

FACULTY OF BIOTECHNOLOGY AND BIOMOLECULAR SCIENCES

Undergraduate Programme offered :

Bachelor Programme

1. *Bachelor of Science in Biochemistry with Honours*
2. *Bachelor of Science in Microbiology with Honours*
3. *Bachelor of Science in Biotechnology with Honours*
4. *Bachelor of Science in Cell and Molecular Biology with Honours*

STUDY SCHEME (BACHELOR OF SCIENCE IN BIOCHEMISTRY WITH HONOURS)

Notes : L = Lecture, L/T = Laboratory/Tutorial							
SEMESTER 1				SEMESTER 2			
1 ST YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
SKP2101	Malaysian Nationhood	3	0	BBI2423	Academic Interaction and Presentation	2	1
SKP2203	Asian and Islamic Civilizations	2	0	MGM3180	Basic Entrepreneurship	2	1
BCH3003	Biological Chemistry	2	1	BCH3108	Enzymology	3	1
BCH3106	Basic Techniques and Calculations in Biochemistry	1	1	BMY3001	Microbiology	4	0
BCH3107	Biomolecules	3	0	BSM3201	Molecular Biology	3	0
BSM3101	Cellular and Developmental Biology	3	0		TOTAL	14	3
QKXXXX	Co-curriculum	0	1				
CEL2102	Effective Listening and Speaking						
LAX							
	TOTAL	14	3				
2 ND YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BBI2424	Academic Writing	2	1	FCE3204	Thinking Skills	2	0
BMY3201	Basic Microbiology Techniques	0	2	PRT2008	Agriculture and Man	2	0
BCH3109	Carbohydrate Metabolism	2	1	BCH3110	Protein and Nucleic Acid Metabolism	3	1
BCH3203	Analysis of Biomolecules	1	1	BSM4301	Bioinformatics	2	1
SKP2204	Ethnic Relation	2	0		Elective		
	Elective				Co-curriculum	0	1
	TOTAL				TOTAL		
3 RD YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
KOM3403	Public Oration	3	0	BCH4959A	Bachelor Dissertation	0	3
BCH3111	Lipid Metabolism and Membranes	3	1	BCH4902	Current Topics in Biochemistry	2	0
BCH4101	Biochemistry of Hormones	3	0	BGY3701	Biostatistics	2	1
	Elective			BCH4904	Service Learning in Biochemistry	0	1
LAX					Elective		
	TOTAL				TOTAL		
4 TH YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BCH4959B	Bachelor Dissertation	0	3	BCH4901	Industrial Training	0	6
BCH4303	Industrial Applications of Biochemistry	3	0		TOTAL	0	6
	Elective						
	TOTAL						

STUDY SCHEME (BACHELOR OF SCIENCE IN MICROBIOLOGY WITH HONOURS)

Notes : L = Lecture , L/T = Laboratory/Tutorial							
SEMESTER 1				SEMESTER 2			
1ST YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
SKP2101	Malaysian Nationhood	3	0	BBI2423	Academic Interaction and Presentation	2	1
BCH3003	Biological Chemistry	2	1	SKP2203	Asian and Islamic Civilizations	2	0
BMY3101	Microbiology I	4	0	BMY3102	Microbiology II	4	0
BMY3201	Basic Microbiology Techniques	0	2	BCH3106	Basic Techniques and Calculations in Biochemistry	1	1
KOM3403	Public Oration	3	0	BMY3202	Techniques in Microbial Characterization	0	3
QKXXXX	Co-curriculum	0	1	FCE3204	Thinking Skills	2	0
CEL2102	Effective Listening and Speaking				Co-curriculum	0	1
LAX					TOTAL	11	6
	TOTAL	12	4				
2ND YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BBI2424	Academic Writing	2	1	MGM3180	Basic Entrepreneurship	2	1
BCH3107	Biomolecules	3	0	BCH3108	Enzymology	3	1
SKP2204	Ethnic Relation	2	0	BMY4302	Virology	3	0
BMY3103	Microbial Physiology	3	0	BMY4303	Mycology	3	0
PRT2008	Agriculture and Man	2	0		Elective		
BMY3203	Advanced Microbiological Techniques	0	3	LAX			
BMY4301	Bacteriology	3	0		TOTAL		
	TOTAL	15	4				
3RD YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BMY4304	Immunology	3	0	BMY4959A	Bachelor Dissertation	0	3
BMY4310	Microbial Genetics	3	1	BGY3701	Biostatistics	2	1
BMY4301	Bacteriology	3	0	BMY4992	Current Topics in Microbiology	0	2
BMY4904	Service Learning in Microbiology	0	1		Elective		
	Elective			CEL2015/ 2016/2017			
LAX					TOTAL	6	6
	TOTAL						
4TH YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BMY4959A	Bachelor Dissertation	0	3	BMY4901	Industrial Training	0	6
	Elective				TOTAL	0	6
LAX or CEL2104/ 2015/ 2016/2017							
	TOTAL						

STUDY SCHEME (BACHELOR OF SCIENCE IN BIOTECHNOLOGY WITH HONOURS)

