



POLITEKNIK NILAI

DIPLOMA IN BIOTECHNOLOGY

STUDENT GUIDEBOOK
KOHORT JUNE 2014

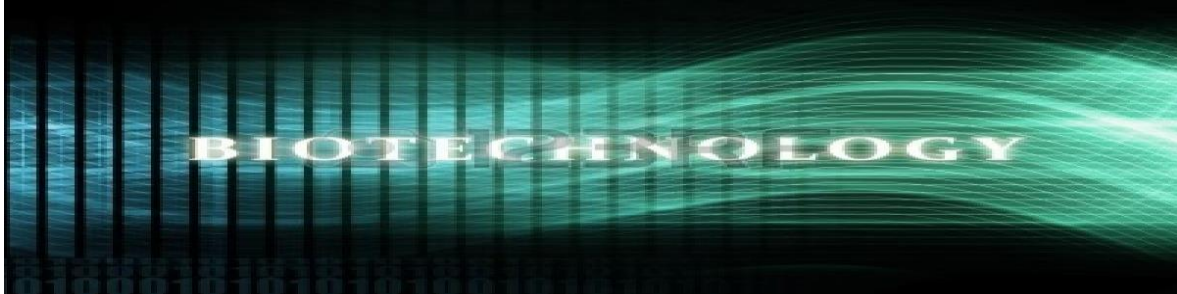
1.0 INTRODUCTION

Established in December 2012, Diploma Biotechnology has started to received its first batch of students. Being as one of two programs offered under Department of Agrotechnology & Bio-Industry as well as a niche area for POLITEKNIK NILAI, NEGERI SEMBILAN, and this program will offer a semi-professional biotechnology graduates that will cater the biotechnology industry needs. The 3 years with 6 semester's diploma will cover the microbiology, biochemistry, genetics and molecular, plant tissue culture and enzymology that will be some of the courses in the diploma biotechnology program structure.

Biotechnology unit is well equipped with an experienced lecturer and specialized in their field and also equipped will all the current laboratory equipment's in order to make sure the Teaching & Learning processes are going smoothly. The complete facilities will help Department of Agrotechnology & Bio-Industry to produce a well-rounded and compatible graduate to fulfill the national biotechnology industry.

2.0 PROGRAMME OFFERED

2.1 DIPLOMA BIOTECHNOLOGY



2.1.1 PROGRAMME OVERVIEW

In order to keep abreast with rapid technological advancements and evolving requirements in industries, the Department of Polytechnic and Community College Education (DPCCE) has initiated a collaborative programme with the nation's key industry players. This collaborative programme aims to equip students with up-to-date knowledge and skills required in the globalised economy. This initiated move, namely blended learning is a form of pedagogy that blends classroom instruction with structured simulated real-life working experience which prepares students for a competitive edge in today's workplace.

This is true especially in the biotechnology area where there is a rapidly growing demand for highly skilled and technically savvy workforce. One of the most important factors driving the growth of productivity is by having qualified manpower in this area, in order for the industry to develop and remain competitive in the world market. To address these issues, the Curriculum Development and Evaluation Division (CDED), DPCCE cooperates with the industries to develop the curriculum and introduces a new programme, Diploma in Biotechnology.

2.1.2 PROGRAMME AIMS

Diploma in Biotechnology graduates in Polytechnics, Ministry of Higher Education will have knowledge, technical skills and attitude to adapt themselves with new technological advancement and challenges in Biotechnology.

2.1.3 PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The Diploma in Biotechnology programme shall produce Semi-professionals who are:

knowledgeable in the basic principle of biotechnology and aware of biohazard and occupational safety issues, competent in basic bioscience practical skills to support bio-related industries and also able to adapt themselves with new technological advancement and challenges in the field of Biotechnology through lifelong learning.

able to trace and solve problems by applying analytical and critical thinking, and demonstrate entrepreneurial skills for successful career advancement.

able to communicate effectively, and demonstrate effective leadership qualities and teamwork to meet common goals.

capable to display good social skills and responsibilities, and upholding positive attitudes, values and professionalism ethics while dealing with work and community.



PEO

2.1.4 PROGRAMME LEARNING OUTCOME (PLO)

1.	apply knowledge of marketing, management and other related areas in business environment.
2.	employ appropriate techniques and skills necessary for business practices.
3.	communicate effectively with other professionals and community.
4.	analyse, interpret and solve data in relation to business projects using appropriate tools and techniques.
5.	develop an effective and excellent teamwork to meet common goals.
6.	engage in life-long learning and professional development to enrich knowledge and competencies
7.	inculcate entrepreneurial skills in related discipline that contributes towards national growth and be competitive in business industries
8.	practice professional and ethical responsibilities, and enhance humanistic values to adapt to the real challenges in working environment.
9.	demonstrate effective leadership and adapt multi-disciplinary teams responsibility

2.1.5 JOB PROSPECT

Graduates of this three year programme will embark on careers in the job market as:

✔ **Technical assistant**

✔ Laboratory assistant

✔ **Research assistant**

✔ Quality assurance supervisor

✔ **Quality control supervisor**

✔ Sales representative for scientific equipment

✔ **Laboratory technician**

✔ Product specialist

✔ **Customer service executive**

✔ Plant breeder

✔ **Specialized technician**

✔ Assay analyst

✔ **Instrument calibration technician**

✔ Manufacturing technician

✔ **Process development assistant**

✔ Technical services representative

✔ **Technical writer**

2.1.6 SEMESTER SYSTEM RULES AND GUIDELINES CURRICULUM AND SYLLABUS

YEAR 1 - SEMESTER 1				YEAR 1 - SEMESTER 2			
No	Code	Course	Credit Hour	No	Code	Course	Credit Hour
1	DUB1012	PENGAJIAN MALAYSIA	2	1	DUA20012	SAINS, TEKNOLOGI DAN KEJURUTERAAN DALAM ISLAM*	2
2	DUE1012	COMMUNICATIVE ENGLISH 1	2	2	DUB2012	NILAI MASYARAKAT MALAYSIA**	2
3	DRB1XX1	ASAS UNIT BERUNIFORM	0	3	DRS2XX1 @ DRB2XX1	SUKAN @ UNIT BERUNIFORM 1	1
4	DBM1053	AGRICULTURAL MATHEMATICS	3	4	DUW1012	OCCUPATIONAL, SAFETY & HEALTH	2
5	DYB1013	BIOLOGY OF ORGANISMS	3	5	DYB2012	INTRODUCTION TO BIOTECHNOLOGY	2
6	DYB1023	LABORATORY TECHNIQUES AND MANAGEMENT	3	6	DYB2024	PHYSICAL ORGANIC CHEMISTRY	4
7	DYB1033	CHEMISTRY	3	7	DYB2033	BIOSTATISTICS	3
				8	DYB2043	BIOCHEMISTRY I	3
TOTAL			16	TOTAL			17
YEAR 2 - SEMESTER 3				YEAR 2 - SEMESTER 4			
No	Code	Course	Credit Hour	No	Code	Course	Credit Hour
1	DUE3012	COMMUNICATIVE ENGLISH 2	2	1	DUT40110	INDUSTRIAL TRAINING	10
2	DRK3XX2 @ DRB3XX2	KELAB/PERSATUAN @ UNIT BERUNIFORM 2	2				
3	DYB3013	CELL AND MOLECULAR BIOLOGY	3				
4	DYB3023	GENETICS	3				
5	DYB3033	BIOCHEMISTRY II	3				
6	DYB3043	MICROBIOLOGY	3				
TOTAL			16	TOTAL			10
YEAR 3 - SEMESTER 5				YEAR 3 - SEMESTER 6			
No	Code	Course	Credit Hour	No	Code	Course	Credit Hour
1	DUE5012	COMMUNICATIVE ENGLISH 3	2	1	DUA6022	KOMUNIKASI DAN PENYIARAN ISLAM	2
2	DYB5013	TECHNIQUES IN RECOMBINANT DNA TECHNOLOGY	3	2	DPB2012	ENTREPRENEURSHIP	2
3	DYB5024	CELL AND TISSUE CULTURE	4	3	DYB6013	FINAL PROJECT 2	3

