Faculty of Chemical & Natural Resources Engineering

FACULTY OF CHEMICAL & NATURAL RESOURCES ENGINEERING

INTRODUCTION

The Faculty of Chemical and Natural Resources Engineering was established on 15 February 2002. The first set of programs offered to students enrolling for session 2002/2003 was Bachelor in Chemical Engineering and Diploma in Chemical Engineering. Two additional programs were offered to students starting with enrolments for session 2003/2004 namely Bachelor in Chemical Engineering (Biotechnology) and Bachelor in Chemical Engineering (Gas Technology). These were competency-based and application-based programs, with emphasis on the combination of theory and practical skills in a learning process which identifies the problems and challenges in industry and solve them. These programs cover the areas of separation process, chemical reaction engineering, process engineering, system control and environmental engineering. These three (3) Bachelor programs were later upgraded to fulfill the requirements for accreditation with the Engineering Accreditation Council (EAC), under the Washington Accord, and were all duly accredited under the EAC. On 12 October 2010 the Faculty was approved by the Ministry of Higher Education Malaysia to offer Masters of Chemical Engineering with Entrepreneurship (by coursework) and intake of students was started in semester 1 of session 2011/2012.

OBJECTIVES OF THE FACULTY

In line with the EAC requirements, the curriculum and syllabus of the Chemical Engineering course were formulated and designed to achieve the following objectives:

i. To provide engineering programs in the field of chemical and natural resources engineering.

ii. To embark on research and development activities, particularly in the area of fine and specialty chemicals, chemical process up-scaling and biotechnology-related processes in order to generate expertise relevant to the needs of the industry.

iii. To play an important role as well as a reference centre for chemical and biotechnology-related activities.

iv. To serve as a catalyst for the development of these activities through programs such as technology transfer, staff exchange, training, consultancy and other services relating to chemical and natural resources engineering.

VISION & MISSION OF THE FACULTY

VISION

To be a leading centre in producing professionals in the area of chemical and natural resources engineering, with emphasis on industrial best practices and applications.

MISSION

To provide for the study of chemical and natural resources engineering in an industrial context through outstanding education; research; and development.

PROGRAMS OFFERED

FKKSA offers both diploma and degree programs related to chemical and natural resources engineering as follows:-

Undergraduate level;

a) Bachelor of Chemical Engineering
b) Bachelor of Chemical Engineering (Biotechnology)
c) Bachelor of Chemical Engineering (Gas Technology)
d) Diploma in Chemical Engineering (Process Plant)

Postgraduate level;

a) PhD in Chemical Engineering
b) PhD in Bioprocess Engineering
c) PhD in Gas Engineering
d) Masters in Chemical Engineering (By Research)
e) Masters in Bioprocess Engineering (By Research)
f) Masters in Gas Engineering (By Research)
g) Masters in Chemical Engineering with Entrepreneurship (By Course)

PROGRAM EDUCATIONAL OBJECTIVES

Program Educational Objectives (PEO) of FKKSA

PEOs and POs attributes will be implanted consistently in the delivery of undergraduate programs. Once graduated, the graduates will be able to develop the attributes at the workplace by contributing in the manner desired by the PEO:-

PEO1 To produce graduates who excel in their chemical engineering positions, in areas of process design; plant operation; safety; and environment.

PEO2 To produce graduates who apply and develop advanced technology through Research & Development and who are keen to pursue post graduate studies.

PEO3 To produce graduates who display leadership qualities to the companies that employ them.

PEO4 To produce graduates who demonstrate strong professional values and responsibilities towards society and environment.

Program Outcomes (PO)

Program Outcomes are specific statements regarding graduates' knowledge, skills and attitudes that describe what students are expected to know and be able to perform or attain by the time of graduation. Consistent with world-class engineering programs, the POs for graduates are as follows:

PO1 ability to acquire and apply knowledge of science and engineering fundamentals in chemical engineering and related areas

PO2 ability to communicate effectively, in verbal and written forms, with both technical and non-technical groups

PO3	ability to acquire in-depth technical competence in chemical engineering and related disciplines
PO4	ability to identify, formulate and solve chemical engineering and related problems
PO5	ability to utilize systems approach to design and evaluate operational performance
PO6	understanding of the principles of design for sustainable development
PO7	understanding of professional, ethical and safety issues in engineering practices, the responsibilities and commitment to them
PO8	ability to function effectively as an individual and in a group with the capacity to be a leader or manager
PO9	understanding and responsive to the social, cultural, global and environmental responsibilities of a professional engineer
PO10	ability to recognize the need for and engage in lifelong learning

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PROGRAMME CURRICULUM

DIPLOMA IN CHEMICAL ENGINEERING (DKK)

YEAR	FIRST		SECOND	
SEMESTER	* SHORT SEMESTER	FIRST & SECOND	FIRST & SECOND	
CHEMICAL ENGINEERING CORE COURSES		DKK1751: Basic Engineering Lab	DKK2333: Thermodynamic	INDUSTRIAL TRAINING (LI) 12 WEEKS
		DKK1741: Basic Science Lab	DKK2142: Plant Supervision	
		DKK1512: Engineering Graphics	DKK2433: Chemical Reaction Engineering	
		DKK1132: Computer Application	DKK2363: Engineering Mechanics	
		DKK1352: Electrical Technology	DKK2373: Fluid Mechanics	
		DKK1413: Material & Energy Balances	DKK2771: Chemical Reaction Lab	
		DKK1493: Transport Processes	DKK2443: Process Instrumentation & Control	
		DKK1761: Mass and Heat Transfer Lab	DKK2523: Environmental Engineering	
		DKK1771: Analytical Instrumental Lab	DKK2462: Plant Commissioning & Start-up	
			DKK2453: Unit Operations	
			DKK2473: Plant Safety & Health	
			DKK2483: Plant Utility	
			DKK2761: Unit Operations Lab	
			DKK2771: Process Instrumentations & Control Lab	
62		**16**	**34**	**12**
30	**University Required Courses** : Calculus, Basic Mathematics, English For General Communication, English For Workplace Communication, English For Technical Communication, Islamic And Asian Civilizations', Ethnic Relations, General Chemistry I, General Chemistry II, Physics, Soft Skills 1, Soft Skill 2, Co-Curriculum I, Technopreneurship			
92	**Total Unit For Graduation**			

BACHELOR OF CHEMICAL ENGINEERING (BKC)

YEAR	FIRST	SECOND	THIRD		FOURTH
SEMESTER	FIRST & SECOND	FIRST & SECOND	FIRST & SECOND		FIRST & SECOND
CHEMICAL ENGINEERING CORE COURSES	BKF1323 Organic Chemistry	BKF2353 Fluid Mechanics	BKF3472 Chemical Reaction Engineering II	INDUSTRIAL TRAINING (LI) 12 WEEKS	BKF4143 Engineering Economics
	BKF1313 Eng. Mechanics	BKF2422 Heat Transfer	BKF2443 Numerical Methods & Optimization		BKF4791 Process Control & Instrumentation Lab
	BKF1243 Analytical Chemistry	BKF2453 Chem. Reaction Engineering I	BKF3553 Process Simulation & Comp. Aided Design		BKC3912 Process & Plant Design I
	BKF2711 Chemistry Lab	BKF2143 Comp. Programming For Engineers	BKF3731 Unit Operation Lab		BKC4934 Process & Plant Design II
	BKF1513 Intro. To Chemical Engineering	BKF1332 Electrical & Instrumentation Tech.	BKF3463 Unit Operation I		BKC3922 Undergraduate Research Project I
	BKF1253 Physical Chemistry	BKF2343 Material & Energy Balance	BKF3413 Process Control & Dynamic		BKC4944 Undergraduate Research Project II
	BKF1333 Thermodynamics	BKF2413 Chemical Engineering Thermodynamics	BKC3492 Unit Operation 2		BKC3771 Environmental Engineering Lab
	BKF2731 Basic Engineering Lab	BKF2432 Mass Transfer	BKC3543 Environmental Engineering		# BKC3**3 Elective 1
		BKF3721 Mass & Heat Transfer Lab	BKF3741 Chemical Reaction Engineering Lab		# BKC 3**3 Elective 2
		BKC3363 Science & Engineering Materials	BKC3533 OSH In Chemical Industries		# BKC4**3 Elective 3
101	**20**	**25**	**24**	**6**	26
29	**University Required Courses** : Applied Calculus, Applied Statistics, Ordinary Differential Equations, Technical English, Technical Writing, Academic Report Writing Islamic And Asian Civilizations 1, Ethnic Relations, Foreign Languages Level 1, Foreign Languages Level 2, Soft Skills 1, Soft Skill 2, Co-Curriculum I, Co-Curriculum II, Technopreneurship				
130	**Total Unit For Graduation**				

 # Elective Subjects : Cell Culture Technology (E), Pharmaceutical Technology (E), Membrane Technology (E), Wastewater Treatment (E), Recycling Technology (E), Operation & Project Management (E), Advanced Reaction Engineering Catalysis (E), Process Monitoring (E), Advanced Process Control (E), Mixing Of Fluids & Particles (E), Fuel Cell Technology (E), Polymer Technology (E), Food Engineering (E), Corrosion Engineering (E), Emulsion Technology (E)

BACHELOR OF CHEMICAL ENGINEERING (BIOTECHNOLOGY) (BKB)

YEAR	FIRST	SECOND	THIRD	INDUSTRIAL TRAINING (LI) 12 WEEKS	FOURTH
SEMESTER	FIRST & SECOND	FIRST & SECOND	FIRST & SECOND		FIRST & SECOND
CHEMICAL ENGINEERING CORE COURSES	BKF1323 Organic Chemistry	BKF2353 Fluid Mechanics	BKF3472 Chemical Reaction Engineering II		BKF4143 Process Engineering Economics
	BKF1313 Engineering Mechanics	BKF2422 Heat Transfer	BKF2443 Numerical Methods & Optimization		BKF4791 Process Control & Instrumentation Lab
	BKF1243 Analytical Chemistry	BKF2453 Chemical Reaction Engineering I	BKF1332 Electrical & Instrumentation Tech.		BKB3912 Process & Plant Design I
	BKF2711 Chemistry Lab	BKF2143 Comp. Programming For Engineers	BKF3553 Process Simulation & Computer Aided Design		BKB4934 Process & Plant Design II
	BKF1513 Intro. To Chemical Engineering	BKF2343 Material & Energy Balance	BKF3731 Unit Operation Lab		BKB3922 Undergraduate Research Project I
	BKF1333 Thermodynamics	BKF2413 Chemical Engineering Thermodynamics	BKF3741 Chemical Reaction Engineering Lab		BKB4944 Undergraduate Research Project II
	BKB2132 Molecular & Cell Biology	BKF2432 Mass Transfer	BKF3413 Process Control & Dynamic		BKB3533 OSH In Chemical & Biotechnology Industries
		BKF2731 Basic Engineering Lab	BKF3721 Mass & Heat Transfer Lab		BKB3781 Bioseparation Engineering Lab
		BKF3463 Unit Operation I	BKB2412 Industrial Biotechnology		BKC3771 Environmental Engineering Lab
		BKB2761 Biochemistry & Microbiology Lab	BKB3513 Environmental Biotechnology		# BKC3**3 Elective 1
		BKB2212 Biochemistry	BKB4493 Bio separation Engineering		
			BKB3423 Bioreactor Engineering		
101	**18**	**26**	**27**	**6**	**24**
29	**University Required Courses** : Applied Calculus, Applied Statistics, Ordinary Differential Equations, Technical English, Technical Writing, Academic Report Writing Islamic And Asian Civilizations 1, Ethnic Relations, Foreign Languages Level 1, Foreign Languages Level 2, Soft Skills 1, Soft Skill 2, Co-Curriculum I, Co-Curriculum II, Technopreneurship				
130	**Total Unit For Graduation**				