Notes : L = Lecture , L/T = Laboratory/Tutorial							
SEMESTER 1				SEMESTER 2			
1 ST YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BTC3000	Biophysical Chemistry	2	1	BTC3001	Introduction to Biotechnology	2	0
BCH3003	Biological Chemistry	2	1	BCH3002	Comprehensive Biochemistry II	3	1
BMY3001	Microbiology	4	0	BSM3201	Molecular Biology	3	0
BCH3001	Comprehensive Biochemistry 1	3	0	BMY3201	Basic Microbiology Techniques	0	2
SKP2203	Asian and Islamic Civilizations	2	0	SKP2101	Malaysian Nationhood	3	0
KOM3403	Public Oration	3	0	BBI2423	Academic Interaction And Presentation	2	1
CEL2102	Effective Listening and Speaking			XXX 1234	Co-curriculum	0	1
LAX					TOTAL	13	5
	TOTAL	16	2				
2 ND YEAR							
CODE	COURSE NAME	L	L/T	COURSE CODE	COURSE NAME	L	L/T
BTC3201	Fermentation Technology	3	1	BTC3301	Bioprocess Engineering	4	0
BTC4001	Biosafety and Bioethics	2	0	BTC3101	Enzyme Technology	3	1
BSM3104	Principles of Cell and Tissue Culture	2	1	BSM3202	Genetic Engineering	3	1
BBI2424	Academic Writing	2	1	BTC3402	Waste Management and Utilisation	2	1
MGM3180	Basic Entrepreneurship	2	1	XXX 1234	Co-curriculum	0	1
PRT2008	Agriculture and Man	2	0	LAX			
	TOTAL	13	4		TOTAL	12	4
3 RD YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BTC3302	Bioseparation and Purification	3	1	BTC4959A	Bachelor Dissertation	0	3
BTC4305	Bioprocess Modelling and Optimization	2	1	BTC3002	Commercialisation and Current Issues in Biotechnology	2	0
BTC4904	Service Learning in Biotechnology	0	1	BTC3305	Bioprocessing and Biomanufacturing Design	2	1
BGY3701	Biostatistics	2	1	SKP2204	Ethnic Relation	2	0
BTCXXX	Specialisation Elective			BSM4301	Bioinformatics	2	1
LAX				BTCXXX	Specialisation Elective		
	TOTAL			CEL2105/ 2106/2107			
					TOTAL		
4 TH YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BTC4959B	Bachelor Dissertation	0	3	BTC4901	Industrial Training	0	6
BTC4991	Seminar	0	1		TOTAL		
	Global Language	2	1				
BTCXXXX	Specialisation Elective						
LAX							
	TOTAL						

STUDY SCHEME (BACHELOR OF SCIENCE IN CELL AND MOLECULAR BIOLOGY WITH HONOURS)

Notes : L = Lecture , L/T = Laboratory/Tutorial							
SEMESTER 1				SEMESTER 2			
1 ST YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
SKP2203	Islamic Civilisation and Asian Civilisation	2	0	BSM3201	Molecular Biology	3	0
BMY3001	Microbiology	4	0	BCH3003	Biological Chemistry	2	1
BSM3101	Cellular and Developmental Biology	3	0	BSM3204	Principles of Genetics	2	1
BCH3001	Comprehensive Biochemistry I	3	0	FCE3204	Thinking Skills	2	0
SKP2101	Malaysian Nationhood	3	0	KOM3403	Public Oration	3	0
QKXXXX	Co-curriculum	0	1	BBI2423	Academic Interaction and Presentation	2	1
CEL2102	Effective Listening and Speaking			BMY3201	Basic Microbiology Techniques	0	2
LAX					TOTAL	14	5
	TOTAL	15	2				
2 ND YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BCH3002	Comprehensive Biochemistry II	3	1	PRT2008	Agriculture and Man	2	0
BSM3501	Plant Cell and Tissue Culture	2	1	BSM3203	Research Techniques in Molecular Biology	2	1
BSM3202	Genetic Engineering	3	1	BSM4301	Bioinformatics	2	1
MGM3180	Basic Entrepreneurship	2	1	BSM3401	Animal Cell and Tissue Culture	2	1
BBI2424	Academic Writing	2	1	SKP2204	Ethnic Relation	2	0
	Elective I	3	0		Elective II	3	0
LAX				QKXXXX	Co-Curriculum	0	1
	TOTAL	15	4	LAX			
					TOTAL	13	4
3 RD YEAR							
CODE	COURSE NAME	L	L/T	CODE	COURSE NAME	L	L/T
BSM4201	Applied Molecular Genetics	3	1	BTC3002	Commercialisation and Current Issues in Biotechnology	2	0
BSM3402	Cell and Molecular Immunology	3	0	BSM4959A	Bachelor Dissertation	0	3
BGY3701	Biostatistics	2	1		Cell and Molecular Biology Core Elective II		
BSM4904	Service Learning in Cell and Molecular Biology	0	1		Management and Humanity Elective I		
	Cell and Molecular Biology Core Elective I			CEL2105/ 2016/2017 or LAX			
LAX					TOTAL		
	TOTAL						
4 TH YEAR							
CODE	COURSE NAME	K	A	CODE	COURSE NAME	L	L/T
BSM4959B	Bachelor Dissertation	0	3	BSM4901	Industrial Training	0	6
BSM4991	Seminar	0	1		TOTAL	0	6
	Cell and Molecular Biology Core Elective III						
	Management and Humanity Elective II						
CEL2105 /2016/2017							
	TOTAL						

