Stereo Microscope and Scanning Electron Microscopes) and proximate analyses (protein, carbohydrate, fat, fiber, ash and moisture).

Course Outcomes:
1. Ability to explain the principles behind the analytical techniques used in food analysis (primarily chemical and physical analyses)
2. Ability to distinguish the isolation and chemical analysis of food component in relation to the chemical and physical properties.
3. Ability to propose the most suitable analysis and instrumentation technique for specific food samples.

References:

PTT 372 (Food Processing & Preservation)

Course Synopsis:
This course covers multidisciplinary field of applied physical sciences combines science, microbiology, and engineering education for food and related industries. Topics to be covered include introduction to food processing, preservation processes, the most common food engineering unit operations, refrigeration, freezing, evaporation, dehydration, membrane separation, extrusion and packaging. It also covers the understanding of the impact of processing and storage conditions on the physical properties and structure of pre- and post-processed materials. Detail guidance in carrying out specific design calculations. The theory is supported by performing several laboratory experiments.
Course Outcomes:
1. Ability to apply and differentiate the principles of food processing and preservation.
2. Ability to analyze the effects of processing on sensory and nutritional properties of food.
3. Ability to evaluate the problems involved in food production and preservation.

References:

PTT 373 (Fats and Oil Technology) (Elective)

Course Synopsis:
This course provides students with the knowledge and concepts of the processing techniques and technologies of fats and oil, methods used to assess the quality, handling and preservation of the oils and fats products.

Course Outcomes:
1. Ability to differentiate the sources of edible fats and oil, their physicochemical and biochemical properties as well as their function as ingredient in food
2. Ability to distinguish the processing techniques and technology as well as methods used to assess the quality of the variety of fats and oil products
3. Ability to predict the best methods of handling and preservation of fats and oil products according to their types and properties

References:

PTT 374 (Food Ingredients) (Elective)

Course Synopsis:
This course provides knowledge in major food ingredients such as water, carbohydrates, lipids, proteins and flavors with other constituent of foods. This includes different categories of food ingredients such as flour, gums, spices, starch, vitamins and other food additives. The course also emphasizes on technical information in the area of ingredient interactions pertaining to foods in order to optimize ingredient performance and obtaining quality food products.

Course Outcomes:
1. Ability to explain the mechanism of the techno-functionality or bio-functionality of ingredients.
2. Ability to propose the right ingredients for food production.
3. Ability to predict and explain the effect of the interaction between ingredient and complex food matrix under different conditions.

References:
3. Zuidam, N. J., Encapsulation Technologies for Active Food Ingredients and Food Processing. Springer. 2010

PTT 353/3 (Final Year Project 1)

Course Synopsis:
This course consists of combination between guided supervision and independent study focusing on the technique of identification of problem statements, research objectives, conducting literature review and proposing research methodology. This course also covers scientific and technical guidance on thesis writing as well as preparation and submission of the project proposal. Presentation of the research proposal to the internal examiners is conducted.

Course Outcomes:
1. Ability to analyze scientific information including standards, code of practice, journals, policies, field data, relevant to the specific research to be undertaken and relate with societal and global issues.
2. Ability to develop problem statements and research objectives of the project.
3. Ability to plan research methodology incorporating clear fundamentals, theories and benchmarked against standard practices governing the research project.
4. Ability to prepare and defend research proposal with effective communication skills.

References:

PTT 354/3 (Plant Design Project 1)

(Pre-requisite: PTT 253/3 Heat Transfer for Chemical Engineering)

Course Synopsis:
This course introduces preliminary design of a process plant to the students. This includes process creation and analysis, selection and design for the principal equipment needed in a process based on the process structure approach. ASPEN PLUS will be implemented throughout the course in the process flow sheeting and equipment design.
Course Outcomes:
1. Ability to create process flow sheets involving reactions, separations and other operations.
2. Ability to design unit operations in plant based on stoichiometry, thermodynamics, separation, reaction and other engineering principles.
3. Ability to develop the mass and energy balances of a major selection of the process plant.

References:

PTT375 (Food Waste Management & Utilization)

Course Synopsis:
This course covers the food sources of pollution, their effect on the environment and properties of food waste materials. It emphasizes on the physical, chemical and biological treatment processes of food wastes in relation to pollution control and waste utilization in relation to pollution problems and technologies for utilization for sustainable environmental. It also provides the knowledge of legislative act that governs environmental management.

Course Outcome:
1. Ability to analyze types of pollution emission from industries and effect of industrial pollution to the environment and public health.
2. Ability to plan strategies to control, reduce, and monitor pollution.
3. Ability to evaluate the key current environmental problems as well as the legislative act for waste management in industry.

References:

PTT 376 (Quality & Safety Management System in Food Production)

Course Synopsis:
This course covers the integration of all functions and processes within an organization in order to achieve continuous improvement of the quality and safety of food production. It covers hazard analysis critical control point (HACCP), good manufacturing practice (GMP) and good hygiene practices (GHP), ISO 22000, and other non-food-safety issues such as
bio-security policy and registration, environmental policy, as well as kosher, organic, vegan and halal certifications.

