UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

BUKU PANDUAN PROGRAM

SESI AKADEMIK **2021/2022** *ACADEMIC SESSION*

UNDERGRADUATE STUDY PROGRAMME HAND BOOK

FAKULTI BIOTEKNOLOGI DAN SAINS BIOMOLEKUL

FACULTY OF BIOTECHNOLOGY AND BIOMOLECULAR SCIENCES

FAKULTI BIOTEKNOLOGI DAN SAINS BIOMOLEKUL

Maklumat Am

Fakulti Bioteknologi dan Sains Biomolekul (FBSB) telah ditubuhkan pada 1hb Ogos 2004 yang menggabungkan dua buah jabatan iaitu Jabatan Bioteknologi di Fakulti Sains Makanan dan Bioteknologi dan Jabatan Biokimia dan Mikrobiologi di Fakulti Sains dan Pengajian Alam Sekitar bagi memberikan penumpuan dan penekanan kepada bidang bioteknologi. Dengan tertubuhnya FBSB, semua aktiviti yang melibatkan bioteknologi dan sains biomolekul di UPM dapat dijalankan dibawah satu pentadbiran.

Penubuhan empat jabatan di FBSB iaitu Jabatan Biokimia, Jabatan Mikrobiologi, Jabatan Teknologi Bioproses dan Jabatan Biologi Sel dan Molekul menawarkan kursus yang boleh dijadikan sebagai teras program pengajian jabatan di samping menawarkan kursus teras atau kursus elektif. Selain dari pengajaran, pegawai akademik juga terlibat di dalam penyelidikan, pengembangan dan perundingan.

FBSB mempunyai kepakaran tenaga mahir dan pelbagai makmal yang dilengkapi dengan kemudahan dan peralatan asas dan berteknologi tinggi bagi menyokong aktiviti pengajaran, penyelidikan dan perkhidmatan profesional dalam bidang bioteknologi dan sains biomolekul. Semua pegawai akademik adalah berpengalaman dan mempunyai kemahiran teknikal yang luas dalam bidang kepakaran masing-masing. Buat masa ini terdapat 14 Profesor, 33 orang Profesor Madya dan 24 orang Pensyarah Kanan.

Kini, Fakulti menawarkan empat (4) program pengajian di peringkat Bacelor. Program pengajian yang ditawarkan adalah Bacelor Sains Biokimia dengan Kepujian, Bacelor Sains Mikrobiologi dengan Kepujian, Bacelor Sains Bioteknologi dengan Kepujian dan Bacelor Sains Biologi Sel dan Molekul dengan Kepujian.

FACULTY OF BIOTECHNOLOGY AND BIOMOLECULAR SCIENCES

General Information

The Faculty of Biotechnology and Biomolecular Sciences (FBBS) was established on 1st August 2004 with the merger of two departments, the Department of Biotechnology from the Faculty of Food Science and Biotechnology and the Department of Biochemistry and Microbiology from the Faculty of Science and Environmental Studies, for greater focus and emphasis on the field of biotechnology. With the formation of FBBS, all activities related to biotechnology and biomolecular sciences at UPM are now under one administration.

Four departments namely Department of Biochemistry, Department of Microbiology, Department of Bioprocess Technology and Department of Cell and Molecular Biology were established. Each department in FBBS offers core and elective courses for its own programs as well as other programs or majors. Apart from teaching, research, development and consultancy are the forte of this Faculty.

FBBS has the necessary expertise and is equipped with basic and high-tech facilities and equipment that support teaching, research, and professional services in biotechnology and biomolecular sciences. The academic staff comprises experienced lecturers respected in their respective fields of expertise, and young enthusiastic PhD holders with advanced technical knowledge trained in some of the best laboratories worldwide. Currently, the Faculty is staffed by 14 Professors, 33 Associate Professors and 24 Senior Lecturers.

At present the Faculty offers four (4) academic programs at the Bachelor's degree level. The programs offered are Bachelor of Science in Biochemistry with Honours, Bachelor of Science in Microbiology with Honours, Bachelor of Science in Biotechnology with Honours and Bachelor of Science in Cell and Molecular Biology with Honours.

Pengurusan Fakulti/ *Faculty Management*

Dekan/ *Dean*
Prof. Dr. Shuhaimi Mustafa

Timbalan Dekan (Akademik & Hal Ehwal Pelajar)
Deputy Dean of Academic & Student Affairs
Prof. Madya Dr. Muhajir Hamid

Timbalan Dekan (Penyelidikan & Pengajian Siswazah)
Deputy Dean of Research & Postgraduate Studies
Prof. Dr. Rosfarizan Mohamad

Timbalan Dekan (Jaringan Industri & Masyarakat)
Deputy Dean of industry & Community Relations
Prof. Ts. Dr. Hidayah Ariffin

Ketua Jabatan Mikrobiologi
Head, Dept. of Microbiology
Prof. Madya Dr. Mohd Termizi Yusof

Ketua Jabatan Biokimia
Head, Dept. of Biochemistry
Prof. Madya Dr. Syahida Ahmad

Ketua Jabatan Biologi Sel & Molekul
Head, Dept. of Cell & Molecular Biology
Prof. Madya Dr. Adam Leow Thean Chor

Ketua Jabatan Teknologi Bioproses
Head, Dept. of Bioprocess Technology
Prof. Madya Dr. Mohd Zulkhairi Mohd Yusoff

Ketua Penolong Pendaftar
Chief Assistant Registrar
Encik Mohd Radzi Mahidin

Program Prasiswazah yang ditawarkan

Bacelor

1. Bacelor Sains Biokimia dengan Kepujian / *Bachelor of Science in Biochemistry with Honours*
2. Bacelor Sains Mikrobiologi dengan Kepujian / *Bachelor of Science in Microbiology with Honours*
3. Bacelor Sains Bioteknologi dengan Kepujian / *Bachelor of Science in Biotechnology with Honours*
4. Bacelor Sains Biologi Sel dan Molekul dengan Kepujian / *Bachelor of Science in Cell and Molecular Biology with Honours*

SKEMA PENGAJIAN PAKEJ ELEx UNTUK PROGRAM 4 TAHUN
BERKUATKUASA UNTUK AMBILAN OKTOBER 2021 DAN SETERUSNYA
ELEx SCHEME FOR 4 YEARS PROGRAMMES FROM OCTOBER 2021 INTAKE ONWARDS

CEFR Tahap	MUET Tahap	TOEFL/IELTS Skor	CIEP Tahap	Pearson Test of English (PTE) Academic Skor	Cambridge English Skor	Keperluan Bergraduat
C1 – C2	5.0 – 5+	TOEFL iBT 95 – 120 IELTS 7.0 – 9.0	-	76 - 90	180 – 230	2 LPE + 1 CEL + 24 mata LAX atau 1 LPE + 1 CEL + 24 mata LAX + 1 Bahasa global
B1 – B2	3.0 – 4.5	TOEFL iBT 42 – 94 IELTS 4.0 – 6.5	104 – 109	43 – 75	140 – 179	2 LPE + 2 CEL + 24 mata LAX
A2	2.0 - 2.5	TOEFL iBT N/A IELTS 3.0 – 3.5	101 – 103	30 – 42	120 – 139	3 LPE + 3 CEL + 24 mata LAX

Semester	SKEMA UNTUK PROGRAM 4 TAHUN			
	MUET 2.0 – 2.5 IELTS 3.0 – 3.5 CIEP 101 – 103 PTE 30 – 42 CE 120 – 139		**MUET 3.0 – 4.5 TOEFL iBT 42 – 94 IELTS 4.0 – 6.5 CIEP 104 – 109 PTE 43 – 75 CE 140 – 179**	**MUET 5.0 – 5+ TOEFL iBT 95 – 120 IELTS 7.0 – 9.0 PTE 76 – 90 CE 180 – 230**
1	**LAX 12 mata**		**LAX 6 mata**	**LAX 6 mata**
2	**CEL2102**	**LAX 6 mata**	**LPE2301**	**Pilih SATU: CEL 2103/2104**
3	**LPE2401**		**LPE2501**	**Pilih SATU: LPE2402/LPE2502/ Bahasa global**
4	**LPE2301**		**LAX 6 mata**	**LAX 6 mata**
5	**LPE2501**		**Pilih SATU: CEL 2105/2106/2107**	**Pilih SATU: LPE2402/LPE2502/ Bahasa global**
6	**Pilih SATU: CEL 2105/2106/2107**		**Pilih SATU: CEL 2105/2106/2107**	**LAX 6 mata**
7	**Pilih SATU: CEL 2105/2106/2107**		**LAX 6 mata**	**LAX 6 mata**
8	**LAX 6 mata**		**LAX 6 mata**	**-**

Note:

Students must follow the prescribed scheme of study based on their MUET results (or equivalent) everysemester.

- MUET Band 5 and 6 students can choose to enrol in either one or two LPE courses. If they choose to do one LPE course, they must also enrol in one global language.

- Students who are away on Industrial Training in any semester do not have to enrol in any course or LAX activity for that particular semester. However, they must enrol in a course or LAX activity inthe prior or subsequent semester (subject to course pre-requisites).

ELEx Package Information

I. LPE Courses [(2+1) credits]

- LPE2401 (Reading for Academic Purposes)
- LPE2301 (Academic Interaction and Presentation)
- LPE2501 (Academic Writing)
- LPE2502 – for MUET Band 5 & 6 students only
- LPE2402 – for MUET Band 5 & 6 students only

Note: If students fail in a LPE course, they must repeat and pass the course before they can enrol in asubsequent LPE course.

II. CEL Courses

- CEL2102 (Effective Listening and Speaking)
- CEL2103 (Writing Academic Texts)
- CEL2105 (Spoken Communication for the Workplace)
- CEL2106 (Communication for Professional Development)
- CEL2107 (Written Business Communication)

Note: If students obtain LEVEL 1, they must repeat and pass the course (LEVEL 2 and above).

III. LAX

- LAX (6 points or 12 points); 1 point = 2 hours per week
- 6-point LAX = 6 weeks x 2 hours per week
- 12-point LAX = 12 weeks x 2 hours per week

Note: If students obtain TM (*Tidak Memuaskan*/Unsatisfactory), they must enrol in the same or different LAX activity to replace the failed points. Students must ensure that they fulfil the required number of LAXpoints for graduation.

Bacelor Sains Biokimia dengan Kepujian

Bachelor of Science in Biochemistry with Honours

KURIKULUM/ *CURRICULUM STRUCTURE*

Nama Program	:	**Bacelor Sains Biokimia dengan Kepujian / *Bachelor of Science in Biochemistry with Honours***
Jumlah Kredit Bergraduat	:	**122 Jam Kredit/ *Credit Hours***
Tempoh Pengajian	:	**8 Semester/ *Semesters* (4 Tahun/ *Years*)**

Matlamat Program :

1. Melahirkan ahli biokimia yang mempunyai pengetahuan asas yang kukuh dan kemahiran teknikal dalam bidang biokimia
2. Melahirkan graduan yang mempunyai pemikiran kritis untuk membangunkan ekonomi Negara berasaskan biokimia
3. Melahirkan graduan yang mempunyai sikap yang positif dan boleh menyesuaikan diri dengan persekitaran kerja global yang kompetitif
4. Melahirkan graduan yang beretika, berintegriti, inovatif, proaktif serta meneruskan pembelajaran sepanjang hayat dalam bidang biokimia serta bidang lain yang diceburi

RINGKASAN HASIL PEMBELAJARAN PROGRAM

Program	Pengetahuan	Kemahiran Teknikal/Praktikal/ Psikomotor	Pendekatan Kemahiran Berfikir dan Saintifik	Kemahiran Berkomunikasi	Kemahiran Sosial dan Bertanggungjawab	Professionalisme, Nilai, Sikap dan Etika	Pendidikan Sepanjang Hayat dan Pengurusan Informasi	Kemahiran Pengurusan dan Keusahawanan	Kemahiran Kepimpinan	Kemahiran Numerasi
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Bacelor Sains Biokimia dengan Kepujian	38	17	21	18	15	11	10	5	5	3

1. Kursus Universiti/ *University Courses* (25 kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
LPE2301	*Academic Interaction and Presentation*	3	3	0	LPE2401/CEL2102
LPE2501	*Academic Writing*	3	3	0	LPE2301
FCE3204	Kemahiran Berfikir/ *Thinking Skills*	2	2	0	Tiada/ None
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0	Tiada/ None
MGM3180	Asas Keusahawanan/ *Basic Entrepreneurship*	3	2	1	Tiada/ None
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1	Tiada/ None

SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0	Tiada/ None
FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0	
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0	Tiada/ None
SKP3113**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society*				
atau/ *or*	atau/ *or*	3	3	0	Tiada/ None
SKP3123**	Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*				
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0	Tiada/ None
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0	Tiada / None
	Kokurikulum/ *Co-curriculum*	1	0	1	Tiada/ None
	Kokurikulum/ *Co-curriculum*	1	0	1	Tiada/ None

Nota: * pelajar tempatan/ *local student* **pelajar antarabangsa/ *international student*

2. Kursus Teras/ *Core Courses* (64 kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BCH3106	Teknik dan Pengiraan Asas dalam Biokimia/*Basic Techniques and Calculations in Biochemistry*	2	1	1	Tiada/ None
BCH3107	Biomolekul/ *Biomolecules*	3	3	0	Tiada/ None
BCH3108	Enzimologi/ *Enzymology*	4	3	1	BCH3001 atau BCH3107
BCH3109	Metabolisme Karbohidrat/ *Carbohydrate Metabolism*	3	2	1	BCH3108
BCH3110	Metabolisme Protein dan Asid Nukleik/ *Protein and Nucleic Acid Metabolism*	4	3	1	BCH3108
BCH3111	Metabolisme Lipid dan Membran/ *Lipid Metabolism and Membranes*	4	3	1	BCH3108
BCH3203	Analisis Biomolekul/ *Analysis of Biomolecules*	2	1	1	BCH3002 atau BCH3108
BCH4101	Biokimia Hormon/ *Biochemistry of Hormones*	3	3	0	BCH3108 atau BCH3002
BCH4901	Latihan Industri/ *Industrial Training*	6	0	6	BCH3109 atau BCH3110 atau BCH3111
BCH4902	Topik Khas dalam Biokimia/ *Current Topics in Biochemistry*	2	2	0	BCH3109 atau BCH3110 atau BCH3111

BCH4959	Disertasi Bacelor/ *Bachelor Dissertation*	6	0	6	BCH3109 atau BCH3110 atau BCH3111
BCH4904	Pembelajaran Perkhidmatan dalam Biokimia/ *Service Learning in Biochemistry*	1	0	1	BCH3109 atau BCH3110 atau BCH3111
BMY3001	Mikrobiologi/ *Microbiology*	4	4	0	Tiada/ None
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2	Tiada/ None
BSM3101	Biologi Sel dan Perkembangan/ *Cellular and Developmental Biology*	3	3	0	Tiada/ None
BSM3201	Biologi Molekul/ *Molecular Biology*	3	3	0	Tiada/ None
BSM4301	Bioinformatik/ *Bioinformatics*	3	2	1	BSM3201 atau BCH3107
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1	Tiada/ None
BGY3701	Biostatistik/ *Biostatistics*	3	2	1	Tiada/ None
BCH4303	Aplikasi Biokimia dalam Industri/ *Industrial Applications of Biochemistry*	3	3	0	BCH3002 atau BCH3108