 # Elective Subjects : Cell Culture Technology (E), Pharmaceutical Technology (E), Membrane Technology (E), Wastewater Treatment (E), Recycling Technology (E), Operation & Project Management (E), Advanced Reaction Engineering Catalysis (E), Process Monitoring (E), Advanced Process Control (E), Mixing Of Fluids & Particles (E), Fuel Cell Technology (E), Polymer Technology (E), Food Engineering (E), Corrosion Engineering (E), Emulsion Technology (E),

BACHELOR OF CHEMICAL ENGINEERING (GAS TECHNOLOGY) (BKG)

YEAR	FIRST	SECOND	THIRD		FOURTH
SEMESTER	FIRST & SECOND	FIRST & SECOND	FIRST & SECOND		FIRST & SECOND
CHEMICAL ENGINEERING CORE COURSES	BKF1323 Organic Chemistry	BKF2353 Fluid Mechanics	BKF3472 Chemical Reaction Engineering II	INDUSTRIAL TRAINING (LI) 12 WEEKS	BKF4143 Process Engineering Economics
	BKF1313 Engineering Mechanics	BKF2422 Heat Transfer	BKF2443 Numerical Methods & Optimization		BKF4791 Process Control & Instrumentation Lab
	BKF1243 Analytical Chemistry	BKF2453 Chemical Reaction Engineering I	BKF1332 Electrical & Instrumentation Tech.		BKG3912 Process & Plant Design I
	BKF2711 Chemistry Lab	BKF2143 Comp. Programming For Engineers	BKF3553 Process Simulation & Comp. Aided Design		BKG4934 Process & Plant Design II
	BKF1513 Intro To Chemical Engineering	BKF3741 Chemical Reaction Engineering Lab	BKF3731 Unit Operation Lab		BKG3922 Undergraduate Research Project I
	BKF1253 Physical Chemistry	BKF2343 Material & Energy Balance	BKF3463 Unit Operation I		BKG4944 Undergraduate Research Project II
	BKF1333 Thermodynamics	BKF2413 Chemical Engineering Thermodynamics	BKF3413 Process Control & Dynamic		BKG4413 Gas Transport & Storage
		BKF2432 Mass Transfer	BKG3473 Gas Processing & Utilization		BKG3412 Oil & Gas Production System
		BKF2731 Basic Engineering Lab	BKC3492 Unit Operation 2		BKG4731 Gas Technology Lab
		BKC3363 Science & Engineering Materials	BKC3543 Environmental Engineering		BKG4423 Osh In Oil & Gas Industries
					BKC3771 Environmental Engineering Lab
					# BKC3**3 Elective 1
103	19	24	25	6	29
27	**University Required Courses** : Applied Calculus, Applied Statistics, Ordinary Differential Equations, Technical English, Technical Writing, Academic Report Writing Islamic And Asian Civilizations 1, Ethnic Relations, Foreign Languages Level 1, Foreign Languages Level 2, Soft Skills 1, Soft Skill 2, Co-Curriculum I, Co-Curriculum II, Technopreneurship				
130	**Total Unit For Graduation**				

 # Elective Subjects : Cell Culture Technology (E), Pharmaceutical Technology (E), Membrane Technology (E), Wastewater Treatment (E), Recycling Technology (E), Operation & Project Management (E), Advanced Reaction Engineering Catalysis (E), Process Monitoring (E), Advanced Process Control (E), Mixing Of Fluids & Particles (E), Fuel Cell Technology (E), Polymer Technology (E), Food Engineering (E), Corrosion Engineering (E), Emulsion Technology (E),

BACHELOR OF ENGINEERING TECHNOLOGY (HONS) (PHARMACEUTICAL) (BTP)

YEAR	FIRST	SECOND	THIRD	FOURTH	
SEMESTER	FIRST & SECOND	FIRST & SECOND	FIRST & SECOND	FIRST & SECOND	
ENGINEERING TECHNOLOGY (HONS) (PHARMACEUTICALS) CORE COURSES	BTF1123 Organic Chemistry	BTF2324 Fluid Mechanics	BTP3513 Material Processes & Colloid Science	BTP4713 TRIZ 2 (Process Product Innovation)	INDUSTRIAL TRAINING (LI) 24 WEEKS
	BTP1133 Biology for Engineers	BTP2332 Bioreactor Engineering	BTP3522 Bio pharmaceutics	BTP4768 Pharma Project	
	BTF1143 Computer Programming	BTP2343 Control Systems	BTP3534 Thermodynamics 2	BTP47*4 Elective II	
	BTF1153 Engineering Graphics	BKF2353 Electrical Power Systems	BTP3543 Automation Systems	BTP47*4 Elective III	
	BTF1163 Engineering Science	BTP2363 Contamination Control & Clean Room	BTP3553 Instrumentation & Control Systems		
	BTF1223 Analytical Chemistry	BTF2412 Numerical Methods & Optimization	BTP2452 Good Manufacturing & Quality Assurance		
	BTP1233 Introduction to Pharmaceutical Science	BTP2424 Thermodynamics 1	BTP3613 TRIZ 1 (Process Product Innovation)		
	BTP1242 Material and Process	BTP2434 Biochemistry & Microbiology	BTP3621 Experimental Design & Statistics		
	BTF1253 Electrical Fundamentals	BTP2442 Electrical Systems & Networks	BTP3643 Industrial Networks		
	BTP1263 Environmental Technology	BTP2463 Manufacturing Process Technology	BTP3652 Contemporary Trends in Pharma Industry		
		BTP2483 Management & Professional Development	BTP3673 Systems Validation		
			BTP36*4 Elective I		
126	29	33	33	19	12
32	**University Required Courses** : Ordinary Differential Equations, Technical English, Applied Calculus, Co-curriculum 1, Technical writing, Applied Statistics, Islamic & Asian Civilization, Co-curriculum 2, Ethnic Relations, Foreign Language 1, Soft Skills 1, Soft Skills 2, Foreign Language 2, Technopreneurship				
158	**Total Unit For Graduation**				

33**# Elective Subjects :** Process biotechnology (E), Process Analytical Techniques (E), Thermal Energy Systems (E)

SYLLABUS

DEGREE LEVEL

BKF1513
INTRODUCTION TO CHEMICAL ENGINEERING

Credit : 3

Pre-requisite
NONE

Synopsis

This subject gives an overview of engineering, the profession and its requirements in Malaysian scenario. Topics include ethics, management and contribution of engineering. Also generic skills and study skills. Basic calculations, unit conversions, engineering graph and solving iterative problem using computer are consisted in this subject as preparation for engineering students. Plant visits and seminars serve as exposure for students to the real field of engineering.

Course Outcomes

CO1	Define engineering and identify different branches of engineering.
CO2	Explain engineering ethics, management and contribution.
CO3	Explain conservation and sustainability of resources, and recommend effective solutions.
CO4	Perform basic calculation and computational knowledge used in chemical the engineering field.
CO5	Apply generic skills and study skills.

BKF1243
ANALYTICAL CHEMISTRY

Credit : 3

Pre-requisite
NONE

Synopsis

The syllabus covers basic knowledge and application of sample and data handling, calibration technique, and quality of analysis in analytical laboratory. It also deals with separation techniques and its basis application such as solid phase extraction, GC and HPLC. The introduction to the theory and application of spectroscopic technique used in chemical analysis such as UV-Visible, FTIR, AES, ICP, and AAS are discussed. The combinations of above technique with their advantages are covered in this course.

Course Outcomes

CO1	Explain and describe theory and application of analytical chemistry.
CO2	Interpret and analyze analytical data.
CO3	Solve problems related to analytical chemistry.
CO4	Explain the concept and of analytical equipments such as SPE, GC, HPLC, AAS, UV-Vis and MS.

BKF1253
PHYSICAL CHEMISTRY

Credit : 3

Pre-requisite
NONE

Synopsis

This course discusses some introduction to thermodynamics in physical chemistry followed by continuation topics related to liquids and their mixtures, principles of chemical equilibrium and rate of reactions. The solid surfaces including their applications will also be discussed in this course. The development of key skills is facilitated by a program of tutorials and practices.

Course Outcomes

CO1 Explain and describe the concept of physical chemistry.

CO2 Apply basic thermodynamics concept to solve problems related to physical chemistry.

CO3 Describe the properties of mixtures and interpret the phase diagram.

CO4 Explain the principles of chemical reactions and solve problems related to it.

BKF1323
ORGANIC CHEMISTRY

Credit : 3

Pre-requisite
NONE

Synopsis

This course discusses the fundamental theory of properties, synthesis and organic reactions where use the functional group as framework as a basic for second level courses with an organic chemical content.

This course focuses on the key concepts of organic chemistry through a study of the reactions of selected nonfunctional aliphatic, salicylic, cyclic and aromatic molecules. Particular emphasis is placed on the underlying mechanistic pathways that are involved and their stereo-chemical consequences.
The stereo-chemistry of the molecular structure is also considered. The development of key skills is facilitated by a program of tutorials and practical.

Course Outcomes

CO1 Explain the common types of reaction mechanism and modern synthetic techniques.

CO2 Explain the significance of stereochemistry in organic chemistry

CO3 Describe the different functional groups that undergo reaction in devising syntheses of other organic compounds.

BKF2353
FLUID MECHANICS

Credit : 3

Pre-requisite
NONE

Synopsis

The objective of this course is to introduce the concept and use of fluid mechanics, both static and dynamics fluid. The covered topics are fluid properties, fluid static and dynamics, Bernoulli's equation and applications, momentum equation and its applications,

analysis of flow in pipeline system and dimensional analysis.

Course Outcomes

CO1 Recognize and describe fundamentals of fluid mechanics

CO2 Apply the concept of fluid mechanics to overcome chemical engineering problems.

CO3 Analyze and find solutions to problems related to fluid mechanics

BKF1313
ENGINEERING MECHANICS

Credit : 3

Pre-requisite
NONE

Synopsis

This subject will introduce students to concepts of statics and dynamics and its application in related engineering field. The topics covered in this subject are static of particle, static of rigid body, distributed forces, analysis of structure, friction, kinematics and kinetics of particles. By completing the course, students will comprehend the basic mechanisms and applications of statics and dynamics in related engineering field.

