UNIVERSITI MALAYA

FAKULTI SAINS
Faculty of Science

FACULTY OF SCIENCE

HANDBOOK

BACHELOR DEGREE OF SCIENCE

2024/2025

Sambutan Jubli Nilam
Sapphire Jubilee 1959-2024

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FACULTY OF SCIENCE HANDBOOK

This booklet provides information that is key to your successful navigation of the Science programme that you have been offered. In particular, you are advised to understand the information provided here that will assist your progress throughout the programme.

- Bachelor of Science with Education

Department of Chemistry

- Bachelor of Science in Chemistry

Department of Geology

- Bachelor of Science in Applied Geology

Department of Physics

- Bachelor of Science in Physics

Institute of Mathematical Sciences

- Bachelor of Science in Mathematics
- Bachelor of Science in Statistics
- Bachelor of Actuarial Science

Institute of Biological Sciences

- Bachelor of Science in Ecology and Biodiversity
- Bachelor of Science in Biochemistry
- Bachelor of Science in Biotechnology
- Bachelor of Science in Microbiology and Molecular Genetics
- Bachelor of Science in Enviromental Management

The Bachelor of Science (BSc) is a 8 semesters programme. The time span of each programme allows undergraduates to sufficiently plan their pathway without burdening themselves with too many credits in one semester. You are advised to seek counsel with any of the appointed members of the panel of academic advisors for your respective programmes of study whenever you are facing any difficulties and uncertainties regarding academic and other matters related to your studies at this Faculty. Students are also reminded to understand and obey the rules set by the university as stated in the Universiti Malaya (Bachelors's Degree) Rules & Regulations 2024 together with Undergraduate Faculty of Science Handbook Academic Session 2024/2025.

THE DEAN'S WELCOME NOTE

Assalamualaikum WBT and Greetings to all.

First and foremost I would like to welcome all of you to the Faculty of Science (FoS) for the 2024/2025 academic session. Being in this faculty means that you are in one of the oldest faculties in the Universiti Malaya. "Old" maybe the general features you will encounter around you — the buildings, the labs and the facade — but old doesnt mean irrelevant. FoS is one the top performers in the university in terms of research output, securing the highest number of research grants and producing the highest numbers of research publications. Researchers in the faculty are very actively involved with their partners in the private and commercial sector, as well as public organisations and agencies. These represent gateways for highly motivated and proactive students like yourselves to start a career of your choice.

I would like to take this opportunity to congratulate all of you for being accepted to the various programmes in the FoS. For those of you who have made FoS as one of your choices, you will find that our programmes offer a lot of opportunities for you to gain valuable knowledge and experience in the fields of your choice. For the rest of you who may have made other career plans I urge you to look at your future with the FoS positively, as an opportunity explore new possibilities and quench your thirst for knowledge with the various courses that we have to offer. The range of courses that you can take is even greater this year, when programmes across different faculties will be made available to you as electives. The choice is yours, and opportunities are there for the taking.

Undergraduate years are probably going to be one of the best years if not THE best for many of you (*it certainly was for me*). You will quickly discover that your experience at the university is more than just about classes and exams. Beside attending lectures and practical labs, or even dealing with crunch-time during the exam weeks, you will inadvertently (or not) be involved in social activities and sporting events organized by the various clubs and student groups. Participating in these activities is important as it broadens your perspectives beyond your classroom, and allows you to sharpen your soft skills. It is definitely a quick and an effective way to make new friends and extend your network, but most important is that it allows you to develop into a holistic individual and become "future proof". With a journey well planned and time well spent, by the time you graduate you will be more than ready to face the challenges ahead. Grab this chance to be the best version of yourself for the future.

There will indeed be times when you face tough challenges and feel that the world is against you; remember that you are never on your own at the FoS. You have friends around you, and the academics and staffs are there to assist and advise you accordingly. I wish you all the best, and remember to take time to smell the roses.

"Attitude Determines Altitude"

Prof Zul-Q
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Professor Dr. Zulqarnain Bin Mohamed
Dean
Faculty of Science

INTRODUCTION TO FACULTY OF SCIENCE

The Faculty of Science is among the oldest and most accomplished faculties in the Universiti Malaya. Established in 1959 with four departments namely Department of Botany, Department of Chemistry, Department of Mathematics and Department of Zoology. Currently, the Faculty of Science is the biggest faculty in Universiti Malaya with nearly 2252 undergraduate students, 693 postgraduate students, 233 academic staffs and 229 support staffs.

In addition to functioning as a teaching centre, the Faculty of Science, staffed with locally and internationally feted researchers, serves as one of the main and excellent research hub for Science & Technology in the region. Faculty of Science has established Research Centres including Photonics, CENAR, CEBAR, UMCiL, Nanocat, CIUM, CRYSTAL, Mushroom Research Centre and Glycolipids Self-Assembly and Related Phenomena. Apart from many modern research facilities and equipment, the faculty also boasts several research centres including the Ulu Gombak Field Studies Centre and the Glami Lemi Biotechnology Research Centre (PPBGL) in Jelebu. Hence, the Faculty of Science continues to be the most productive faculty in Universiti Malaya in terms of research activities and scientific publications.

The faculty also manages its very own online scientific journal, the "Malaysian Journal of Science" which publishes high quality research outputs of its members besides receiving other worldwide contributions.

VISION, MISSON, CORE VALUES AND QUALITY POLICY, UNIVERSITI MALAYA

VISION

A global university impacting the world.

MISSION

Pushing the boundaries of knowledge and nurturing aspiring leaders.

CORE VALUES

QUALITY POLICY

Universiti Malaya is committed to conduct teaching and learning, carry out research and provide quality services on a global level, generate and enhance knowledge through continuous improvement efforts for the benefit of all stakeholders, especially Universiti Malaya's students.