Pelajar dikehendaki mengambil 21 kredit dari kursus yang tersenarai dalam Elektif Bidang Biokimia, di mana 15 kredit perlu diambil daripada kursus elektif jabatan manakala 6 kredit lagi boleh diambil daripada kursus elektif jabatan atau kursus elektif luar jabatan. (*Students are required to take 21 credits of elective courses that are listed in the Elective in Biochemistry , where 15 credits of elective courses must be taken from the department while 6 more credits can be taken from elective courses in the department or elective courses outside the department*)

Seterusnya pelajar perlu mengambil 6 kredit dari kursus yang tersenarai dalam kursus Elektif Pengurusan dan Kemanusiaan dan mengambil kursus Elektif Bebas sebanyak 6 kredit termasuk satu kursus bahasa global. (*The students must take 6 credits from the courses listed in the Management and Humanities Elective courses and take 6 credits from Free Elective courses include one global language courses.*)

3. Kursus Elektif / *Elective Course*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
Kursus Elektif Bidang Biokimia/ (*Elective Course in Biochemistry*) (21 kredit/ *credits*)					
BCH4301	Biokimia Tumbuhan/ *Plant Biochemistry*	3	3	0	BCH3108 atau BCH3002
BCH4302	Manipulasi Genetik Tumbuhan/ *Plant Genetic Manipulation*	3	2	1	BCH4301
BCH4304	Biokimia Makanan/ *Food Biochemistry*	3	3	0	BCH3002 atau BCH3108
BCH4305	Biokimia Pemakanan/ *Nutritional Biochemistry*	3	3	0	BCH3002 atau BCH3108
BCH4306	Biokimia Tisu Haiwan/ *Biochemistry of Animal Tissues*	3	3	0	BCH3002 atau BCH3108

BCH4307	Biokimia Alam Sekitar/ *Environmental Biochemistry*	3	3	0	BCH3002 atau BCH3108
BCH4308	Teknik Dalam Metabolomik/ *Techniques in Metabolomics*	3	2	1	BCH3109 atau BCH3110 atau BCH3111
BMY4301	Bakteriologi/ *Bacteriology*	3	3	0	BMY3102 atau BMY3001
BMY4302	Virologi/ *Virology*	3	3	0	BMY3102 atau BMY3001
BMY4303	Mikologi/ *Mycology*	3	3	0	BMY3102 atau BMY3001
BMY4304	Imunologi/ *Immunology*	3	3	0	BMY3102 atau BMY3001
BMY4305	Ekologi Mikrob/ *Microbial Ecology*	3	3	0	BMY3102 atau BMY3001
BMY4309	Mikrobiologi Makanan Gunaan/ *Applied Food Microbiology*	3	3	0	BMY3102 atau BMY3001
BSM3202	Kejuruteraan Genetik/ *Genetic Engineering*	4	3	1	BSM3201
BSM3204	Prinsip Genetik/ *Principles of Genetics*	3	2	1	Tiada/ None
BSM3401	Kultur Sel dan Tisu Haiwan/ *Animal Cell and Tissue Culture*	3	2	1	BSM3101
BSM3501	Kultur Sel dan Tisu Tumbuhan/ *Plant Cell and Tissue Culture*	3	2	1	BSM3101
BSM4701	Bahan Nano dan Bioteknologi/ *Nanomaterials and Biotechnology*	3	2	1	BCH3201 atau BCH3107
BTC3402	Pengurusan dan Penggunaan Sisa/ *Waste Management and Utilization*	3	2	1	Tiada/ None
BTC4104	Bioteknologi Makanan/ *Food Biotechnology*	3	2	1	BTC3101
BTC4205	Mikrobiologi Industri/ *Industrial Microbiology*	3	2	1	BMY3001 atau BMY3101
Kursus Elektif Pengurusan Dan Kemanusiaan / *Management and Humanities Elective Course (*6 kredit/ *credits*)					
ACT2111	Pengantar Perancangan dan Penggunaan Maklumat Kewangan/ *Introduction to planning and use of financial information*	3	3	0	Tiada/ None
ACT3211	Pengurusan Kewangan/ *Financial Management*	3	3	0	ACT3112 atau ACT3113
ECN3010	Prinsip Ekonomi/ *Principles of Economics*	3	3	0	Tiada/ None
MGM3101	Prinsip Pengurusan/ *Principles of Management*	3	3	0	Tiada/ None
MGM3113	Gelagat Organisasi/ *Organizational Behavior*	3	3	0	MGM3101
MGM3211	Prinsip Pemasaran/ *Principles of Marketing*	3	3	0	Tiada/ None

MGM4174	Pengurusan Perkhidmatan/ *Services Management*	3	3	0	MGM3211
MGM4184	Pengurusan Perniagaan Kecil/ *Small Business Management*	3	3	0	MGM3101
MGM4187	Pengurusan Usahaniaga Baharu/ *New Venture Management*	3	3	0	MGM3211 dan ACT3211
SKM2300	Pengenalan Kepada Multimedia/ *Introduction to Multimedia*	3	2	1	Tiada/ None
Kursus Elektif Bebas/ (*Elective Course*) (6 kredit/*credits*)					
BBA2401	Bahasa Arab I/ *Arabic I*	3	2	1	Tiada/ None
BBC2401	Bahasa Cina I/ *Chinese I*	3	2	1	Tiada/ None
BBD2401	Bahasa Jerman I/ *German I*	3	2	1	Tiada/ None
BBE2401	Bahasa Korea I/ *Korean I*	3	2	1	Tiada/ None
BBF2401	Bahasa Perancis I/ *French I*	3	2	1	Tiada/ None
BBJ2401	Bahasa Jepun I/ *Japanese I*	3	2	1	Tiada/ None
	Elektif Bebas	3			

Nota/ Notes : Kr = Jam Kredit/ *Credit Hour*, K = Kuliah/ *Lecture*, A = Amali/ *Laboratory*, T = Tutorial

Nota Penting/*Important Notes* :

1. **Pelajar diwajibkan memilih 2 kredit daripada kursus kokurikulum yang ditawarkan oleh universiti/ *It is compulsory for students to take 2 credits of co-curriculum courses offered by the university***
2. **Pelajar perlu melengkapkan pakej keperluan Bahasa Inggeris seperti jadual di bawah : (Butiran lanjut mengenai CEL dan LAX sila rujuk di muka surat belakang buku panduan ini)**
   Students need to complete the English package as the table below : For more details on CEL and LAX please refer to the back/last page of this book.

MUET Band	TOEFL/IELTS Score	CIEP Level	Graduation Requirements for 4-year programmes
1 & 2	-	107	3 LPE + 3 CEL + 24 LAX points
3 & 4	TOEFL 500 - 599 IELTS 5.5 - 6.5	108 – 109	2 LPE + 2 CEL + 24 LAX points
5 & 6	TOEFL 600 - 677 IELTS 7.0 - 9.0	-	2 LPE + 1 CEL + 24 LAX points or 1 LPE + 1 CEL + 24 LAX points (+1 global language)

SKEMA PENGAJIAN/ *STUDY SCHEME*

TAHUN 1/ *1ST YEAR*

SEMESTER 1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0
FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0
SKP3113**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society*			
atau/ *or*	atau/ *or*	3	3	0
SKP3123**	Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*			
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1
BCH3106	Teknik dan Pengiraan Asas dalam Biokimia/*Basic Techniques and Calculations in Biochemistry*	2	1	1
BCH3107	Biomolekul/ *Biomolecules*	3	3	0
BSM3101	Biologi Sel dan Perkembangan/ *Cellular and Developmental Biology*	3	3	0
QKXXXX	Kokurikulum/ *Co-curriculum*	1	0	1
CEL2102	*Effective Listening and Speaking*			
LAX				
	JUMLAH/ *TOTAL*	**17**	**14**	**3**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
LPE2301	*Academic Interaction and Presentation*	3	3	0
MGM3180	Asas Keusahawanan/ *Basic Entrepreneurship*	3	2	1
BCH3108	Enzimologi/ *Enzymology*	4	3	1
BMY3001	Mikrobiologi/ *Microbiology*	4	4	0
BSM3201	Biologi Molekul/ *Molecular Biology*	3	3	0
	JUMLAH/ *TOTAL*	**17**	**15**	**2**

TAHUN 2/ *2ND YEAR*

SEMESTER1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
LPE2501	*Academic Writing*	3	3	0
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2
BCH3109	Metabolisme Karbohidrat*/ Carbohydrate Metabolism*	3	2	1
BCH3203	Analisis Biomolekul/ *Analysis of Biomolecules*	2	1	1
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0
	Elektif/ *Elective*	6		
	JUMLAH/ *TOTAL*	**18**	**10**	**4**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
FCE3204	Kemahiran Berfikir/ *Thinking Skills*	2	2	0
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1
BCH3110	Metabolisme Protein dan Asid Nukleik/ *Protein and Nucleic Acid Metabolism*	4	3	1
BSM4301	Bioinformatik/ *Bioinformatics*	3	2	1
	Elektif/ *Elective*	6		
	Kokurikulum/ *Co-curriculum*	1	0	1
	JUMLAH/ *TOTAL*	**18**	**7**	**4**

TAHUN 3/ *3RD YEAR*

SEMESTER 1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BCH3111	Metabolisme Lipid dan Membran/ *Lipid Metabolism and Membranes*	4	3	1
BCH4101	Biokimia Hormon/ *Biochemistry of Hormones*	3	3	0

BGY3701	Biostatistik/ *Biostatistics*	3	2	1
	Elektif/ *Elective*	6		
LAX				
	JUMLAH/ *TOTAL*	**16**	**8**	**2**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BCH4959A	Disertasi Bacelor/ *Bachelor Dissertation*	3	0	3
BCH4902	Topik Khas dalam Biokomia/ *Current Topics in Biochemistry*	2	2	0
BCH4904	Pembelajaran Perkhidmatan dalam Biokimia/ *Service Learning in Biochemistry*	1	0	1
	Elektif/ *Elective*	6		
	JUMLAH/ *TOTAL*	**15**	**2**	**4**

TAHUN 4/ *4TH YEAR*

SEMESTER 1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BCH4959B	Disertasi Bacelor/ *Bachelor Dissertation*	3	0	3
BCH4303	Aplikasi Biokimia dalam Industri/ *Industrial Applications of Biochemistry*	3	3	0
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0
	Elektif/ *Elective*	6		
	JUMLAH/ *TOTAL*	**15**	**6**	**3**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BCH4901	Latihan Industri/ *Industrial Training*	6	0	6
	JUMLAH/ *TOTAL*	**6**	**0**	**6**

Bacelor Sains Mikrobiologi dengan Kepujian

Bachelor of Science in Microbiology with Honours

STRUKTUR KURIKULUM/ *CURRICULUM STRUCTURE*

Nama Program	**:**	**Bacelor Sains Mikrobiologi dengan Kepujian / *Bachelor of Science in Microbiology with Honours***
Jumlah Kredit Bergraduat	**:**	**126 Jam Kredit/ *Credit Hours***
Tempoh Pengajian	**:**	**8 Semester/ *Semesters* (4 Tahun/ *Years*)**
Matlamat Program	**:**	1. melahirkan ahli mikrobiologi yang berpengetahuan tinggi dalam aspek teori dan praktikal serta berdaya saing bagi menerajui bidang berkaitan mikrobiologi negara 2. melahirkan penyelidik yang berfikiran kritis dalam mengaplikasi pengetahuan mikrobiologi dalam pengajian lanjutan 3. melahirkan graduan yang inovatif, beretika dan berintegriti dalam bidang yang diceburi

RINGKASAN HASIL PEMBELAJARAN PROGRAM

Program	Pengetahuan	Kemahiran Teknikal/Praktikal/ Psikomotor	Pendekatan Kemahiran Berfikir dan Saintifik	Kemahiran Berkomunikasi	Kemahiran Sosial dan Bertanggungjawab	Professionalisme, Nilai, Sikap dan Etika	Pendidikan Sepanjang Hayat dan Pengurusan Informasi	Kemahiran Pengurusan dan Keusahawanan	Kemahiran Kepimpinan	Kemahiran Numerasi
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Bacelor Sains Mikrobiologi dengan Kepujian	39	19	18	19	15	14	18	6	4	7

1. Kursus Universiti/ *University Courses* (25 kredit */ credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
LPE2301	*Academic Interaction and Presentation*	3	3	0	LPE2401/CEL2102
LPE2501	*Academic Writing*	3	3	0	LPE2301
FCE3204	Kemahiran Berfikir/ *Thinking Skills*	2	2	0	Tiada/ None
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0	Tiada/ None
MGM3180	Asas Keusahawanan/ *Basic Entrepreneurship*	3	2	1	Tiada/ None
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1	Tiada/ None
SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0	Tiada/ None

FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0	
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0	Tiada/ None
SKP3113**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society*				
atau/ *or*	atau/ *or*	3	3	0	Tiada/ None
SKP3123**	Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*				
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0	Tiada/ None
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0	Tiada / None
	Kokurikulum/ *Co-curriculum*	2	0	2	

Nota: * pelajar tempatan/ *local student* **pelajar antarabangsa/ *international student*

2. Kursus Teras/ *Core Courses* (68 kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BCH3106	Teknik dan Pengiraan Asas dalam Biokimia/*Basic Techniques and Calculations in Biochemistry*	2	1	1	Tiada/ None
BCH3107	Biomolekul/ *Biomolecules*	3	3	0	Tiada/ None
BCH3108	Enzimologi/ *Enzymology*	4	3	1	BCH3001 atau BCH3107
BMY3101	Mikrobiologi I/ *Microbiology I*	4	4	0	Tiada/ None
BMY3102	Mikrobiologi II/ *Microbiology II*	4	4	0	BMY3101
BMY3103	Fisiologi Mikrob/ *Microbial Physiology*	3	3	0	BMY3102 atau BMY3001
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2	Tiada/ None
BMY3202	Teknik Pencirian Mikroorganisma/ *Techniques in Microbial Characterization*	3	0	3	BMY3201
BMY3203	Teknik Mikrobiologi Lanjutan/ *Advanced Microbiological Techniques*	3	0	3	BMY3202
BMY4301	Bakteriologi/ *Bacteriology*	3	3	0	BMY3102 atau BMY3001
BMY4302	Virologi/ *Virology*	3	3	0	BMY3102 atau BMY3001
BMY4303	Mikologi/ *Mycology*	3	3	0	BMY3102 atau BMY3001
BMY4304	Imunologi/ *Immunology*	3	3	0	BMY3102 atau BMY3001