COURSE SYNOPSIS

Department of Biochemistry

- BCH3001 Comprehensive Biochemistry I** 3(3+0)
Prerequisite : None
This course encompasses various structures and characteristics of biomolecules in the biological system. Role and function of biomolecules such as carbohydrates, amino acids, proteins, lipids and nucleic acids in biological system are discussed
- BCH3002 Comprehensive Biochemistry II** 4(3+1)
Prerequisite : BCH3001
This course encompasses major metabolism pathways of biomolecules occurring in biological systems. Physico-chemical properties and biomolecules metabolism are discussed. Analyses of biomolecules metabolism reactions are also conducted
- BCH3003 Biological Chemistry** 3(2+1)
Prerequisite : None
This course encompasses basic principles and techniques of biological chemistry in biomolecules analysis. Concept of organic chemistry in identifying functional groups of biomolecules' structures are emphasized. Experimentation using basic laboratory instruments in biological chemistry are also conducted
- BCH3106 Basic Techniques and Calculations in Biochemistry** 2(1+1)
Prerequisite : None
This course encompasses techniques and basic calculations in biochemistry. Experimentation using basic biochemistry instruments and data analysis are also emphasized
- BCH3107 Biomolecules** 3(3+0)
Prerequisite : None
This course encompasses various structures and characteristics of biomolecules in the biological system. Role and function of biomolecules such as carbohydrates, amino acids, proteins, lipids and nucleic acids in biological system are discussed
- BCH3108 Enzymology** 4(3+1)
Prerequisite : BCH3001 or BCH3107
This course encompasses general characteristics and factors affecting enzyme activity. Enzyme activation factors and regulations are discussed. Enzyme purification process from living system using various purification techniques is also conducted
- BCH3109 Carbohydrate Metabolism** 3(2+1)
Prerequisite : BCH3108
This course encompasses carbohydrate metabolism in cell. Integration and regulation mechanisms of carbohydrate metabolism are discussed. Experimentation and analysis of carbohydrates metabolic processes are conducted
- BCH3110 Protein and Nucleic Acid Metabolism** 4(3+1)
Prerequisite : BCH3108
This course encompasses metabolism of amino acids, proteins, nucleotides and nucleic acids in cells. Metabolisms of proteins and nucleic acids and their regulations are discussed. Analyses of protein and nucleic acid metabolic reactions are conducted

- BCH3111 Lipid Metabolism and Membranes** 4(3+1)
 Prerequisite : BCH3108
 This course encompasses cellular metabolisms of lipid and membrane. Regulation of lipid and membrane metabolisms are discussed. Analysis of lipid and membrane metabolic reactions are conducted
- BCH3203 Analysis of Biomolecules** 2(1+1)
 Prerequisite : BCH3002 or BCH3108
 This course encompasses analytical techniques of water content, acidity, carbohydrates, lipids, proteins and nucleic acids. Analysis of physical and chemical properties, molecular weight and homogeneity of biomolecules are discussed. Analyses of biomolecules are conducted
- BCH4101 Biochemistry of Hormones** 3(3+0)
 Prerequisite : BCH3105 or BCH3002
 This course encompasses the classification, chemical properties and production of hormones. The function of hormones in cell metabolism, cell coordination, interactions among molecules and pathophysiological disorders are also discussed.
- BCH4301 Plant Biochemistry** 3(3+0)
 Prerequisite : BCH3108 or BCH3002
 This course encompasses classification of primary and secondary metabolites as well as various metabolic systems in plant. Metabolic integration in plants and its regulations are discussed
- BCH4302 Plant Genetic Manipulation** 3(2+1)
 Prerequisite : BCH4301
 This course encompasses plant gene manipulation techniques through genetic transformation, biomarkers application, reporter genes and bioinformatic. Implication of plant gene manipulation technologies towards economy, environment and sociocultural are discussed. Plant gene manipulation is conducted
- BCH4303 Industrial Applications of Biochemistry** 3(3+0)
 Prerequisite : BCH3002 or BCH3108
 This course encompasses biochemistry concepts in product manufacturing. Application of biochemistry in various industries such as pharmaceuticals, chemicals, food and diagnostic are discussed. The importance of patent and safety aspects are also described
- BCH4304 Food Biochemistry** 3(3+0)
 Prerequisite : BCH3108 or BCH3002
 This course encompasses physico-chemical properties of foods and their main components. Microbial activity, food preservation methods and the use of enzymes in food technology are discussed. Effects of biochemical reactions on appearance and the nutritional value of food are also discussed
- BCH4305 Nutritional Biochemistry** 3(3+0)
 Prerequisite : BCH3108 or BCH3002
 This course encompasses the role of nutrients in human and animal physiology. Nutritional requirement and effects of nutrient imbalance towards human and animal health are discussed. Dietary assessment methods are also discussed
- BCH4306 Biochemistry of Animal Tissues** 3(3+0)
 Prerequisite : BCH3108 or BCH3002
 This course encompasses biochemical processes in various tissues of animals. Metabolic integrations between tissue are discussed. Pathophysiological related to animal tissue biochemistry are also discussed