Course Outcomes

CO1 Define the basic concepts in statics to solve problems concerning resultant of forces acting on a particle and equilibrium of a particle.

CO2 Analyze problems involving the equilibrium of a rigid body and use the fundamental principles in statics to solve them.

CO3 Analyze problems involving the kinematics and kinetics of rectilinear and curvilinear motions of a particle by applying the basic principles in dynamics

BKF1333
THERMO DYNAMICS

Credit : 3

Pre-requisite
NONE

Synopsis

This course is designed to introduce basic concept in thermodynamic in a thorough way. Topics cover are properties of pure substances, thermodynamics system, heat transfer through conduction, convection and radiation, the first law of thermodynamics for closed systems, open systems and their application in steady-flow and unsteady-flow processes, the second law of thermodynamics, entropy, introduction to refrigeration and steam power plant.

Course Outcomes

CO1 Discover the state of properties from property diagram and obtaining data from property table.

CO2 Solve energy balance (heat, mass and work) of a process for both closed and open system by using the first law of thermodynamics and the concept of entropy through its reversible

and irreversible processes.

CO3 Analyze the thermal efficiency of heat engine, heat pump, and refrigerator and Carnot cycle using Second Law of Thermodynamics.

BKF2711
CHEMISTRY LABORATORY

Credit : 1

Pre-requisite
NONE

Synopsis

Students are required to perform laboratory work which covers the basic concept of physical and organic chemistry such as solubility and miscibility, chemical equilibrium, buffer effect, calorimetry, solvent extraction and gravimetric determination of chloride. This lab also contain a few experiments which cover the concept of analytical instrument such as uv-visible, fourier transform infra red, differential scanning calorimetry and gas chromatography.

Course Outcomes

CO1 Apply all physical, organic & analytical chemistry theory in laboratory.

CO2 Apply all basic science and analytical chemistry knowledge in operation of analytical chemistry equipment.

CO3 Demonstrate and operate each analytical equipment base on the theories applied in analytical chemistry.

CO4 Indicate any minor/major malfunction of equipment, incorrect step/result & troubleshoots it.

BKF2731
BASIC ENGINEERING LABORATORY

Credit : 1

Pre-requisite
NONE

Synopsis

In basic engineering lab, students are required to perform laboratory work on the Bomb Calorimeter, Rockwell Hardness Tester, Losses in Pipe System, Marcet Boiler, Stability of Floating Body Apparatus, Vortex Apparatus, Tensile and Brinell Machine, Twist and Bending Machine and Sieving Apparatus. The aim is to strengthen the student's fundamental knowledge as it covers all the basic engineering subjects such as fluid mechanics, strength of material and thermodynamics.

Course Outcomes

CO1 Apply basic engineering concepts to solve lab experimental problem.

CO2 Operate and demonstrate different types of equipments relevant to engineering principle/theory

CO3 Enable students to work in group and commit to date lines.

CO4 Comply with all lab and regulations.

BKF2343
MATERIAL & ENERGY BALANCE

Credit : 3

Pre-requisite
NONE

Synopsis

The course helps students to understand and acquire basic knowledge and skill in engineering calculations usually used in chemical processes. Beginning with chapter 1 and 2, conversion of units and determination of process variables is taught on how scale differs as resulted in using different units within particular dimension of measurement and how variables of a process are identified and calculated. Next, from chapter 3 to 7, material balance calculations are taught covering various aspects of mass and mole change in a system.

Furthermore, consequences appeared when different number of phase is considered in a system are taken into account in the subsequent chapters: 9 to 12.

Finally, energy balance associated with the material system is taught from chapter 13 to 15 to complete a conceptual design of chemical process system. The ultimate goal of this course is to aid students to develop MEB of a process in Excel and Aspen Plus.

Course Outcomes

CO1 Apply basic chemical engineering calculations involving conversion of units and determination of process variables.

CO2 Apply ideal and non-ideal gas calculations to solve problems related to single phase system.

CO3 Solve problems on multiphase systems related to multi-component gas-liquid system and liquid-liquid system

CO4 Analyze and solve material balance of process systems for nonreactive and reactive processes in single and multiple units.

CO5 Analyze and solve energy balance calculation in both non reactive and reactive systems.

BKF2413
CHEMICAL ENIGEERING THERMO-DYNAMICS

Credit : 3

Pre-Requisite
BKF1333 THERMODYNAMICS

Synopsis

This subject mainly covers the topics of pure substances, heat effects, thermodynamics properties, VLE, thermodynamics solution and chemical reaction equilibrium. The course covers the theory and applications of thermodynamics concept and deals with composition dependent thermodynamics relations. This course requires conceptual thinking and requires greater mathematical sophistication to generate ideas and problem solving.

Course Outcomes

CO1 Estimate thermodynamic properties from available data by using appropriate methods.

CO2 Select specific equations of state or the generalized correlations that is appropriate for solving given problems.

CO3 Apply thermodynamic concepts to solve problems in VLE, solution thermodynamics and chemical reaction equilibrium.

BKF1332
ELECTRICAL & INSTRUMENTATION TECHNOLOGY

Credit : 2

Pre-requisite
NONE

Synopsis

This is an introductory level course of electrical principles for chemical engineering students. As far as this matter is concerned, instrumentation technology is identified to be one of the main areas which strongly related to the chemical engineering domain, particularly in designing a control system application. Thus, the course has been divided into two main parts which are fundamentals of electrical principles and essentials of instrumentation applications. Regarding electrical principles, the topics consist of introduction to electrical principles, DC electricity, AC electricity, AC power analysis, multiphase system and transformer. Meanwhile, topics on instrumentation include introduction to process instrumentation elements, data communications and instrumentation devices.

Course Outcomes

CO1 Identify elements and explain the importance of electrical principles from the chemical engineering perspective.

CO2 Apply and analyze the fundamental concepts and basic practicality of electrical applications.

CO3 Identify the elements and analyze the importance of process instrumentation in the control system context

CO4 Apply and analyze various instrumentation applications based on specified process conditions.

BKF2143
COMPUTER PROGRAMMING FOR ENGINEERS

Credit : 3

Pre-requisite
NONE

Synopsis

This subject aims to introduce the fundamental element and feasibilities of the computer programming by using Excel and MATLAB mathematical computing program. Students will be taught on analyzing data, developing a program using m-file and using the command window. Solve general engineering mathematical equations in MATLAB, displaying the data via 2D and 3D graphs and to learn to develop the graphical user interface (GUI) for program.

Course Outcomes

CO1 Organize and analyze data by using EXCEL and MATLAB softwares

CO2 Understand and develop the program to solve the mathematical problems.

CO3 Apply software to solve general chemical engineering and mathematical problems.

CO4 Demonstrate the ability to transform problem into design and from design to operational program

BKF2422
HEAT TRANSFER

Credit : 2

Pre-requisite
NONE

Synopsis

The objective of this course is to provide students with concepts of heat transfer. This course will emphasize on the principles of heat transfer in a steady state by conduction, convection and radiation. The students will be exposed to the procedure for general problem solving and its application on heat exchanger.

Subsequently, the principles of unsteady-state convective heat transfer will be covered at the end of the course.

Course Outcomes

CO1 Solve heat transfer problems that involve conduction, convection and radiation in steady-state heat transfer.

CO2 Integrate design equations for heat exchanger to solve problems related to heat exchanger and chemical reactors.

CO3 Solve heat transfer problems related to unsteady -state systems.

BKF2432
MASS TRANFER

Credit : 2

Pre-requisite
NONE

Synopsis

This course is to provide students with concepts of mass transfer. This course will emphasize on the principles of mass transfer in gases, liquids, biological solutions and gels, and solids.

Subsequently, the principles of unsteady state and convective mass transfer will be covered to establish knowledge of mass transfer. The students will be exposed to the procedure for general problem solving and its application on real system.

Course Outcomes

CO1 Apply fundamental understanding of mass transfer in diffusion phenomena in gas, fluid and solid system.

CO2 Analyze and solve problems related to diffusion and convection mass transfer in steady/unsteady state.

CO3 Relate the concept of mass transfer in problems related to unit operations.

BKF2443
NUMERICAL METHODS & OPTIMIZATION

Credit : 3

Pre-requisite
BUM2133
ORDINARY DIFFERENTIAL EQUATIONS

Synopsis

This subject teaches the techniques by which mathematical problems are formulated so that they can be solved with arithmetic operations. The course is divided into several chapters starting from basics to problem solving in engineering applications. Matlab software will be introduced to empower students in developing simple and well-structured programs**.**

Course Outcomes

CO1 Apply numerical methods as a problem solving tool

CO2 Optimize a process employing numerical methods

CO3 Solve numerical methods problem by using MS Excel and MATLAB

CO4 Optimize a process employing MS Excel and MATLAB

BKC3363
SCIENCE & ENGINEERING MATERIALS

Credit : 3
Pre-requisite
NONE

Synopsis

This course is designed to provide a working knowledge in the solving of materials problems encountered by chemical engineers and in the engineering of new and improved materials used in chemical processes. The approach used is the correlation of engineering properties with atomic and microstructures, utilizing the analysis techniques of materials characterization and phase relationships. Topics include structure and properties of metallic and nonmetallic materials of construction; interrelations between chemical bonding, structure, and behavior of materials, corrosion resistant materials, and polymers used in construction materials, particularly for pollution control. Each of the materials classes (metals, ceramics, semiconductors, and polymers) is discussed in detail in this context.

Course Outcomes

CO1 Describe the relationships between structure of a material and its underlying properties.

CO2 Apply the science and engineering materials principles into the solution of real engineering-based problems.

CO3 Explain the fundamental knowledge of strength of material in various aspects of materials construction.

BKF3721
MASS & HEAT TRANSFER LAB

Credit : 1

Pre-requisite
BKF2422 HEAT TRANSFER
BKF2432 MASS TRANSFER

Synopsis

This laboratory course is offered to enhance their understanding through experiments to observe the application of theories learn in Unit Operation, Mass Transfer and Heat Transfer. Numbers of unit operation experiments have been designed such as shell and tube heat exchanger, plate heat exchanger, tray dryer, spray dryer, crystallizer, mass transfer coefficient apparatus, fixed and fluidized bed apparatus, and also climbing film evaporator. In this lab, student will be given a main objective of each experiment and instructor will explain about the Work Instruction to run the experimental. Then, by working in their group student will run the experiment under supervision of the instructor. This will encourage student to be more creative and inculcate the critical thinking among the group member. Besides that, students will be exposed to industrial environment and safety precaution.

Course Outcomes

CO1	Apply fundamental theories of chemical unit operation
CO2	Operate common unit operation equipment which use in industries and be familiar to their components and function
CO3	Determine suitable equipment when certain chemical substance is given

BKF2453
CHEMICAL REACTION ENGINEERING I

Credit : 3

Pre-requisite
BKF2343 MATERIAL & ENERGY BALANCE
BKF2413 CHEMICAL ENGINEERING THERMODYNAMICS

Synopsis

This subject covers the knowledge of the reaction kinetics and reactor design which distinguishes chemical engineer from other engineers. The course introduces the basic design calculation and design of commercial chemical reactors, emphasizing synthesis of chemical kinetics and transport phenomena. The topics cover in this subject are kinetic rate theory, homogeneous reaction in batch and continuous systems, heterogeneous reaction and catalysis, temperature effect, effect of heat transfer and catalytic reactor also reactor design, sizing and modeling performance.