Home of the Bright, Land of the Brave

Di Sini Bermulanya Pintar, Tanah Tumpahnya Berani

ACADEMIC CALENDAR
2024/2025 ACADEMIC SESSION
(BACHELOR DEGREE LEVEL)

SEMESTER I			
Orientation (Week of Welcome) – WOW	1 week	29.09.2024	- 06.10.2024
Lectures	7 weeks*	07.10.2024	- 24.11.2024
Mid-Semester I Break Lectures	1 week	24.11.2024	- 01.12.2024
Lectures	7 weeks*	02.12.2024	- 19.01.2025
Revision Week	1 weeks*	20.01.2025	- 26.01.2025
Semester I Final Examination	3 weeks	27.01.2025	- 16.02.2025
Semester I Break	4 weeks	17.02.2025	- 16.03.2025
	23 weeks		
SEMESTER II			
Lectures	7 weeks*	17.03.2025	- 04.05.2025
Mid – Semester II Break Lectures	1 week*	05.05.2025	- 11.05.2025
Lectures	7 weeks*	12.05.2025	- 29.06.2025
Revision Week	1 week	30.06.2025	- 06.07.2025
Semester II Final Examination	3 weeks*	07.07.2025	- 27.07.2025
	23 weeks		
SEMESTER BREAK			
Semester Break	4 weeks*	28.07.2025	- 24.08.2025
SPECIAL SEMESTER			
Lectures	7 weeks*	28.07.2025	-14.09.2025
Special Semester Final Examination	1 week*	15.09.2025	-21.09.2025
Semester Break	1 weeks	22.09.2025	-28.09.2025
	9 weeks		

Note:

(*) The Academic Calendar has taken into account public and festive holidays.

Deepavali (01 November 2024)
Christmas Day (25 December 2024)
New Year (1 January 2025)
Chinese New Year (29 & 30 February 2025) (Wednesday & Thursday)
Federal Territory Day (1 February 2025)
Thaipusam (11 February 2025) (Tuesday)
Nuzul Al-Quran (17 March 2025) (Monday)
Eidul Fitri (31 March & 01 April)
Wesak Day (12 May 2025)
His Majesty's King's Birthday (2 June 2025)
Eidul Adha (06 June 2025)
Awal Muharam (27 June 2025)

(Senate 24.1.2024)

BACHELOR OF SCIENCE PROGRAMME STRUCTURE

Table 1: Programme Structure

COURSE	COURSE CO NTENT		CREDIT
UNIVERSITY COURSES (12 / 14 credits)	GIG1012 / GLT1049	Philosophy and Current Issues (local students) / Malay Language Communication(*only for international students)	2
	GIG1013	Appreciation of Ethics and Civilisations	2
	GIG1003	Basic Entrepreneurship Enculturation	2
	GKA/GKI/GKK/ GKP/GKS/GKU	Co-Curriculum	2 / 4
	English Course : Refer to the List of Courses To Be Completed By All Students (New Cohort) **Table 3**		4
PROGRAMME COURSES* (96-98 credits)	Core Courses		73 - 87
	Elective Courses		
	(I) Programme Elective Courses or/and Minor Package **		24 – 38
	(II) Elective University Courses (Student Holistic Empowerment [SHE] Kluster 1 – Kluster 4) Note: Refer to the List of Student Holistic Empowerment (SHE) – **Table 4**		8
OVERALL TOTAL			**132 - 135**

Note:

* Programme Course

For Bachelor of Actuarial Science programme:
(1) Programme Course : 133 credits
(2) Overall Total: 145 credits.

** Minor package

(1) Students are required to complete a minimum of 25 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, student can refer to UMSItS Guide via this link : https://umsitsguide.um.edu.my/

(3) Minor package is not eligible for the following programmes :
(a) Bachelor of Science with Education
(b) Bachelor of Science in Biotechnology

List of Minor Package

- Malay Studies
- Japanese language
- Arabic Language
- Economy
- Sport management
- Sport Science (Exercise Science)
- Statistical Sciences
- Mathematical Sciences
- Chemistry
- Geology
- Physics
- Biochemistry
- Enviromental Management
- Ecology and Biodiversity
- Microbiology and Molecular Genetics
- Microbiology
- Genetics
- Information Technology
- Islamic Studies
- Performing Arts
- Anthropology and Sociology
- English
- Environmental Studies
- International and Strategic Studies
- Southeast Asian Studies
- East Asia Studies
- Indian Studies
- Chinese Studies
- Social Administration
- History
- Gender Studies
- Chemical Engineering
- Electrical Engineering
- Biomedical Engineering
- Civil Engineering
- Mechanical Engineering

In order for the minor qualification to be displayed on the transcript, student must complete the minimum 25 credits under the same Minor Package.