BMY4310	Genetik Mikrob/ *Microbial Genetics*	4	3	1	BMY3102 atau BMY3001
BMY4901	Latihan industri/ *Industrial Training*	6	0	6	Tiada/ None
BMY4904	Pembelajaran Perkhidmatan Dalam Mikrobiologi/ *Service Learning in Microbiology*	1	0	1	BMY3203
BMY4992	Topik Terkini Mikrobiologi/ *Current Topics in Microbiology*	2	0	2	BMY3203
BMY4959	Disertasi Bacelor/ *Bachelor Dissertation*	6	0	6	Tiada/ None
BSM4301	Bioinformatik/*Bioinformatics*	3	2	1	BSM3201 atau BCH3107
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1	Tiada/ None
BGY3701	Biostatistik/ *Biostatistics*	3	2	1	Tiada/ None

3. Kursus Elektif/ *Elective Course* (33 kredit/ *credits*)

Pelajar perlu mengambil 33 kredit bagi kursus elektif merangkumi/ *Student must take 33 credits of elective course* encompass :
i. 21 kredit minimum bagi elektif teras/ *Minimum 21 credits of core elective*
ii. 6 kredit Elektif pengurusan dan kemanusiaan/ *6 credits of Management and Humanities Elective*
iii. 6 kredit Elektif Bebas (3 kredit mesti kursus bahasa global)/ *6 credits of elective (3 credits must from the global language course)*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
Kursus Elektif Teras/ *Core Elective Courses* (21 kredit)					
BMY4201	Teknik Khas dalam Mikrobiologi/ *Specialised Techniques in Microbiology*	3	0	3	BMY3203
BMY4305	Ekologi Mikrob/ *Microbial Ecology*	3	3	0	BMY3102 atau BMY3001
BMY4306	Mikrobiologi Patogenik/ *Pathogenic Microbiology*	3	3	0	BMY3102 atau BMY3001
BMY4307	Fisiologi Kulat/ *Fungal Physiology*	3	3	0	BMY4303
BMY4309	Mikrobilogi Makanan Gunaan/ *Applied Food Microbiology*	3	3	0	BMY3102 atau BMY3001
BCH3109	Metabolisme Karbohidrat/ *Carbohydrate Metabolism*	3	2	1	BCH3108
BCH3110	Metabolisme Protein dan Asid Nukleik/ *Protein and Nucleic Acid Metabolism*	4	3	1	BCH3108
BCH3111	Metabolisme Lipid dan Membran/ *Lipid Metabolism and Membranes*	4	3	1	BCH3108
BCH3203	Analisis Biomolekul/ *Analysis of Biomolecules*	2	1	1	BCH3002 atau BCH3108
BCH4301	Biokimia Tumbuhan/ *Plant Biochemistry*	3	3	0	BCH3108 atau BCH3002

BCH4302	Manipulasi Genetik Tumbuhan/ *Plant Genetic Manipulation*	3	2	1	Tiada/ None
BCH4303	Aplikasi Biokimia dalam Industri/ *Industrial Applications of Biochemistry*	3	3	0	BCH3002 atau BCH3108
BCH4304	Biokimia Makanan/ *Food Biochemistry*	3	3	0	BCH3002 atau BCH3108
BCH4305	Biokimia Pemakanan/ *Nutritional Biochemistry*	3	3	0	BCH3002 atau BCH3108
BCH4307	Biokimia Alam Sekitar/ *Environmental Biochemistry*	3	3	0	BCH3002 atau BCH3108
BSM3104	Prinsip Kultur Sel dan Tisu/ *Principles of Cell and Tissue Culture*	3	2	1	Tiada/ None
BSM4601	Kejuruteraan Protein/ *Protein Engineering*	4	3	1	BSM3202 dan BMY4310 dan BSM4301
BTC3002	Komersilalisasi dan Isu Semasa Bioteknologi/ *Commercialisation and Current Issues in Biotechnology*	2	2	0	Tiada/ None
BTC3201	Teknologi Fermentasi/ *Fermentation Technology*	4	3	1	BMY3001 atau BMY3101
BTC3402	Pengurusan dan Penggunaan Sisa/ *Waste Management and Utilisation*	3	2	1	Tiada/ None
BTC4001	Biokeselamatan Dan Bioetika/ *Biosafety and Bioethics*	2	2	0	Tiada/ None
BTC4205	Mikrobiologi Industri/ *Industrial Microbiology*	3	2	1	BMY3001 atau BMY3101
Kursus Elektif Pengurusan Dan Kemanusiaan / *Management and Humanities Elective Course* (6 kredit/*credits*)					
ACT2111	Pengantar Perancangan Dan Penggunaan Maklumat Kewangan/ *Introduction to planning and use of financial information*	3	3	0	Tiada/ None
ACT3211	Pengurusan Kewangan/ *Financial Management*	3	3	0	ACT3112 atau ACT3113
ECN3010	Prinsip Ekonomi/ *Principles of Economics*	3	3	0	Tiada/ None
MGM3101	Prinsip Pengurusan/ *Principles of Management*	3	3	0	Tiada/ None
MGM3113	Gelagat Organisasi/ *Organizational Behavior*	3	3	0	MGM3101
MGM3211	Prinsip Pemasaran/ *Principles of Marketing*	3	3	0	Tiada/ None
MGM4174	Pengurusan Perkhidmatan/ *Services Management*	3	3	0	MGM3211
MGM4184	Pengurusan Perniagaan Kecil/ *Small Business Management*	3	3	0	MGM3101
MGM4187	Pengurusan Usahaniaga Baharu/ *New Venture Management*	3	3	0	MGM3211 dan ACT3211

SKM2300	Pengenalan Kepada Multimedia/ *Introduction to Multimedia*	3	2	1	Tiada/ None
Kursus Elektif Bebas/ *Elective Course* (6 kredit/*credits*)					
BBA2401	Bahasa Arab I/ *Arabic I*	3	2	1	Tiada/ None
BBC2401	Bahasa Cina I/ *Chinese I*	3	2	1	Tiada/ None
BBD2401	Bahasa Jerman I/ *German I*	3	2	1	Tiada/ None
BBE2401	Bahasa Korea I/ *Korean I*	3	2	1	Tiada/ None
BBF2401	Bahasa Perancis I/ *French I*	3	2	1	Tiada/ None
BBJ2401	Bahasa Jepun I/ *Japanese I*	3	2	1	Tiada/ None
	Ekeltif Bebas	3			

Nota/ Notes : Kr = Jam Kredit/ *Credit Hour*, K = Kredit/ *Credit*, A = Amali/ *Laboratory*, T = Tutorial

Nota Penting/*Important Notes* :

1. **Pelajar diwajibkan memilih 2 kredit daripada kursus kokurikulum yang ditawarkan oleh universiti/ It is *compulsory for students to take 2 credits of co-curriculum courses offered by the university***
2. ***Pelajar perlu melengkapkan pakej keperluan bahasa inggeris seperti jadual di bawah : (Butiran lanjut mengenai CEL dan LAX sila rujuk di muka surat belakang buku panduan ini)***
   Students need to complete the english package as the table below : For more details on CEL and LAX please refer to the back/last page of this book.

MUET Band	TOEFL/IELTS Score	CIEP Level	Graduation Requirements for 4-year programmes
1 & 2	-	107	3 LPE + 3 CEL + 24 LAX points
3 & 4	TOEFL 500 - 599 IELTS 5.5 - 6.5	108 – 109	2 LPE + 2 CEL + 24 LAX points
5 & 6	TOEFL 600 - 677 IELTS 7.0 - 9.0	-	2 LPE + 1 CEL + 24 - LAX points or 1 LPE + 1 CEL + 24 LAX points (+1 global language)

SKEMA PENGAJIAN/ *STUDY SCHEME*

TAHUN 1/ *1ST YEAR*

SEMESTER 1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0
FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1
BMY3101	Mikrobiologi I/ *Microbiology I*	4	4	0
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0
QKXXXX	Kokurikulum/ *Co-curriculum*	1	0	1
CEL2102	*Effective Listening and Speaking*			
LAX				
	JUMLAH/ *TOTAL*	**16**	**12**	**4**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
LPE2301	*Academic Interaction and Presentation*	3	3	0
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0
SKP3113**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society*	3	3	0
atau/ *or*	atau/ *or*			
SKP3123**	Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*			
BMY3102	Mikrobiologi II/ *Microbiology II*	4	4	0
BCH3106	Teknik dan Pengiraan Asas dalam Biokimia/*Basic Techniques and Calculations in Biochemistry*	2	1	1
BMY3202	Teknik Pencirian Mikroorganisma/ *Techniques in Microbial Characterization*	3	0	3
FCE3204	Kemahiran Berfikir/ *Thinking Skills*	2	2	0
	Kokurikulum/ *Co-curriculum*	1	0	1
	JUMLAH/ *TOTAL*	**17**	**12**	**5**

TAHUN 2/ *2ND YEAR*

SEMESTER 1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
LPE2501	*Academic Writing*	3	3	0
BCH3107	Biomolekul/ *Biomolecules*	3	3	0
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0
BMY3103	Fisiologi Mikrob/ *Microbial Physiology*	3	3	0
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1
BMY3203	Teknik Mikrobiologi Lanjutan/ *Advanced Microbiological Techniques*	3	0	3
BMY4301	Bakteriologi/ *Bacteriology*	3	3	0
	JUMLAH/ *TOTAL*	**19**	**16**	**4**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
MGM3180	Asas Keusahawanan/ *Basic Entrepreneurship*	3	2	1
BCH3108	Enzimologi/ *Enzymology*	4	3	1
BMY4302	Virologi/ *Virology*	3	3	0
BMY4303	Mikologi/ *Mycology*	3	3	0
	Elektif/ Elective	6		
LAX				
	JUMLAH/ *TOTAL*	**19**	**11**	**2**

TAHUN 3/ *3RD YEAR*

SEMESTER 1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BMY4304	Imunologi/ *Immunology*	3	3	0
BMY4310	Genetik Mikrob/ *Microbial Genetics*	4	3	1
BGY3701	Biostatistik/ *Biostatistics*	**3**	**2**	**1**

BMY4904	Pembelajaran Perkhidmatan Dalam Mikrobiologi/ *Service Learning in Microbiology*	1	0	1
	Elektif/ Elective	7		
LAX				
	JUMLAH/ *TOTAL*	**18**	**8**	**3**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BMY4959A	Disertasi Bacelor/ *Bachelor Dissertation*	3	0	3
BMY4992	Topik Terkini Mikrobiologi/ *Current Topics in Microbiology*	2	0	2
	Elektif/ Elective	12		
CEL2015/2016/2017				
	JUMLAH/ *TOTAL*	**17**	**0**	**6**

TAHUN 4/ *4TH YEAR*

SEMESTER 1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BMY4959A	Disertasi Bacelor/ *Bachelor Dissertation*	3	0	3
BSM4301	Bioinformatik/ Bioinformatic	3	2	1
	Elektif/ Elective	8		
LAX or CEL2104/2015/ 2016/2017				
	JUMLAH/ *TOTAL*	**14**	**2**	**4**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BMY4901	Latihan industri/ *Industrial Training*	6	0	6
	JUMLAH/ *TOTAL*	**6**	**0**	**6**

Bacelor Sains Bioteknologi dengan Kepujian

Bachelor of Science in Biotechnology with Honours

STRUKTUR KURIKULUM/*CURRICULUM STRUCTURE*

Nama Program	:	**Bacelor Sains Bioteknologi dengan Kepujian /*Bachelor of Science in Biotechnology with Honours***
Jumlah Kredit Bergraduat	:	**126 Jam Kredit/ *Credits Hours***
Tempoh Pengajian	:	**8 Semester/*Semesters* (4 Tahun/ *Years*)**

Matlamat Program :

1. Melahirkan graduan yang mempunyai pemahaman bioteknologi yang komprehensif dan pemikiran yang inovatif serta memiliki kebolehan memimpin, keupayaan analitikal dan penyelesaian masalah.
2. Melahirkan graduan yang kompeten dalam kemahiran praktikal yang luas
3. Melahirkan graduan yang mampu beradaptasi dengan kemajuan bioteknologi terkini berkaitan keusahawanan, komersial, etika, sosial dan perundangan.
4. Melahirkan graduan yang kompeten dalam kemahiran komunikasi dan interpersonal dalam persekitaran kerja global yang kompetitif

RINGKASAN HASIL PEMBELAJARAN PROGRAM

Program	Mempamerkan pengetahuan dan kefahaman komprehensif bioteknologi	Menggunakan peralatan asas yang berkaitan dengan bidang bioteknologi	Menganalisis, mensintesis, dan mengintegrasi pengetahuan dan maklumat	Mengaplikasikan pengetahuan teori dan kemahiran praktikal	Mengendalikan penyelidikan berpandu asas	Menunjukkan kebolehan mencari, mengadaptasi dan memberi penyelesaian bagi menangani cabaran dan permasalahan bioteknologi	Mengamalkan konsep pembelajaran sepanjang hayat	Menunjukkan kesedaran dan pemahaman terhadap isu asas keusahawanan dan pengkomersilan, etika, perundangan dan sosial yang berkaitan dengan bioteknologi	Mempamerkan kemahiran berkomunikasi dan interpersonal
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Bacelor Sains Bioteknologi dengan Kepujian	31	10	15	20	2	4	15	16	20

1. Kursus Sains Asas / *Fundamental Sciences Courses* (13 kredit/*credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BTC3000	Kimia Biofizikal*/ Biophysical Chemistry*	3	2	1	Tiada/ None
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1	Tiada/ None
BMY3001	Mikrobiologi/*Microbiology*	4	4	0	Tiada/ None
BGY3701	Biostatistik/ *Biostatistics*	3	2	1	Tiada/ None

2. Teras : Sains Teras dan Gunaan/ *Core Sciences and Applied Courses* (57 Kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BTC3001	Pengenalan Kepada Bioteknologi/ *Introduction to Biotechnology*	2	2	0	Tiada/ None
BTC3002	Komersialisasi dan Isu Semasa Bioteknologi/ *Commercialisation and Current Issues in Biotechnology*	2	2	0	Tiada/ None
BTC3101	Teknologi Enzim/*Enzyme Technology*	4	3	1	BCH3002 atau BCH3108
BTC3201	Teknologi Fermentasi/*Fermentation Technology*	4	3	1	BMY3001 atau BMY3101
BTC3301	Kejuruteraan Bioproses/*Bioprocess Engineering*	4	4	0	BTC3201
BTC3302	Biopemisahan dan Penulenan/*Bioseparation and Purification*	4	3	1	BTC3201
BTC3305	Rekabentuk Bioproses dan Biopenghasilan/ *Bioprocessing and Biomanufacturing Design*	3	2	1	BTC3301
BTC3402	Pengurusan dan Penggunaan Sisa/ *Waste Management and Utilisation*	3	2	1	Tiada/ None
BTC4001	Biokeselamatan dan Bioetika/ *Biosafety and Bioethics*	2	2	0	Tiada/ None
BTC4305	Pemodelan dan Pengoptimuman Bioproses/ *Bioprocess Modelling and Optimization*	3	2	1	BTC3201 dan BTC3301
BTC4904	Khidmat Pembelajaran dalam Bioteknologi/ *Service Learning in Biotechnology*	1	0	1	BTC3001
BCH3001	Biokimia Komprehensif I/*Comprehensive Biochemistry* ***I***	3	3	0	Tiada/ None
BCH3002	Biokimia Komprehensif II/ *Comprehensive Biochemistry II*	4	3	1	BCH3001
BSM3104	Prinsip Kultur Sel dan Tisu/*Principles of Cell and Tissue Culture*	3	2	1	Tiada/ None
BSM3201	Biologi Molekul/ *Molecular Biology*	3	3	0	Tiada/ None
BSM3202	Kejuruteraan Genetik/*Genetic Engineering*	4	3	1	BSM3201
BSM4301	Bioinformatik/*Bioinformatics*	3	2	1	BSM3201 atau BCH3107
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2	Tiada/ None
MGM3180	Asas Keusahawanan/*Basic Entrepreneurship*	3	2	1	Tiada/ None