Course Outcomes

CO1	Combine the basic fundamentals of chemical reaction engineering such as mole balance, rate law and stoichiometry in reactor design
CO2	Design the industrial reactors for the chemical processes using the analytical and modeling skills
CO3	Evaluate the complex solution in design reactor using commercial software

BKF3463
UNIT OPERATION I

Credit : 3

Pre-requisite
BKF2343 MATERIAL & ENERGY BALANCE

Synopsis

The objective of this course is to provide students with concepts of separation processes in unit operation. This subject will emphasize in various unit operations, namely evaporation, distillation, absorption and extraction. By completing the subject, students will understand the basic mechanisms of the unit operations in chemical engineering fields.

Course Outcomes

CO1	of evaporation, distillation, absorption and extraction processes
CO2	Apply knowledge of unit operation in the identification, formulation and solution of chemical engineering problems.
CO3	Analyse basic design parameters associated with certain unit operations.

BKF3472
CHEMICAL REACTION ENGINEERING II

Credit : 2

Pre-requisite
BKF2453 CHEMICAL REACTION ENGINEERING I

Synopsis

This subject furthers the knowledge of chemical reactor. Topics to be covered are the heterogeneous systems of the catalytic reaction, including the effects which significantly influence the reactor performance, the study of the real scenario for non-ideal reactors in industries, and introduction of biochemical reaction systems. The analysis of industrial chemical reactors frequently requires solution of non-linear algebraic and differential equations. Hence, modeling the non-ideal reactor will be the crucial skill to fulfill the outcome requirement for each chemical engineer and researcher in chemical reaction engineering.

Course Outcomes

CO1	Explain the factors that affect the performance of industrial reactor such as diffusion and other limiting situation.
CO2	Apply fundamental of biochemical reaction systems.
CO3	Analyze the effect factors of catalytic reaction performance.
CO4	Develop an understanding of catalysts, reaction mechanisms and catalytic reactor design.
CO5	Investigate the model and solve the problems of non-ideal reactor using commercial software.

BKF3741
CHEMICAL REACTION ENGINEERING LAB

Credit : 1

Pre-requisite
NONE

Synopsis

This laboratory course is to strengthen their understanding through experiments by observing the application of theories learnt in chemical reaction engineering subject. Numbers of reaction in various reactors are to facilitate student to gain the objective of each experiment whereby the procedure will be instructed to run the experiment. Every 5-students group will run the experiment under supervision of the instructor. This will encourage student to be more creative and inculcate the critical thinking among the group member. Besides that, students will be exposed to industrial environment and safety precaution.

Course Outcomes

CO1 Apply engineering and chemical reaction knowledge in operation of chemical engineering equipment.

CO2 Operate & demonstrate the different type of reactors with different reactions.

CO3 Use critical data analysis to solve the problem related to chemical reaction engineering

BKC3492
UNIT OPERATION II

Credit : 2

Pre-requisite
BKF2343 MATERIAL & ENERGY BALANCE

Synopsis

This course aims to introduce the principles of typical unit operations involved in chemical and petrochemical industry such as drying of process material, adsorption and fixed-bed separation, membrane separation, mechanical-physical separation and crystallization. At the end of this course, it is expected that the students will understand theories, principles, calculations and basic design parameters associated with every unit operation.

Course Outcomes

CO1 Understand the concept and principles of unit operations in Chemical Engineering.

CO2 Able to apply the formulas and do the calculations relating to the unit operations.

CO3 Able to solve problems or issues associated with unit operations in Chemical Industry.

BKC3543
ENVIRONMENTAL ENGINEERING

Credit : 3
Pre-requisite
NONE

Synopsis

This subject is designed to introduce to the students the principles of environmental engineering. Topics includes introduction of environmental engineering, water and wastewater quality management, water and wastewater treatment, air pollution, and solid waste and hazardous waste management.

Course Outcomes

CO1 Apply the standards and laws in environmental problems

CO2 Analyze and solve environmental problems

CO3 Describe the current environmental issues

BKF4143
PROCESS ENGINEERING ECONOMICS

Credit : 3

Pre-requisite
NONE

Synopsis

This course deals with cost analysis in engineering decision-making, the management aspects and control of complex projects. Engineering economics topics include cost estimation, time value of money, interest formulas and equivalence calculations, measures of investment worth, depreciation and income tax analysis. Engineering project management topics include knowledge on roles and responsibilities, planning, organization, time, cost, risk and quality management.

Course Outcomes

CO1 Discuss the need of chemical engineering graduates when they have to make financial decisions as a team member or project manager.

CO2 Apply theoretical and conceptual basis on which the practice of engineering economics project analysis is built.

CO3 Analyze the economic feasibility of a chemical plant, carried out by examining the capital cost and the manufacturing cost obtained from the cost estimation techniques.

BKF4791
PROCESS CONTROL & INSTRUMENTATIONS LAB

Credit : 1

Pre-requisite
NONE

Synopsis

This laboratory have been developed to address the key engineering educational challenge of realistic problem solving within the constraints of a typical lecture-style course in process dynamics and control. Students will conduct experiments based on two major process operations which is based on computer simulation and plant experimental works. In computer

Simulation, students will simulate a case study using Matlab environment software and also operate a system on Distributed Control System (DCS). While the students also run the experiment using pilot plant available in this laboratory. This application will encourage students to apply their process control theories into practical term and inculcate the critical thinking among the group members.

Course Outcomes

CO1 Apply the process instrumentation and control hardware of the control system

CO2 To implement control strategies manually and automatically using software packages and plant

CO3 To perform scan, control, alarm and data acquisition (SCADA) functions and operate a system using DCS

CO4 To develop convenient graphical interface for students that allowed them to interact in real-time with the evolving virtual experiment

CO5 Function effectively as an individual and in a group throughout the semester based on tasks/modules assigned.

BKC 3771
ENVIRONMENTAL ENGINEERING LAB

Credit : 1

Pre-requisite
NONE

Synopsis

This course will focus on various water and wastewater treatment plants, air pollution, environmental testing techniques, common laboratory protocols, data analysis and reporting. Topics covered will be introduction to water and wastewater treatment plants, atomic absorption spectrophotometer, analysis of surface water, domestic wastewater and industrial wastewater, air particulate sampling and wet scrubber system. Skills gained will be directly applicable to careers in environmental engineering both in data collection and managing field assessments. The course will provide an appreciation for the effort involved in environmental samples testing, and an ability to critically evaluate data from a sampling program.

Course Outcomes

CO1 Able to understand various analytical methods, air pollution and wastewater treatment pilot plant in environmental engineering

CO2 Able to apply various analytical method and operate wastewater treatment pilot plant, air contaminants and its equipment for air pollution reduction

CO3 Able to evaluate data from a sampling program

CO4 Able to work in group and fulfill datelines

BKB2761
BIOCHEMISTRY & MICROBIOLOGY LAB

Credit : 1

Pre-requisite
NONE

Synopsis

This course covers basic handling of microbial culture using aseptic techniques. Consideration will be given to microbial cultures and enzyme kinetics. The course will also emphasize on the introduction to biochemistry, including appropriate analytical techniques that are DNS calorimetric method, burette method, UV-Vis spectrophotometer and protein concentration.

Course Outcomes

CO1 Describe the fundamental of laboratory practice in microbiology and biochemistry

CO2 Analyze and clarify experiments data based on experiment theories products

CO3 Culture and grow the micro organism

CO4 Transfer the microorganism aseptically

CO5 Analyze the biological components using biochemistry methods

CO6 Demonstrate the technique on enzymes extraction

BKB2212
BIOCHEMISTRY

Credit : 2

Pre-requisite
NONE

Synopsis

The subject provides an overview of fundamental concepts in biochemistry, which focuses upon the living organisms and major bio-molecules in living systems. Important topics include the structure and function of water, amino acids, proteins, carbohydrates and lipids. The application of buffers as well as enzyme kinetics will be extensively emphasized. Various metabolisms for carbohydrates, lipids and nitrogen will be discussed in detail. The course will be completed by genetic elements of cells involving nucleic acids and genetic information.

Course Outcomes

CO1 Describe the overview of living organisms, structure and the functional properties of bio-molecules.

CO2 Explain the major bio-molecules and their metabolisms

CO3 Describe the genetic elements of cells regarding nucleic acids and genetic information.

BKB2412
INDUSTRIAL BIOTECHNOLOGY

Credit : 2

Pre-requisite
NONE

Synopsis

The subject introduces students to introductory microbiology and fundamentals of biochemical engineering as used in industrial biotechnology such as microorganisms, microbial growth, nutrition and design of industrial growth media. It also covers design and operation of clean-in-place systems, clean rooms and heating, ventilation and air-conditioning (HVAC) systems. In addition, facility layout and engineering for compliance with Good Manufacturing Practices are discussed. Design for containment and validation, flow sheets and case studies are used to illustrate several representative industrial microbial processes relevant to biotechnology industry facilities.

Course Outcomes

CO1 Classify major types of micro-organism and their characteristic

CO2 Implement Good Manufacturing Practices and construct bioprocess facility

CO3 Automated in place cleaning that complied to the industry GMP standard

CO4 Discover the bioprocess involved in the industrial microbial and construct

CO5 Flow-sheets for several representative process

CO6 Construct the application of biotechnology for industrial application

BKB3423
BIORECTOR ENGINEERING

Credit : 3

Pre-requisite
NONE

Synopsis

This subject covers the basic concepts of microbial growth phases and growth kinetic, selection and operating factors of bioreactor. This subject also emphasizes on the application of transport phenomena in bioreactor, sterilization methods, scale up and control system and instrumentation.

Course Outcomes

CO1 Summaries current issue, development and application of bioreactor (i.e. journals review)

CO2 Solve the calculation problem regarding to the cell growth and kinetic in different fermentation mode. Explain and discuss the different operation mode of bioreactor and its related instrumentation.

CO3 Designing a mass (i.e. OUR, DO, kLa) and heat transfer (i.e. jacket or cooling coil) system in a bioreactor. Solving mathematical models related to the mass and heat transfer in bioreactor. Explain and discuss the different operation various method for heat and mass transfer

measurement in bioreactor.

CO4 Designing a sterilization system in a bioreactor as well as solving the mathematical model related to sterilization.

CO5 Evaluate the effect of scale-up to the performance of gas-liquid stirred tank bioreactor.

BKB3533
OSH IN CHEMICAL & BIOTECHNOLOGY INDUSTRIES

Credit : 3

Pre-requisite
NONE

Synopsis

This course is primarily exposes students with the fundamental concepts, practical aspects and applications of occupational safety and health (OSH) in chemical industries. Among others, the students will be taught the fundamental application and day-to-day aspects of OSH and at the same time, the management aspects of it. Local and international regulations of SH&E such as OSHA and FMA will also be covered. Case studies from several chemical industries globally will also be included.