Scan for more information

TABLE 2 : ENGLISH COMMUNICATION PROGRAMME(UNIVERSITY COURSE) (KURSUS BAHASA INGGERIS KOMUNIKASI- KURSUS UNIVERSITI) FACULTY OF LANGUAGES AND LINGUISTICS LIST OF COURSES TO BE COMPLETED BY ALL STUDENTS (NEW COHORT)		
PATH 1	• **MUET Band 2 *(2008-2020)** • **MUET Band 2 & 2.5 (2021)** • **IELTS Band 4.0** • **TOEFL Paper – Based Test (437 –473)** • **TOEFL Computer – Based Test(123 – 150)** • **TOEFL Internet – Based Test (41–52)** • **PTE (Academic) – (10 – 28)**	Students need to complete 2 courses (2 courses x 2 credits each) from this PATH **COMPULSORY** ● GLT1018 – Proficiency in English I **** CHOOSE ONE :** ● GLT1019 – Let's Speak ● GLT1020 – Fundamental Writing
PATH 2	• **MUET Band 3 (2008-2020)** • **MUET Band 3 & 3.5 (2021)** • **IELTS Band 4.5 – 5.0** • **TOEFL Paper – Based Test (477 – 510)** • **TOEFL Computer – Based Test (153 – 180)** • **TOEFL Internet – Based Test (53 – 64)** • **PTE (Academic) – (29 - 41)**	Students need to complete 2 courses (2 courses x 2 credits each) from this PATH **COMPULSORY** ● GLT1021 – Proficiency in English II **** CHOOSE ONE :** ● GLT1022 – Speak Up ● GLT1023 – Effective Workplace Writing
PATH 3	• **MUET Band 4 (2008 – 2020)** • **MUET Band 4 & 4.5 (2021)** • **ELTS Band 5.5 – 6.0** • **TOEFL Paper – Based Test (513 – 547)** • **TOEFL Computer – Based Test (183 – 210)** • **TOEFL Internet – Based Test (65-78)** • **PTE (Academic) – (42 – 57)** • **FCE (B & C)** • **GCE A Level (English) (Minimum C)** • **IGCSE/GCSE (English) (A, B & C)**	Students need to complete 2 courses (2 courses x 2 credits each) from this PATH **COMPULSORY** ● GLT1024 – Proficiency in English III **** CHOOSE ONE :** ● GLT1025 – Effective Oral Communication ● GLT1026 – Writing at the Workplace
PATH 4	• **MUET Band 5 & Band 6 (2008- 2020)** • **MUET Band 5 & 5+ (2021)** • **IELTS Band 6.5 – 9.0** • **TOEFL Paper – Based Test (550 – 677)** • **TOEFL Computer – Based Test (213 – 300)** • **TOEFL Internet – Based Test (79 – 120)** • **PTE (Academic) (58 – 90)** • **FCE (A)** • **GCE A Level (English) (B & A)**	Students need to complete 2 courses (2 courses x 2 credits each) from this PATH ● GLT1027– Advanced Oral Communication* ● GLT1028 – Advanced Business Writing* *(Students can only register for one course per semester) ** Foreign language (For MUET Band 5 & 6

** Kursus ini mempunyai Pra Syarat dan hanya boleh didaftar selepas pelajar LULUS kursus WAJIB mengikut Path yang ditetapkan.
These courses have prerequisites and students can only register for them after obtaining a PASS in the compulsory course as stipulated in the respective PATH.

Languageunit-fbl-rm(12/4/2021)

BACHELOR OF SCIENCE WITH EDUCATION PROGRAMME STRUCTURE

Table 3: Programme Structure

COURSE	COURSE CONTENT		CREDIT
UNIVERSITY COURSES (22 credits)	GIG1012	Philosophy and Current Issues (Local Student)	2
	GIG1013	Appreceation of Ethics and Civilisations	2
	GIG1003	Basic Entrepreneurship Culture	2
	GIG1004	Information Literacy	2
	GIG1005	Social Engagement	2
	GKA/GKI/GKK/ GKP/GKS/GKU	Co-Curriculum	2
	GIA-GIX^{xxxx} *(Except with code GIS^{xxxx} courses)*	External Faculty Elective Courses (KELF)	4
	English Course : Refer to the List of Courses To Be Completed By All Students (New Cohort) **Table 3**		6
FACULTY CORE COURSES (8 credits)	SIX1001	Introduction to Science & Technology Studies	3
	SIX1002	Ethics and Safety	2
	SIX1003/1004/1005	Biostatistics/Statistics/Geostatistics	3
PROGRAMME COURSES* (66 - 103credits)	Major Program Core Courses Program Elective Courses	Refer to the Structure of Programme at the respective Institutes/Departments: *Biology/Mathematics/Chemistry/Physics*	66
	Minor Program Courses	Compulsory Minor Courses Program Elective Courses (KT1) Program Elective Courses (KT2)	37
FACULTY ELECTIVE COURSES (8 credits)	Faculty Elective Courses	Courses taken from other Institutes/Departments *Note: Refer to the List of Faculty* Elective Courses *from the various Institutes/Departments*	8
OVERALL TOTAL**			**141**

ELECTIVE UNIVERSITY COURSES
(STUDENT HOLISTIC EMPOWERMENT [SHE])

Table 4

KLUSTER 1 THINKING MATTERS: MIND AND INTELLECT		
Course Code	**Course Name**	**Credit**
GBI0001	Principles of Muamalat and Islamic Management	2
GBI0012	Hadith and Life	2
GBI0013	Islam and Science	2
GBI0014	Quran andCivilization	2
GBT0002	Critical Thinking and Problem SolvingSkills	2
GBE0003	Economics 123	2
GBE0015	Seeing theWorld like an Economist	2
GBE0018	Philosophy, Religion and Spiritual Life	2
GBC0004	Personal Finance	2
GBC0019	Personal Income Tax	2
GBC0020	Tourism as a Business	2
GBC0005	UnderstandingConsumer Psychology	2
GBM0006	Physics andRadiation in Life	2
GBA0021	AppreciatingLiterature	2
GBA0022	An Overview ofEuropean Civilisation	2
GBA0007	DigitalLiteracy for student success	2
GBS0023	Dealing withpseudoscience	2
GBL0008	My Constitution	2
GBR0024	Introduction to Drama Aesthetic	2
GBX0009	Information seeking, Writing, and Academic publications	2
GBX0010	Introduction to Social Entrepreneurship	2
GBX0011	STEM EducationManagement	2
GBX0016	Mining the Millionaire Mind	2
GBX0017	Rethinking Development Ideas	2
KLUSTER 2 **EMOTIONAL, PHYSICAL AND SPIRITUAL INTELLIGENCE: HEART, BODY AND SOUL**		
GDI0001	Strengthening ofIslamic Creed	2
GDI0002	Basic of IslamicPsychospiritual	2
GDI0003	Islamic AkhlaqEducation	2
GDM0006	Global Trends in Food and Health	2
GDA0007	Psychology Positive in Daily Life	2
GDR0008	Music Moves	2
GDR0009	Mindfulnessthrough Music	2
GDR0010	Dance in the World	2
GDV0011	Wellness,Fitness and Nutrition	2