3. Kursus Elektif Pengkhususan / Specialization Elective Course / (20 kredit/ *credits*)

Kursus elektif pengkhususan (20 kredit) merangkumi pelbagai kursus elektif bidang bioteknologi seperti bioteknologi industri, bioteknologi alam sekitar, bioteknologi haiwan dan tumbuhan, dan bioteknologi makanan. *(Specialization elective course covers various biotechnology field elective courses such as industrial biotechnology, environemental biotechnology, animal and plant biotechnology, and food biotechnology.*

Selain kursus **Elektif Bioteknologi**, pelajar boleh memilih kursus elektif keusahawanan bioteknologi: *Other than **Biotechnology Elective** course, student can choose biotechnology entrepreneurship elective course.*

Elektif Keusahawanan Bioteknologi - pelajar yang mengambil elektif ini perlu mengambil kursus elektif berjumlah 20 jam kredit yang terdiri daripada elektif bioteknologi (8 kredit) dan elektif keusahawanan bioteknologi (12 kredit). ***Biotechnology Entrepreneurship Elective*** *– Student opted for this elective is required to choose 20 credit hours from biotechnology elective (8 credits) and biotechnology entrepreneurship elective (12 credits).*

i) Elektif Bioteknologi/ *Biotechnology Elective*

Pilih minimum 20 kredit; atau 8 kredit bagi pelajar elektif keusahawanan bioteknologi/ *Choose 20 credits minimum; or 8 credits for biotechnology entrepreneurship elective student.*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BTC3003	Instrumentasi dalam Penyelidikan Bioteknologi / *Instrumentation in Biotechnology Research*	3	2	1	Tiada/ None
BTC3004	Penulisan Saintifik dalam Bioteknologi/ *Scientific Writing in Biotechnology*	3	3	0	Tiada/ None
BTC3306	Sistem Bioreaktor/ *Bioreactor System*	3	3	0	BTC3201 dan BTC3301
BTC4002	Bioteknologi Dalam Bioekonomi/ *Biotechnology in Bioeconomy*	2	2	0	BTC3002
BTC4102	Teknologi Enzim Lanjutan/*Advanced Enzyme Technology*	4	3	1	BTC3101
BTC4104	Bioteknologi Makanan/ *Food Biotechnology*	3	2	1	BTC3101
BTC4105	Bioteknologi Makanan Lanjutan/ *Advanced Food Biotechnology*	2	2	0	BTC4104
BTC4205	Mikrobiologi Industri/ *Industrial Microbiology*	3	2	1	BMY3001 atau BMY3101
BTC4406	Bioremediasi/ *Bioremediation*	3	3	0	BTC3402
BTC4407	Teknologi Rawatan Sisa Pepejal/ *Solid Waste Treatment Technology*	3	2	1	BTC3402
BTC4408	Teknologi Rawatan Air Sisa/ *Wastewater Treatment Technology*	3	2	1	BTC3402
BSM3101	Biologi Sel dan Perkembangan/ *Cellular and Developmental Biology*	3	3	0	Tiada/ None
BSM3501	Kultur Sel dan Tisu Tumbuhan/ *Plant Cell and Tissue Culture*	3	2	1	BSM3101

BSM3203	Teknik Penyelidikan dalam Biologi Molekul/ *Research Techniques in Molecular Biology*	3	2	1	BSM3201
BSM4201	Genetik Molekul Gunaan/*Applied Molecular Genetics*	4	3	1	BSM3202
BSM4501	Kultur Sel dan Tisu Tumbuhan Gunaan/ *Applied Plant Cell and Tissue Culture*	4	3	1	BSM3501
BSM4502	Biologi Sel dan Molekul Tumbuhan Gunaan/ *Applied Plant Molecular and Cell Biology*	4	3	1	BSM3202
BSM4503	Biologi Molekul Perkembangan Tumbuhan/ *Molecular Biology of Plant Development*	4	4	0	BSM3201 dan BSM3101
BSM4601	Kejuruteraan Protein/*Protein Engineering*	4	3	1	BSM3202 atau BMY4310, dan BSM4301
BSM4701	Bahan Nano Dan Bioteknologi/ *Nanomaterials and Biotechnology*	3	3	0	BCH3201 atau BCH3107
BMY4305	Ekologi Mikrob/*Microbial Ecology*	3	3	0	BMY3102 atau BMY3001

ii) **Elektif Keusahawanan Bioteknologi/ *Biotechnology Entrepreneurship Elective*** (12 kredit/ *Credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BTC3501	Konsep Biokeusahawanan /*Biotechnology Entrepreneurship I*	3	2	1	MGM3180
BTC3502	Perancangan Biokeusahawanan/ *Bioentrepreneurship Planning*	3	2	1	BTC3501
BTC4502	Pengurusan Biokeusahawanan/ *Bioentrepreneurship Management*	3	1	2	BTC3502
BTC4503	Perniagaan Bioteknologi/ *Biotechnology Business*	3	1	2	BTC4502

4. Projek PenyelidikanTahun Akhir /*Final Year Project* (7 kredit/*credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BTC4959	Disertasi Bacelor/ *Bachelor Dissertation*	6	0	6	Tiada/ None
BTC4991	Seminar/*Seminar*	1	0	1	BTC4959

5. Latihan Industri /*Industrial Training* (6 kredit/*credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BTC4901	Latihan industri/*Industrial Training*	6	0	6	Tiada/ None

6. Kemahiran Generik, Kemanusiaan dan Sastera Liberal/ *(Generic Skills, Humanities and Liberal Arts)* (23 kredit/*credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
LPE2301	*Academic Interaction And Presentation*	3	3	0	LPE2401/MUET Band 3.0-4.5
LPE2501	*Academic Writing*	3	3	0	LPE2301
SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0	Tiada/ None
FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0	
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0	Tiada/ None
SKP3113**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society*	3	3	0	Tiada/ None
atau/ *or*	atau/ *or*				
SKP3123**	Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*				
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0	Tiada/ None
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0	Tiada / None
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1	Tiada/ None
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0	Tiada/ None
XXX1234	Kokurikulum/*Co-curriculum*	1	0	1	Tiada/ None
YYY1234	Kokurikulum/*Co-curriculum*	1	0	1	Tiada/ None
	Bahasa Global	3	3	0	

Nota: * pelajar tempatan/ *local student* **pelajar antarabangsa/ *international student*

Nota Penting/I*mportant Notes* :

1. **Pelajar diwajibkan memilih 2 kredit daripada kursus kokurikulum yang ditawarkan oleh universiti/ *It is compulsory for students to take 2 credits of co-curriculum courses offered by the university***
2. **Pelajar perlu melengkapkan pakej keperluan Bahasa Inggeris seperti jadual di bawah : (Butiran lanjut mengenai CEL dan LAX sila rujuk di muka surat belakang buku panduan ini)**
   Students need to complete the english package as the table below : For more details on CEL and LAX please refer to the back/last page of this book.

MUET Band	TOEFL/IELTS Score	CIEP Level	Graduation Requirements for 4-year programmes
1 & 2	-	107	3 LPE + 3 CEL + 24 LAX points
3 & 4	TOEFL 500 - 599 IELTS 5.5 - 6.5	108 – 109	2 LPE + 2 CEL + 24 LAX points
5 & 6	TOEFL 600 - 677	-	2 LPE + 1 CEL + 24 LAX points

	IELTS 7.0 - 9.0		or 1 LPE + 1 CEL + 24 LAX points (+1 global language)

SKEMA PENGAJIAN/ *STUDY SCHEME*

TAHUN 1/*1ST YEAR*

SEMESTER 1/*1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC3000	Kimia Biofizikal/ *Biophysical Chemistry*	3	2	1
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1
BMY3001	Mikrobiologi/*Microbiology*	4	4	0
BCH3001	Biokimia Komprehensif I/*Comprehensive Biochemistry 1*	3	3	0
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0
SKP3113** atau/ *or* SKP3123**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society* atau/ *or* Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*	3	3	0
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0
CEL2102	*Effective Listening and Speaking*			
LAX				
	JUMLAH/ *TOTAL*	**18**	**16**	**2**

SEMESTER 2/*2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC3001	Pengenalan Kepada Bioteknologi/ *Introduction to Biotechnology*	2	2	0
BCH3002	Biokimia Komprehensif II/*Comprehensive Biochemistry II*	4	3	1
BSM3201	Biologi Molekul/ *Molecular Biology*	3	3	0
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2
SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0
FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0
LPE2301	*Academic Interaction And Presentation*	3	3	0
XXX 1234	Ko-Kurikulum / *Co-curiculum*	1	0	1
	JUMLAH/ *TOTAL*	**18**	**14**	**4**

TAHUN 2/*2ND YEAR*

SEMESTER 1/*1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC3201	Teknologi Fermentasi/*Fermentation Technology*	4	3	1
BTC4001	Biokeselamatan dan Bioetika/ *Biosafety and Bioethics*	2	2	0
BSM3104	Prinsip Kultur Sel dan Tisu/*Principles of Cell and Tissue Culture*	3	2	1
LPE2501	*Academic Writing*	3	3	0
MGM3180	Asas Keusahawanan/*Basic Entrepreneurship*	3	2	1
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1
	JUMLAH/ *TOTAL*	**17**	**13**	**4**

SEMESTER 2/*2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC3301	Kejuruteraan Bioproses/*Bioprocess Engineering*	4	4	0
BTC3101	Teknologi Enzim/*Enzyme Technology*	4	3	1
BSM3202	Kejuruteraan Genetik/*Genetic Engineering*	4	3	1
BTC3402	Pengurusan dan Penggunaan Sisa/ *Waste Management and Utilisation*	3	2	1
XXX 1234	Ko-Kurikulum / *Co-curiculum*	1	0	1
LAX				
	JUMLAH/ *TOTAL*	**16**	**12**	**4**

TAHUN 3/*3RD YEAR*

SEMESTER 1/*1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC3302	Biopemisahan dan Penulenan/*Bioseparation and Purification*	4	3	1
BTC4305	Pemodelan dan Pengoptimuman Bioproses/ *Bioprocess Modelling and Optimization*	3	2	1
BTC4904	Khidmat Pembelajaran dalam Bioteknologi/ *Service Learning in Biotechnology*	1	0	1

BGY3701	Biostatistik/ *Biostatistics*	3	2	1
BTCXXX	Elektif Pengkhususan/ *Specialisation Elective*	8		
LAX				
	JUMLAH/ *TOTAL*	**19**	**7**	**4**

SEMESTER 2/2ND *SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC4959A	Disertasi Bacelor/ *Bachelor Dissertation*	2	0	2
BTC3002	Komersialisasi dan Isu Semasa Bioteknologi/ *Commercialisation and Current Issues in Biotechnology*	2	2	0
BTC3305	Rekabentuk Bioproses dan Biopenghasilan/ *Bioprocessing and Biomanufacturing Design*	3	2	1
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0
BSM4301	Bioinformatik/*Bioinformatics*	3	2	1
BTCXXX	Elektif Pengkhususan/ *Specialisation Elective*	4		
CEL2105/2106/2107				
	JUMLAH/ *TOTAL*	**16**	**10**	**4**

TAHUN 4/ 4TH *YEAR*

SEMESTER 1/*1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC4959B	Disertasi Bacelor/ *Bachelor Dissertation*	4	0	4
BTC4991	Seminar/*Seminar*	1	0	1
	Bahasa Global/ *Global Language*	3	2	1
BTCXXXX	Elektif Pengkhususan/ *Specialisation Elective*	8		
LAX				
	JUMLAH/ *TOTAL*	**16**	**2**	**6**

SEMESTER 2/2ND *SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC4901	Latihan Industri/*Industrial Training*	6	0	6
	JUMLAH/ *TOTAL*	**6**	**0**	**6**

Bacelor Sains Biologi Sel dan Molekul dengan Kepujian

Bachelor of Science in Cell and Molecular Biology with Honours

STRUKTUR KURIKULUM/ *CURRICULUM STRUCTURE*

Nama Program	:	**Bacelor Sains Biologi Sel dan Molekul dengan Kepujian / *Bachelor of Science in Cell and Molecular Biology with Honours***
Jumlah Kredit Bergraduat	:	**125 Jam Kredit/ *Credit Hours***
Tempoh Pengajian	:	**8 Semester/ *Semesters* (4 Tahun/ *Years*)**

Matlamat Program :

1. melahirkan ahli biologi sel dan molekul yang mempunyai pengetahuan asas yang kukuh dan kemahiran teknikal dalam bidang biologi sel dan molekul serta mempunyai sikap positif dan boleh menyesuaikan diri dalam persekitaran kerja global yang kompetitif
2. melahirkan graduan yang beretika, prihatin, proaktif, berketerampilan dan berdaya saing serta meneruskan pembelajaran sepanjang hayat dalam bidang biologi sel dan molekul
3. melahirkan penyelidik yang mempunyai pemikiran kritis dalam mengaplikasikan pengetahuan dan kemahiran yang diperoleh bagi membangun ekonomi Negara

RINGKASAN HASIL PEMBELAJARAN PROGRAM

Program	Pengetahuan	Kemahiran Teknikal/Praktikal/ Psikomotor	Pendekatan Kemahiran Berfikir dan Saintifik	Kemahiran Berkomunikasi	Kemahiran Sosial dan Bertanggungjawab	Professionalisme, Nilai, Sikap dan Etika	Pendidikan Sepanjang Hayat dan Pengurusan Informasi	Kemahiran Pengurusan dan Keusahawanan	Kemahiran Kepimpinan	Kemahiran Numerasi
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Bacelor Sains Biologi Sel dan Molekul dengan Kepujian	38	19	17	18	16	13	11	5	3	4

1. Kursus Universiti/ *University Courses* (25 kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
LPE2301	*Academic Interaction and Presentation*	3	3	0	LPE2401/CEL2102
LPE2501	*Academic Writing*	3	3	0	LPE2301
FCE3204	Kemahiran Berfikir/ *Thinking Skills*	2	2	0	Tiada/ None
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0	Tiada/ None
MGM3180	Asas Keusahawanan/ *Basic Entrepreneurship*	3	2	1	Tiada/ None
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1	Tiada/ None

SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0	Tiada/ None
FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0	
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0	Tiada/ None
SKP3113**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society*				
atau/ *or* SKP3123**	atau/ *or* Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*	3	3	0	Tiada/ None
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0	Tiada/ None
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0	Tiada / None
	Kokurikulum/ *Co-curriculum*	1	0	1	Tiada/ None
	Kokurikulum/ *Co-curriculum*	1	0	1	Tiada/ None

Nota: * pelajar tempatan/ *local student* **pelajar antarabangsa/ *international student*

2. Kursus Teras/ *Core Courses* (67 kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BCH3001	Biokimia Komprehensif I/ *Comprehensive Biochemistry I*	3	3	0	Tiada/ None
BCH3002	Biokimia Komprehensif II/ *Comprehensive Biochemistry II*	4	3	1	BCH3001
BMY3001	Mikrobiologi/ *Microbiology*	4	4	0	Tiada/ None
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2	Tiada/ None
BSM3101	Biologi Sel dan Perkembangan/ *Cellular and Developmental Biology*	3	3	0	Tiada/ None
BSM3201	Biologi Molekul/ *Molecular Biology*	3	3	0	Tiada/ None
BSM3202	Kejuruteraan Genetik/ *Genetic Engineering*	4	3	1	BSM3201
BSM3203	Teknik Penyelidikan dalam Biologi Molekul/ *Research Techniques in Molecular Biology*	3	2	1	BSM3201
BSM3204	Prinsip Genetik/ *Principles of Genetics*	3	3	0	Tiada/ None
BSM3401	Kultur Sel dan Tisu Haiwan/ *Animal Cell and Tissue Culture*	3	2	1	BSM3101
BSM3402	Imunologi Sel dan Molekul/ *Cell and Molecular Immunology*	3	3	0	BSM3401
BSM3501	Kultur Sel dan Tisu Tumbuhan/ *Plant Cell and Tissue Culture*	3	2	1	BSM3101

BSM4201	Genetik Molekul Gunaan/ *Applied Molecular Genetics*	4	3	1	BSM3202
BSM4301	Bioinformatik/ *Bioinformatics*	3	2	1	BSM3201 / BCH3107
BSM4901	Latihan Industri/ *Industrial Training*	6	0	6	Tiada/ None
BSM4991	Seminar/ *Seminar*	1	0	1	BSM4201
BSM4959	Disertasi Bacelor/ *Bachelor Dissertation*	6	0	6	Tiada/ None
BSM4904	Pembelajaran Perkhidmatan dalam Biologi Sel dan Molekul/ *Service Learning in Cell and Molecular Biology*	1	0	1	BSM3202
BTC3002	Komersilalisasi dan Isu Semasa Bioteknologi/ *Commercialisation and Current Issues in Biotechnology*	2	2	0	Tiada/ None
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1	Tiada/ None
BGY3701	Biostatistik/ *Biostatistics*	3	2	1	Tiada/ None

3. Kursus Elektif/ *Elective Course*

Pelajar perlu mengambil 33 kredit bagi kursus elektif merangkumi/ *Student must take 33 credits of elective course encompass :*

- 21 kredit minimum bagi Elektif Teras Biologi Sel dan Molekul/ *minimum 21 credits of core elective*
- 6 kredit Elektif Pengurusan dan Kemanusiaan/ *Management And Humanity*
- 6 kredit Elektif Bebas (termasuk 3 kredit kursus bahasa global)/ *6 credits of elective (3 credits must from global language*

i. Kursus Elektif Teras Biologi Sel dan Molekul/ *Core Elective Course in Cell and Molecular Biology* (21 kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BCH3108	Enzimologi/ *Enzymology*	4	3	1	BCH3001 / BCH3107
BCH4301	Biokimia Tumbuhan/ *Plant Biochemistry*	3	3	0	BCH3108 / BCH3002
BCH4308	Teknik dalam Metabolomik/ *Techniques in Metabolomics*	3	2	1	BCH3109 / BCH3110 / BCH3111
BMY4302	Virologi/ *Virology*	3	3	0	BMY3102 / BMY3001
BSM4101	Mikroteknik/ *Microtechniques*	4	3	1	BSM3101
BSM4203	Diagnostik Molekul/ *Molecular Diagnostics*	2	2	0	BSM3401
BSM4204	Genomik Fungsian/ *Functional Genomics*	3	3	0	BSM3201 atau BMY4310
BSM4501	Kultur Sel dan Tisu Tumbuhan Gunaan *Applied Plant Cell and Tissue Culture*	4	3	1	BSM3501
BSM4502	Biologi Sel dan Molekul Tumbuhan Gunaan/ *Applied Plant Molecular and Cell Biology*	4	3	1	BSM3202

BSM4503	Biologi Molekul Perkembangan Tumbuhan/ *Molecular Biology of Plant Development*	4	4	0	BSM3201 & BSM3101
BSM4601	Kejuruteraan Protein/ *Protein Engineering*	4	3	1	BSM3202 / BMY4310 & BSM4301
BSM4602	Proteomik/ *Proteomics*	4	3	1	BSM3201 atau BMY4310
BSM4603	Biologi Struktur/ *Structural Biology*	3	3	0	BSM3201 atau BMY4310
BSM4701	Bahan Nano Dan Bioteknologi/ *Nanomaterials and Biotechnology*	3	3	0	BCH3201 / BCH3107
BTC3003	Instrumentasi dalam Penyelidikan Bioteknologi / *Instrumentation in Biotechnology Research*	3	2	1	Tiada/ None
BTC3004	Penulisan Saintifik dalam Bioteknologi/ *Scientific Writing in Biotechnology*	3	3	0	Tiada/ None
BTC3201	Teknologi Fermentasi/ *Fermentation Technology*	4	3	1	BMY3001 / BMY3101
BTC4001	Biokeselamatan dan Bioetika/ *Biosafety and Bioethics*	2	2	0	Tiada/ None
BTC4205	Mikrobiologi Industri/ *Industrial Microbiology*	3	2	1	BMY3001 / BMY3101
PLP3204	Patologi Tumbuhan Asas/ *Fundamentals of Plant Pathology*	3	2	1	Tiada/ None

ii. Kursus Elektif Pengurusan dan Kemanusiaan/ *Management And Humanity* (6 kredit/ *credits*)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
ACT3112	Perakaunan Pengenalan/ *Introductory Accounting*	4	3	1	Tiada/ None
ACT3211	Pengurusan Kewangan/ Financial Management	3	3	0	ACT3112/ ACT2114
ECN3010	Prinsip Ekonomi/ *Principles Of Economics*	3	3	0	Tiada/ None
MGM3101	Prinsip Pengurusan/ *Principles of Management*	3	3	0	Tiada/ None
MGM3113	Gelagat Organisasi/ *Organizational Behavior*	3	3	0	MGM 2111 / MGM3101
MGM3211	Prinsip Pemasaran/ *Principles of Marketing*	3	3	0	MGM3101 / MGM2111
MGM4174	Pengurusan Perkhidmatan/ *Services Management*	3	3	0	MGM3211
MGM4184	Pengurusan Perniagaan Kecil/ *Small Business Management*	3	3	0	MGM3101
MGM4187	Pengurusan Usahaniaga Baru/ *New Venture Management*	3	3	0	MGM3211 dan ACT3211
SKM2300	Pengenalan Kepada Multimedia/ *Introduction to Multimedia*	3	2	1	Tiada/ None

i. Kursus Eleltif Bebas (termasuk 3 kredit kursus bahasa global)/ *Free Elective courses (including 3 credits global language course)* (6 kredit/ credits)

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A	PRASYARAT/ *PREREQUISITE*
BBA2401	Bahasa Arab I/ *Arabic I*	3	2	1	Tiada/ None
BBC2401	Bahasa Cina I/ *Chinese I*	3	2	1	Tiada/ None
BBD2401	Bahasa Jerman I/ *German I*	3	2	1	Tiada/ None
BBE2401	Bahasa Korea I/ *Korean I*	3	2	1	Tiada/ None
BBF2401	Bahasa Perancis I/ *French I*	3	2	1	Tiada/ None
BBJ2401	Bahasa Jepun I/ *Japanese I*	3	2	1	Tiada/ None
	Ekeltif Bebas	3			

Nota Penting/*Important Notes* :

1. **Pelajar diwajibkan memilih 2 kredit daripada kursus kokurikulum yang ditawarkan oleh universiti/ *It is compulsory for students to take 2 credits of co-curriculum courses offered by the university***
2. **Pelajar perlu melengkapkan pakej keperluan bahasa inggeris seperti jadual di bawah :**
   (Butiran lanjut mengenai CEL dan LAX sila rujuk di muka surat belakang buku panduan ini)
   Students need to complete the english package as shown in the table below. For more details on CEL and LAX please refer to the back/last page of this book.

MUET Band	TOEFL/IELTS Score	CIEP Level	Graduation Requirements for 4-year programmes
1 & 2	-	107	3 LPE + 3 CEL + 24 LAX points
3 & 4	TOEFL 500 - 599 IELTS 5.5 - 6.5	108 – 109	2 LPE + 2 CEL + 24 LAX points
5 & 6	TOEFL 600 - 677 IELTS 7.0 - 9.0	-	2 LPE + 1 CEL + 24 LAX points or 1 LPE + 1 CEL + 24 LAX points (+1 global language)

SKEMA PENGAJIAN/ *STUDY SCHEME*

TAHUN 1/ *1ST YEAR*

SEMESTER1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
SKP3112*	Falsafah dan Isu Semasa/ *Philosophy and Current Issues*	2	2	0
SKP3113** atau/ *or* SKP3123**	Falsafah dan Isu Semasa Masyarakat Sivil/ *Philosophy and Current Issues in Civil Society* atau/ *or* Penghayatan Etika dan Peradaban di Malaysia/ *Internalization of Ethics and Civilization in Malaysia*	3	3	0
BMY3001	Mikrobiologi/ *Microbiology*	4	4	0
BSM3101	Biologi Sel dan Perkembangan/ *Cellular and Developmental Biology*	3	3	0
BCH3001	Biokimia Komprehensif I/ *Comprehensive Biochemistry I*	3	3	0
SKP2101*	Kenegaraan Malaysia/ *Malaysian Nationhood*	3	3	0
FEM2401**	Politik Malaysia dan Masyarakat/ *Malaysian Politics and Society*	2	2	0
QKXXXX	Kokurikulum/ *Co-curriculum*	1	0	1
CEL2102	*Effective Listening and Speaking*			
LAX				
	JUMLAH/ *TOTAL*	**16**	**15**	**1**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BSM3201	Biologi Molekul/ *Molecular Biology*	3	3	0
BCH3003	Kimia Biologi/ *Biological Chemistry*	3	2	1
BSM3204	Prinsip Genetik/ *Principles of Genetics*	3	3	0
FCE3204	Kemahiran Berfikir/ *Thinking Skills*	2	2	0
KOM3403	Pengucapan Awam/ *Public Oration*	3	3	0
LPE2301	Interaksi dan Pembentangan Akademik/ *Academic Interaction and Presentation*	3	3	0
BMY3201	Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques*	2	0	2
	JUMLAH/ *TOTAL*	**19**	**16**	**3**

TAHUN 2/ *2ND YEAR*

SEMESTER1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BCH3002	Biokimia Komprehensif II/ *Comprehensive Biochemistry II*	4	3	1
BSM3501	Kultur Sel dan Tisu Tumbuhan/ *Plant Cell and Tissue Culture*	3	2	1
BSM3202	Kejuruteraan Genetik/ *Genetic Engineering*	4	3	1
MGM3180	Asas Keusahawanan/ *Basic Entrepreneurship*	3	2	1
LPE2501	Penulisan Akademik/ *Academic Writing*	3	3	0
	Elektif Bebas I/ *Elective I*	3	3	0
	JUMLAH/ *TOTAL*	**20**	**16**	**4**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2	1	1
BSM3203	Teknik Penyelidikan dalam Biologi Molekul/ *Research Techniques in Molecular Biology*	3	2	1
BSM4301	Bioinformatik/ *Bioinformatics*	3	2	1
BSM3401	Kultur Sel dan Tisu Haiwan/ *Animal Cell and Tissue Culture*	3	2	1
SKP3122*	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2	2	0
LPM2100**	Bahasa Melayu Komunikasi/ *Malay Language Communication*	2	2	0
	Elektif Bebas II */ Elective II*	3	3	0
QKXXXX	Kokurikulum/ *Co-Curriculum*	1	0	1
LAX				
	JUMLAH/ *TOTAL*	**17**	**13**	**4**

TAHUN 3/ *3RD YEAR*

SEMESTER1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BSM4201	Genetik Molekul Gunaan/ *Applied Molecular Genetics*	4	3	1
BSM3402	Imunologi Sel dan Molekul/ *Cell and Molecular Immunology*	3	3	0
BGY3701	Biostatistik/ *Biostatistics*	3	2	1
BSM4904	Pembelajaran Perkhidmatan dalam Biologi Sel dan Molekul/ *Service Learning in Cell and Molecular Biology*	1	0	1

	Elektif Teras Biologi Sel dan Molekul I/ *Cell and Molecular Biology Core Elective I*	8	8	0
CEL2103				
	JUMLAH/ *TOTAL*	**19**	**16**	**3**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BTC3002	Komersialisasi dan Isu Semasa Bioteknologi/ *Commercialisation and Current Issues in Biotechnology*	2	2	0
BSM4959A	Disertasi Bacelor/ *Bachelor Dissertation*	2	0	2
	Elektif Teras Biologi Sel dan Molekul II/ *Cell and Molecular Biology Core Elective II*	9		
	Elektif Pengurusan dan Kemanusiaan I/ *Management and Humanity Elective I*	3		
CEL2105/2016/2017				
	JUMLAH/ *TOTAL*	**16**	**2**	**2**

TAHUN 4/ *4TH YEAR*

SEMESTER1/ *1ST SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BSM4959B	Disertasi Bacelor/ *Bachelor Dissertation*	4	0	4
BSM4991	Seminar/ *Seminar*	1	0	1
	Elektif Teras Biologi Sel dan Molekul III/ *Cell and Molecular Biology Core Elective III*	4		
	Elektif Pengurusan dan Kemanusiaan II/ *Management and Humanity Elective II*	3		
LAX				
	JUMLAH/ *TOTAL*	**12**	**0**	**5**

SEMESTER 2/ *2ND SEMESTER*

KOD KURSUS/ *COURSE CODE*	NAMA KURSUS/*COURSE NAME*	Kr	K	A
BSM4901	Latihan Industri/ *Industrial Training*	6	0	6
	JUMLAH/ *TOTAL*	**6**	**0**	**6**

SINOPSIS KURSUS/ *COURSE SYNOPSIS*

Jabatan Biokimia/ *Department of Biochemistry*

BCH3001 Biokimia Komprehensif I/ *Comprehensive Biochemistry 1* 3(3+0)

Prasyarat : Tiada

Kursus ini merangkumi pelbagai struktur dan ciri biomolekul dalam sistem biologi. Peranan dan fungsi biomolekul seperti karbohidrat, asid amino, protein, lipid dan asid nukleik dalam sistem biologi dibincangkan

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 Biokimia Komprehensif II/ *Comprehensive Biochemistry II* 4(3+1)

Prasyarat : BCH3001

Kursus ini merangkumi laluan utama metabolisme biomolekul yang berlaku dalam sistem biologi. Ciri fisiko-kimia dan metabolisme biomolekul dibincangkan. Penganalisisan tindak balas metabolisme biomolekul juga dijalankan

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 Kimia Biologi/ *Biological Chemistry* 3(2+1)

Prasyarat : Tiada

Kursus ini merangkumi prinsip dan teknik asas kimia biologi dalam menganalisis struktur biomolekul. Konsep kimia organik dalam mengenalpasti kumpulan berfungsi struktur biomolekul ditekankan.