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TECHNOLOGY			
4	DYB5034	INDUSTRIAL MICROBIOLOGY	4
5	DYB5042	FINAL PROJECT 1	2
6	DUF1022	FOREIGN LANGUAGE***	2
7	DBC2012	COMPUTER APPLICATION***	2
8	DYB5052	AGROBIOTECHNOLOGY***	2
TOTAL			17

4	DYB6023	INSTRUMENTATION IN BIOTECHNOLOGY	3
5	DYB6033	BIOPROCESS TECHNOLOGY	3
6	DYB6042	FOOD BIOTECHNOLOGY***	2
7	DYB6043	ENZYMOMOLOGY***	3
8	DYB6052	ENVIRONMENTAL BIOTECHNOLOGY***	2
9	DUA6012	INTEGRASI MALAYSIA***	2
TOTAL			15 @ 16

* For muslim students

** For non muslim students

*** Elective

3.0 CURRICULUM AND SYLLABUS

DYB1013 BIOLOGY OF ORGANISMS

BIOLOGY OF ORGANISMS introduces students to cell as a basic unit of life, aerobic and anaerobic respiration and the five-kingdom systems: Kingdom Monera, Kingdom Protista, Kingdom Fungi, Kingdom Plantae and Kingdom Animalia. This course also covers variations, evolution, reproduction and growth of plants and mammals, ecology, biogeochemical cycle as well as impacts of human activity on biosphere.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. explain the structure and function of cell, aerobic and anaerobic respiration, reproduction and growth of plants and animals, biological diversity, variation and evolution as well as the ecology of organisms. (C2, PLO1)
2. observe the specimen and perform laboratory techniques correctly. (P2, PLO2)
3. justify the nature of biodiversity and life evolution in general. (A3, PLO6)

SUMMARY

(LECTURE : PRACTICAL)

	SST	RTA
1.0	CELLS AS A UNIT OF LIFE This topic covers the structure of the cell, function of organelles in cell, the cell theory as well as cell division that occurs in organisms.	(04 : 08)
2.0	CELLULAR RESPIRATION This topic covers different types of respiration; aerobic and anaerobic, oxidation and reduction reactions in energy production, and concepts involved in catabolic process.	(06 : 00)
3.0	BIOLOGICAL DIVERSITY This topic covers the taxonomy hierarchy of living organisms, five-kingdom systems by Whittaker, characteristics and importance of organisms from several kingdom including Kingdom Monera, Kingdom Protista, Kingdom Fungi, Kingdom Plantae and Kingdom Animalia.	(04 : 12)

4.0 VARIATION AND EVOLUTION (06 : 00)

This topic covers the continuous and discontinuous variation, sources of variation, natural and artificial selection, allopatric and sympatric speciation, factors involved in speciation, Lamarck and Darwin-Wallace theory, and evolutionary agents.

5.0 REPRODUCTION AND GROWTH OF PLANTS AND ANIMALS (06 : 10)

This topic covers the asexual reproduction in plants and animals, sexual reproduction in flowering plants, reproductive organs in plants, development of female and male gamete in plants, pollination process, seed germination, male and female reproductive systems, spermatogenesis, oogenesis and hormonal control of female and male reproductive systems.

6.0 ECOLOGY (04 : 00)

This topic covers the ecological niche and habitat, biotic and abiotic components, interactions between biotic components, flow of energy and essential elements in environment, components in biogeochemical cycle, destructive consequences of human activity to environment and ecosystem management through conservation and preservation.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)

RTA – Recommended Time Allocation

SST – Suggested Sequence of Topics

DYB1023 LABORATORY TECHNIQUES AND MANAGEMENT

LABORATORY TECHNIQUES AND MANAGEMENT introduces students to safety procedures in laboratory, chemical hazards, industrial safety and health, legislations and laws pertaining to laboratory operation, general analysis, good laboratory practices and first aid knowledge. A series of practical classes is integrated with lectures to further develop concepts covered and also to familiarize students with materials and equipment commonly used in laboratories.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. discuss basic laboratory techniques, recognize various hazards, the importance of first aid and industrial safety issues, together with the application of Good Laboratory Practice (GLP). (C2, PLO1)

2. perform practical proficiency in managing lab equipment and biohazard material in laboratory according to procedures in a team. (P3, PLO2)
3. display Good Laboratory Practice (GLP) in laboratory ethically and professionally.(A3, PLO8)

SUMMARY

(LECTURE : PRACTICAL)

SST	RTA
<p>1.0 SAFETY PROCEDURES IN LABORATORIES AND WORKPLACES This topic covers safety procedures in offices and general areas, proper techniques in handling and cleaning glassware, recognize and handling common laboratory apparatus.</p>	(04 : 18)
<p>2.0 BIOHAZARDS AND ELECTRICITY SAFETY HAZARDS This topic covers types of biohazardous materials; effects of biohazards to living organisms and environment, regulations and guidelines for handling biohazards, strategies for minimizing the risk of biohazards; handling biohazardous waste materials; respond to biohazard spills; effects of electricity safety hazards; ways to minimize the electrical hazards.</p>	(06 : 04)
<p>3.0 CHEMICAL HAZARDS This topic covers toxic substances and vapours; poison, corrosive and irritant substances; handling, storage and transport of chemicals; the labelling of chemicals.</p>	(06 : 04)
<p>4.0 FIRST AID KNOWLEDGE This topic deals with treatment for respiratory injury, chemical and heat burns, severe bleeding, eye injuries.</p>	(04 : 04)
<p>5.0 INDUSTRIAL SAFETY AND HEALTH This topic covers factors affecting the level of risks in workshop; protection devices; electrical hazards; ultraviolet radiation; microbiological hazards; mechanical hazards; fire hazards; safety and laboratory design; OSHA.</p>	(04 : 00)
<p>6.0 THE GOOD LABORATORIES PRACTICES This topic covers GMP, GCP, HACCP, and Legislation and Law.</p>	(06 : 00)
	(03)
DEPENDENT LEARNING COURSEWORK ASSESSMENT	

RTA - Recommended Time Allocation

SST - Suggested Sequence of Topics

DYB1033 CHEMISTRY

CHEMISTRY provides students with theoretical knowledge and laboratory experience in a range of topics in chemistry including the atomic structure, periodic table, chemical bonds, chemical reactions, acid-base equilibrium, anion and cation and the behaviour of gases. In addition, students will also be introduced to the common concepts and terminology associated with the field of chemistry

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. apply the fundamental principle and concepts in chemistry to solve chemical equation and reactions as well as gas law. (C3, PLO1)
2. display practical skills through group work in chemistry laboratory experiment. (P2, PLO2)
3. appreciate the impact and the importance of chemistry in life through continuous learning. (A3,PLO6)

SUMMARY**(LECTURE : PRACTICAL)**

SST	RTA
1.0 INTRODUCTION TO CHEMISTRY	(05 : 12)
This topic introduces students to some fundamental concepts in chemistry including atoms, element, matter, compounds, molecules, substances, mixtures, mass, weight, physical and chemical properties, the different states of matter, scientific measurements and unit conversions.	
2.0 ATOMS AND ELECTRON CONFIGURATION	(05 : 00)
This topic covers the structures, atomic number, and mass number of the atoms, Dalton's atomic theory, Bohr's model of the atom, electron configurations within atom, and writing electron configurations and orbital diagrams.	
3.0 PERIODIC TABLE	(04 : 04)
This topic covers groups and periods of the periodic table, atomic trends and properties, classification based on electronic configurations, the chemistry of selected groups of elements, the chemistry of metals and non-metals and the prediction of physical and chemical properties of elements.	