Course Outcomes

CO1 Value fundamentals of technical safety for chemical industries.

CO2 Explain the various features of OSH management and regulations.

CO3 Review OSH aspects in the design and operation of chemical industries such as source model, dispersion model, fire triangle & prevention and HAZOP study

BKB2132
MOLECULAR & CELL BIOLOGY

Credit : 2

Pre-requisite
NONE

Synopsis

This subject intends to develop an understanding of the cell as the basic biological unit, molecular biotechnology, basic principles of genetic engineering and its applications. The students will be able to discuss the basic molecular biology knowledge to genetically engineered living organisms. By completing this subject, students should be able to emphasize issues relevant to process knowledge.

Course Outcomes

CO1 Describe the concept and the function of macromolecules of the cells

CO2 Explain the pathway from DNA to protein

CO3 Explain the concept and basic steps in gene cloning

CO4 Explain the concept and the use of Agrobacterium for genetic engineering in plants.

BKB4493
BIOSEPARATION ENGINEERING

Credit : 3

Pre-requisite
NONE

Synopsis

This course is designed to introduce that commonly employed to separate biological products. An idealized process of bio-separation consists of four phases which are the removal of insoluble products, the isolation of desired biological products. The basic methods that will be covered in this course include microfiltration, sedimentation and centrifugation, coagulation and flocculation, cell disruption, precipitation, extraction, adsorption, ultra-filtration, chromatography, electrophoresis, crystallization and drying.

Course Outcomes

CO1	Differentiate four phases involve bio-separation which are recovery, isolation, purification and polishing
CO2	Explain the principles of each technique Justify the underlying reasons for choosing a particular technique, as well as suggest any related improvement
CO3	Utilize the related engineering or scientific principles in solving any related bio-separation problems
CO4	Propose a train of bioseparation for any Bio product

BKB4944,
BKG4944, BKC4944
UNDERGRADUATE

Credit : 4

RESEARCH
PROJECT II

Pre-requisite
BKC3922, BKB3922, BKG3922
UNDERGRADUATE RESEARCH PROJECT I

Synopsis

This subject is the continuation of the subject Research Project I. In this subject, the students are required to conduct the research, collect and analyze data, discuss the findings and form the conclusions. At the end of this semester, the students are required to produce a research project report and present it to faculty's evaluation panel.

Course Outcomes

CO1	Analyze data, discuss and conclude the findings
CO2	Manage the research work
CO3	Practice positive attitude in research activities
CO4	Present the research report and cited latest publications on the subject

BKC3922, BKB3922,BKG3922
UNDERGRADUATE RESEARCH PROJECT I

Credit : 2

Pre-requisite
BKF3463 UNIT OPERATION I

Synopsis

This course is designed to expose students to a research project. They have to apply all the knowledge they have learned in the program to complete the research project. Each student will be supervised by at least one lecturer or two lecturers (main supervisor and co-supervisor). During the research project I, the students will be able to do a literature survey and prepare a draft which contains objective of the project, problem statement, literature survey, solving techniques, methodology, expected result, treatment of results and list of reference publications. At the end of this subject, the students are required to present the draft in a short seminar which will be evaluated by a faculty's panel.

Course Outcomes

CO1	Propose background study, problem statement, objective and scopes of the research.
CO2	Practice positive attitude in research activities
CO3	Present the research proposal and cited latest publications on the subject

BKC3912,
BKG3912, BKB3912
PROCESS & PLANT DESIGN I

Credit : 2

Pre-requisite
BKF3463 UNIT OPERATION I
BKF2453 CHEMICAL REACTION ENGINEERING I

Synopsis

In this subject, students will be exposed to the chemical plant design principles. This subject will emphasize on synthesizing complete process flow diagram, synthesis and simulate of process using commercial simulation software. Subsequently, students will be exposed to heat integration to minimize utilities cost, sizing of equipment and costing, and economic analysis to determine the profitability as well as the consideration of environmental aspect. At the end of this subject, students are expected to complete a design project until mass and energy balance.

Course Outcomes

CO1	Review on equipment sizing, utilities in process plant and safety issues
CO2	Estimate minimum energy requirement, cost and profitability of a process plant
CO3	Solve material and energy balance manually and using commercial simulation software
CO4	Synthesis of process flow diagram

CO5 Present design report for the proposed case study

BKC4934, BKG4934, BKB4934

PROCESS & PLANT DESIGN II

Credit : 4

Pre-requisite
BKC3912,
BKG3912, BKB3912
PROCESS & PLANT
DESIGN I

Synopsis

In this course, students will carry out a plant design project to demonstrate the practical aspects in designing Chemical/ Bio/ Gas processing plant. The students will be divided into groups where they are expected to design a Chemical/ Biological/ Gas processing plant. They will also apply their previously obtained knowledge from Process & Plant Design I and other elated subject, in completing the design task given. Students will be assessed based on their presentations, reports, log book and attitude wise.

Course Outcomes

CO1 Solve mass & energy balance manually and using commercial process simulators

CO2 Calculate utilities, equipment sizing, cost involves

CO3 Propose control mechanism, HAZOP and waste management approach

CO4 Present design report for the proposed case study

BKC3833
RECYCLING TECHNOLOGY (E)

Credit : 3

Pre-requisite
NONE

Synopsis

The course is intended to expose students to the nature of recycling industry in Malaysia and worldwide. Explanation and description will be given on the nature of wastes in Malaysia, trend of activities, rules and regulations in handling wastes etc. Students will also be given hands-on projects to conduct and present in the area of waste recycling related to the Malaysian scenario.

Course Outcomes

CO1 Ability to differentiate various types of wastes, scheduled and non-scheduled waste.

CO2 Understand the requirement for handling of wastes

CO3 Able to prepare market study and business plan for waste recycling activities.

BKC3873
MIXING OF FLUIDS AND PARTICLES (E)

Credit : 3

Pre-requisite
NONE

Synopsis

This subject covers the basic concepts of mixing such as power consumption, flow patterns and blending in single phase systems, fluid and particulate mixtures, gas-liquid dispersion and mass

transfer, liquid-liquid dispersion with applications in emulsion formation, solids suspension and distribution in agitated flows and non-Newtonian flow effects. The subject also emphasizes on CFD modeling of stirred tank reactor, mixing effects on product structure and selection of mixers for multi-purpose batch operations. This subject also taught a CFD simulation of mixing tank using FLUENT.

Course Outcomes

CO1 Explain, discuss and present the common types of mixing operations and measurement techniques for fluids and particles mixing.

CO2 Solve mathematical problems related to mixing i.e. power number, flow regimes, impeller Reynolds number, aeration number, mass transfer, mixing time, scale-up and homogeneity.

CO3 Design a suitable mixing technique for a given process conditions with or without chemical reactions and performing the scale-up calculation especially for multiphase system.

CO4 Evaluate and analyse performance of stirred tank via CFD.

BKC4683
FOOD ENGINEERING (E)

Credit : 3

Pre-requisite
NONE

Synopsis

This course is designed to introduce the applications of certain unit operations in the processing of different types of food products. The principles and methods of heating and dehydration, refrigeration and freezing, are discussed with emphasis on their applications in the processing of dairy, fruit and vegetables, eggs, poultry, meat and fish products. The course will also provide an appreciation on the importance of food packaging, food safety and hygiene.

Course Outcomes

CO1 Discuss the current status and future trends of food industry in Malaysia

CO2 Discuss and elaborate on the production of refrigerated foods

CO3 Interpret the materials used and roles of food packaging

CO4 Discuss the importance of safety and hygiene in food production

CO5 Apply and analyze the principles of dehydration in food products

BKC3533
OSH IN CHEMICAL INDUSTRIES

Credit : 3

Pre-requisite
NONE
Synopsis

This course is primarily to expose students with the fundamental concepts, practical aspects and applications of occupational safety and health (OSH) in chemical industries. Among others, the students will be taught the fundamental application and day-to-day aspects of OSH and at the same time, the management aspects of it. Local and international regulations of SH&E such as OSHA and FMA will also be covered. Case studies from several chemical industries globally will also be included.

Course Outcomes

CO1	Value fundamentals of technical safety for chemical industries.
CO2	Explain the various features of OSH management and regulations.
CO3	Review OSH aspects in the design and operation of chemical industries such as source model, dispersion model, fire triangle & prevention and HAZOP study.

BKF4916
INDUSTRIAL TRAINING

Credit : 6

Pre-requisite
COMPLETE ALL LEARNED SUBJECTS

Synopsis

In industrial training the students should gain insight into the industrial practice, in order to visualize the tasks and possibilities of their later occupation work. All students are required to undergo ten weeks of industrial training during the short semester of the third academic year. The performance of each student during the periods of his/her Industrial Training is evaluated jointly by the faculty staff, and the representatives from employer organizations.
The student is required to maintain proper records and submit reports on the training received by him/her. The industrial training report should cover all periods of approved employment. The report document is expected to demonstrate development of practical and professional skills in Engineering through technical experience and application of theoretical knowledge. Development of skills in dealing with people, and communication skills are part of the subject objectives. The student should be able to present the report to university supervisor, as a complement to their degree.

Course Outcomes

CO1	Display independency in actual working environment with minimal supervision
CO2	Display communication skill with different levels of staff in the organization

CO3 Present technical documents related to the work completed

CO4 Practice positive attitude during the training

BTF1123
ORGANIC CHEMISTRY

Credit : 3

Pre-requisite
NONE

Synopsis

This course discuss the fundamental theory of properties, synthesis and organic reactions where use the functional group as framework as a basic for second level courses with an organic chemical content. This course focuses on the key concepts of organic chemistry through a study of the reactions of selected nonfunctional aliphatic, alicyclic, cyclic and aromatic molecules. Particular emphasis is placed on the underlying mechanistic pathways that are involved and their stereo-chemical consequences. The stereochemistry of the molecular structure is also considered. The development of key skills is facilitated by a program of tutorials and practical.

Course Outcomes

CO1 Name simple organic compounds and draw structures corresponding to names

CO2 Identify the factors which affect the rate of a chemical reaction.

CO3 Perform a synthesis and purification of a simple organic compound.

CO4 Identify the chemical building blocks of bio-molecules.

CO5 Relate many of the chemical principles of the theory course to the practical applications in the laboratory.

BTP1133
BIOLOGY FOR ENGINEERS

Credit : 3

Pre-requisite
NONE

Synopsis

This course deals with biology fundamentals and associated subjects required for engineers to understand and acquire multidisciplinary technology in the fused areas of biological sciences and engineering. To accommodate those who do not have biological background, the course covers biological principles and engineering applications of general biology including: biochemistry, genetics and physiology. Subsequently special emphasis is placed on applying engineering concepts to biological problems.

Course Outcomes

CO1 Have knowledge of basic cell biology including cell structure, function and cell division.

CO2 Identify mammalian organs and systems.

CO3 Be competent in basic laboratory based skills applicable to biologists e.g. microscopy.

CO4 able to report on a laboratory experiment.