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GDV0012	Exercise andActive Living	2
GDO0013	Tobacco and Smoking Cessation Programme	2
GDP0014	Stress Management	2
GDX0015	Appreciation of Harmony Singing	2
GDD0004	Dental Health	2
KLUSTER 3 TECHNOLOGY/ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS: i-TECHIE		
GFT0006	Technologyin language learning	2
GFE0007	DataAnalytics Made Easy: For Beginners	2
GFK0008	Electrical and Electronics Technologies for the Non-Engineer	2
GFP0009	Digital Creativity	2
GFP0010	EducationalTechnology for All	2
GFP0011	Responsible Digital Citizenship	2
GFC0012	Digital Business	2
GFS0013	Introduction toBiocomputing	2
GFS0014	ScientificComputing for Non-Scientists	2
GFW0015	Computational Thinking with Robotics	2
GFW0003	Data Analyticsfor Digital Community	2
GFW0016	Cinematography 101	2
GFW0002	Computational Thinking	2
GFW0017	Social Informatics	2
GFW0018	Security andEthics in Cyberspace	2
GFW0001	Artificial Intelligencefor Everyone	2
GFW0021	Excel Associate	2
GFW0022	Microsoft Office Specialist: Microsoft Excel Expert	2
GFW0023	Microsoft Office Specialist: Word Expert	2
GFW0024	Microsoft Office Specialist: Powerpoint Associate	2
GFW0025	Microsoft Office Specialist: Word Associate	2
GFL0004	ECommerceLaw	2
GFR0019	Digital Video Productionfor Web	2
GFX0020	Basic Digital Graphics	2
GFX0005	Digital Photography	2
KLUSTER 4 GLOBAL ISSUES AND COMMUNITY SUSTAINABILITY: MAKING THE WORLD A BETTER PLACE		
GQI0001	Fundamentals of IslamicPolitical Thought	2
GQI0002	Islamic Law and GlobalIssues	2
GQI0003	Islamic Economic Institutions	2
GQJ0004	Malay Language Usage in society	2
GQJ0005	Malay LanguageCompetency	2
GQJ0006	Introduction toMalay Literature	2
GQJ0007	Introduction to MalayCulture	2
GQB0008	Sustainable Construction	2
GQB0009	Exploring Real Estate	2

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GQB0010	Urbanism	2
GQE0011	Democracy and Society	2
GQE0012	CommunityEconomic Empowerment	2
GQE0013	Sustainability In Practice	2
GQP0014	Educationfor Sustainable and Sustainability	2
GQP0015	Global Education	2
GQP0016	ComparingEducation Systems	2
GQC0017	Introduction to Corporate Social Responsibility	2
GQA0018	Gender andCitizenship	2
GQA0019	Human Rights inSoutheast Asia	2
GQA0020	Literature and Gender	2
GQA0021	Introduction toChinese Culture	2
GQA0022	Bite-Size Climate Action	2
GQS0023	Geoheritage andGeotourism	2
GQS0024	Environmental Science and Pollution Control	2
GQS0025	Science, Technology and Sustainable Development	2
GQS0026	Earth Natural Resources	2
GQL0027	Children and theLaw	2
GQX0028	Introduction toReligious Dialogue	2
GQX0029	Introduction toCivilisational Dialogue	2
GQX0030	Appreciation of Calligraphy	2
GQX0031	Appreciation ofMalaysian Heritage Dance	2
GQX0032	Peace andGlobal Citizenship	2
GQX0033	Social Cohesion inMalaysia	2
GQX0034	Indigenous Communities in Malaysia and Its CurrentIssues	2
GQX0035	Introduction to Disability Equality Training	2
GQX0036	Heritage of the Art of Canting	2
GQX0037	Heritage of TraditionalCraft	2
GQX0038	Introduction to Tobacco Control	2
GQT0039	Communication Skills for Employment Purposes	2
GQT0040	Quranic Language	2
GQT0041	Arabic Language andCulture	2
GQT0042	Chinese Language andCulture	2

* Refer to Centre for Internship Training and Academic Enrichment (CITrA) Website: https://citra.um.edu.my/ for further information

UNIVERSITI MALAYA
GRADING SCHEME

The official University grades including the marks and their meaning are as follows:

MARKS	GRADE	GRADE POINT	DESCRIPTION
90.00 – 100.00	A+	4.00	High Distinction
80.00 – 89.99	A	4.00	Distinction
75.00 – 79.99	A-	3.70	Distinction
70.00 – 74.99	B+	3.30	Good
65.00 – 69.99	B	3.00	Good
60.00 – 64.99	B-	2.70	Good
55.00 – 59.99	C+	2.30	Pass
50.00 – 54.99	C	2.00	Pass
45.00 – 49.99	C-	1.70	Fail
40.00 – 44.99	D+	1.30	Fail
35.00 – 39.99	D	1.00	Fail
00.00 – 34.99	F	0.00	Fail

Sarjana Muda Sains dengan Pendidikan

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Introduction

Bachelor of Science with Education (B.Sc.Ed.) is a programme that was established in the year 1975 with the co-operation of the Faculty of Education. It is designed to provide students with opportunities to become certified physics, chemistry, biology, or mathematics teachers at the secondary and pre-university levels. The programme will cater to students with solid grounding in physics, chemistry, biology or mathematics content knowledge. Students will also be provided with the pedagogical knowledge and skills to professionally equip them to become effective classroom teachers.

The programme had been recently reviewed to ensure the curriculum will prepare students to adapt to the 21st century challenges of teaching science or mathematics. Students will get to graduate after a minimum of 8 semesters where they will have to complete 141 credits comprising of courses from the University Courses (22 credits); Faculty Core Courses (8 credits), Faculty Elective Courses (8 credits), Science Major Courses (66 credits), and Education Minor Courses (37 credits).