Eksperimen menggunakan peralatan asas makmal dalam kimia biologi turut dijalankan.

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 Teknik dan Pengiraan Asas dalam Biokimia/*Basic Techniques and Calculations in Biochemistry* 2(1+1)

Prasyarat : Tiada

Kursus ini merangkumi teknik dan pengiraan asas dalam biokimia. Eksperimen menggunakan peralatan asas dalam biokimia dan penganalisaan data turut ditekankan.

This course encompasses techniques and basic calculations in biochemistry. Experimentation using basic biochemistry instruments and data analysis are also emphasized

BCH3107 Biomolekul/ *Biomolecules* 3(3+0)

Prasyarat : Tiada

Kursus ini merangkumi pelbagai struktur dan ciri biomolekul dalam sistem biologi. Peranan dan fungsi biomolekul seperti karbohidrat, asid amino, protein, lipid dan asid nukleik dalam sistem biologi dibincangkan.

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 Enzimologi/ *Enzymology* 4(3+1)

Prasyarat : BCH3001 atau BCH3107

Kursus ini merangkumi ciri umum enzim dan faktor yang mempengaruhi keaktifan enzim. Faktor keaktifan dan pengawalaturan aktiviti enzim dibincangkan. Penulenan enzim daripada sistem kehidupan menggunakan pelbagai teknik penulenan turut dijalankan.

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 Metabolisme Karbohidrat/ *Carbohydrate Metabolism* 3(2+1)

Prasyarat : BCH3108

Kursus ini merangkumi metabolisme karbohidrat di dalam sel. Integrasi dan mekanisme pengawalan metabolisme karbohidrat dibincangkan. Ujikaji dan penganalisaan tindak balas metabolisme karbohidrat turut dijalankan.

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 Metabolisme Protein dan Asid Nukleik/ *Protein and Nucleic Acid Metabolism* 4(3+1)

Prasyarat : BCH3108

Kursus ini merangkumi metabolisme asid amino, protein, nukleotidadan asid nukleik di dalam sel. Integrasi metabolisme protein dan asid nukleik serta pengawalannya dibincangkan. Penganalisaan tindak balas metabolisme protein dan asid nukleik turut dijalankan

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 Metabolisme Lipid dan Membran/ *Lipid Metabolism and Membranes* 4(3+1)

Prasyarat : BCH3108

Kursus ini merangkumi metabolisme lipid dan membran di dalam sel. Pengawalan metabolisme lipid dan membran dibincangkan. Penganalisaan hasil tindak balas metabolisme lipid dan membran turut dijalankan.

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 Analisis Biomolekul/ *Analysis of Biomolecules* 2(1+1)

Prasyarat : BCH3002 atau BCH3108

Kursus ini merangkumi teknik penganalisaan karbohidrat, lipid, protein dan asid nukleik. Analisis sifat fizikal dan kimia, berat molekul dan kehomogenan biomolekul dibincangkan. Penganalisaan biomolekul turut dijalankan

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 Biokimia Hormon/ *Biochemistry of Hormones* 3(3+0)

Prasyarat : BCH3105 atau BCH3002

Kursus ini merangkumi pengkelasan, sifat kimia dan penghasilan hormon. Fungsi hormon dalam metabolisme sel, koordinasi sel, interaksi antara molekul dan kecacatan patofisiologi turut dibincangkan.

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 Biokimia Tumbuhan/ *Plant Biochemistry* 3(3+0)

Prasyarat : BCH3108 atau BCH3002

Kursus ini merangkumi pengkelasan metabolit primer dan sekunder serta kepelbagaian sistem metabolik dalam tumbuhan. Integrasi laluan metabolik dalam tumbuhan dan pengawalannya dibincangkan

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 Manipulasi Genetik Tumbuhan/ *Plant Genetic Manipulation* 3(2+1)

Prasyarat : BCH4301

Kursus ini merangkumi teknik manipulasi gen tumbuhan melalui kaedah transformasi gen, penggunaan penanda bio, gen pelapor dan bioinformatik. Kesan penggunaan teknologi manipulasi gen tumbuhan kepada ekonomi, alam sekitar dan sosio-budaya dibincangkan. Manipulasi gen tumbuhan dijalankan.

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 Aplikasi Biokimia dalam Industri/ *Industrial Applications of Biochemistry* 3(3+0)

Prasyarat : BCH3002 atau BCH3108

Kursus ini merangkumi konsep biokimia dalam penghasilan produk. Aplikasi biokimia dalam pelbagai industri seperti farmaseutika, kimia, makanan dan diagnostik dibincangkan. Kepentingan paten dan aspek keselamatan juga dihuraikan

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 Biokimia Makanan/ *Food Biochemistry* 3(3+0)

Prasyarat : BCH3108 atau BCH3002

Kursus ini merangkumi ciri fisiko-kimia makanan dan komponen utamanya. Aktiviti mikrob, kaedah pengawetan makanan serta penggunaan enzim dalam teknologi makanan dibincangkan. Kesan tindak balas biokimia terhadap perubahan luaran serta nilai nutrisi makanan turut dibincangkan.

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 Biokimia Pemakanan/ *Nutritional Biochemistry* 3(3+0)

Prasyarat : BCH3108 atau BCH3002

Kursus ini merangkumi peranan nutrien dalam fisiologi manusia dan haiwan. Keperluan pemakanan dan kesan ketidakseimbangan nutrien ke atas kesihatan manusia dan haiwan dibincangkan. Kaedah penilaian pemakanan turut dibincangkan.

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 Biokimia Tisu Haiwan/ *Biochemistry of Animal Tissues* 3(3+0)

Prasyarat : BCH3108 atau BCH3002

Kursus ini merangkumi proses biokimia di dalam pelbagai jenis tisu haiwan. Integrasi metabolisme di antara tisu dibincangkan. Patofisiologi yang berkaitan dengan biokimia tisu haiwan turut dibincangkan.

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 Biokimia Alam Sekitar/ *Environmental Biochemistry* 3(3+0)

Prasyarat : BCH3108 atau BCH3002

Kursus ini merangkumi proses penguraian jisim organik, rawatan air buangan dan penyesuaian mekanisme molekul terhadap persekitaran lampau. Kesan bioakumulasi, ketoksikan, rintangan pencemar persekitaran dan kepatogenan terhadap metabolisme sel, alam sekitar, ekonomi dan kesihatan dibincangkan

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 Teknik Dalam Metabolomik/ *Techniques in Metabolomics* 3(2+1)

Prasyarat : BCH3109 atau BCH3110 atau BCH3111

Kursus ini merangkumi teknik analisis komponen metabolit dalam tumbuhan, haiwan, mikrob, alam sekitar dan makanan. Penggunaan peralatan terkini dalam metabolomik ditekankan. Penganalisaan data metabolomik menggunakan perisian dan pangkalan data juga dijalankan.

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 Latihan Industri/ *Industrial Training* 6(0+6)

Prasyarat : BCH3109 atau BCH3110 atau BCH3111

Kursus ini mendedahkan pelajar kepada persekitaran kerja yang sebenar di industri/organisasi. Latihan merangkumi aplikasi aspek teori dan praktikal yang telah dipelajari dengan amalan semasa di

tempat kerja. Kemahiran menyelesaikan masalah dan komunikasi turut diberi penekanan

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 Topik Khas dalam Biokimia/ *Current Topics in Biochemistry* 2(2+0)

Prasyarat : BCH3109 atau BCH3110 atau BCH3111

Kursus ini memberi tumpuan kepada masalah, isu dan trend terpilih berkaitan bidang biokimia. Penerokaan isu penting dan hala tuju baharu dibuat melalui analisis isu kritikal dan permasalahan bagi mencadangkan penyelesaian. Peluang perniagaan dalam pengkomersilan produk berkaitan bidang biokimia dibincangkan

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 Pembelajaran Perkhidmatan dalam Biokimia/ *Service Learning in Biochemistry* 1(0+1)

Prasyarat : BCH3109 atau BCH3110 atau BCH3111

Kursus ini merangkumi aktiviti di antara pelajar dan komuniti bagi meningkatkan kesedaran dan kefahaman komuniti tentang kepentingan biokimia dalam kehidupan seharian. Perkhidmatan

komuniti berdasarkan aplikasi pengetahuan biokimia ditekankan. Kerjasama bagi membina pengetahuan sains di kalangan masyarakat turut ditekankan

This course encompases 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 Disertasi Bacelor/ *Bachelor Dissertation* 6(0+6)

Prasyarat : BCH3109 atau BCH3110 atau BCH3111

Kursus ini merangkumi penyediaan cadangan, pelaksanaan dan penulisan saintifik untuk sesuatu projek penyelidikan. Pendekatan saintifik bagi menjana data secara sistematik melalui reka bentuk,

pengumpulan dan analisis data yang sesuai diberi penekanan

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

Jabatan Mikrobiologi/ *Department of Microbiology*

BMY3001 Mikrobiologi/ *Microbiology* 4(4+0)

Prasyarat : Tiada

Kursus ini merangkumi beberapa aspek mikrobiologi asas termasuk organisasi dan struktur mikrob, mikroskopi, sistematik dan ekologi mikrob. Pengkelasan dan pengenalpastian mikroorganisma juga dibincangkan

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 Mikrobiologi I/ *Microbiology I* 4(4+0)

Prasyarat : Tiada

Kursus ini merangkumi aspek mikrobiologi asas termasuk organisasi dan ciri sel prokariot dan eukariot. Metabolisme, pertumbuhan dan pengawalan mikroorganisma dibincangkan

This course encompasses aspects of basic microbiology including the organization and characteristics of prokaryotes and eukaryotes. Microbial metabolism, growth and control are discussed

BMY3102 Mikrobiologi II/ *Microbiology II* 4(4+0)

Prasyarat : BMY3101

Kursus ini merangkumi sistematik dan ekologi mikrob serta pengenalan kepada imunologi. Aplikasi mikroorganisma dalam persekitaran dan peranannya dalam kehidupan harian dibincangkan.

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 Fisiologi Mikrob/ *Microbial Physiology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi struktur dan aktiviti metabolik mikroorganisma. Metabolisme berpusat dan tindak balas penjanaan tenaga dihuraikan. Biogenesis dan fungsi makromolekul serta integrasi proses metabolik dibincangkan

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 Teknik Asas Mikrobiologi/ *Basic Microbiology Techniques* 2(0+2)

Prasyarat : Tiada

Kursus ini merangkumi teknik asas mikrobiologi dalam mengendalikan kultur mikroorganisma. Penggunaan mikroskop dan pelbagai jenis kaedah pewarnaan ditekankan. Keperluan fizikal dan kimia dalam pertumbuhan mikroorganisma, serta teknik enumerasi mikroorganisma juga dibincangkan.

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 Teknik Pencirian Mikroorganisma/ *Techniques in Microbial Characterization* 3(0+3)

Prasyarat : BMY3201

Kursus ini merangkumi analisis biokimia untuk pengenalpastian mikroorganisma dari pelbagai sumber. Pelbagai teknik dalam pengenalpastian mikrob dan pengiraan virus dijalankan. Kesan faktor fizikal dan kimia terhadap pertumbuhan mikroorganisma juga dikaji.

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 Teknik Mikrobiologi Lanjutan/ *Advanced Microbiological Techniques* 3(0+3)

Prasyarat : BMY3202

Kursus ini merangkumi beberapa teknik dalam mikrobiologi termasuk identifikasi bakteria enterik menggunakan bantuan komputer, pembiakan dan penulenan virus serta keupayaan fungus menggunakan pelbagai sumber karbon untuk pertumbuhan. Pelbagai teknik serologi dan molekular juga dijalankan

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 Teknik Khas dalam Mikrobiologi/ *Specialised Techniques in Microbiology* 3(0+3)

Prasyarat : BMY3203

Kursus ini merangkumi teknik khas yang digunakan dalam mikrobiologi. Pemencilan dan pengenalpastian mikroorganisma anaerobik juga dihuraikan. Teknik fermentasi makanan, bioinformatik dan kultur sel haiwan dibincangkan

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 Bakteriologi/ *Bacteriology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi pengkelasan, pencirian, ekologi dan aktiviti pelbagai jenis bakteria. Kepatogenan bakteria di dalam persekitaran dan kepada manusia diterangkan. Kegunaan bakteria dalam industri dan pertanian dibincangkan

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 Virologi/ *Virology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi ciri virus dan kaedah yang digunakan dalam virologi. Pengkelasan dan taksonomi virus diperkenalkan. Viroid dan prion dibincangkan. Jangkitan virus dan kesannya ke atas perumah, epidemiologi dan kepatogenan dihuraikan.

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 Mikologi/ *Mycology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi pengkelasan, struktur, pertumbuhan dan pembiakan, genetik dan interaksi fungus sebagai saprofit dan parasit. Peranan fungus dalam pencegahan dan pengawalan pertumbuhan mikrob dibincangkan

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 Imunologi/ *Immunology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi pelbagai konsep imunologi. Sistem kawalan imun dan peranannya dalam penyakit dibincangkan. Penyelidikan dan perkembangan terkini dalam imunologi

dihuraikan

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 Ekologi Mikrob/ *Microbial Ecology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi pelbagai aspek ekologi mikrob yang melibatkan hubungan dan interaksi sesuatu mikroorganisma dengan persekitarannya. Kaedah dan teknologi yang digunakan untuk mengkaji mikrob dan aktiviti dibincangkan. Kepentingan ekonomi dan biodiversiti populasi mikrob juga dihuraikan

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 Mikrobiologi Patogenik/ *Pathogenic Microbiology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini menekankan kepentingan mikrobiologi dalam perubatan. Interaksi antara bakteria, virus, dan fungus patogenik dengan hos dibincangkan. Diagnosis, rawatan dan pencegahan jangkitan dihuraikan

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 Fisiologi Kulat/ *Fungal Physiology* 3(3+0)

Prasyarat : BMY4303

Kursus ini merangkumi komposisi kimia dan struktur molekular sel fungus. Keperluan fizikal dan kimia untuk pertumbuhan fungus, metabolisme primer dan sekunder serta genetik dan perkembangan spora turut dibincangkan. Kerintangan dan mekanisme pertahanan terhadap fungisid dihuraikan

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 Mikrobiologi Makanan Gunaan/ *Applied Food Microbiology* 3(3+0)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi isu semasa mikrobiologi makanan gunaan termasuk kemunculan patogen bawaan makanan baharu, kaedah pantas pengenalpastian dan pencirian mikroorganisma makanan. Kesan komposisi dan kaedah pengawetan makanan dihuraikan. Ciri fungsian mikroorganisma makanan terpilih dan aplikasi dalam industri dibincangkan.