**Course Outcomes:**
1. Ability to explain the principles of quality and safety management system in food production.
2. Ability to analyze the effectiveness of each quality and safety management system in maintaining quality and prevention of food safety hazards.
3. Ability to critically evaluate the issues related to food quality and safety management system.

**References:**

**PTT 377 (Functional Foods & Nutraceuticals)(Elective)**

**Course Synopsis:**
This course examines the relation of functional foods and nutraceuticals to food and drugs. The safety and efficacy of individual functional foods and nutraceuticals products, and the regulatory issues that influence the development and commercialization of functional foods and nutraceuticals in global markets are emphasize.

**Course Outcomes:**
1. Ability to apply various research tools in determining the efficacy of functional foods and nutraceuticals.
2. Ability to analyze the safety and efficacy of individual functional foods and nutraceutical products.

**References:**

**PTT378 (Dairy and Meat Technology)(Elective)**

**Course Synopsis:**
This course provides students with the knowledge and concepts of the processing techniques and technologies to produce variety types of dairy and meat products, methods used to assess the quality, handling and preservation of the dairy and meat products.

**Course Outcomes:**
1. Ability to demonstrate the understanding on composition and properties of dairy and meat
2. Ability to distinguish the processing techniques and technology as well as method used to assess the quality of dairy and meat products
3. Ability to predict the best methods of handlings and preservation of dairy and meat products.

**References:**

**PTT 451/5 (Final Year Project II)**
*(Pre-requisite: PTT 353/3 Final Year Project 1)*

**Course Synopsis:**
This course consists of combination between guided supervision and independent study focusing on the techniques of conducting laboratory and/or field experiments. This course also covers on the implementation of research activities and monitored based on research plan, data analysis, interpretation and conclusion. The students are required to write, submit and defend their thesis to the internal examiners.

**Course Outcomes:**
1. Ability to plan activities pertaining to research project to meet the required research objectives and datelines.
2. Ability to assess techniques and modern tools to solve research problems.
3. Ability to evaluate experimental data and deduce good conclusion.
4. Ability to produce standard thesis and defend the findings.

**References:**

**PTT 452/3 (Plant Design Project 2)**

**Course Synopsis:**
This course utilizes the knowledge gained by the student's in earlier courses and applies in the complete design a plant. The plant design includes cost estimation, profitability analysis,
piping and instrumentation, plant control, waste management, plant safety, reliability and operability and plant layout. ASPEN PLUS will be implemented throughout the course in the process plant design.

**Course Outcomes:**
1. Ability to create a piping and instrumentation diagram (P&ID) and identify potential control system of the designed project
2. Ability to recommend suitable safety and waste management.
3. Ability to evaluate economic profitability analysis of the designed project.

**References:**

**PTT 471 (Food Product Development & Commercialization)**

**Course Synopsis:**
This course studies the different categories of new food products, identifies reasons for product success and product failure. It also covers on the developing an innovation strategy, gap analysis, product development processes, knowledge- and consumer-based for product development. It includes food product planning and marketing mix strategies, product pricing, promotion and distribution.

**Course Outcomes:**
1. Ability to analyze the product gap based on knowledge and consumer requirements.
2. Ability to predict product opportunities for commercialization.
3. Ability to develop an optimized food product prototype that can be launched.

**References:**

**PTT 472 (Food Packaging Technology) (Elective)**

**Course Synopsis:**
The course provides the students with the basic knowledge regarding food packaging materials, equipments and technology. It provides an overview of the packaging science and technology applied to the preservation and shelf life, distribution and marketing of various
food products. This course also explains the different procedures and food safety requirements for developing, evaluating and testing of food packages in accordance to international standards.

**Course Outcomes:**
1. Ability to demonstrate the importance and functions of a packaging system in relation to food preservation.
2. Ability to analyze the properties, economic use and manufacture of packaging materials (glass, plastic, paper and aluminium).
3. Ability to assess the interaction mechanism of packaging materials with various food products to maximise quality and shelf-life of the products.

**References:**

**PTT473 (Poultry and Fish Technology)(Elective)**

**Course Synopsis:**
This course provides students with the knowledge and concepts of the processing techniques and technologies to produce variety types of fish and poultry products, methods used to assess the quality, handling and preservation of the products originating from fish and poultry.

**Course Outcomes:**
1. Ability to demonstrate the understanding on chemical and biochemical constitution of muscle and fish.
2. Ability to distinguish the processing techniques and technology as well as method used to assess the quality of variety types of fish and poultry products.
3. Ability to predict the best methods of handleings and preservation of fish and poultry products.

**References:**
Instrumentation Engineering Technology (IET) is a nationally accredited program that provides a comprehensive course of studies in industrial measurement and control. With a provincial economy that is largely industrial-based, instrumentation has become an extremely important field. Industries are also becoming increasingly automated to improve productivity, conserve energy, and reduce pollution.