Apart from the lectures in the Science Major Courses, students will be posted to schools to undergo professional preparation as school teachers as part of the Education Minor Courses. Students get to choose their preferred specialization to become either a physics, chemistry, biology, or mathematics teacher that is qualified to teach not only at public secondary schools but also at the private secondary schools or pre-university colleges.

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BACHELOR OF SCIENCE WITH EDUCATION (BIOLOGY) SESSION 2024/2025 (141 CREDITS)		
UNIVERSITY COURSES (22 Credits)		
Course Code	**Course Name**	**Credit**
GLT^{XXXX}	English Course (subject to MUET bands)	6
GIG1012	Philosophy and Current Issues	2
GIG1013	Appreciation of Ethics and Civilisations	2
GIG1003	Basic Entrepreneurship Culture	2
GIG1004	Information Literacy	2
GIG1005	Social Engagement	2
GKA/GKI/GKK/GKP/GKS/GKU	Co-Curriculum	2
GIA-GIX^{XXXX}	External Faculty Elective courses (KELF)	4
FACULTY CORE COURSES (8 Credits) [TF]		
Course Code	**Course Name**	**Credit**
SIX1001	Introduction to Science and Technology Studies	3
SIX1002	Ethics and Safety	2
SIX1003	Biostatistics	3
FACULTY ELECTIVE COURSES (8 Credits) [TF] ***Courses offered by other Institute/Department in Faculty of Science.** (Refer to the List of Courses offered by various Institute/Department in Faculty of Science other than Institute of Biological Sciences)		
Institute/ Department	**Course Code**	**Course Title**	**Credit**
Dept. of Chemistry	SIX1009	Basic Chemistry	2
Dept. of Geology	SIX1010	Earth's Ecosystem	2
Dept. of Physics	SIX1011	Contemporary Physics	2
Dept. of Science and Technology Studies	SIX1012	Logical Thinking in Science	3
Institute of Mathematical Sciences	SIX1013	Fundamentals of Advanced Mathematics	4
PROGRAMME COURSES (103 Credits)		
(I) MAJOR PROGRAMME CORE COURSES (66 Credits) [TP]		

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Course Code	Course Name	Pre-Requisite(s)	Credit
LEVEL 1 (14 Credits)			
SIJ1001	Life Processes		2
SIL1001	Cell Biology		2
SIE1001	Organism Biology		2
SIH1001	Population Biology		2
SIH1003	Plant and Environment		2
SIK1001	Biology Practical		2*
SIO1001	Basic Physics		2
LEVEL 2 (41 Credits)			
SIV2001	Fundamentals of Bioinformatics	SIL1001 and SIK1001	3*
SIK2004	Human and Animal Physiology	SIJ1001	3
SIK2001	Human Anatomy	SIJ1001 and SIL1001	3*
SIK2003	General Biochemistry	SIJ1001	3
SIK2007	Histology	SIJ1001 and SIK1001	3*
SIL2002	Cytogenetics	SIL1001	3*
SIL2009	Recombinant DNA Technology	SIL1001	3*
SIR2008	Microbial Physiology and Biochemistry	SIJ1001	3*
SIR2004	General Microbiology	SIJ1001	3*
SIH2004	Environmental Pollution		2
SIH2010	Limnology		3*
SIO2003	Higher Plant Physiology	SIJ1001	3*
SIO2004	Cell and Tissue Culture	SIL1001 and SIK1001	3*
SIO2011	Plant Breeding	SIJ1001	3*
LEVEL 3 (7 Credits)			
SIH3003	Ecology		3*
SIH3008	Sustainable Development		2
SIK3004	Biology of Hormones	SIK2004	2
LEVEL 4 (4 Credits)			
SIP4007	Scientific Project	Completed minimum 42 credit major program courses	4
(II) MINOR PROGRAMME COURSES (37 CREDITS)			

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Course Code	Course Name	Pre-Requisite(s)	Credit
COMPULSORY COURSES (19 CREDITS)			
PIX1002	Basic of Physical Education, Health and Co-curriculum		3
SIP1001	Integrating STEM in Science and Mathematics Education		3
PIX2001	Educational Psychology		3
SIP2001	School Experience		2
SIP3001	Teaching Practice I	SIP2001	4
SIP4001	Teaching Practice II	SIP3001	4
BIOLOGY TEACHING METHOD (12 Credits)			
SIP1006	Cognition in Biology Education		2
SIP1007	History, Philosophy and Curriculum in Biology Education		2
SIP2006	Technology in Biology Education		2
SIP2007	Teaching and Assessment of Abstract Concept in Biology		2
SIP3005	Teaching and Assessment of Field Work in Biology		2
SIP3006	Teaching and Assessment of Practical Work in Biology		2
SCIENCE TEACHING METHOD (6 Credits)			
SIP4004	Teaching and Assessment of Chemistry Components in Science		3
SIP4006	Teaching and Assessment of Physics Component in Science		3

Note:
* With practical component.