- BCH4307 Environmental Biochemistry** 3(3+0)
Prerequisite : BCH3108 or BCH3002
This course encompasses process of decomposition of organic matter, waste water treatment and the molecular mechanisms of adaptation to extreme environments. Effects of bioaccumulation, development of resistance to environmental contaminants and pathogenicity towards cellular metabolism, environment, economy and health are discussed
- BCH4308 Techniques in Metabolomics** 3(2+1)
Prerequisite : BCH3109 or BCH3110 or BCH3111
This course encompasses analytical techniques of metabolite components in plants, animals, microbes, environment and foods. Usage of advanced instruments in metabolomics is emphasized.
Analyses of metabolomics data using related software and database are also conducted
- BCH4901 Industrial Training** 6(0+6)
Prerequisite : BCH3109 or BCH3110 or BCH3111
This course introduces students to the real working environment in industries/organizations. Training includes application of the theoretical and practical aspects that have been studied with current practices in the workplace. Problem solving and communication skills are also emphasized
- BCH4902 Current Topics in Biochemistry** 2(2+0)
Prerequisite : BCH3109 or BCH3110 or BCH3111
This course focuses on selected problems, issues and trends related to biochemistry field. Exploration of key issues and new direction is conducted through analysis of critical issues and problems to recommend solutions. Business opportunities in commercialization of products related to biochemistry field is discussed
- BCH4904 Service Learning in Biochemistry** 1(0+1)
Prerequisite : BCH3109 or BCH3110 or BCH3111
This course encompasses activities between students and communities to increase awareness and understanding of the importance of biochemistry in daily lives among communities. Community services through application of biochemistry knowledge are emphasized. Cooperation towards enhancing scientific knowledge among society is also emphasized
- BCH4959 Bachelor Dissertation** 6(0+6)
Prerequisite : BCH3109 or BCH3110 or BCH3111
This course covers the preparation of proposal, implementation and scientific writing of research project. Scientific approach to generate data systematically through appropriate design, data collection and analysis are emphasized

Department of Microbiology

- BMY3001 Microbiology** 4(4+0)
Prerequisite : None
This course encompasses several aspects of basic microbiology including the microbial organization and structure, microscopy, microbial systematics and ecology. Classification and identification of microorganisms are also described
- BMY3101 Microbiology I** 4(4+0)
Prerequisite : None
This course encompasses aspects of basic microbiology including the organization and characteristics of prokaryotes and eukaryotes. Microbial metabolism, growth and control are discussed
- BMY3102 Microbiology II** 4(4+0)
Prerequisite: BMY3101
This course encompasses microbial systematics and ecology, and introductory to immunology. Application of microorganisms in the environment and their roles in daily lives are discussed
- BMY3103 Microbial Physiology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course encompasses structure and metabolic activities of microorganisms. Central metabolism and energy production reactions are described. Macromolecular biogenesis and functions as well as the integration of metabolic processes are discussed
- BMY3201 Basic Microbiology Techniques** 2(0+2)
Prerequisite : None
This course encompasses basic microbiology techniques in handling microbial culture. The use of microscope and various staining techniques are emphasized. Physical and chemical requirements in microbial growth and enumeration techniques are discussed
- BMY3202 Techniques in Microbial Characterization** 3(0+3)
Prerequisite : BMY3201
This course encompasses biochemical tests for the identification of microorganisms from various sources. Techniques in microbial identification and virus enumeration are conducted. Effects of physical and chemical factors on microbial growth are also studied
- BMY3203 Advanced Microbiological Techniques** 3(0+3)
Prerequisite : BMY3202
This course encompasses several techniques in microbiology including identification of enteric bacteria using computer-assisted system, virus propagation and purification as well as the ability of fungi to utilise various carbon sources for growth. Various techniques on serology and molecular are also conducted
- BMY4201 Specialised Techniques in Microbiology** 3(0+3)
Prerequisite : BMY3203
This course encompasses the specialized techniques in microbiology. Isolation and identification of anaerobic microorganism are demonstrated. Techniques of food fermentation, bioinformatics and animal cell culture are discussed
- BMY4301 Bacteriology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course encompasses classification, characterisation, ecology and activities of various bacteria. The pathogenicity of bacteria in environment and human is explained. The uses of bacteria in the industry and agriculture are discussed