- 4.0 CHEMICAL BONDS** (06 : 00)
This topic covers the identification of ionic and molecular compounds, types of chemical bonds, valence electron and bond characteristic, anions and cations, Lewis's structures of ionic compounds, writing symbols and formulas for ionic compounds, reactions of anions and cations.
- 5.0 CHEMICAL REACTIONS** (06 : 08)
This topic covers the importance of balanced chemical equations, strategies used to balance an equation, types of chemical reactions, the relation between the mole and Avogadro's number, and calculations involving mass and mole of reactants and products.
- 6.0 GASES** (04 : 06)
This topic covers the physical behaviour of matter according to the kinetic molecular theory, and basic principles of different gas laws.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)

RTA – Recommended Time Allocation
SST – Suggested Sequence of Topics

DYB2012 INTRODUCTION TO BIOTECHNOLOGY

INTRODUCTION TO BIOTECHNOLOGY explores the meaning and origins of biotechnology by looking at the progress and development in the areas of food, agriculture, medicine and the environment. Various definitions and developments in biotechnology are discussed to emphasize its impact on modern science and technology. This course also introduces students to a wide-ranging, multi-disciplinary technology of the twenty-first century which includes recombinant DNA techniques and the application of microbiology and other cell culture technologies to the production of a wide range of goods.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. explain the development of biotechnology, and different branches of biotechnology.
(C2, PLO1)

2. explain the central dogma of molecular biology, invention of genetically modified organisms (GMO) through genetic engineering, its impacts and arising public concerns of GMO. (C2 , PLO1)
3. discuss ethical, social and legal issues relating to biotechnological scenario appropriately. (A2, PLO8)

SUMMARY

(LECTURE : PRACTICAL)

SST	RTA
1.0 INTRODUCTION TO BIOTECHNOLOGY This topic covers definition of biotechnology, branches of biotechnology, history and development of biotechnology, and the development of biotechnology in Malaysia.	(06 : 00)
2.0 GENETIC ENGINEERING AND BIOTECHNOLOGY This topic covers importance of nucleic acids as the basis of genetics, the central dogma of molecular biology, some technologies used in biotechnology and illustration of classic examples of genetic engineering.	(10 : 00)
3.0 BIOTECHNOLOGY MODIFICATION OF PLANTS AND ANIMALS This topic covers definition of genetically modified organisms (GMO), and few examples of genetically modified plants and animal.	(06 : 00)
4.0 ISSUES IN BIOTECHNOLOGY This topic covers biotechnology issues related to human health, climate change, and arising bio-ethical, bio-safety and legal issues.	(08 : 00)

DEPENDENT LEARNING COURSEWORK ASSESSMENT

(02)

RTA – Recommended Time Allocation

SST – Suggested Sequence of To

DYB2024 PHYSICAL ORGANIC CHEMISTRY

PHYSICAL ORGANIC CHEMISTRY is designed to strengthen the students' basic knowledge in physical chemistry which is widely applicable in life science including identifying acids, bases and buffers, the acid-base reactions, and the oxidation-reduction reactions. It also covers organic chemistry including classification, nomenclature, structures, physical properties, as well as the industrial applications of organic compounds, aromatic compounds and other homologous series.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. discuss the basic principles of acids, bases and buffer solution, the electrochemistry of Galvanic cell, the characteristics and properties as well as the basic concept of organic, aromatic and other homologous series of organic compounds. (C3, PLO1)
2. display practical proficiency through group work in laboratory experiments and write technical reports. (P2, PLO2)
3. respond well as good follower or leader while practicing team working during lab work. (A2, PLO9)

SUMMARY

(LECTURE : PRACTICAL)

SST

RTA

1.0 ACIDS, BASES AND BUFFER

(04 : 14)

This topic covers the acid-base reactions, writing acid-base equations, identification of the strength of acids and bases, pH values of solutions, acid-base titration, and the composition and action of buffer solutions.

2.0 ELECTROCHEMISTRY

(04 : 14)

This topic covers calculation of oxidation number, redox reactions, balancing redox reactions, categorization of strong, weak and non-electrolytes, and the Galvanic cell.

3.0 ORGANIC COMPOUNDS

(08 : 20)

This topic covers the structures, IUPAC nomenclatures, physical

properties and reactions of simple hydrocarbon such as alkanes, alkenes and alkynes, polarity and isomerisms of alkenes.

4.0 AROMATIC COMPOUNDS (08 : 00)

This topic covers the structures and nomenclatures of aromatic compounds including benzene, arenes and phenols, the principles of aromaticity, common properties and the reactions of aromatic compounds.

5.0 OTHER HOMOLOGOUS SERIES / OTHER ORGANIC COMPOUNDS (06 : 12)

This topic covers the structures and nomenclatures of alcohols, aldehydes and ketones, carboxylic acids and esters; together with their physical properties and common applications in industries.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (04)

RTA - Recommended Time Allocation

SST - Suggested Sequence of Topics

DYB2033 BIOSTATISTICS

BIOSTATISTICS provides both theoretical knowledge and practical examples in the following areas: statistical analyses – probability concepts, parametric hypothesis testing, probability distributions, sampling, regression and correlation; and quality management, quality assurance and quality control. Statistical tests are carried out, evaluated and interpreted to maintain quality standards.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. distinguish appropriately the basic statistical terminologies, types of statistics and their applications as well as solve accurately the statistical problems in life science through calculation. (C3, PL01)
2. select appropriately the statistical test in data presentation, data description and data analysis by using computer software. (P1, PL04)
3. generalize specifically on data generated through data analysis. (A4, PL04)

SUMMARY	(LECTURE : PRACTICAL)
SST	RTA
<p>1.0 INTRODUCTION This topic explains statistical terminologies, types of statistics, and relationship between statistics and research objectives. This topic also introduces the use of the scientific calculator in statistical analyses.</p>	(02 : 02)
<p>2.0 DATA AND SAMPLING This topic explains the definition of data, types of data, sources of data, methods of data collection and methods of data sampling. This topic also introduces the use of computer software in statistical analyses.</p>	(02 : 06)
<p>3.0 DESCRIPTIVE STATISTICS This topic defines descriptive statistics, identifies the various forms of data presentation methods (frequency table, histogram, frequency polygon, ogive, graph, pie chart, bar chart, multiple bar chart, component bar chart), explains the determination of measures of central tendency (mean, medium, mode), and measures of dispersion (range, standard deviation and variance) in clarifying the distribution of data collected.</p>	(06 : 06)
<p>4.0 CORRELATION AND REGRESSION This topic introduces scatter diagram, application of correlation coefficient, the difference between the application Spearman Rank correlation coefficient and Pearson Moment correlation and the importance of correlation in the research field. This topic includes definitions of independent variable, dependent variable, regression equation and its importance.</p>	(04 : 04)
<p>5.0 PROBABILITY AND PROBABILITY DISTRIBUTION This topic covers the addition & multiplication rules for probability, discrete and continuous distributions. It also includes probability distribution, normal distribution, standard normal distribution, and sampling distribution.</p>	(06 : 00)
<p>6.0 HYPOTHESIS TESTING This topic covers testing of hypotheses, which are null hypothesis and alternative hypothesis. It also includes the possibilities of errors being made during hypothesis testing.</p>	(02: 00)

7.0 THE 'STUDENT' T-TEST (04 : 06)

It covers the concept of t-distribution, and the usage of different types of t-test which are: t-test for one group, t-test for unpaired (independent) data, and t-test for paired (related) data.