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BACHELOR OF SCIENCE WITH EDUCATION (MATHEMATICS) SESSION 2024/2025 (141 CREDITS)		
UNIVERSITY COURSES (22 Credits)		
Course Code	**Course Name**	**Credit**
GLT^{XXXX}	English Course (subject to MUET bands)	6
GIG1012	Philosophy and Current Issues	2
GIG1013	Appreciation of Ethics and Civilisations	2
GIG1003	Basic Entrepreneurship Culture	2
GIG1004	Information Literacy	2
GIG1005	Social Engagement	2
GKA/GKI/ GKK/GKP/ GKS/GKU	Co-Curriculum	2
GIA-GIX^{XXXX}	External Faculty Elective courses (KELF)	4
FACULTY CORE COURSES (8 Credits) [TF]		
Course Code	**Course Name**	**Credit**
SIX1001	Introduction to Science and Technology Studies	3
SIX1002	Ethics and Safety	2
SIX1004	Statistics	3
FACULTY ELECTIVE COURSES (8 Credits) [TF] *** Courses offered by other Institute/Department in Faculty of Science.** (Refer to the List of Courses offered by various Institute/Department in Faculty of Science other than Institute of Mathematical Sciences)		
Institute/ Department	**Course Code**	**Course Title**	**Credit**
Institute of Biological Sciences	SIX1006	Malaysian Flora	3
	SIX1007	Malaysian Fauna	3
	SIX1008	Bio Computing	2
Dept. of Chemistry	SIX1009	Basic Chemistry	2
Dept. of Geology	SIX1010	Earth's Ecosystem	2
Dept. of Physics	SIX1011	Contemporary Physics	2
Dept. of Science and Technology Studies	SIX1012	Logical Thinking in Science	3

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PROGRAMME COURSES (103 Credits)			
(I) MAJOR PROGRAMME CORE COURSES (66 Credits) [TP]			
Course Code	**Course Name**	**Pre-Requisite**	**Credit**
LEVEL 1 (22 Credits)			
SIM1001	Basic Mathematics		4
SIM1002	Calculus I		4
SIN1002	Introduction to Worksheet		2
SIN1003	Mathematical Methods I	SIM1002	4
SIM1003	Calculus II	SIM1002	4
SIT1001	Probability and Statistics I	SIM1002	4
LEVEL 2 (36 Credits)			
SIM2001	Advanced Calculus	SIM1003	4
SIM2002	Linear Algebra	SIM1001	4
SIM2003	Introduction to Combinatorics	SIM1001	4
SIN2001	Mathematical Methods II	SIN1003	4
SIN2002	Structured Programming	SIM1002	4
SIN2003	Basic Operational Research	SIM1001 and SIN1002	4
SIN2005	System of Differential Equations	SIN1003	4
SIQ2003	Financial Mathematics and Derivatives	SIM1002	4
SIT2001	Probability and Statistics II	SIT1001	4
LEVEL 3 (4 Credits)			
SIM3003	Number Theory	SIM2002	4
LEVEL 4 (4 Credits)			
SIP4007	Scientific Project	Completed minimum 42 credit major program courses	4
(II) MINOR PROGRAMME COURSES (37 CREDITS)			
Course Code	**Course Name**	**Pre- Requisite**	**Credit**
COMPULSORY COURSES (19 CREDITS)			
PIX1002	Basic of Physical Education, Health and Co-curriculum		3
SIP1001	Integrating STEM in Science and Mathematics Education		3

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PIX2001	Educational Psychology		3
SIP2001	School Experience		2
SIP3001	Teaching Practice I	SIP2001	4
SIP4001	Teaching Practice II	SIP3001	4
MATHEMATICS TEACHING METHOD (12 Credits)			
SIP1002	Assessment in Mathematics Education		2
SIP1003	Psychology in Learning Mathematics		2
SIP2002	Technology in Mathematics Education		2
SIP2003	Teaching of Numbers		2
SIP2004	Teaching of Algebra		2
SIP3002	Teaching of Geometry		2
ADVANCED MATHEMATICS TEACHING METHOD (6 Credits)			
SIP3003	Teaching of Probability and Statistics		2
SIP4002	Teaching of Discrete Mathematics		2
SIP4003	Teaching of Calculus		2

Note:
* With practical component.

BACHELOR OF SCIENCE WITH EDUCATION (CHEMISTRY) SESSION 2024/2025 (141 CREDITS)		
UNIVERSITY COURSES (22 Credits)		
Course Code	**Course Name**	**Credit**
GLT^{XXXX}	English Course (subject to MUET bands)	6
GIG1012	Philosophy and Current Issues	2
GIG1013	Appreciation of Ethics and Civilisations	2
GIG1003	Basic Entrepreneurship Culture	2
GIG1004	Information Literacy	2
GIG1005	Social Engagement	2
GKA/GKI/ GKK/GKP/ GKS/GKU	Co-Curriculum	2
GIA-GIX^{XXX}	External Faculty Elective courses (KELF)	4
FACULTY CORE COURSES (8 Credits) [TF]		
Course Code	**Course Name**	**Credit**
SIX1001	Introduction to Science and Technology Studies	3
SIX1002	Ethics and Safety	2
SIX1004	Statistics	3
FACULTY ELECTIVE COURSES (8 Credits) [TF] ***Courses offered by other Institute/Department in Faculty of Science.** (Refer to the List of Courses offered by various Institute/Department in Faculty of Science other than Department of Chemistry)		
Institute/ Department	**Course Code**	**Course Title**	**Credit**
Institute of Biological Sciences	SIX1006	Malaysian Flora	3
	SIX1007	Malaysian Fauna	3
	SIX1008	Biocomputing	2
Dept. of Geology	SIX1010	Earth's Ecosystem	2
Dept. of Physics	SIX1011	Contemporary Physics	2
Dept. of Science and Technology Studies	SIX1012	Logical Thinking in Science	3
Institute of Mathematical Sciences	SIX1013	Fundamentals of Advanced Mathematics	4