BTF1143
COMPUTER PROGRAMMING

Credit : 3

Pre-requisite
NONE

Synopsis

This subject gives an overview, knowledge and understanding in computer programming. Topics that will be included are computer systems and it usage in engineering field, programming concept and programming language. C language, Visual Basic and MATLAB have been introduced in this subject.

Course Outcomes

CO1 Define computer appliances and softwares

CO2 Understand the program's coding written in C and Visual Basic.

CO3 Understand the usage of Matlab program.

CO4 Analyze the problem solving logic into a program, using the C programming language, Visual Basic and Matlab.

BTF1152
ENGINEERING GRAPHICS

Credit : 2

Pre-requisite
NONE

Synopsis

This particular course will introduce the usage of four common engineering tools for simulation and drawing to students, i.e.; Aspen Plus, Microsoft Visio, Solid Works and AutoCAD 2008. Aspen Plus will involve dynamic process simulation. Others software deal with standards of drawing instruments, lettering, lines, dimensioning, geometrical constructions, principle of orthographic and isometric projections. Besides that, student will be teach on the basics constructions of PFD and P & ID diagrams, as well as applying the software to draw 2D and 3D engineering objects. This subject very important as to prepare students for future usage of the software in any engineering fields involving design and simulations.

Course Outcomes

CO1 Apply the concept of the softwares in the basic fundamental for the real working environment.

CO2 Apply the engineering tools in order to create technical drawings for the chemical equipment and related disciplines.

CO3 Develop the application of the softwares in order to solve the problem related to chemical engineering processes and related discipline.

BTF1163
ENGINEERING SCIENCE

Credit : 3

Pre-requisite
NONE

Synopsis

This subject is an introduction to the basic principles of physics and explores concepts in the areas of mechanics, properties of matter, heat, waves, sound, light and atomic physics which are relevant for engineering students.

Course Outcomes

CO1 Solve fundamental problems in mechanics, waves, heat, light and atomic physics.

CO2 Explain fundamental principles of mechanics, waves and heat and light, and the construction and operation of devices based on these principles.

CO3 Gather and analyze experimental data and write short laboratory reports.

BTF1223
ANALYTICAL CHEMISTRY

Credit : 3

Pre-requisite
NONE

Synopsis

The objective of this course is to provide students with a basic understanding of analytical chemistry, the science of chemical characterization and measurement. The course is an introductory part of a series of analytical chemistry courses for industrial chemistry majors. It will concentrate upon descriptive analytical chemistry and analytical methods based on chemical equilibriums which include precipitation, volumetric and thermal analysis. A brief introduction to instrumental methods, separation methods, instruments calibration and methods validation, process analytical chemistry as well as good laboratory practice will also be discussed.

Course Outcomes

CO1 Describe and apply a various types of analytical methods, especially chemical equilibrium based ones, including gravimetric, volumetric, and thermal analysis.

CO2 Apply chemical method to other analytical methods such as spectrochemical, electrochemical and adiochemical ones, in addition to chromatography and separation sciences.

CO3 Excel on the chemical based analytical

methods leading to sound analytical results.

CO4 Select an appropriate technique for specific analytical problems and critical evaluation of the results.

CO5 Communicate effectively in written and oral form through group discussions (lab reports and assignment), tutorial and lab session presentation session.

BTP1233
INTRODUCTION TO PHARMACEUTICAL SCIENCE

Credit : 3

Pre-requisite
NONE

Synopsis

This module aims to provide the student with an understanding of the stepwise manufacture of tablets and some other pharmaceutical dosage forms.

Course Outcomes

CO1 Differentiate between different classes of pharmaceuticals.

CO2 Explain the unit operations involved in the manufacture of a drug formulation.

CO3 Prepare granulates, formulate tablets and analyze the final formulations.

CO4 Differentiate between different types of packaging, closure systems and labels/leaflets used in pharmaceutical manufacturing environments.

CO5 Understand the significance of labels and leaflets.

BTP1242
MATERIAL & PROCESSES

Credit : 2

Pre-requisite
NONE

Synopsis

This course is designed to provide a working knowledge in the solving of materials problems encountered by chemical engineers and in the engineering of new and improved materials used in chemical processes. The approach used is the correlation of engineering properties with atomic and microstructures, utilizing the analysis techniques of materials characterization and phase relationships. Topics include structure and properties of metallic and nonmetallic materials of construction; interrelations between chemical bonding, structure, and behavior of materials, corrosion resistant materials, polymers and composites as construction materials, particularly for sustainable environment. Each of the materials classes (metals, ceramics, polymer and composites) is discussed in detail in this context.

Course Outcomes

CO1 Explain the elementary relationships between structure, properties and performance of materials that are essential for understanding the role of materials in the design of engineering systems.

CO2 Distinguish the various classes of materials (metals, ceramics, polymers and composites), their fundamental chemical and structural nature and processing methods.

CO3 Utilize the knowledge on structure and properties of materials to solve real engineering-based case studies.

BTF1253
ELECTRICAL FUNDAMENTALS

Credit : 3

Pre-requisite
NONE

Synopsis

The module will familiarize the student with the principles of energy storage and transport in electrical and magnetic circuits. The module will provide the knowledge and skills required to safely build electrical circuits, and to measure and analyse the currents, voltage and power in the circuit.

Course Outcomes

CO1 Explain the flow of power in electrical systems and common components.

CO2 Analyse AC circuits performing calculations for current/voltage in series and parallel resonant circuit. Power calculations in reactive circuits.

CO3 Calculate circuit parameters of three phase Star and Delta circuits.

CO4 Construct simple electrical circuits using correct safety procedures.

CO5 measure power/power factor and voltage/current on simple installations adhering to safety procedures.

BTP1263
ENVIRONMNET TECHNOLOGY

Credit : 3

Pre-requisite
NONE

Synopsis

This module aims to familiarise the student with the primary sources of pollution. The module introduces the student to the techniques for the testing and analysis of waste streams.

Course Outcomes

CO1 Identify the different types of pollution. List the most common pollutant and the most toxic pollutants. Describe the different techniques of pollution testing.

CO2 Describe the techniques used in industry to minimize waste generation in manufacturing plants. List and outline the suitability material types for recycle ability and waste treatment.

CO3 Describe the processes used for municipal and industrial waste water treatment. Describe the processes used for Air pollution detection and treatment. Describe the process of incineration

and discuss the factors affecting its suitability for use with particular waste streams.

CO4 Describe the construction of a modern engineered landfill facility. List and describe the engineering controls incorporated in a modern landfill facility to minimize environmental risk.

CO5 List and describe the of an environmental audit. Describe the typical engineering controls that can be used to mitigate environmental risks.

BTF2324
FLUID MECHANICS

Credit : 4

Pre-requisite
NONE

Synopsis

This module will introduce students to the principals of fluid mechanic. Students will apply these principles to the solution of engineering problems such as pipe sizing and the selection of system components such as valves and pumps.

Course Outcomes

CO1 Apply Bernoulli's equation to steady flow of fluids in pipelines.

CO2 Use manometric principles to calculate the pressure at a point in a fluid.

CO3 Explain the difference between laminar and turbulent flow in pipelines.

CO4 Calculate pressure drop due to fluid friction.

CO5 Size pipes for various applications.

BTP2332
BIOREACTOR ENGINEERING

Credit : 2

Pre-requisite
NONE

Synopsis

This subject covers the basic concepts of microbial growth phases and growth kinetic, selection and operating factors of bioreactor. Furthermore it also emphasizes on the application of transport phenomena in bioreactor, sterilization methods, scale up and control system and instrumentation.

Course Outcomes

CO1 Explain and discuss different operation mode of bioreactor and its related instrumentation. Able to solve calculation problem regarding to the cell growth and kinetic in different fermentation mode.

CO2 Designing a mass (i.e. OUR, DO, kLa) and heat transfer (i.e. jacket or cooling coil) system in a bioreactor. Solving mathematical models related to mass and heat transfer in bioreactor.

CO3 Designing a sterilization system in a bioreactor as well as solving the mathematical model related to sterilization.

CO4 Performing a scale-up analysis for gas-liquid stirred tank bioreactor.

CO5 Producing a critical review on current development and application of bioreactor (i.e. journals review).

BTP2343
CONTROL SYSTEMS

Credit : 3

Pre-requisite
NONE

Synopsis

This course exposes students to the measurement and manipulation of process signals. Both analog and digital sensors and actuators are dealt with.

Course Outcomes

CO1 Use a variety of analog sensors and meters (thermal, position, speed, flow, power) to acquire process information.

CO2 Use a variety of digital sensors (proximity switches, relays, opto-couplers, and encoders) to acquire discrete data.

CO3 Use signal conditioning circuits to modify/clean the signals.

CO4 Operate actuators (valves, motors, relays, heaters, servos) based on electronic, PC and PLC derived actuation signals.

CO5 Implement closed loop control of process variables (temperature, level, voltage, current, torque) in sample systems.

BTP2353
ELECTRICAL POWER SYSTEMS

Credit : 3

Pre-requisite
NONE

Synopsis

This module imparts knowledge and skills to enable the student to select and specify the components of a domestic/light industrial electrical installation incorporating some local renewable electricity generation. The module also introduces some aspects of large scale electrical distribution systems.

Course Outcomes

CO1 Describe and specify the components and construction of Low Voltage domestic and industrial electrical distribution systems.

CO2 Describe the components and construction and protection of the service providers LV distribution.

CO3 Explain and analyse the control of small generators and convertors.

CO4 Specify the hardware needed to integrate small scale generation equipment with a local installation: cabling, protection, batteries, controllers, inverters, switchgear.

CO5 Safely performs electrical measurements on AC electrical systems.

BTP2352
CONTAMINATION CONTROL & CLEAN ROOM MANAGEMENT

Credit : 2

Pre-requisite
NONE

Synopsis

Practical comprises Identify the common sources of contaminants. Apply the fundamental steps of aseptic practice. Use a wide range of cleaning agents and know when to apply them. Define and apply the basis of cleaning validation. Work in a clean-room environment. Describe the basis of clean-room operation. Monitor the clean-room environment. Decontaminate the clean-room.

Course Outcomes

CO1 Identify the common sources of contaminants. Apply the fundamental steps of aseptic practice.

CO2 Use a wide range of cleaning agents and know when to apply them. Define and apply the basis of cleaning validation.

CO3 Work in a clean-room environment. Describe the basis of clean-room operation.

CO4 Monitor the clean-room environment.

CO5 Decontaminate the clean-room

BTP2483
MANAGEMENT & PROFESSIONAL DEVELOPMENT

Credit : 3

Pre-requisite
NONE

Synopsis

The primary purpose of this module is to inform the student of the societal and business context in which they practice their engineering profession. This context includes the constraints imposed by the environment, health and safety and the ethical and professional standards expected of an engineer in society. The business and economic context includes an understanding of the role of business, entrepreneurship, business competitiveness and marketing. The subject also provides foundation skills for graduate engineers to manage their work in a modern engineering or manufacturing environment and to calculate the cost implications of engineering decisions.