- BMY4302 Virology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course encompasses various properties of viruses and the methods used in virology. Classification and taxonomy of viruses are introduced. Viroids and prions are discussed. Viral infection and its effects in hosts, epidemiology and pathogenicity are described.
- BMY4303 Mycology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course encompasses classification, structure, growth and reproduction, genetics and interactions of fungi as saprophytes and parasites. The roles of fungi in the prevention and control of microbial growth are discussed
- BMY4304 Immunology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course encompasses several concepts in immunology. Immune system regulations and their roles in diseases are discussed. Research and current developments in immunology are described
- BMY4305 Microbial Ecology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course encompasses various aspects of microbial ecology which involve the interaction between microorganisms with their environment. Methods and technology used to study microbes and their activities are discussed. The economic importance and biodiversity of microbial population are also elaborated
- BMY4306 Pathogenic Microbiology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course emphasizes the importance of microbiology in medicine. Interactions between bacterial, viral, and fungal pathogens with their hosts are discussed. Diagnosis, treatment and prevention of infections are described
- BMY4307 Fungal Physiology** 3(3+0)
Prerequisite : BMY4303
This course encompasses the chemical composition and molecular structures of fungal cells. The physical and chemical requirements for fungal growth, primary and secondary metabolisms, genetics and spore development are discussed. Resistance and defensive mechanisms against fungicides are described
- BMY4309 Applied Food Microbiology** 3(3+0)
Prerequisite : BMY3102 or BMY3001
This course encompasses current issues in applied food microbiology which include new and emerging food-borne pathogens, rapid identification and characterization of food microorganisms. The effects of food compositions and preservation techniques are described. Functional properties of selected food microorganisms and their industrial applications are discussed
- BMY4310 Microbial Genetics** 4(3+1)
Prerequisite : BMY3102 or BMY3001
This course encompasses various aspects of microbial genetics such as DNA replication, control of gene expression, mechanisms of DNA transfer and genetic recombination. Elements and mechanisms of transposition as well as molecular techniques in microbial and applied genetics are discussed
- BMY4901 Industrial Training** 6(0+6)
Prerequisite : None
This course introduces students to real working environment in industries/organizations. Training includes application of the theoretical and practical aspects that have been studied with current practices in the workplace. Problem solving and communication skills are also emphasized

BMY4904 Service Learning in Microbiology 1(0+1)

Prerequisite : BMY3203

This course encompasses activities to increase awareness and understanding of the community on the importance of microbiology in daily lives. Knowledge in microbiology is applied through joined activities with the community

BMY4992 Current Topics in Microbiology 2(0+2)

Prerequisite : BMY3203

This course encompasses reviews on current topics in microbiology such as nanobiotechnology, molecular biology, molecular immunology and genomics. Reviews on the selected topics are presented in the form of seminars

BMY4959 Bachelor Dissertation 6 (0+6)

Prerequisite : None

This course covers the preparation of proposals, implementation and scientific writing of research projects. Scientific approaches to generate data systematically through appropriate design, data collection and analysis are emphasized

Department of Bioprocess Technology

- BTC3000 Biophysical Chemistry** 3(2+1)
Prerequisite : None
This course encompasses principles of biophysical chemistry related to life science. Fundamental knowledge of quantitative technique in measuring the physico-chemical properties of biomolecules is elaborated
- BTC3001 Introduction to Biotechnology** 2(2+0)
Prerequisite : None
This course encompasses the introduction on various biotechnology fields. Recent advances and issues in biotechnology will also be discussed through seminar presentation
- BTC3002 Commercialisation and Current Issues in Biotechnology** 2(2+0)
Prerequisite : None
This course encompasses concept and steps in the commercialization of biotechnology products. Case studies and latest development related to commercialization of biotechnology products are also discussed
- BTC3003 Instrumentation in Biotechnology Research** 3(2+1)
Prerequisite : None
This course encompasses the principles of scientific instrument operation in biotechnology research. Method for research data interpretation resulted from the selected scientific experiment is also discussed
- BTC3004 Scientific Writing in Biotechnology** 3(3+0)
Prerequisite : None
This course encompasses methods to search and evaluate information related to biotechnology field from various sources for scientific writing. Several selected manuscripts are also discussed
- BTC3101 Enzyme Technology** 4(3+1)
Prerequisite : BCH3002 or BCH3108
This course encompasses various aspects of production, extraction and purification of intracellular and extracellular enzymes. The use of enzyme in various fields is also discussed
- BTC3201 Fermentation Technology** 4(3+1)
Prerequisite : BMY3001 or BMY3101
This course encompasses important aspects in fermentation technology that include the steps involved prior to and during fermentation and the analyses after fermentation process. The applications of fermentation technology in industry are discussed
- BTC3402 Waste Management and Utilization** 3(2+1)
Prerequisite : None
This course encompasses introduction towards various waste, including methods of waste management and utilization, as well as case study in Malaysia and other countries. Standard characterization of solid waste and wastewater is also introduced
- BTC3501 Biotechnology Entrepreneurship I** 3(2+1)
Prerequisite : MGM3180
This course encompasses bioentrepreneurship concept involving elements such as selection of biotechnological products and services, types of business and market analysis. Market survey activity for commercialization of biotechnological products and services is emphasized