8.0 ANALYSIS OF VARIANCE (ANOVA) (04 : 06)

This topic includes one-way and two-way ANOVA, procedures in solving variance analysis, interpretation of results as well as the importance of variance analysis in research.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)

RTA – Recommended Time Allocation

SST – Suggested Sequence of Topics

DYB2043 BIOCHEMISTRY I

BIOCHEMISTRY I is an introduction to biochemistry. The course introduces students to the physical and chemical properties, functions of macromolecules such as carbohydrates, proteins, and vitamins in living organisms. A series of practical classes is integrated with lectures to allow students to further develop concepts covered in the lectures, and also to become familiar with the use of materials and equipment commonly used in biochemistry laboratories.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students will be able to:-

1. interpret the basic knowledge of biological macromolecules, including general formulas, common properties and the importance of carbohydrates, lipids and proteins properly as well as the importance of water, vitamins and hormones for the growth of living . (C2,PL01)
2. demonstrate laboratory procedures in groups using appropriate methods, techniques and biochemical concepts. (P2, PL02)
3. work collaboratively as leader and team member in a group. (A3, PLO9)

SUMMARY	(THEORY : PRACTICAL)
SST	RTA
<p>1.0 INTRODUCTION TO BIOCHEMISTRY This topic covers the basic knowledge of biological macromolecules: proteins, carbohydrates, lipids, nucleic acids; and the life-supporting properties of water.</p>	(04 : 02)
<p>2.0 CARBOHYDRATES This topic covers the structures of carbohydrate molecules, physical and chemical properties of carbohydrate; and its physiological and commercial importance to humans.</p>	(06 : 08)
<p>3.0 PROTEINS This topic covers the structures of protein molecules, nomenclature and classification of amino acids, structures, physical and chemical properties of amino and proteins, specialized functions and commercial uses of proteins and the importance of enzymes in metabolism.</p>	(06 : 08)
<p>4.0 LIPIDS This topic covers the structures of lipid molecules, nomenclature and classification of different types of lipids, common properties of lipids, biological and commercial importance and applications of lipids.</p>	(08 : 08)
<p>5.0 VITAMINS This topic covers differentiation of two groups of vitamins, the structures and biochemical functions of vitamins, and the role of vitamins in metabolism.</p>	(04 : 04)
<p>6.0 HORMONES This topic covers structures of some plant and animal hormones and their functions, classes of hormones, and the importance of hormones for growth and metabolism.</p>	(02 : 00)
<p>DEPENDENT LEARNING COURSEWORK ASSESSMENT</p>	(03)
<p>RTA- Recommended Time Allocation SST - Suggested Sequence of Topics</p>	

DYB3013 CELL AND MOLECULAR BIOLOGY

CELLS AND MOLECULAR BIOLOGY introduces students to cell structures, molecular organization, gene transfer mechanism in bacteria, protein synthesis, gene regulation, protein detection techniques, genetic mutations and principles of recombinant DNA.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. distinguish the structures of prokaryotic and eukaryotic cells, basic principles in gene structure, gene transfer, isolation and expression of genetic materials through the techniques of recombinant DNA and gene mutation. (C4, PLO1)
2. display practical proficiency through group work in cell and molecular biology laboratory experiment. (P2, PLO2)
3. valuing the advancement of molecular biology through continuous learning. (A2, PLO6)

SUMMARY

(LECTURE : PRACTICAL)

	SST	RTA
1.0 CELL STRUCTURES	This topic covers the structures of eukaryotic and prokaryotic cells; differentiation between eukaryotic and prokaryotic cells.	(02 : 02)
2.0 NUCLEIC ACID	This topic covers the common physical properties of DNA including DNA denaturation, and DNA reannealing as well as isolation of nucleic acid from bacteria.	(02 : 04)
3.0 GENE STRUCTURES AND DNA REPLICATIONS	This topic covers the bacterial gene structures and the replications of bacterial chromosomes.	(02 : 00)
4.0 INTRODUCTION TO RECOMBINANT DNA	This topic covers extraction of DNA, importance of gene identification and isolation and gene transfer.	(06 : 06)

- 5.0 ISOLATION OF GENOMIC DNA AND RNA (04 : 06)**
This topic provides an overview of the protocols for the isolation of genomic DNA and RNA from living organisms.
- 6.0 GENE TRANSFER (04 : 06)**
This topic covers the mechanisms of gene transfer in bacteria including conjugation, transformation and transduction.
- 7.0 EXPRESSION OF GENETIC MATERIAL (06 : 06)**
This topic describes relationship between genes and proteins, DNA and protein synthesis, the control of process in gene expression as well as structure of eukaryote gene.
- 8.0 MUTATIONS AND DNA REPAIR (04 : 00)**
This topic discusses the mutations in DNA and their importance in molecular biology, types of gene mutation, mutation causing agents involved and the methods in DNA repair

DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)

RTA – Recommended Time Allocation
SST – Suggested Sequence of Topic

DYB3023 GENETICS

GENETICS contains the basic principles of genetics including cell divisions, Mendellian and Non-Mendellian Law, chromosome linkage, genetic mapping, genetic populations and principles of plant and animal breeding.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. summarize the cell divisions, genetic inheritance and plant and animal breeding as well as solve the problem in genetic inheritance and population genetics. (C4, PLO1)
2. display practical proficiency through group work in genetics laboratory experiment. (P2, PLO2)
3. discuss issues arise from genetic inheritance by using critical and analytical thinking. (A2, PLO4)

SUMMARY

(LECTURE : PRACTICAL)

	SST	RTA
1.0 INTRODUCTION TO GENETICS		(06 : 06)
This topic provides a general overview of genetics, describes the genetics terminology and genetics concept (classical, molecular and evolutionary).		
2.0 INTRODUCTION TO GENETICS CELL DIVISIONS		(04 : 00)
This topic introduces students to the basic concepts of cell divisions, cell cycle, mitosis, meiosis and cytokinesis.		
3.0 GENETIC INHERITANCE		(08 : 14)
This topic covers the Mendellian and non-Mendellian's inheritance, 1 st and 2 nd law of Mendellian, sex determination, chromosome linkage and genetic mapping.		
4.0 POPULATION GENETICS		(08 : 04)
This topic covers the concepts of Gene Pool and Hardy-Weinberg Law.		
5.0 PLANT AND ANIMAL BREEDING		(04 : 06)
This topic covers the principles of plant and animal breeding, methods of selection, male sterility, polyploidy in plant and breeding, heterosis or hybrid vigour, mutation breeding and transgenic plants and animals.		
DEPENDENT LEARNING COURSEWORK ASSESSMENT		(03)
RTA - Recommended Time Allocation		
SST – Suggested Sequence of Topics		

BIOCHEMISTRY II introduces students to the basic of bioenergetic. Metabolism of macromolecules, metabolic pathway and regulation of metabolism will be covered leading to the understanding of energy metabolism.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. explain the overview of metabolism and the metabolism of lipid and amino acid. (C2,PL01)
2. discuss the glycolysis, citric acid cycle, electron transport and oxidative phosphorylation. (C2,PL01)
3. valuing intrinsically the complexity of various biological processes to support life of organisms. (A3, PL05)

SUMMARY

(LECTURE : TUTORIAL)

	RTA
<p>1.0 SST INTRODUCTION TO METABOLISM This topic covers the general overview of metabolism, principles of bioenergetics, biological coupling reactions, and energy-rich compounds (ATP, NADH, FADH₂).</p>	<p>(04 : 03)</p>
<p>2.0 CARBOHYDRATE METABOLISM This topic covers the glycolytic pathway and tricarboxylic acid cycle reactions, regulations of metabolism, metabolic intermediates and end products, electron transport and oxidative phosphorylation, and the net yield of ATP and NADH.</p>	<p>(10 : 05)</p>
<p>3.0 LIPID METABOLISM This topic covers gluconeogenesis, gluconeogenic substrates, glycogen metabolism, mobilization, biosynthesis and degradation of fatty acids. β-oxidation of saturated and unsaturated fatty acids, ketogenesis, and biosynthesis of fatty acids are also included.</p>	<p>(08 : 04)</p>

4.0 AMINO ACID METABOLISM

(08 : 03)

This topic covers deamination of amino acids by transamination leading to ketogenic and glucogenic amino acids, and destination of the ammonium ion and the carbonated skeleton during metabolism.