PROGRAMME COURSES (103 Credits)			
(I) MAJOR PROGRAMME CORE COURSES (66 Credits) [TP]			
Course Code	**Course Name**	**Pre-Requisite(s)**	**Credit**
LEVEL 1 (17 Credits)			
SIC1001	Principles of Chemistry		2
SIC1002	Inorganic Chemistry I		4*
SIC1003	Organic Chemistry I		4*
SIC1004	Physical Chemistry I		4*
SIC1005	Basic Mathematics for Chemistry		3
LEVEL 2 (33 Credits)			
SIC2001	Inorganic Chemistry II	SIC1001 and SIC1002	4*
SIC2002	Organic Chemistry II	SIC1001 and SIC1003 This course is to be taken together with SIC2007 and SIC2008	4*
SIC2003	Physical Chemistry II	SIC1001, SIC1004 and SIC1005	4*
SIC2004	Analytical Chemistry I	SIC1001 and SIC1002	3*
SIC2005	Polymer Chemistry I	SIC1003 and SIC1004	3*
SIC2006	Molecular Spectroscopy	SIC1001, SIC1004 and SIC1005	3
SIC2007	Spectroscopic Methods in Organic Chemistry	SIC1003 This course is taken together with SIC2002	2
SIC2008	Biomolecules	SIC1003 This course is to be taken together with SIC2002	2
SIC2009	Introduction to Environmental Chemistry	SIC1002 and SIC1003	2
SIC2011	General Industrial Chemistry	SIC1001	2
SIC2012	Nuclear Chemistry	SIC1001 and SIC1002	2
SIC2013	Solid State Chemistry	SIC1002 and SIC1004	2

LEVEL 3 (12 Credits)			
SIC3001	Inorganic Chemistry III	SIC2001	4*
SIC3002	Organic Chemistry III	SIC2002	4*
SIC3003	Physical Chemistry III	SIC2003	4*
LEVEL 4 (4 Credits)			
SIP4007	Scientific Project	Completed minimum 42 credit major program courses	4
(I) MINOR PROGRAMME COURSES (37 CREDITS)			
Course Code	**Course Name**	**Pre-Requisite(s)**	**Credit**
COMPULSORY COURSES (19 CREDITS)			
PIX1002	Basic of Physical Education, Health and Co-curriculum		3
SIP1001	Integrating STEM in Science and Mathematics Education		3
PIX2001	Educational Psychology		3
SIP2001	School Experience		2
SIP3001	Teaching Practice I	SIP2001	4
SIP4001	Teaching Practice II	SIP3001	4
CHEMISTRY TEACHING METHOD (12 Credits)			
SIP1004	Trends and Issues in Chemistry Education		2
SIP1005	Practical Work in Chemistry		2
SIP2005	Teaching in Physical Chemistry	SIP1004	2
SIP2010	Teaching in Inorganic Chemistry	SIP1004	2
SIP2011	Teaching in Organic Chemistry	SIP1004	2
SIP3004	Assessment in Chemistry Education		2
SCIENCE TEACHING METHOD (6 Credits)			
SIP4005	Teaching and Assessment of Biology Components in Science		3
SIP4006	Teaching and Assessment of Physics Component in Science		3

Note:
***** With practical component.

BACHELOR OF SCIENCE WITH EDUCATION (PHYSICS) SESSION 2024/2025 (141 CREDITS)			
UNIVERSITY COURSES (22 Credits)			
Course Code	**Course Name**		**Credit**
GLT^{XXXX}	English Course (subject to MUET bands)		6
GIG1012	Philosophy and Current Issues		2
GIG1013	Appreciation of Ethics and Civilisations		2
GIG1003	Basic Entrepreneurship Culture		2
GIG1004	Information Literacy		2
GIG1005	Social Engagement		2
GKA/GKI/GKK/ GKP/GKS/GKU	Co-Curriculum		2
GIA-GIX^{XXXX}	External Faculty Elective courses (KELF)		4
FACULTY CORE COURSES (8 Credits) [TF]			
Course Code	**Course Name**		**Credit**
SIX1001	Introduction to Science and Technology Studies		3
SIX1002	Ethics and Safety		2
SIX1004	Statistics		3
FACULTY ELECTIVE COURSES (8 Credits) [TF] *** Courses offered by other Institute/Department in Faculty of Science.** (Refer to the List of Courses offered by various Institute/Department in Faculty of Science other than Department of Physics)			
Institute/ Department	**Course Code**	**Course Title**	**Credit**
Institute of Biological Sciences	SIX1006	Malaysian Flora	3
	SIX1007	Malaysian Fauna	3
	SIX1008	Biocomputing	2
Dept. of Chemistry	SIX1009	Basic Chemistry	2
Dept. of Geology	SIX1010	Earth's Ecosystem	2
Dept. of Science and Technology Studies	SIX1012	Logical Thinking in Science	3
Institute of Mathematical Sciences	SIX1013	Fundamentals of Advanced Mathematics	4
PROGRAMME COURSES (103 Credits)			
(I) MAJOR PROGRAMME CORE COURSES (66 Credits) [TP]			
Course Code	**Course Name**	**Pre-Requisite**	**Credit**
LEVEL 1 (13 Credits)			
SIF1001	Mathematical Methods I		3
SIF1002	Vibrations and Waves I		2

SIF1003	Thermal Physics		2
SIF1004	Modern Physics		2
SIF1005	Electronics I		2
SIF1006	Practical Physics I		2
LEVEL 2 (40 Credits)			
SIF2001	Quantum Mechanics I	SIF1001 and SIF1004	3
SIF2002	Electromagnetism I	SIF1001 and SIF1002	3
SIF2003	Electromagnetism II	SIF2002	3
SIF2004	Mechanics	SIF1001	3
SIF2005	Statistical Physics	SIF1001 and SIF1003	3
SIF2006	Optics	SIF1001 and SIF1002	2
SIF2007	Numerical and Computational Methods	SIF1001	3
SIF2009	Practical Electronics	SIF1005	2
SIF2010	Practical Physics II	SIF1006	2
SIF2011	Practical Applied Physics	SIF1006	4
SIF2012	Modern Optics and Laser Physics	SIF1002	3
SIF2014	Cosmology and General Relativity	SIF1004	3
SIF2015	Astrophysics	SIF2014	3
SIF2016	Materials Science	SIF1003 and SIF1004	3
LEVEL 3 (9 Credits)			
SIF3001	Nuclear Physics	SIF2001	3
SIF3002	Atomic and Molecular Physics	SIF2001	3
SIF3003	Solid State Physics	SIF2001 & SIF2005	3
LEVEL 4 (4 Credits)			
SIP4007	Scientific Project	Completed minimum 42 credit major program courses	4
(II) MINOR PROGRAMME COURSES (37 CREDITS)			
Course Code	**Course Name**	**Pre-Requisite**	**Credit**
COMPULSORY COURSES (19 CREDITS)			