- BTC3502 Bioentrepreneurship Planning** 3(2+1)
Prerequisite : BTC3501
This course encompasses preparation of a business plan for biotechnological products or services. Important elements in business plan and creative techniques in developing product concept are also discussed
- BTC3301 Bioprocess Engineering** 4 (4+0)
Prerequisite : BTC3201
This course encompasses aspects related to bioprocess engineering such as fundamental engineering calculation and process optimisation. Overview on the industrial equipments and the engineering aspects in the bioreactor operation for cell cultures and enzyme reaction are discussed
- BTC3302 Bioseparation and Purification** 4 (3+1)
Prerequisite : BTC3201
This course encompasses the downstream processing for the recovery and purification of biotechnological products. Various bioseparation and purification techniques are discussed using flow chart, mass balance analysis and costing
- BTC3305 Bioprocessing and Biomanufacturing Design** 3 (2+1)
Prerequisite : BTC3301
This course encompasses aspects of designing and consolidating various unit operations involved in the production, bioseparation, purification and formulation of biotechnological products. Process synthesis and analysis as well as case studies related to bioprocess are discussed
- BTC3306 Bioreactor System** 3 (3+0)
Prerequisite : BTC3201 and BTC3301
This course encompasses various aspects of bioreactor system used in the production of biotechnological products employing microorganisms, enzymes, animal and plant cells. Specific requirement for the design and scaling-up approaches of bioreactor for different biological systems are discussed
- BTC4001 Biosafety and Bioethics** 2 (2+0)
Prerequisite : None
This course covers biosafety and bioethics issues in biotechnology including safety level in laboratory design. Issues on safety and ethics, including the handling of biological issues and rational decisions-making are also discussed
- BTC4002 Biotechnology in Bioeconomy** 2 (2+0)
Prerequisite : BTC3002
This course covers concept and issues related to biotechnology in bioeconomy. The importance of bioresources and contribution of biotechnology towards sustainable generation of economy are discussed. The advantages and challenges of bioeconomy globally are also elaborated
- BTC4102 Advanced Enzyme Technology** 4 (3+1)
Prerequisite : BTC3101
This course encompasses immobilization of enzymes and cells and application of immobilized enzyme in the industry. The use of immobilized enzymes and cells in biosensor and non-conventional media are discussed
- BTC4104 Food Biotechnology** 3 (2+1)
Prerequisite : BTC3101
This course involves the applications of biological catalysts in the food and food ingredient industries, and students will learn about the preparation and modification of traditional foods, beverages, food macromolecules, transgenic foods and food ingredients (genetically modified foods and ingredients) and current issues; and laws that regulate the use of biocatalysts in foods.

BTC4105	Advanced Food Biotechnology	2 (2+0)
Prerequisite : BTC4104		
This course encompasses the roles and contributions of food biotechnology towards people's lifestyle, security and social well-being. Latest development in food biotechnology is discussed		
BTC4205	Industrial Microbiology	3(2+1)
Prerequisite : BMY3001 or BMY3101		
This course encompasses methods of increasing product yield from microorganisms used in industry. A variety of applications in the production of industrial microbiology products are discussed		
BTC4305	Bioprocess Modelling and Optimization	3(2+1)
Prerequisite : BTC3201 and BTC3301		
This course encompasses application of optimisation and simulation technique in biological process. Computer simulation programs are used for modeling of mathematical equations, statistical analysis and bioprocess parameters optimisation		
BTC4406	Bioremediation	3(3+0)
Prerequisite : BTC3402		
This course encompasses treatment methods and bioremediation of toxic waste especially in polluted soil and groundwater. The potential use of microorganisms in various treatments of toxic and hazardous wastes are discussed. Industrial processes are referred in order to clarify the method and concept of bioremediation		
BTC4407	Solid Waste Treatment Technology	3(2+1)
Prerequisite : BTC3402		
This course covers management and treatment technologies for solid waste from various sources. Solid waste treatment methods for sustainable development and case studies related to solid waste treatment technology are also discussed		
BTC4408	Wastewater Treatment Technology	3(2+1)
Prerequisite : BTC3402		
This course encompasses technologies involved in wastewater treatment. The types of treatment methods and comparison of each method, wastewater disposal and re-use are discussed		
BTC4502	Bioentrepreneurship Management	3(1+2)
Prerequisite : BTC3502		
This course encompasses the study of current issues on business operation and management, marketing, financial and entrepreneurship. Risk analysis and management are discussed towards sustainability of biotechnology entrepreneur in the global market		
BTC4503	Biotechnology Business	3(1+2)
Prerequisite : BTC4502		
This course encompasses strategies for biotechnology business or company set up. Methods to design biotechnological products or services for promotional purpose are discussed		
BTC4901	Industrial Training	6(0+6)
Prerequisite : None		
This course introduces students to real working environment in industries/organizations. Training includes application of the theoretical and practical aspects that have been studied with current practices in the workplace. Problem solving and communication skills are also emphasized		
BTC4904	Service Learning in Biotechnology	1(0+1)
Prerequisite : BTC3001		
This course encompasses involvement of students in community / industrial activities to promote awareness and understanding to the public on the role of biotechnology in their daily lives. The learning process involves activities planning with the community, demonstrations and hands-on activities to meet community needs		