DEPENDENT LEARNING COURSEWORK ASSESSMENT

(03)

RTA – Recommended Time Allocation

SST – Suggested Sequence of Topics

DYB 3043 MICROBIOLOGY

MICROBIOLOGY introduces the basics of microbiology, characteristics and classification of microorganisms, ecology of microorganism, cell metabolism, reproduction and growth of microorganisms, cell cultivation and microorganism control. Students will apply safe and correct techniques in staining, cell enumeration, media preparation, isolation, aseptic techniques and cultivation of pure culture.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. explain the characteristics and classification of microorganisms, common properties of every class of microorganisms, the growth and control of microorganisms. (C3, PLO1)
2. display practical skills through group work in microbiology laboratory experiment. (P2, PLO2)
3. discuss the characteristics and ecology of microorganisms through lifelong learning. (A2, PLO6)

SUMMARY	(LECTURE : PRACTICAL)
SST	RTA
<p>1.0 INTRODUCTION TO MICROBIOLOGY This topic covers the definitions of common terms used and the important concepts in microbiology. The history and developments in this field are also explored.</p>	(04 : 03)
<p>2.0 CHARACTERISTICS AND CLASSIFICATION OF MICROORGANISMS This topic covers the general characteristics, structures and functions of prokaryotic and eukaryotic cells, classification and nomenclature of microorganisms. The properties of bacterial endospores are also discussed.</p>	(04 : 03)
<p>3.0 VIRUSES This topic describes the structures, classification and replication of viruses. The environmental and physiological impact of viruses on plants, animals and microbes, the life cycle, significance and control of one viral agent are also included.</p>	(04 : 00)
<p>4.0 BACTERIA This topic differentiates the characteristics of the major groups of bacteria and identifies common species of bacteria using plating, biochemical tests, mini-test kits and rapid methods.</p>	(04 : 15)
<p>5.0 FUNGI, PROTOZOA AND ALGAE This topic covers the identification and classification systems of fungi, protozoa and algae. Culture of fungi on selective media and identification of the spore structure are also discussed.</p>	(04 : 06)
<p>6.0 REPRODUCTION AND GROWTH OF MICROORGANISMS This topic discusses the various mechanisms for microbial reproduction, the concept and basic requirement for microbial growth and the life cycle of bacteria.</p>	(04 : 12)
<p>7.0 ISOLATION, MAINTENANCE AND PRESERVATION This topic discusses the various types of culture media, isolation techniques, chemical and physical methods of controlling and factors influencing microbial growth. The number of bacteria is calculated using different counting methods and different samples. It also covers the method of preserving microorganism.</p>	(06 : 06)
<p>FACE TO FACE COURSEWORK ASSESSMENT</p>	(03)
<p>RTA : Recommended Time Allocation SST : Suggested Sequence of Topics</p>	

DYB5013 TECHNIQUES IN RECOMBINANT DNA TECHNOLOGY

TECHNIQUES IN RECOMBINANT DNA TECHNOLOGY introduces the students to the techniques used in gene cloning and DNA analysis; application of gene cloning in various aspects of biotechnology applications, including the development of genetically modified organism (GMO) and transgenic plants. A series of practical classes is integrated with the lectures to further develop concepts covered in the lectures. Students will be familiarised with the use of materials and equipment commonly used in biotechnology laboratories.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. explain the basic knowledge of techniques in recombinant DNA technology and DNA analysis in general. (C4, PL01)
2. perform practical proficiency of basic recombinant DNA technology through laboratory work in a group. (P3, PL02)
3. apply knowledge of recombinant DNA technology in laboratory ethically and professionally. (A5, PL08)

SUMMARY

(LECTURE : PRACTICAL)

SST	RTA
<p>1.0 INTRODUCTION TO RECOMBINANT DNA This topic covers the definition of recombinant DNA, brief overview of techniques in recombinant DNA and the applications of recombinant DNA in modern science.</p>	<p>(02 : 00)</p>
<p>2.0 POLYMERASE CHAIN REACTION This topic provides an overview of PCR, designing of primers, preparation of reaction mixture and PCR regimes, analysis of PCR products</p>	<p>(04 : 00)</p>
<p>3.0 ELECTROPHORESIS AND BLOTTING This topic provides an overview of basic concepts and types of blotting. Gel preparation, samples loading, parameters affecting molecules separation, visualizing DNA molecules are discussed.</p>	<p>(08 : 06)</p>

4.0 EXAMPLES OF GENE CLONING APPLICATIONS (04 : 00)

This topic briefly describes the other applications of cloning technology, including the production of recombinant proteins and its application in forensic sciences.

5.0 APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY (12 : 24)

This topic provides knowledge and laboratory skills in recombinant DNA technology. It covers the extraction, isolation of DNA and RNA, amplification of certain gene segments by polymerase chain reaction, detection of specific protein fragments by electrophoresis, transformation and cloning of genes, DNA sequencing.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)

RTA – Recommended Time Allocation

SST – Suggested Sequence of Topics

DYB5024 CELL AND TISSUE CULTURE TECHNOLOGY

CELL AND TISSUE CULTURE TECHNOLOGY introduces students to the structure, growth and function of plant and animal cells. The course focuses on the technical requirements and media preparations for the culture processes, and discusses various factors affecting the growth of cell and tissue culture. The course also discusses the applications of tissue culture technology in agriculture, and applications of stem cells for agriculture and therapeutic purposes

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. distinguish general principles, technical requirement, the development and applications of culture processes. (C4, PLO1)
2. perform media preparation, inoculation and sub-culture techniques aseptically in plant tissue culture laboratory. (P2, PLO2)
3. recognise scaling up of plant tissue cultures and animal cell culture in healthcare as the potentials to practice entrepreneurship. (A3, PLO7)