Course Outcomes

CO1 branches of engineering and apply ethical codes to case study ethical dilemmas.

CO2 List, explain and analyse environmental issues for management and engineers.

CO3 Sketch an outline of the competitive position of a company in relation to its market position, its product portfolio, its intellectual property and its financial performance.

CO4 Calculate product costs based on absorption costing and apply cost data to business decisions.

CO5 Develop and interpret budgets for a manufacturing company.

BTP2412
NUMERICAL METHODS & OPTIMIZATION

Credit : 2

Pre-requisite
NONE

Synopsis

This subject teaches the techniques by which mathematical problems are formulated so that they can be solved with arithmetic operations. Topics covered in this subject are roots of equation, systems of linear algebraic equations, optimization, curve fitting, numerical differentiation & integration, ordinary differential equation and partial differential equation. Some software packages are introduced to empower the students in problem solving.

Course Outcomes

CO1 Apply numerical methods as a problem-solving tool.

CO2 Optimize a process employing numerical methods.

CO3 Solve numerical methods problem by using MS Excel and MATLAB.

CO4 Optimize a process employing MS Excel and MATLAB.

BTP2424
THERMODYNAMICS 1

Credit : 4

Pre-requisite
NONE

Synopsis

Thermodynamics 1 will introduce the student to the fundamentals of thermodynamics and will apply these principles to the analysis of engines and elements of process plant as encountered in the food, pharmaceutical and bio-engineering industries. The student will be capable of describing the layout of typical systems, the operating principles of typical plant components and have sufficient theoretical knowledge to evaluate the performance of these systems.

Course Outcomes

CO1 Use the ideal gas laws and associated relationships to calculate properties of thermodynamic systems.

CO2 Apply the 1st Law of thermodynamics.

CO3 Describe process steam plant and evaluate steam plant performance and describe the elements and functions of boiler feed water treatment plant.

CO4 Describe and analyze the basic internal combustion engine cycle and evaluate heat transfer coefficients and overall heat transfer rates in cases involving combined composite conduction and convection.

CO5 Describe heat exchanger flow configurations and give detailed descriptions of shell and tube, finned and plate type heat exchangers.

BTP2434
BIOCHEMISTRY & MICROBIOLOGY

Credit : 4

Pre-requisite
NONE

Synopsis

This course covers basic handling of microbial culture using aseptic techniques. Consideration will be given to microbial cultures and enzyme kinetics.
The course will also emphasize on the introduction to biochemistry.

Course Outcomes

CO1 identify the scope of the microbial world and nature of the different microbial types.

CO2 Be competent in aseptic technique.

CO3 Have a general knowledge of the structure and functions of the major groups of biomolecules.

CO4 Describe the nature and importance of enzymes as biological catalysts.

CO5 Identify the basic approaches to biochemical analysis.

BTP2442
ELECTRICAL SYSTEM & NETWORKS

Credit : 2

Pre-requisite
NONE

Synopsis

This module demonstrates to the student where the basic principles of electro-magnetism translate into industrial actuators such as DC motors, AC motors and Stepper motors. This module will apply knowledge of the National Rules for Electrical Installations to allow the graduate to work safely with electrical panels. Finally the module aims to equip students with the ability to read and understand drawings of electrical installations and hence communicate with other professional engineers.

Course Outcomes

CO1 Describe the application of Malaysian Standards for Electrical Installation to the design of electrical panels for the supply of electrical motors. Explain the use and operation of safety systems.

CO2 State the working principles of DC/AC Motors. Describe various methods of speed control for DC/AC Motors.

CO3 Describe the working principle of stepper. Analyze the requirements for sizing a motor for an application.

CO4 Describe the principles of field bus systems.

CO5 Describe the applications of some of the main fieldbus systems.

BTP2463
MANUFACTURING & PROCESSING TECHNOLOGY

Credit : 3

Pre-requisite
NONE

Synopsis

This module aims to provide the student with an in-depth knowledge of the current unit processes and scale up technologies pertinent to a modern Pharmaceutical plant.

Course Outcomes

CO1 Understand the organisation of a pharmaceutical plant and the functions of each department.

CO2 Explain the basic operations involved in the synthesis and purification of chemicals on a large scale.

CO3 Demonstrate a detailed knowledge of the equipment used in a bulk pharmaceutical plant and its operation.

CO4 Understand the basic issues associated with materials & environmental control. Know the grades of water used along with purification procedures.

CO5 Demonstrate knowledge of the concepts and technology used in process control, particularly in the pharmaceutical plant.

BTP3513
THERMODYNAMICS 2

Credit : 3

Pre-requisite
THERMODYNAMICS 1

Synopsis

This course will build on the fundamentals introduced in Thermodynamics 1, introduce the student to the 2nd Law of Thermodynamics and explain its consequences. This will enable the student to analyze the performance of heat engines and heat pumps. In addition it will give the student an understanding of heat transfer processes and the analytical skills to evaluate the performance of heat exchangers typically found in process industries such as the food, pharmaceutical and bio-engineering industries.

Course Outcomes

CO1 Analyse the thermal efficiency of heat engine, heat pump, and refrigerator and Carnot cycle using Second Law of Thermodynamics.

CO2 Describe and analyse the Rankine cycle and Brayton gas cycle and its application.

CO3 Describe the and operation of constant volume air-conditioning plant.

CO4 Describe and analyse simple direct expansion refrigeration plant.

CO5 Describe and analyse performance of heat exchangers using LMTD and NTU methods.

BTP3513
MATERIAL PROCESSES & COLLOID SCIENCE

Credit : 3
Pre-requisite
NONE

Synopsis

The aim of the course is to describe technical surface and colloid chemical phenomena at a molecular level, the basic principles of surface activity and behind the functionality of surface active components in disperse systems, self-association and the solution chemistry of surface active components, qualitatively describe colloidal interactions between particles and based on that predict colloidal stability or instability.

Course Outcomes

CO1	Understanding knowledge of colloids and surface science and the usage in industry and daily life.
CO2	Produce a study proposal to help resolve problems available in the area around Gambang using colloids and emulsion technology.
CO3	Produce an emulsion-based sample (lab scale) that has potential value for daily applications (cosmetics, nanomanipulations, separation process, nanomaterial synthesis).

BTP3522
BIOPHARMACEUTICS

Credit : 2

Pre-requisite
NONE

Synopsis

This course is devoted to the exploration and examination of the physical and physicochemical behavior of drugs, dosage forms, and drug delivery systems in physiological milieu and their implications for pharmaceutical care. Drug absorption processes, bioavailability, and bioequivalence will be highlighted. Pharmacokinetic and Pharmacodynamics concepts, including absorption kinetics, volume of distribution, and compartmental models, will be introduced to the students.

Course Outcomes

CO1	Understand the compartmental modeling and its significance and also Understand drug absorption, distribution and elimination.
CO2	Understand drug clearance including (total, renal and hepatic clearance) and Understand pharmacokinetics and biopharmaceutics after I.V bolus, I.V infusion, and oral administration of drugs.
CO3	Understand protein binding and its effects and Understand bioavailability and bioequivalence.
CO4	Understand Multiple dosage regimen and Have a knowledge on biopharmaceutics

considerations in dosage form design.

BTP3543
AUTOMATION SYSTEM

Credit : 3

Pre-requisite
NONE

Synopsis

This module equips graduates to work with automated technologies by providing them with knowledge, understanding and practical experience in PLCs, robotics and automated assembly. Safety strategies in both the design and implementation of automated systems are emphasized. The practical work is designed to develop team working skills.

Course Outcomes

CO1 Design and test PLC programs using the most appropriate technique. Describe PLC architecture and the types of I/O interfaces.

CO2 Select a PLC for a particular task. Interface a PLC with electropneumatic equipment.

CO3 Design and specify electropneumatic circuits for particular applications. Identify suitable applications for PLC's, robots, and other automation equipment.

CO4 Describe the classification, operation and applications of industrial robots. Write and test interactive robot control program.

CO5 Describe and specify the components of automated systems Incorporate safety strategies in both the design and implementation of automated equipment. Function independently, and within a team, to design, build and problem solves integrated automation solutions.

BTP3553
INSTRUMENTATION & CONTROL SYSTEMS

Credit : 3

Pre-requisite
NONE

Synopsis

The aim of this subject is to enable the student to apply mathematical formulae and techniques to the solution of engineering control problems. In a workplace context the student should be able to analyse and model an engineering problem and apply an appropriate control strategy.

Course Outcomes

CO1 Describe and specify static and dynamic performance of measurement transducers and control systems.

CO2 Describe, analyze and use analogue and digital signal processing systems used in control systems.

CO3 Analyse the steady state and transient response of control systems. Reduce complex control systems to a single transfer function.

CO4 Set up and use test and equipment including signal generator, digital multimeter, control system circuits and oscilloscope strategies in both the design and implementation of automated equipment. Function independently, and within a team, to design, build and problem solves integrated automation solutions.

BTP2452
GOOD MANUFACTURING PRACTICES & QUALITY ASSURANCE

Credit : 2

Pre-requisite
NONE

Synopsis

Students are exposed to competency in identifying, interpreting and applying cGMP guidelines and healthcare/pharmaceutical regulations, specifically within the Quality Control area and give them an understanding of sampling and some analytical methods.

Course Outcomes

CO1 Identify the agencies which regulate healthcare manufacturing .Understand how documentation is identified and managed.

CO2 Understand the of validation. Understand the QC testing pathway control systems.

CO3 Interpret QC specifications of ingredients, components and products.

CO4 Write a QC test procedure for a component and non conformance reports.

CO5 Report defects and define the status of ingredients components and products.

BTP3613
TRIZ 1 CONTEMPORARY TRENDS IN INDUSTRY

Credit : 3

Pre-requisite
NONE

Synopsis

This module aims to provide students with an insight into innovation and to equip them with the knowledge and tools to embark on incremental innovation projects. It will highlight issues such as psychological inertia, ideality, contradictions and root conflict analysis. The lecture approach will be to provide activity based lecture formats with active involvement from students in groups and as individuals.

Course Outcomes

CO1 Be able to describe the impact of psychological inertia on creative thinking and innovative solutions.

CO2 Be capable of understanding ideality and to identify an Ideal Final Result (IFR).

CO3 Apply root conflict analysis to identify the real cause of a problem\ contradiction.

CO4 Use the contradiction matrix and move between generic\abstract solutions to specific\explicit solutions.

CO5 Analyse a series of potential solution and select the most ideal.

BTP3621
EXPERIMENTAL DESIGN & STATISTICS

Credit : 1

Pre-requisite
NONE

Synopsis

This module aims to equip students with the statistical methods needed to design and analyse industrial experiments.

Course Outcomes

CO1 Design experiments for product or process improvement.

CO2 Analyse experimental data with and without the help of software packages.

CO3 Model the relationship between process inputs and outputs.

BTP3632
MEASUREMENT & CONTROL SYSTEMS

Credit : 2

Pre-requisite
NONE

Synopsis

This module aims to equip students with the statistical methods needed to design and analyse industrial experiments.

Course Outcomes

CO1 Select the appropriate information acquisition and management software.