BTC4959 Bachelor Dissertation 6(0+6)

Prerequisite : None

This course covers the preparation of proposal, implementation and scientific writing of research project. Scientific approach to generate data systematically through appropriate design, data collection and analysis are emphasized

BTC4991 Seminar 1(0+1)

Prerequisite : BTC4959

This course encompasses the effective preparation and delivery of seminar on research project in bioprocess technology. Exposure to different techniques of seminar presentation is achieved by attending selected seminars held in campus

Department of Cell & Molecular Biology

- BSM3101 Cellular and Developmental Biology** 3(3+0)
Prerequisite : None
This course encompasses the principles of biology and compares various cell types such as prokaryotes, eukaryotes and viruses in terms of physiology and genome organisation. Concept of the cell cycle, structure and function of various cell types and organelles are compared. Endosymbiosis theory, structure and function of sel and nuclear membrane and the mechanism of molecular transport are explained. Cellular development and differentiation of eukaryotic cell and current issues related current issues related to cellular and developmental biology are discussed.
- BSM3104 Principles of Cell and Tissue Culture** 3(2+1)
Prerequisite : None
This course encompasses the principles and basic procedures of cell and tissue culture. The basic requirements for establishing and maintaining cell cultures in the laboratory will be emphasized. This includes various methods such as Zygotic embryo culture, callus culture and organogenesis. Genetic stability and somaclonal variation are discussed. This course also covers various concept and techniques in animal cell culture. Principles of monoclonal antibody production and various cytotoxic assays are also discussed.
- BSM3201 Molecular Biology** 3(3+0)
Prerequisite : None
This course encompasses the principles of molecular biology such as the structure and role of DNA and RNA as genetic materials, structure of chromosome and extrachromosomal inheritance. Transposable elements, DNA replication, transcription, translation, mutation, methylation, DNA repair and relationship between all these processes are discussed. The regulations of gene expression in eukaryotes and prokaryotes are compared.
- BSM3202 Genetic Engineering** 4(3+1)
Prerequisite : BSM3201
This course encompasses the basic techniques for cloning and manipulation of genes. Procedures for cloning, screening and identification of heterologous genes, cloning vectors, restriction of vector and insertion of DNA and transformation process are discussed. PCR technology and DNA sequencing are also explained. Ethical issues in relation to recombinant DNA technology are emphasised
- BSM3203 Research Techniques in Molecular Biology** 3(2+1)
Prerequisite : BSM3201
This course encompasses the theories and applications of techniques used in molecular-biological research including genomic DNA isolation (eukaryotes and prokaryotes), DNA purification, DNA blotting and hybridization, probes labelling, RNA isolation and electrophoresis, microarray and real-time PCR. Advance techniques in analysis of DNA, RNA and protein such as cDNA-AFLP, SDS-PAGE, 2D-gel electrophoresis and in-vitro translation are also discussed.
- BSM3204 Principles of Genetics** 3(2+1)
Prerequisite : None
Genetics, the science of heredity and variation are discussed based on Mendel's discoveries. The important roles and applications of basic genetic principles such as Mendel's Law and Hardy-Weinberg Principle in hereditary at the individual and population levels as well as their relevance in human life today are also discussed. Various recent concepts and branches of genetics are also introduced. Applications of genetic concepts in biodiversity and bioresource conservation are discussed
- BSM3401 Animal Cell and Tissue Culture** 3(2+1)
Prerequisite : BSM3101
This course encompasses the development, organization and laboratory requirements for animal cell and tissue culture. Emphasis is given on various techniques of animal cell and tissue culture such as preparation of suspension and adherent cells and primary tissue culture. Application of the principles and techniques for large scale culture, generation of hybridoma cells and culture of hemopoietic stem cells are explained. Application of animal tissue culture techniques and ethical issues are discussed