SUMMARY SST	(LECTURE : PRACTICAL) RTA
<p>1.0 INTRODUCTION TO CELL AND TISSUE CULTURE This topic covers overview on the history, definition and application of cell and tissue culture in agriculture and industry.</p>	(02 : 00)
<p>2.0 DEVELOPMENT OF TISSUE CULTURE FACILITIES This topic covers the set-up and development of a tissue culture laboratory including space and equipment.</p>	(02 : 04)
<p>3.0 BASIC ASEPTIC TECHNIQUES IN PLANT TISSUE CULTURE This topic covers the importance of maintaining a sterile environment to reduce contamination in the tissue culture laboratory and Introduce various aseptic techniques commonly used in the laboratory.</p>	(02 : 04)
<p>4.0 MEDIA COMPOSITION AND PREPARATION This topic covers the importance of media manipulation in the tissue culture, the major components of plant tissue culture medium including macronutrients, micronutrient, iron supplements, vitamins, carbon source, commonly used plant growth regulators and others.</p>	(02 : 08)
<p>5.0 TYPES OF CULTURE AND INOCULATION TECHNIQUES This topic covers types of tissue culture such as callus culture, explant culture, callus culture, cell culture and protoplast culture. This topic also covers inoculation and subculture techniques.</p>	(04 : 28)
<p>6.0 FACTORS AFFECTING TISSUE CULTURE GROWTH This topic covers genotype factors such as genotype, tissue types, characteristic of explants and culturing methods, environmental factors including nutrient and pH of the media, and physical factors such as growth room temperature, light, ventilation.</p>	(04 : 00)
<p>7.0 PLANT REGENERATION This topic covers regeneration processes and discusses their importance in organogenesis and somatic embryogenesis, initiation and maintenance of callus, cell culture and cell suspension.</p>	(04 : 12)
<p>8.0 MICROPROPAGATION STAGES This topic covers stages of micropropagation.</p>	(02 : 00)
<p>9.0 ANIMAL CELL CULTURE This topic covers the history, definition and application of animal cell culture, including animal cell culture techniques, important features of animal cell culture, type of cell culture, desegregations of the tissue, primary cell culture, secondary cell cultures and cell</p>	(06 : 04)

lines, finite cell line, characterisation of cell line and cryopreservation.

10.0 APPLICATIONS OF PLANT TISSUE CULTURE TECHNOLOGY (02 : 00)

This topic covers clonal propagation, disease free planting materials, somaclonal variation and meristem culture for the creation of new crop varieties, in-vitro production of secondary metabolites including biofarming, production of cytoplasmic hybrids and germplasm preservation.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (04)

RTA – Recommended Time Allocation

SST – Suggested Sequence of Topics

DYB5034 INDUSTRIAL MICROBIOLOGY

INDUSTRIAL MICROBIOLOGY introduces students to the important roles of bacteria, algae, fungi in human life and environment and also the classification and characterization of microorganisms. Students will explore the main role of microbes in environment, agriculture and industrial sectors and in food production. Students will explore the development of applied microbiology in Malaysian industries

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. summarise basic principles of industrial fermentation and application of microbiology in food and pharmaceutical industries appropriately as well as the microbiological aspects of pollution and issues related to hygiene and sanitation in industrial microbiology (C4, PLO1)
2. display practical proficiency through group work in industrial microbiology laboratory experiment. (P2, PLO2)
3. appreciate the development of technologies in industrial microbiology through continuous learning. (A3, PLO6)

SUMMARY	(LECTURE : PRACTICAL)
SST	RTA
1.0 MICROBIOLOGY IN INDUSTRY This topic covers the principles of industrial fermentation, types of industrial fermentation, and products of industrial fermentation.	(04 : 00)
2.0 MICROBIOLOGY IN FOOD INDUSTRY This topic covers the principles of food microbiology, microorganisms in food production, food preservation and food spoilage.	(08 : 28)
3.0 MICROBIOLOGY IN PHARMACEUTICAL INDUSTRY This topic covers the principles of microbiology in pharmaceutical industry and the roles of microorganisms in the production of antibiotics and hormones.	(06 : 12)
4.0 MICROBIOLOGY AND THE ENVIRONMENT This topic covers the microbiological aspects of pollution, including the roles of microorganisms as pollutant, and their roles in reducing pollution.	(08 : 20)
5.0 FOOD HYGIENE AND SANITATION This topic covers the various methods used to reduce contamination and promote food hygiene in food industry.	(04 : 00)
DEPENDENT LEARNING COURSEWORK ASSESSMENT	(04)
RTA - Recommended Time Allocation	
SST - Suggested Sequence of Topics	

DYB5042 FINAL PROJECT 1

FINAL PROJECT 1 is a theoretical and practical - based study that guides the students to produce a well written research proposal in the field of biotechnology. It outlines the basic principles involved in the selection and choice of a research topic, the scope of the research, planning the research and research methodology. At the end of the study, the project proposal will be presented for evaluation purposes

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:-

1. select accordingly research related to the practice of biotechnology discipline. (C3,PL04)
2. produce a written proposal comprising research topic, introduction, literature review, research objectives, research questions or hypothesis, research design, research methods and proposed analysis. (C4,PL01)
3. present the proposal to an audience orally. (A4,PL06)

SUMMARY

(LECTURE:PRACTICAL)

SST

RTA

1.0 INTRODUCTION TO RESEACH METHODOLOGY

(10 : 00)

This topic discusses on final project planning, approach and project implementation related to biotechnology discipline. This topic covers different types of research, research design, research ethics, data collection methods and data analysis methods to enable students to plan and conduct a research study.

2.0 LITERATURE REVIEW AND RESEARCH TOPIC IDENTIFICATION

(04 : 00)

This topic explains the need for literature review to help identify and select a topic for research, the different sources for literature review that can be accessed, identify research objectives, research questions or hypothesis, problem statement and research rationale.

3.0 PROJECT PLANNING

(04 : 00)

This topic highlights the different aspects that need to be taken into consideration when conducting the research study identified. These aspects include research design, data collection methods, data

analysis methods, preparation of Gantt Chart, costing as well as types and quantity of materials and instruments required.

4.0 FORMAT OF A WRITTEN PROPOSAL AND A FINAL REPORT (06:00)

This topic outlines the format of a scientific proposal as well as the format for a final report emphasizing the difference between a proposal and a final report.

5.0 PROJECT PROPOSAL PRESENTATION (06:00)

This topic provides input to guide the oral presentation of a proposal including the preparation of appropriate audio visual aids.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (02)

RTA : Recommended Time Allocation

SST : Suggested Sequence of Topics

DYB 6013 FINAL PROJECT 2

PROJECT is a laboratory based study that requires the student to carry out a research project in the field of biotechnology. It outlines the basic principles involved in the selection and choice of a research topic, the scope of the research, planning and conducting the project. The findings of the study will be written as a report as well as presented for evaluation.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. apply the concept of biotechnology in conducting a research or case study. (C4, PLO4)
2. organize a selected project or case study based on planned design. (P4, PLO2)
3. organize an appropriate project report and present the findings orally. (A4, PLO3)

SUMMARY

(LECTURE : PRACTICAL)

	RTA
1.0 INTRODUCTION TO A RESEARCH PROJECT Review the proposal and prepare a Gantt Chart to conduct research project.	(00 : 02)
2.0 PROJECT PLANNING Prepare the project proposal, identify types and quantity of materials required, design methodology, select data collection methods, identify types of data analysis and calculate costing.	(00 : 30)
3.0 CONDUCTING RESEARCH PROJECT Conduct the project, identify problems encountered during the course of the project, consult project supervisor and submit draft reports for supervision.	(00 : 30)
4.0 PROGRESS REPORT (DRAFT 1) Sending a draft of the progress report to the supervisor for evaluation and approval.	(00 : 08)
5.0 PROJECT PRESENTATION Present project findings using appropriate audio visual aids before an evaluation panel.	(00 : 12)
6.0 WRITING PROJECT REPORT Write the project report and submit to the supervisor for evaluation.	(00 : 08)

DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)

RTA – Recommended Time Allocation
SST – Suggested Sequence of Topics

DYB6023 INSTRUMENTATION IN BIOTECHNOLOGY

INSTRUMENTATION IN BIOTECHNOLOGY emphasizes the use of instrumentation for chemical analysis. The theory, construction, application and operation of instrument are discussed. These instruments include spectrophotometry (visible, ultra violet, near infrared and infrared, emission, absorption), flame photometry, chromatography (gas, liquid, high pressure liquid) and mass spectrometry.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. Explain the functions and applications of different instruments in biotechnology. (C4, PL01)
2. Display practical proficiency through group work in instrumentation laboratory experiment. (P2, PL02)
3. Practice knowledge regarding to instrumentation in biotechnology professionally. (A5, PL08)