CO2 Characterize and construct simple computerized measurement systems.

CO3 Compare techniques for measuring flow, level, temperature, pressure, pH and evaluate the advantages and disadvantages of each techniques.

CO4 Define the fundamental elements of a process control system.

CO5 Define and manage appropriate pneumatic and vacuum technology.

BTP3643
INDUSTRIAL NETWORKS

Credit : 3

Pre-requisite
NONE

Synopsis

This module aims to equip the student with the skills necessary understand various different network topologies and protocols which are encountered in the industrial environment. The students are also familiarized with hardware elements of a typical network system such as cabling, nodes, sensors, network devices and interfaces.

Course Outcomes

CO1 Construct a basic single office LAN.

CO2 Define key network configurations.

CO3 Describe the concept of Network Protocols.

CO4 Describe basic network components and their functions and uses in relation to the specific network and the key principles of wireless communications.

CO5 Demonstrate typical industrial networking protocols. Assemble the essential elements of a SCADA system.

BTP3652
CONTEMPORARY TRENDS IN PHARMA INDUSTRY

Credit : 2

Pre-requisite
NONE

Synopsis

The purpose of this module is to expose the students to the current trends in the industry, to advances in technology that are topical, to update on important codes or regulations. In addition, some of the topics covered will serve as fusion talks where the student will be made aware of how processes or systems knit together. It is proposed that there would be 12 X 2 hour presentations from academics or industry professionals on given topic areas.
Obviously, the topic areas would be open to revision annually.

Course Outcomes

CO1 Be able to describe the impact of psychological inertia on creative thinking and innovative solutions.

CO2 Be capable of understanding ideality and to identify an Ideal Final Result (IFR).

CO3 Apply root conflict analysis to identify the real cause of a problem\ contradiction.

CO4 Use the contradiction matrix and move between generic\abstract solutions to specific\explicit solutions.

CO5 Analyse a series of potential solution and select the most ideal

BTP3673
SYSTEMS VALIDATION

Credit : 3

Pre-requisite
NONE

Synopsis

This module aims to provide students to understand the validation of a process or element of a process.

Course Outcomes

CO1	Draft validation plans and protocols.
CO2	Understand, structure and write validation reports. Validate a water purification system.
CO3	Analyse and Validate selected pharmaceutical equipment and processes. Interpret statistical data and establish validation limits.
CO4	Validate a Bulk Pharmaceutical Process. Define the core regulatory guidelines governing use of computerised systems.
CO5	Validate cleaning procedures for pharmaceutical equipment. Contribute to the validation of computer and automated systems from a user perspective.

BTP3713
TRIZ 2 (PROCESS PRODUCT INNOVATION)

Credit : 3

Pre-requisite
TRIZ 1

Synopsis

This module aims to provide students with an insight into innovation and to equip them with the knowledge and tools to embark on incremental innovation projects. It will highlight issues such as psychological inertia, ideality, contradictions and root conflict analysis. The lecture approach will be to provide activity based lecture formats with active involvement from students in groups and as individuals.

Course Outcomes

CO1	Be able to undertake a functional analysis of a simple product or system.
CO2	Use substance-field modeling to model technical systems and inherent contradictions.
CO3	76 inventive standards approach to model and solve problems.
CO4	Discuss the TRIZ laws and trends of technology evolution.
CO5	Use the basic components of ARIZ

BTP4768
PHARMA PROJECT

Credit : 8

Pre-requisite
NONE

Synopsis

This module aims to provide students with an insight into innovation and to equip them with the knowledge and tools to embark on incremental innovation projects. It will highlight issues such as psychological inertia, ideality, contradictions and root conflict analysis. The lecture approach will be to provide activity based lecture formats with active involvement from students in groups and as individuals.

Course Outcomes

CO1 Demonstrate the ability to independently approach a project task in a structured and efficient manner.

CO2 Review relevant information from a variety of sources in deciding how to develop a project plan and a relevant methodology.

CO3 Collect and collate relevant material in the execution of the project. Use networking skills in all aspects of the project.

CO4 Use an objective/scientific approach in the execution and reporting of the project.

CO5 Prepare an informative report that is concise and clear in content and layout. Effectively present their project to a peer group and the supervisory team.

BTP3664
PROCESS BIOTECHNOLOGY (E)

Credit : 4

Pre-requisite
NONE

Synopsis

This module aims to provide the student with the theoretical and practical fundamentals of recombinant DNA technology and the application of this technology to biopharmaceutical production. The module initially focuses on providing an understanding of how proteins are made and how they can be genetically engineered, and on key areas of the immune system. These biological systems are then applied to the upstream processes of biopharmaceutical production.

Course Outcomes

CO1 Understand the significance of Biotechnology in Biopharmaceutical production.

CO2 Demonstrate a detailed knowledge of therapeutic agents of microbial origin and their production methods. Through their understanding of microbial growth kinetics be able to control both batch and continuous processes.

CO3 Understand animal cell culture systems and their ability to express therapeutic proteins and the requirements for their industrial scale production.

CO4 Apply knowledge of microbial and cell culture systems to industrial situations to allow for problem-solving of scale up issues.

CO5 Understand the applications and production processes for monoclonal antibodies.

BTP4734
PROCESS ANALYTICAL TECHNIQUES (E)

Credit : 4

Pre-requisite
NONE

Synopsis

This subject gives students knowledge and skills and an understanding of a system for designing, analyzing, and controlling manufacturing processes using on-line measurements of important quality and performance attributes of raw and in-process materials and processes with the goal of ensuring final product quality.

Course Outcomes

CO1 Describe fundamental process control theory in relation to the monitoring and control of industrial processes and typical PAT applications and the associated capabilities and limitations of the methodology.

CO2 Identify the suitability and validity of the statistics and instrumental approaches applied to PAT and describe sampling and instrumental issues in relation to presenting process material for common spectroscopic measurements and analysis.

CO3 Describe the necessary fundamentals for evaluating and choosing different sensor systems for process characteristics. Plan and execute a scientific analysis of an industrial process.

CO4 Evaluate and assess current industrial guidelines regarding quality control systems.

CO5 Critically assess relevant scientific literature and communicate effectively using appropriate information and communication tools.

BTP4754
THERMAL ENERGY SYSTEMS (E)

Credit : 4

Pre-requisite
NONE

Synopsis

This module aims to present a more comprehensive and rigorous treatment of engineering thermodynamics and to prepare students to use and apply fundamental thermodynamic principles in professional practice. The second law of thermodynamics is examined and developed more fully and important concepts like entropy generation and energy degradation principles are developed and applied to more complex and detailed engineering systems. In light of the deregulation of the energy sector,

renewable energy technologies and local power generation technologies are also examined.

Course Outcomes

CO1 State the Kelvin-Planck and Clausius Statements of the 2nd Law and define a reversible and irreversible process.

CO2 Explain the physical significance of entropy, entropy generation and exergy destruction.

CO3 Analyse vapour and gas power cycles from a 1st and 2nd law perspective.

CO4 Describe and analyse vapour-compression and gas refrigeration and heat pump cycles from a 1st and 2nd law perspective.

CO5 Analyse air-conditioning processes and apply the theory to internal environmental control.

DIPLOMA LEVEL

DKK1132
COMPUTER APPLICATION

Credit : 2

Pre-requisite
NONE

Synopsis

This subject aiming to introduce the basic principles of computer types, capabilities, uses and limitations. The subject also aim to provide experience in using local and wide area network as well as to introduce students to problem solving using a computer

Course Outcomes

CO1 Identify capabilities, limitations and procedures for using computer systems to solve personal, business and educational problems.

CO2 Perform a mini project using the basic application software.

CO3 Apply general concepts of word processing and document design for personal and educational purpose.

CO4 Organize, analyze and graph numeric data using spreadsheet programs.

DKK2363
ENGINEERING MECHANICS

Credit : 3

Pre-requisite
NONE

Synopsis

This subject will introduce students with concept of statics and dynamics and its application in related engineering field. The topics covered in this subject are static of particle, static of rigid body, distributed forces, analysis of structure, friction, kinematics and kinetics of particles. By completing the course, students will comprehend the basic mechanisms and applications of statics and dynamics in related engineering field.

Course Outcomes

CO1	Analyze problems involving the equilibrium of a particle or rigid body, and use the fundamental principles in statics to solve them
CO2	Apply the basic principles in dynamics to analyze problems involving the rectilinear and curvilinear motions of a particle
CO3	Apply Newton's second law to solve problems involving the relationship between forces and acceleration

FACILITIES

Bio-Processing Lab
Autoclave, evaporator, centrifuge, incubator, safety hood, oven, homogenizer, microscope, shaker etc.

Bio-Analytical Lab
Protein purification system, HPLC, HPLC-MS, UV-Vis, bio-imaging system, glucose analyzer, sizer data system etc.

Bio-Scale Up Processing Lab
Bioreactor, large scale fermenter, filtration system, spray dryer, filling machine, chromatography system etc.

Analytical Lab
FTIR, GC, GCMS, TGA, DSC, pycnometer, UV-Vis, refractometer, AAS, vaporization mercury analyzer etc.

Basic Science Lab
Furnace, pressure instrument, calibrator system, PRT scanner, water analysis system, dropping point apparatus etc.

Basic Engineering Lab
Hardness tester, bomb calorimeter, tensile tester, pressure measurement system, market boiler, twist & bending tester etc.

Reaction Lab
Pilot plant reactor, CSTR reactor, batch reactor, mixer, plug flow reactor, catalytic reactor etc.

Unit Operation Lab
Heat exchanger system, tray drier, extraction system, absorption system, evaporation system, fixed & fluidized bed system etc.

Process Control & Instrumentation Lab
Process control simulation system, level process control training system, distribution control system, temperature & water flow measurement system, calibration system, level & density measurement system etc.

Gas Engineering Lab
Gas testing & gas meter calibration system, turbine gas, service station unit, combustion unit, gas fuel caloric meter, fire & gas detection system, corrosion study unit, gas absorption system, gas fire & explosion testing unit etc.

Pilot Plant
Chemical blending & mixing plant, multipurpose extraction pilot plant, spray drier pilot plant, waste water treatment pilot plant, scott modular pilot plant, Batch & CSTR reactor pilot plant, integrated pilot plant etc.

Engineering Workshop
Solder gun, bender, angle grinder, electrode dryer, gauge, tap & die set, welding system, cutting machine etc.

Utility Lab

Computer Lab
Matlab, simulink, Aspen, Super-pro, CFD, AutoCAD etc.

Glass Blowing Area

Machining & Fabrication Area

CAREER PROSPECTS

- Chemical Engineer
- Project Engineer
- Design Engineer
- Operations Engineer
- Research & Development Engineer
- Energy Engineer
- Process Plant Engineer
- Oil & Gas Engineer
- Bioprocess Engineer
- Sales Engineer
- Quality Assurance Engineer
- Production Engineer
- Pharmaceutical Engineer
- Materials Engineer
- Consulting Engineer
- Instrumentation/Control Engineer
- Technopreneur/Management
- Lecturer

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