- BSM3402 Cell and Molecular Immunology** 3(3+0)
 Prerequisite : BSM3401
 This course encompasses the important concepts in immunology including basic properties of immune responses, cells and tissues in the immune system and the mechanism of immune responses. The biology of T and B lymphocytes including development of T and B cells from the progenitor cells, activation and regulation of T and B cells, antibody and antigen, and Major Histocompatibility Complex (MHC) molecule, transplantation immunology, hypersensitivity and autoimmunity are discussed
- BSM3501 Plant Cell and Tissue Culture** 3(2+1)
 Prerequisite : BSM3101
 This course encompasses the development of plant cell and tissue culture, organization and laboratory requirements to carry out aseptic techniques. Emphasis is given to the medium component, important concepts and different types of plant cell and tissue culture. Genetic stability, somaclonal variation, experimental design and applications of plant cell and tissue culture techniques in agriculture-based industries are discussed
- BSM4101 Microtechniques** 4(3+1)
 Prerequisite : BSM3101
 This course encompasses the basic principles and methods of histological studies in plant and animal. Tissue fixation, infiltration and paraffin embedding, histological staining, slide preparation and identification of plant or animal cells and tissues are discussed. Integration of microscopic morphology with basic physiology of cells or tissues are also explained. Developing skills in light microscopy and histological techniques are also emphasized
- BSM4201 Applied Molecular Genetics** 4(3+1)
 Prerequisite : BSM3202
 This course encompasses development of molecular genetic technologies and their applications in various fields of biotechnology. The development and use of recombinant proteins in eukaryotic and prokaryotic systems, the role of functional genomics in understanding and manipulating biological processes at the molecular level, and the applications of genetic engineering in various industries are discussed
- BSM4203 Molecular Diagnostics** 2(2+0)
 Prerequisite : BSM3401
 This course encompasses the discoveries that have created a field called molecular diagnostics. Scientific concepts in the revolution of molecular diagnostics are explained. Molecular cytogenetics, molecular oncology and detection of infectious disease causing microorganisms are examined. Advanced technology such as human genome microarray and its applications in disease diagnosis are discussed
- BSM4204 Functional Genomics** 3(3+0)
 Prerequisite : BSM3202 and BSM3203
 This course encompasses the principles of functional genomics and research approaches involved in related research. The molecular biology that determines the biological function of genes and their products by making use of genome sequences are discussed. The applications of genome-wide approaches are introduced. Current topics in functional genomics are also discussed
- BSM4301 Bioinformatics** 3(2+1)
 Prerequisite : BSM3201 or BCH3107
 The course encompasses details on fundamental concepts and methods in bioinformatics. Emphasis is on the theory and practical aspects of analysis and manipulations of nucleic acid and amino acid sequences, and the use of software in the analyses. Applications of bioinformatics in molecular biology are discussed
- BSM4501 Applied Plant Cell and Tissue Culture** 4(3+1)
 Prerequisite : BSM3501
 This course encompasses the essential concepts for clonal propagation of agricultural, horticultural and medicinal plants. Methods for production of pathogen-free plants, disease-resistant and stress-tolerant strains and the

importance in the production of new varieties are discussed. The principles of germplasm storage, secondary metabolites and potential of genetic engineering in plants are described

BSM4502 Applied Plant Molecular and Cell Biology 4(3+1)

Prerequisite : BSM3202

This course encompasses aspects of manipulation and analyses of plant genome. Applications of molecular biology techniques in plant breeding are explained. Various issues on genetically modified products are also discussed

BSM4503 Molecular Biology of Plant Development 4(4+0)

Prerequisite : BSM3201 and BSM3101

This course encompasses the basic principles of plant developmental biology. Aspects of plant cell and organ development, such as cell structures and physiology, cell and organ developmental processes are discussed. The relationship of gene expression to structure and physiological functions of plant tissues is explained

BSM4601 Protein Engineering 4(3+1)

Prerequisite : BSM3202 and BMY4310 and BSM4301

This course encompasses the use of genetic and chemical techniques to modify protein. Emphasis is on the theories related to protein stabilization, purification techniques, analysis, 3D structure determination and protein modification techniques

BSM4602 Proteomics 4(3+1)

Prerequisite : BSM3201 and BSM4201

This course encompasses the concepts, technologies and applications of proteomics. The dynamics and complexity of proteome, protein modification and diversity, proteome expression and interaction, proteome technologies and their applications, and protein informatics are described. Applications of proteomics in biotechnology and medical research are discussed

BSM4603 Structural Biology 3(3+0)

Prerequisite : BSM4201

This course encompasses the basic knowledge about the three dimensional structure of proteins. The importances of protein structures in determining the functions of proteins are discussed. In addition, a few major techniques in determining protein structures via crystallography and Nuclear Magnetic Resonance (NMR) are explained. The applications related to structural biology in other fields of science are also discussed

BSM4701 Nanomaterials and Biotechnology 3(3+0)

Prerequisite : BCH3201 or BCH3107

This course encompasses the basic principles of nano materials in biotechnological research. The concepts in the synthesis and characterization of nanomaterials, as well as the various instrumentation in nanobiotechnology are compared and described. The in vitro and in vivo toxicity and persistence of nano materials are also discussed. The applications of nano materials in various fields including medicine, agriculture, and the environment are explored

BSM4901 Industrial Training 6(0+6)

Prerequisite : None

This course introduces students to real working environment in industries/organizations. Training includes application of the theoretical and practical aspects that have been studied with current practices in the workplace. Problem solving and communication skills are also emphasized

BSM4904 Service Learning in Cell and Molecular Biology 1(0+1)

Prerequisite : BSM3202

This course encompasses activities to increase awareness of community and to enhance understanding of the importance of cell and molecular biology in daily lives. The learning process involves working together with the public to develop science lessons, demonstrations and hands-on activities to meet community needs

BSM4991 Seminar

1(0+1)

Prerequisite : BSM4201

This course encompasses the effective preparation and delivery of seminars on research project in cell and molecular biology. Students are required to review the literature, organise and present information on cell and molecular biology in a seminar

BSM4959 Bachelor Dissertation

8(0+8)

Prerequisite : None

This course covers the preparation of proposal, implementation and scientific writing of research project. Scientific approach to generate data systematically through appropriate design, data collection and analysis are emphasized