SUMMARY

(LECTURE : PRACTICAL)

	RTA
<p>1.0 SST INTRODUCTION TO INSTRUMENTATION Basic principles in handling analytical instruments, types of instruments, food analysis standards and general methods of analysis.</p>	(02 : 00)
<p>2.0 QUALITY LABORATORY MEASUREMENTS, TESTS AND ASSAY This topic covers standards, calibration and traceability; and their relationship, measurement error such as variability and error, accuracy and precision and evaluating of precision and accuracy of a measurement system.</p>	(04 : 04)
<p>3.0 SPECTROPHOTOMETER This topic covers basic the principles of spectroscopy, the types and components of spectrometers, sample preparation method, standard solutions preparation method, and procedures to conduct analysis using spectroscopy instrumentation.</p>	(06 : 08)
<p>4.0 CHROMATOGRAPHY This topic explains the working principles, components, parameter analyzed and handling procedure of Gas Chromatography, High Performance Liquid Chromatography and Thin Layer Chromatography.</p>	(14 : 12)
<p>5.0 ENZYME-LINKED IMMUNOSORBENT ASSAY (ELISA) PROCEDURES This topic covers basic ELISA procedures i.e. coating of wells with antibody, washing, incubation with test samples and peroxidase-conjugated antibody. Colour development and reading of results are also discussed. This topic also explains how to plot the standard curve on semi logarithmic paper with $A_{490\text{ nm}}$ as ordinate and \log_{10} concentration of standard as abscissa.</p>	(04 : 06)

DEPENDENT LEARNING COURSEWORK ASSESSMENT

(03)

RTA – Recommended Time Allocation

SST – Suggested Sequence of Topics

DYB6033 BIOPROCESS TECHNOLOGY

BIOPROCESS TECHNOLOGY introduces students to the theoretical and practical aspects of bioprocessing. Starting with the kinetics of microbial growth, students will also be given an exposure to the operation of bioreactors and have to run a series of experiments involving various types of processes and conditions. Besides that, students will also need to carry out downstream activities of bioprocess production such as extraction and purification.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. Explain the development and basic principles in bioprocess technology. (C4, PLO1)
2. Perform bioprocess procedures in line with safety precaution professionally. (P3, PLO2)
3. Justify the development of bioprocess technology intrinsically. (A3, PLO5)

SUMMARY

(LECTURE : PRACTICAL)

SST	RTA
<p>1.0</p> <p>INTRODUCTION TO BIOPROCESS TECHNOLOGY</p> <p>This topic covers the historical aspect of bioprocessing and its functions in the industry.</p>	<p>(02 : 02)</p>
<p>2.0</p> <p>MATERIAL BALANCE IN BIOPROCESS</p> <p>This topic covers basic understanding of the equation of mass conservation.</p>	<p>(04 : 00)</p>
<p>3.0</p> <p>BIOREACTORS AND ITS OPERATION</p> <p>This topic covers insights into the functions of bioreactors and their ancillaries. It also discusses the suitability of each equipment according to the characteristics of bioprocess operation.</p>	<p>(06 : 06)</p>

- 4.0 PREPARATION OF BIOPROCESS OPERATION (06 : 06)**
This topic covers all the preparations and setup involved in a bioprocess system.
- 5.0 FERMENTATION PROCESS (06 : 08)**
This topic covers the details of fermentation process and the functions of related equipment. It also explains the different conditions and characteristics of fermentation and the techniques of fermentation.
- 6.0 UPSTREAM AND DOWNSTREAM PROCESSING (06 : 08)**
This topic examines and differentiates related processes before and after fermentation.
- DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)**
RTA – Recommended Time Allocation
SST – Suggested Sequence of Topics

DYB5052 AGROBIOTECHNOLOGY

AGROBIOTECHNOLOGY introduces the students to the importance of agricultural sector and the breeding programs in Malaysia. This course focuses on the application of tissue culture, the development of genetically modified organisms (GMO), as well as the importance of detection of contaminants in agricultural produces, alongside with ethical issues and public concerns towards genetically modified organisms and bio-safety regulations.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. explain the importance of agricultural sector, and the scenarios of transformation of conventional breeding methods to modern biotechnology as well as the applications of genetic engineering, tissue culture, and detection of pathogens using biotechnology approaches, to improve life quality of human-beings. (C4, PL01)
2. generalise the importance of intellectual property, biosafety regulations, ethical issues and public concerns on genetically modified organisms (GMO). (C4, PL01)
3. justify bio-ethical issues and increasing public concerns over GMO. (A3, PL08)

SUMMARY	(LECTURE: PRACTICAL)
SST	RTA
1.0 INTRODUCTION TO MALAYSIAN AGRICULTURE This topic covers the importance of agricultural sector, and food and industrial crops that are of economic importance in Malaysia.	(02 : 00)
2.0 BREEDING OF IMPORTANT AGRICULTURE CROPS IN MALAYSIA This topic covers the a few crop breeding programs in Malaysia; and the limitations of conventional breeding programs.	(02 : 00)
3.0 GENETICALLY MODIFIED CROPS This topic covers the history of transgenic crops; and transgenic crops with herbicide tolerance, stem borer resistant, virus resistant and other desired trait	(08 : 00)
4.0 GENETICALLY ENGINEERED ANIMALS This topic covers transgenic animal as a model for human disease study; the development of transgenic livestock to increase meat or wool production, and for healthier and more robust animals; and transgenic animals as bioreactors to produce important human proteins or pharmaceuticals.	(04 : 00)
5.0 TISSUE CULTURE FOR CROP PROPAGATION AND HEALTH This topic covers propagation of planting materials of horticultural crops and disease-free planting materials.	(04 : 00)
6.0 DETECTION OF PATHOGENS AND CONTAMINANTS IN CROPS AND CROP PRODUCES This topic includes examples of pathogens causing diseases in several crops and their detection methods; and the importance of fast and reliable methods to detect contaminants in agricultural produces.	(04 : 00)
7.0 COMMERCIALIZATION OF GENETICALLY MODIFIED ORGANISMS AND PUBLIC CONCERNS This topic covers the concept and the importance of intellectual property including issues of patenting; public perceptions on genetically modified organism (GMO); and bio-safety regulations.	(06 : 00)
DEPENDENT LEARNING COURSEWORK ASSESSMENT	(02)
RTA – Recommended Time Allocation	
SST – Suggested Sequence of Topics	

DYB6042 FOOD BIOTECHNOLOGY

FOOD BIOTECHNOLOGY explores the field of biotechnology beginning with its origins and the use of genetic engineering techniques. Many of the applications of biotechnology will be discussed with emphasis placed on food biotechnology applications. Food commodities discussed in this course include fermentation of dairy products, fish, meat, vegetables, alcohol, acids, flavors, amino acids and enzymes. Ethical, safety and regulation issues will also be addressed.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. Explain the practice of biotechnology and the role of biotechnology in the production of certain food commodities. (C2, PL01)
2. Discuss the development and applications of genetically modified foods, and the ethical issues and arising public concerns. (C4, PL01)
3. Relate the public concerns regarding ethics, safety and regulation of biotechnology developments appropriately. (A4, PL08)

SUMMARY

(LECTURE : PRACTICAL)

SST

RTA

1.0

INTRODUCTION TO FOOD BIOTECHNOLOGY

This topic covers the definition and areas of food biotechnology, its importance to the food industry and its benefits to the consumers.

(04 : 00)

2.0 BIOTECHNOLOGY APPLICATION IN FOOD PRODUCT

This topic covers the applications of biotechnology approach in producing some food products and enzymes.