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 Genetik Mikrob/ *Microbial Genetics* 4(3+1)

Prasyarat : BMY3102 atau BMY3001

Kursus ini merangkumi pelbagai aspek genetik mikrob seperti replikasi DNA, pengawalan pengekspresan gen, mekanisme pemindahan DNA dan rekombinasi genetik. Unsur dan mekanisme transposisi serta teknik molekul dalam genetik mikrob dan gunaan dibincangkan

This course encompases 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 Latihan industri/ *Industrial Training* 6(0+6)

Prasyarat : Tiada

Kursus ini mendedahkan pelajar kepada persekitaran kerja yang sebenar di industri/organisasi. Latihan merangkumi aplikasi aspek teori dan praktikal yang telah dipelajari dengan amalan semasa di tempat kerja. Kemahiran menyelesaikan masalah dan komunikasi turut diberi penekanan

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 Pembelajaran Perkhidmatan Dalam Mikrobiologi/ *Service Learning in Microbiology* 1(0+1)

Prasyarat : BMY3203

Kursus ini merangkumi aktiviti bagi meningkatkan kesedaran dan kefahaman komuniti tentang kepentingan mikroorganisma dalam kehidupan harian. Pengetahuan mikrobiologi diaplikasikan melalui aktiviti kerjasama dengan masyarakat luar

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 Topik Terkini Mikrobiologi/ *Current Topics in Microbiology* 2(0+2)

Prasyarat *:* BMY3203

Kursus ini merangkumi sorotan literatur ke atas topik terkini dalam mikrobiologi seperti nanobioteknologi, biologi molekul, imunologi molekul dan genomik. Sorotan terhadap topik terpilih dibentangkan dalam bentuk seminar

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 Disertasi Bacelor/ *Bachelor Dissertation* 6 (0+6)

Prasyarat : Tiada

Kursus ini merangkumi penyediaan cadangan, pelaksanaan dan penulisan saintifik untuk projek penyelidikan. Pendekatan saintifik bagi menjana data secara sistematik melalui rekabentuk, pengumpulan dan analisis data yang sesuai diberi penekanan

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

Jabatan Teknologi Bioproses/*Department of Bioprocess Technology*

BTC3000 Kimia Biofizikal/ *Biophysical Chemistry* 3(2+1)

Prasyarat : Tiada

Kursus ini merangkumi prinsip kimia biofizikal yang berkaitan dengan sains biologi. Pengetahuan asas teknik kuantitatif dalam pengukuran ciri fisiko-kimia biomolekul dihuraikan

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 Pengenalan Kepada Bioteknologi/*Introduction to Biotechnology* 2(2+0)

Prasyarat : Tiada

Kursus ini merangkumi pengenalan asas kepada pelbagai bidang bioteknologi. Kemajuan dan isu terkini dalam bidang bioteknologi turut dibincangkan secara pembentangan seminar.

This course encompasses the introduction on various biotechnology fields. Recent advances and issues in biotechnology will also be discussed through seminar presentation

BTC3002 Komersialisasi dan Isu Semasa Bioteknologi/*Commercialisation and Current Issues in Biotechnology* 2(2+0)

Prasyarat : Tiada

Kursus ini merangkumi konsep dan langkah dalam pengkomersilan produk bioteknologi. Kajian kes dan kemajuan terkini yang berkaitan dengan pengkomersilan produk bioteknologi turut dibincangkan

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 Instrumentasi dalam Penyelidikan Bioteknologi/*Instrumentation in Biotechnology Research* 3(2+ 1)

Prasyarat : Tiada

Kursus ini merangkumi prinsip operasi dan cara penggunaan instrumen saintifik dalam penyelidikan bioteknologi. Kaedah interpretasi data penyelidikan yang terhasil dari kajian saintifik terpilih yang dijalankan juga dibincangkan

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 Penulisan Saintifik dalam Bioteknologi/ *Scientific Writing in Biotechnology* 3(3+0)

Prasyarat : Tiada

Kursus ini merangkumi kaedah untuk mencari dan menilail maklumat bidang bioteknologi daripada pelbagai sumber untuk penulisan saintifik. Beberapa manuskrip terpilih juga dibincangkan

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 Teknologi Enzim/*Enzyme Technology* 4(3+1)

Prasyarat : BCH3002 atau BCH3108

Kursus ini merangkumi aspek penghasilan, pengekstrakan dan penulenan enzim intrasel dan ekstrasel. Penggunaan enzim dalam pelbagai bidang turut dibincangkan

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 Teknologi Fermentasi/*Fermentation Technology* 4(3+1)

Prasyarat : BMY3001 atau BMY3101

Kursus ini merangkumi pelbagai aspek penting di dalam teknologi fermentasi yang melibatkan langkah sebelum dan semasa proses fermentasi serta analisis selepas proses fermentasi. Aplikasi teknologi fermentasi di dalam industri dibincangkan

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 Pengurusan Dan Penggunaan Sisa/ *Waste Management and Utilization* 3(2+1)

Prasyarat : Tiada

Kursus ini merangkumi pengenalan kepada pelbagai jenis sisa, termasuk kaedah pengurusan dan penggunaan sisa, serta kajian kes di Malaysia dan di negara lain. Pencirian sisa pepejal dan air sisa mengikut piawaian turut diperkenalkan.

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 Keusahawanan Bioteknologi I/*Biotechnology Entrepreneurship I* 3(2+1)

Prasyarat : MGM3180

Kursus ini merangkumi konsep biokeusahawanan yang melibatkan elemen seperti pemilihan produk dan perkhidmatan bioteknologi, jenis perniagaan dan analisis pasaran. Aktiviti kajian pasaran bagi pengkomersilan produk dan perkhidmatan bioteknologi ditekankan

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 Perancangan Biokeusahawanan/ *Bioentrepreneurship Planning* 3(2+1)

Prasyarat : BTC3501

Kursus ini merangkumi penyediaan rancangan perniagaan bagi produk atau perkhidmatan bioteknologi. Elemen penting rancangan perniagaan dan teknik kreatif dalam membina konsep produk turut dibincangkan

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 Kejuruteraan Bioproses/*Bioprocess Engineering* 4 (4+0)

Prasyarat : BTC3201

Kursus ini merangkumi aspek yang berkaitan kejuruteraan bioproses seperti asas pengiraan kejuruteraan dan pengoptimuman proses. Pengenalan kepada peralatan industri dan aspek kejuruteraan di dalam operasi bioreaktor untuk kultur sel dan tindakbalas enzim turut dibincangkan

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 Biopemisahan dan Penulenan/*Bioseparation and Purification* 4 (3+1)

Prasyarat : BTC3201

Kursus ini merangkumi pemprosesan hiliran untuk pemulihan semula dan penulenan produk bioteknologi. Pelbagai teknik biopemisahan dan penulenan dibincangkan melalui carta alir, analisis imbangan jisim dan kos

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 Rekabentuk Bioproses Dan Biopenghasilan/ *Bioprocessing and Biomanufacturing Design* 3 (2+1)

Prasyarat : BTC3301

Kursus ini merangkumi aspek rekaan dan penggabungan pelbagai unit operasi yang terlibat di dalam penghasilan, biopemisahan, penulenan dan formulasi produk bioteknologi. Sintesis dan analisis proses serta kajian kes yang berkaitan dengan rekabentuk bioproses dibincangkan

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 Sistem Bioreaktor/ *Bioreactor System* 3 (3+0)

Prasyarat : BTC3201 dan BTC3301

Kursus ini merangkumi pelbagai aspek sistem bioreaktor yang digunakan dalam proses penghasilan produk bioteknologi menggunakan mikroorganisma, enzim, sel haiwan dan tumbuhan. Keperluan spesifik terhadap rekabentuk dan pendekatan peningkatan skala bioreaktor untuk sistem biologi yang berbeza dibincangkan

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 Biokeselamatan Dan Bioetika/ *Biosafety and Bioethics* 2 (2+0)

Prasyarat : Tiada

Kursus ini merangkumi isu biokeselamatan dan bioetika dalam bioteknologi, termasuk tahap biokeselamatan dalam rekabentuk makmal. Isu berkaitan keselamatan dan etika, serta cara pengendalian isu dan pelaksanaan keputusan yang rasional turut dibincangkan

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 Bioteknologi Dalam Bioekonomi/ *Biotechnology in Bioeconomy* 2 (2+0)

Prasyarat : BTC3002

Kursus ini merangkumi konsep dan isu berkaitan aplikasi bioteknologi dalam penjanaan bioekonomi. Kepentingan teknologi berasaskan biosumber serta sumbangan bioteknologi kepada penjanaan ekonomi secara mampan dibincangkan. Kebaikan dan cabaran bioekonomi peringkat global juga dihuraikan

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 Teknologi Enzim Lanjutan/*Advanced Enzyme Technology* 4 (3+1)

Prasyarat : BTC3101

Kursus ini merangkumi aspek penyekatgerakan enzim dan sel dan aplikasi enzim tersekatgerak dalam industri. Penggunaan enzim dan sel tersekatgerak dalam biosensor dan media bukan konvensional dibincangkan

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 Bioteknologi Makanan/ *Food Biotechnology* 3 (2+1)

Prasyarat : BTC3101

Kursus ini merangkumi penggunaan biomangkin dalam industri dan ramuan makanan, dan pelajar akan mempelajari tentang penyediaan dan pengubahsuaian makanan, minuman tradisional, makromolekul makanan, makanan transgenik dan ramuan makanan dan isu semasa,serta undang-undang yang mengawal penggunaan biomangkin dalam makanan.

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 (geneticallymodified foods and ingredients) and current issues; and laws that regulate the use of biocatalysts in foods.

BTC4105 Bioteknologi Makanan Lanjutan/ *Advanced Food Biotechnology* 2 (2+0)

Prasyarat : BTC4104

Kursus ini merangkumi peranan dan sumbangan bioteknologi makanan terhadap gaya hidup masyarakat, keselamatan dan kesejahteraan sosial. Perkembangan terkini dalam bidang bioteknologi makanan dibincangkan

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 Mikrobiologi Industri/ *Industrial Microbiology* 3(2+1)

Prasyarat : BMY3001 atau BMY3101

Kursus ini merangkumi kaedah peningkatan hasil produk daripada mikroorganisma yang digunakan dalam industri. Pelbagai aplikasi dalam penghasilan produk mikrobiologi industri dibincangkan.

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 Pemodelan Dan Pengoptimuman Bioproses/ *Bioprocess Modelling and Optimization* 3(2+1)

Prasyarat : BTC3201 dan BTC3301

Kursus ini merangkumi penggunaan teknik pengoptimuman dan simulasi dalam proses biologi. Program simulasi komputer digunakan untuk pemodelan persamaan matematik, analisis statistik dan pengoptimuman parameter bioproses

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 Bioremediasi/ *Bioremediation* 3(3+0)

Prasyarat : BTC3402

Kursus ini merangkumi kaedah rawatan dan bioremediasi ke atas sisa toksik terutama terhadap tanah dan air bawah tanah yang tercemar. Potensi penggunaan mikroorganisma untuk pelbagai rawatan sisa toksik dan berbahaya dibincangkan. Proses yang diguna pakai dalam industri dirujuk untuk menjelaskan kaedah dan konsep bioremediasi.

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 Teknologi Rawatan Sisa Pepejal/ *Solid Waste Treatment Technology* 3(2+1)

Prasyarat : BTC3402

Kursus ini merangkumi teknologi pengurusan dan rawatan sisa pepejal dari pelbagai sumber. Kaedah rawatan sisa pepejal bagi pembangunan lestari dan kajian kes berkaitan teknologi rawatan sisa pepejal turut dibincangkan

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 Teknologi Rawatan Air Sisa/ *Wastewater Treatment Technology* 3(2+1)

Prasyarat : BTC3402

Kursus ini merangkumi teknologi yang terlibat di dalam rawatan air sisa. Jenis rawatan dan perbandingan bagi setiap jenis kaedah rawatan air sisa, pembuangan dan penggunaan semula air sisa dibincangkan

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 Pengurusan Biokeusahawanan/ *Bioentrepreneurship Management* 3(1+2)

Prasyarat : BTC3502

Kursus ini merangkumi pelbagai isu semasa dalam perniagaan seperti pengurusan dan operasi, pemasaran, kewangan dan keusahawanan. Analisis dan pengurusan risiko dibincangkan ke arah kemapanan usahawan bioteknologi dalam pasaran global

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 Perniagaan Bioteknologi/ *Biotechnology Business* 3(1+2)

Prasyarat : BTC4502

Kursus ini merangkumi strategi bagi pembentukan perniagaan atau syarikat bioteknologi yang sah dari segi undang-undang. Kaedah merekabentuk sampel produk atau perkhidmatan bioteknologi bagi tujuan promosi turut dibincangkan.

This course encompasses strategies for biotechnology business or company set up. Methods to design biotechnological products or services for promotional purpose are discussed

BTC4901 Latihan industri/*Industrial Training* 6(0+6)

Prasyarat : Tiada

Kursus ini memperkenalkan pelajar kepada persekitaran kerja yang sebenar di industri/organisasi. Latihan merangkumi aplikasi aspek teori dan praktikal yang telah dipelajari dengan amalan semasa di tempat kerja. Kemahiran menyelesaikan masalah dan komunikasi turut diberi penekanan

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 Khidmat Pembelajaran Dalam Bioteknologi/ *Service Learning in Biotechnology* 1(0+1)

Prasyarat : BTC3001

Kursus ini merangkumi penglibatan pelajar dalam aktiviti bersama komuniti / industri bagi meningkatkan kesedaran dan kefahaman orang awam berkenaan peranan bioteknologi dalam kehidupan seharian. Proses pembelajaran merangkumi perancangan aktiviti bersama komuniti, demonstrasi dan aktiviti 'hands-on' yang memenuhi keperluan komuniti

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 Disertasi Bacelor/ *Bachelor Dissertation* 6(0+6)

Prasyarat : Tiada

Kursus ini merangkumi penyediaan cadangan, pelaksanaan dan penulisan saintifik untuk sesuatu projek penyelidikan. Pendekatan saintifik bagi menjana data secara sistematik melalui rekabentuk, pengumpulan dan analisis data yang sesuai diberi penekanan

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/*Seminar* 1(0+1)

Prasyarat : BTC4959

Kursus ini merangkumi penyediaan dan penyampaian seminar secara berkesan mengenai projek penyelidikan dalam bidang teknologi bioproses. Pendedahan kepada pelbagai teknik penyampaian seminar dicapai dengan menghadiri seminar tertentu di dalam kampus

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

Jabatan Biologi Sel dan Molekul/ *Department of Cell & Molecular Biology*

BSM3101 Biologi Sel dan Perkembangan/ *Cellular and Developmental Biology* 3(3+0)

Prasyarat : Tiada

Kursus ini merangkumi prinsip biologi dan membandingkan pelbagai jenis sel seperti prokariot, eukariot dan virus, dari segi fisiologi dan organisasi genom. Konsep kitaran sel, struktur dan fungsi pelbagai jenis sel dan organel dibandingkan. Teori endosimbiosis, struktur dan fungsi membran sel dan nukleus serta mekanisme pengangkutan molekul juga diterangkan. Proses perkembangan dan perbezaan sel eukariot dan isu terkini berkaitan biologi sel dan perkembangan dibincangkan.