(10 : 00)

3.0 GENETICALLY MODIFIED (GM) FOODS

This topic covers the application of recombinant DNA techniques in food industry to produce genetically modified organisms (GMO). It also discuss on the implications, and challenges of genetically modified food.

(12 : 00)

4.0 ETHICS, SAFETY AND REGULATIONS

(04 : 00)

This topic covers the public perspectives of food biotechnology, safety assessment and regulation of Transgenic Crops and Diagnostic Tests, the development of biotechnology in developing countries and the future of food biotechnology industry.

DEPENDENT LEARNING COURSEWORK ASSESSMENT (02)

RTA – Recommended Time Allocation

SST – Suggested Sequence of Topics

DYB5023 ENZYMOLOGY

ENZYMOLOGY discusses the complex organic molecules acting as catalysts in living cells bringing about chemical changes in substances. This course introduces students to the classification of enzymes, the principles of enzyme kinetics, mechanism of reaction, factors affecting enzyme activity and the usage of enzymes in industrial processes to aid in different types of chemical transformations.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. point out characteristics of enzyme and enzyme activity; basic concepts on enzyme kinetic and enzyme regulation; as well as the applications of enzymes in various industries. (C4, PLO1)
2. display practical proficiency through group work during the laboratory experiments. (P2, PLO2)
3. justify the development and advancement of enzymology in modern era. (A3, PLO5)

SUMMARY

(LECTURE : PRACTICAL)

SST

RTA

1.0

INTRODUCTION TO ENZYMES

(08 : 06)

This topic covers the structures, functions, and classification of enzymes, the modes of enzyme actions and the importance of cofactors.

- | | |
|--|--------------------|
| 2.0 ENZYME ACTIVITY | (04 : 18) |
| This topic covers the units used and the different factors affecting enzyme activity, and how to perform enzyme assays. | |
| 3.0 ENZYME KINETICS | (10 : 06) |
| This topic covers First and Second Law of Thermodynamics, the enzyme kinetic theories by Michaelis-Menton, and Lineweaver-Burke, and also the mechanism of enzyme reactions. | |
| 4.0 ENZYMES IN INDUSTRIES | (08 : 00) |
| This topic covers the roles of enzymes and immobilized enzyme in food industries, clinical diagnosis, and other commercial applications. | |

DEPENDENT LEARNING COURSEWORK ASSESSMENT (03)
RTA - Recommended Time Allocation
SST - Suggested Sequence of Topics

DYB6052 ENVIRONMENTAL BIOTECHNOLOGY

ENVIRONMENTAL BIOTECHNOLOGY emphasizes knowledge and understanding of biotechnology as a tool to protect and conserve the environment. Two important areas of environmental biotechnology (waste treatment and bioenergy production) are also covered.

COURSE LEARNING OUTCOMES (CLO)

Upon completion of this course, students should be able to:

1. explain the importance of environmental biotechnology, and the applications of biofuels, bioremediation, waste water treatment, and metal biotechnology in protecting the environment. (C4, PLO1)
2. explain the risk of biohazard in environment and the increasing importance of hazardous waste management in modern era. (C2, PLO1)
3. justify the importance of biotechnology approach to reduce pollution and fighting global warming. (A3, PLO5)

SUMMARY

(LECTURE : PRACTICAL)

SST	RTA
<p>1.0 INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY This topic covers nature's cycle of matter, social-economic strategies and the benefits of biotechnology to the environment.</p>	(02 : 00)
<p>2.0 BIOHAZARD This topic covers hazard identification, hazard assessment, hazard control and administrative controls for biohazard.</p>	(04 : 00)
<p>3.0 HAZARDOUS WASTE MANAGEMENT This topic covers definitions and types of hazardous waste and biotechnology application on hazardous waste management such as detoxication of cyanite, oxalate, urea and petrochemical industrial effluents.</p>	(04 : 00)
<p>4.0 BIOREMEDIATION This topic covers types of bioremediation, usage of wastes as renewable source of energy and the production of biofuels: biogas, ethanol, hydrocarbon and hydrogen fuel.</p>	(04 : 00)
<p>5.0 BIOLOGICAL TREATMENT OF WASTE WATER This topic covers the types of waste water treatment such as aerobic and anaerobic biological treatment, the roles of microbes, the advantages and the constraints of each type of biological treatment.</p>	(06 : 00)
<p>6.0 METAL BIOTECHNOLOGY This topic covers bioleaching processes involving metals such as copper, uranium, gold, silver and silica.</p>	(04 : 00)
<p>7.0 BIOFUELS This topic covers the mechanism of methane formation, the types of fermentation system involved, the production of biogas from aquatic weeds, plants waste etc, the fermentation process in ethanol production and the environment impacts.</p>	(06 : 00)

**DEPENDENT LEARNING COURSEWORK ASSESSMENT
(03)**

**RTA – Recommended Time Allocation
 SST – Suggested Sequence of Topics**

4.0 POLYTECHNIC GENERAL COURSES

General studies department was established with the objective to help Politeknik Nilai introduce students to the importance and value of spiritual, human and universal human values of purity in a dignified living as well as emphasizing the importance of using the English oral skills (speaking and communication) and writing skills. This will enable students functioning effectively in the context of his future. In daily life every human being cannot prevent himself from human contact and interaction with each other. Thus, human relations through inter-personal aspects and intra-personal skills are an art which can assess the humanitarian in a person. Behaviour and actions cannot be taught through a technical education and professional skill only without spiritual and human values. Advanced nations in science and technology, but disregards the aspect of human behaviour will be considered as no glory and goodness of these people even seen as a nation who are not civilized and dignified. Therefore, the general education department serves as a complement to all departments in Politeknik Nilai in helping the students fill in the spiritual and human values.

The courses offered in this department are general courses which include modules in Islamic Education, Moral Education, Islamic Civilization, Communicative English, Co-Curricular, Soft Skills and Occupational Safety and Health (OSHA).

5.0 REGULATIONS FOR COURSE REGISTRATION

COURSE REGISTRATION

Students must:

1. Register courses within seven (7) days after semester begins.
2. Obtain the advice from Academic Advisor (PA) before register.
3. Submit the completed form to the Academic Advisor (PA)
4. Finally get the signature of Academic Advisor and Head of Department.

COURSE CREDIT

Credit for each course is as stated in the Document Kurikulum dan Struktur Kursus approved by Lembaga Kurikulum Kursus Pengajian dan program Latihan Politeknik. Number of credits to be taken by the student for each semester is between Twelve (12) to Twenty (20) or as specified in the Document Kurikulum dan Struktur Program. The minimum credit amount to be collected by the students before they are eligible to be considered for the award of a certificate are stated in the Document Kurikulum dan Struktur Program.

CARRY COURSES/CARRY SEMESTER

Students need to repeat all failed courses (grade point <2.00) including the General Courses (such as Islamic Studies, Civilization etc) and the Discipline Courses. Students with carry courses must discuss and get advice from Academic Advisor (PA) and approved by Head Of Department. Students should repeat all the learning activities of the courses in addition to other courses for that semester.

DROP/ADD COURSES

Students who have registered for courses can drop or add courses, provided that the number of credit hours for that semester no less or no more than a specified number of credit hours.

The dropping and adding courses must be done within the prescribed period and they must seek for advice from Academic Advisor (PA) and approval from Head of Department.

Drop/Add courses can be done during the third to six (3rd – 6th) week of the semester.

ATTENTION

Students who have registered should follow the learning activities for the course. In order to evaluate the learning activities undertaken by a student, students must achieve a minimum percentage of attendance.

(References: Arahan-arahan Peperiksaan dan Kaedah Penilaian dikeluarkan oleh Bahagian Pengurusan Politeknik, Edisi 4 2013)