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 Prinsip Kultur Sel dan Tisu/ *Principles of Cell and Tissue Culture* 3(2+1)

Prasyarat : Tiada

Kursus ini merangkumi prinsip dan prosedur asas kultur tisu tumbuhan dan haiwan. Keperluan asas untuk mewujudkan dan memelihara kultur sel di dalam makmal akan ditekankan. Ini termasuklah pelbagai kaedah seperti kultur embrio zigotik, kultur kalus dan organogenesis. Kestabilan genetik dan variasi somaklon akan dibincangkan. Kursus ini juga meliputi pelbagai konsep dan teknik dalam pengkulturan sel haiwan. Prinsip penghasilan antibodi monoklonal dan perbagai asai sitotoksik juga akan dibincangkan.

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 Biologi Molekul/ *Molecular Biology* 3(3+0)

Prasyarat : Tiada

Kursus ini merangkumi prinsip biologi molekul seperti struktur dan peranan DNA dan RNA sebagai bahan genetik, struktur kromosom dan pewarisan di luar kromosom. Elemen yang boleh ditransposisikan, replikasi DNA, transkripsi, translasi, mutasi, metilasi, pembaikan DNA dan hubungan antara proses tersebut dibincangkan. Pengawalaturan ekspresi gen di antara prokariot dan eukariot dibandingkan.

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 Kejuruteraan Genetik/ *Genetic Engineering* 4(3+1)

Prasyarat : BSM3201

Kursus ini merangkumi teknik asas untuk pengklonan dan manipulasi gen. Prosedur pengklonan, penyaringan dan pengenalpastian gen asing, vektor pengklonan, pembatasan vektor dan selitan DNA dan proses transformasi dibincangkan. Teknologi PCR dan penjujukan DNA juga diterangkan. Isu

etika berkaitan dengan teknologi DNA rekombinan turut diberikan penekanan

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 Teknik Penyelidikan Dalam Biologi Molekul/ *Research Techniques in Molecular Biology* 3(2+1)

Prasyarat : BSM3201

Kursus ini merangkumi teori dan penggunaan teknik dalam penyelidikan biologi molekul termasuk teknik pemencilan DNA genom (prokariot dan eukariot), penulenan DNA, penghibridan dan pemblotan DNA, pelabelan prob, pemencilan dan elektroforesis RNA, tatasusunan mikro dan PCR masa-nyata. Teknik lanjutan untuk analisis DNA, RNA dan protein seperti cDNA-AFLP, SDS-PAGE, gel elektroforesis-2D dan translasi *in vitro* turut dibincangkan.

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 disscussed.

BSM3204 Prinsip Genetik/ *Principles of Genetics* 3(2+1)

Prasyarat : Tiada

Genetik, sains pewarisan dan variasi dibincangkan berdasarkan penemuan Mendel. Peranan dan aplikasi penting hukum genetik asas seperti Hukum Mendel dan Prinsip Hardy-Weinberg dalam ciri pewarisan di peringkat individu dan populasi serta relevannya hukum ini di dalam kehidupan manusia juga dibincangkan. Pelbagai konsep dan cabang genetik terkini turut diperkenalkan. Aplikasi konsep genetik dalam pemuliharaan biodiversiti dan biosumber dibincangkan

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 heriditary 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 Kultur Sel dan Tisu Haiwan/ *Animal Cell and Tissue Culture* 3(2+1)

Prasyarat : BSM3101

Kursus ini merangkumi pelbagai teknik pengkulturan sel dan tisu haiwan seperti penyediaan kultur sel ampaian, sel melekat dan kultur tisu primer. Penggunaan prinsip dan teknik pengkulturan sel skala besar, penghasilan sel hibridoma dan pengkulturan sel stem hemopoitik dihuraikan. Aplikasi teknik pengkulturan tisu haiwan dan isu etika dibincangkan

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 Imunologi Sel dan Molekul/ *Cell and Molecular Immunology* 3(3+0)

Prasyarat : BSM3401

Kursus ini merangkumi konsep penting dalam imunologi termasuk ciri asas tindakbalas imun, sel dan tisu dalam sistem imun serta mekanisme keimunan. Biologi limfosit T dan B termasuk perkembangan sel T dan B dari sel induk, pengaktifan dan pengawalaturan sel T dan B, antibodi dan antigen, molekul kompleks keserasian histo utama, imunologi transplantasi, hipersensitiviti dan autoimuniti dibincangkan

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 Kultur Sel dan Tisu Tumbuhan/ *Plant Cell and Tissue Culture* 3(2+1)

Prasyarat : BSM3101

Kursus ini merangkumi penghasilan kultur sel dan tisu tumbuhan, organisasi dan keperluan makmal bagi menjalankan teknik aseptik. Penekanan diberikan kepada komponen media, konsep penting dan pelbagai jenis kultur sel dan tisu tumbuhan. Kestabilan genetik, variasi somaklon, rekabentuk eksperimen, serta aplikasi teknik kultur sel dan tisu tumbuhan dalam industri berasaskan pertanian dibincangkan

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 Mikroteknik/ *Microtechniques* 4(3+1)

Prasyarat : BSM3101

Kursus ini merangkumi prinsip dan kaedah asas dalam kajian histologi tumbuhan dan haiwan. Pengawetan tisu, penyusupan dan pembenaman parafin, pewarnaan histologi, penyediaan slaid, identifikasi sel dan tisu tumbuhan serta haiwan dibincangkan. Integrasi antara morfologi mikroskopi dengan fisiologi asas sel dan tisu juga diterangkan. Kemahiran menggunakan mikroskop cahaya dan teknik asas histologi juga diberi penekanan

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 Genetik Molekul Gunaan/ *Applied Molecular Genetics* 4(3+1)

Prasyarat : BSM3202

Kursus ini merangkumi pembangunan teknologi genetik molekul dan kegunaannya dalam pelbagai bidang bioteknologi. Pembangunan dan penggunaan protein rekombinan dalam sistem prokariot dan eukariot, peranan genomik fungsian dalam pemahaman dan pengubahsuaian proses biologi di peringkat molekul dan aplikasi kejuruteraan genetik dalam pelbagai industri dibincangkan

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 Diagnostik Molekul/ *Molecular Diagnostics* 2(2+0)

Prasyarat : BSM3401

Kursus ini merangkumi penemuan yang membawa kepada kewujudan bidang yang dipanggil diagnostik molekul. Konsep saintifik dalam revolusi diagnostik molekul diterangkan. Sitogenetik molekul, onkologi molekul dan pengesanan mikroorganisma penyebab penyakit berjangkit dikaji. Teknologi lanjutan seperti tatasusunan mikro genom manusia dan penggunaannya dalam diagnosis penyakit dibincangkan

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 Genomik Fungsian/ *Functional Genomics* 3(3+0)

Prasyarat : BSM3201 atau BMY4310

Kursus ini merangkumi prinsip genomik fungsian dan kaedah penyelidikan yang terlibat dalam bidang yang berkaitan. Biologi molekul yang menentukan fungsi biologi gen dan produknya dengan menggunakan jujukan genom dibincangkan. Aplikasi kaedah berskala genom diperkenalkan. Topik semasa dalam fungsian genomik juga dibincangkan

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 Bioinformatik/ *Bioinformatics* 3(2+1)

Prasyarat : BSM3201 atau BCH3107

Kursus ini merangkumi penelitian konsep asas dan kaedah dalam bioinformatik. Penekanan adalah kepada aspek teori dan praktik dalam analisis dan pengolahan jujukan asid nukleik dan protein,

serta penggunaan perisian dalam analisis. Kegunaan bioinformatik dalam biologi molekul dibincangkan

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 Kultur Sel dan Tisu Tumbuhan Gunaan/ *Applied Plant Cell and Tissue Culture* 4(3+1)

Prasyarat : BSM3501

Kursus ini merangkumi konsep penting bagi pembiakan klon tumbuhan pertanian, hortikultur dan perubatan. Kaedah bagi pengeluaran tumbuhan bebas dari patogen, variasi rintang penyakit dan tekanan serta kepentingannya dalam penghasilan varieti baru dibincangkan. Prinsip penyimpanan germplasma dan penghasilan metabolit sekunder serta potensi kejuruteraan genetik tumbuhan diterangkan

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 Biologi Sel dan Molekul Tumbuhan Gunaan/ *Applied Plant Molecular and Cell Biology* 4(3+1)

Prasyarat : BSM3202

Kursus ini merangkumi aspek manipulasi dan penganalisaan genom tumbuhan. Teknik biologi molekul dalam pembiakbakaan tumbuhan diterangkan. Pelbagai isu berkaitan dengan produk terubahsuai secara genetik juga dibincangkan.

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 Biologi Molekul Perkembangan Tumbuhan/ *Molecular Biology of Plant Development* 4(4+0)

Prasyarat : BSM3201 dan BSM3101

Kursus ini merangkumi prinsip asas biologi perkembangan tumbuhan. Aspek perkembangan sel dan organ tumbuhan seperti struktur dan fisiologi sel, proses perkembangan sel dan organ dibincangkan. Hubungkait di antara pengekspresan gen dengan fungsi struktur dan fisiologi tisu tumbuhan diterangkan

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 Kejuruteraan Protein/ *Protein Engineering* 4(3+1)

Prasyarat : BSM3201/BMY4310 dan BSM4301

Kursus ini merangkumi penggunaan teknik kimia dan genetik untuk mengubahsuai protein. Penekanan diberikan kepada teori penstabilan protein, teknik penulenan, analisis, penentuan struktur 3D dan teknik pengubahsuaian protein

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 Proteomik/ *Proteomics* 4(3+1)

Prasyarat : BSM3201 atau BMY4310

Kursus ini merangkumi konsep, teknologi dan kegunaan proteomik. Dinamik dan kekompleksan proteom, pengubahsuaian dan kepelbagaian protein, pengekspresan dan interaksi proteom, teknologi proteom dan

penggunaannya, serta informatik protein dihuraikan. Kegunaan proteomik dalam penyelidikan berasaskan bioteknologi dan perubatan dibincangkan

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 Biologi Struktur/ *Structural Biology* 3(3+0)

Prasyarat :BSM3201 atau BMY4310

Kursus ini merangkumi pengetahuan asas mengenai struktur tiga dimensi protein. Kepentingan struktur protein dalam penentuan fungsi protein dibincangkan. Selain itu, beberapa teknik penting penentuan struktur protein secara kristalografi dan Nuclear Magnetic Resonance (NMR) juga diterangkan. Aplikasi berkaitan biologi struktur dalam bidang sains turut dibincangkan

This course encompasses the basic knowledge about the three dimensional struture 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 Bahan Nano Dan Bioteknologi/ *Nanomaterials and Biotechnology* 3(3+0)

Prasyarat : BCH3201 atau BCH3107

Kursus ini merangkumi prinsip asas penggunaan bahan nano dalam kajian bioteknologi. Konsep sintesis dan pencirian bahan nano, serta instrumentasi dalam nanobioteknologi dibandingkan dan diterangkan. Kadar ketoksikan dan kelangsungan in vitro serta in vivo pelbagai bahan nano turut dibincangkan. Aplikasi bahan nano dalam pelbagai bidang seperti perubatan, pertanian, dan alam sekitar diterokai

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 Latihan Industri/ *Industrial Training* 6(0+6)

Prasyarat : Tiada

Kursus ini mendedahkan pelajar kepada persekitaran kerja yang sebenar di industri/organisasi. Latihan merangkumi aplikasi aspek teori dan praktikal yang telah dipelajari dengan amalan semasa di tempat kerja. Kemahiran menyelesaikan masalah dan komunikasi turut diberi penekanan

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 Pembelajaran Perkhidmatan dalam Biologi Sel dan Molekul/ *Service Learning in Cell and Molecular Biology* 1(0+1)

Prasyarat : BSM3202

Kursus ini merangkumi aktiviti bagi meningkatkan kesedaran dan kefahaman komuniti tentang kepentingan biologi sel dan molekul dalam kehidupan harian. Proses pembelajaran dan bekerjasama dengan masyarakat luar bagi membina pengetahun sains, demonstrasi dan aktiviti ”hands-on‟ bagi memenuhi keperluan komuniti

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/ *Seminar* 1(0+1)

Prasyarat : BSM4201

Kursus ini merangkumi penyediaan dan penyampaian seminar secara berkesan mengenai projek penyelidikan dalam bidang biologi sel dan molekul. Pelajar perlu membuat sorotan literatur, menyusun dan membentangkan maklumat biologi sel dan molekul dalam satu seminar

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 Disertasi Bacelor/ *Bachelor Dissertation* 8(0+8)

Prasyarat : Tiada

Kursus ini merangkumi penyediaan cadangan, pelaksanaan dan penulisan saintifik untuk sesuatu projek penyelidikan. Pendekatan saintifik bagi menjana data secara sistematik melalui rekabentuk, pengumpulan dan analisis data yang sesuai diberi penekanan

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

KURSUS TAWARAN FAKULTI LAIN

(Sila rujuk sinopsis pada fakulti berkenaan)

1. FAKULTI EKOLOGI

1.1	SKP2101	Kenegaraan Malaysia/ *Malaysian Nationhood*	3(3+0)
1.2	SKP3112	Falsafah Dan Isu Semasa/ *Philosophy And Current Issues*	2(2+0)
1.3	SKP3122	Penghayatan Etika dan Peradaban/ *Internalization of Ethics and Civilization*	2(2+0)

2. FAKULTI EKONOMI DAN PENGURUSAN

2.1	ACT2112	Perakaunan Pengenalan/ *Introductory Accounting*	4(4+0)
2.2	MGM3123	Pengurusan Sumber Manusia/ *Human Resource Management*	3(3+0)
2.3	MGM3180	Asas Keusahawanan/ *Basic Entrepreneurship*	3(2+1)
2.4	MGM3211	Prinsip Pemasaran/ *Principles of Marketing*	3(3+0)
2.5	MGM4184	Pengurusan Perniagaan Kecil/ *Small Business Management*	3(3+0)
2.6	MGM4174	Pengurusan Perkhidmatan/ *Services Management*	3(3+0)

3. PUSAT PEMAJUAN KOMPETENSI BAHASA

3.1	LPE2301	*Academic Interaction and Presentation*	3(3+0)
3.2	LPE2501	*Academic Writing*	3(3+0)

4. FAKULTI PERTANIAN

4.4	PLP3204	Patologi Tumbuhan Asas/ *Fundamentals of Plant Pathology*	4(3+1)
4.5	PRT2009	Pertanian dan Kehidupan/*Agriculture and Life*	2(1+1)

5. FAKULTI SAINS

5.1	BGY3701	Biostatistik/ *Biostatistics*	3(2+1)