PIX1002	Basic of Physical Education, Health and Co-curriculum		3
PIX2001	Educational Psychology		3
SIP1001	Integrating STEM in Science and Mathematics Education		3
SIP2001	School Experience		2
SIP3001	Teaching Practice I	SIP2001	4
SIP4001	Teaching Practice II	SIP3001	4
PHYSICS TEACHING METHOD (12 Credits)			
SIP1008	Teaching of Matter, Force and Energy		2
SIP1009	Teaching of Optics and Sound		2
SIP2008	Teaching of Electricity		2
SIP2009	Curriculum In Physics Education		2
SIP3007	Technology in Physics Education		2
SIP3008	Assessment Challenges in Physics Education		2
SCIENCE TEACHING METHOD (6 Credits)			
SIP4005	Teaching and Assessment of Biology Components in Science		3
SIP4004	Teaching and Assessment of Chemistry Components in Science		3
Note: * With practical component.			

PROGRAMME GOAL

Untuk menghasilkan graduan yang mempunyai pengetahuan dan kemahiran dalam bidang sains, matematik dan Pedagogical Content Knowledge (PCK) serta mempunyai nilai integriti, kemahiran kepimpinan, tanggung jawab sosial dan profesionalisme, supaya dapat menghadapi persekitaran yang kompetitif dan mampu menyumbang kepada bidang pendidikan dan perguruan dalam pembangunan nasional dan global.

To produce graduates who have knowledge and skills in science, mathematics and Pedagogical Content Knowledge (PCK) and have the value of integrity, leadership skills, social responsibility and professionalism, to be able to face a competitive environment and be able to contribute to the education field and teaching for national and global development.

PROGRAMME LEARNING OUTCOME

Pada akhir program, graduan dapat:

1. Menguasai ilmu dan kemahiran dalam bidang sains, matematik dan Pedagogical Content Knowledge (PCK).

2. Menggunakan pendekatan secara sistematik dan pembuktian mantap dalam mempraktikkan amalan-amalan sains, matematik dan pendidikan dalam menganalisis dan menilai penggunaan sumber secara lebih teratur.

3. Mempamerkan kemahiran sosial dalam tanggungjawab terhadap masyarakat dan alam sekitar.

4. Mengamalkan nilai beretika, profesionalisme dan integriti dalam mempraktikkan amalan sains dan pendidikan bagi memenuhi keperluan pelajar, pihak berkepentingan dan masyarakat amnya.

5. Berkomunikasi dengan berkesan, berkebolehan bekerja dalam satu kumpulan dan menunjukkan ciri kepimpinan.

6. Menggunakan kemahiran saintifik dalam membuat keputusan dan menyelesaikan masalah.

7. Menggunakan kemahiran pengurusan teknologi, maklumat dan amalan-amalan sains serta berkeupayaan meningkatkan pengetahuan melalui pembelajaran sepanjang hayat.

8. Menggunakan pendekatan saintifik yang berasaskan logik dan analitikal dalam pengurusan dan keusahawanan.

At the end of the programme, graduates can:

1. *Master the knowledge and skills in science, mathematics and Pedagogical Content Knowledge (PCK).*

2. *Use a systematic approach and solid evidence in practicing the science practices, mathematics and education in analyzing and evaluating the use of resources more systematically.*

3. *Demonstrate social skills responsibly towards society and the environment.*

4. *Practice ethical values, professionalism and integrity in practicing science and education habits to meet the needs of students, stakeholders and society in general.*

5. *Communicate effectively, be able to work in a group and demonstrate leadership qualities.*

6. *Use scientific skills in decision making and problem solving.*

7. *Apply technology management skills, information and science practices and be able to enhance knowledge through lifelong learning.*

8. *Use a logical and analytical-based scientific approach in management and entrepreneurship.*

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE WITH EDUCATION
(BIOLOGY)

COMPONENT	SEMESTER 1		SEMESTER 2		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GLT^{xxxx}	3	GLT^{xxxx}	3	**14**
	GIG1004	2	GIG1013	2	
	-	-	GIG1012	2	
	-	-	GIG1005	2	
Faculty Core Courses	SIX1001	3	SIX1003	3	**8**
	SIX1002	2	-	-	
Programme Courses	SIK1001	2	SIJ1001	2	**14**
	SIL1001	2	SIP1006	2	
	SIP1001	3	-	-	
	PIX1002	3	-	-	
TOTAL CREDITS		**20**		**16**	**36**

COMPONENT	SEMESTER 3		SEMESTER 4		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GIG1003	2	-	-	**8**
	GKA/GKI/GKK/GKP/GKS/GKU	2	-	-	
	GIA-GIX^{xxxx}	4	-	-	
Programme Courses	SIH1001	2	SIO1001	2	**26**
	SIE1001	2	SIO2003	3	
	SIH1003	2	SIO2011	3	
	SIP1007	2	SIK2001	3	
	SIP2006	2	SIK2007	3	
	-	-	SIP2007	2	
TOTAL CREDITS		**18**		**16**	**34**

COMPONENT	SPECIAL SEMESTER (YEAR 2)		TOTAL CREDITS
	COURSE	CREDIT	
Programme Courses	SIP2001 School Experience	2	**2**
TOTAL CREDIT		**2**	**2**

COMPONENT	SEMESTER 5		SEMESTER 6		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
Faculty Elective Courses	Faculty Elective Courses	2	Faculty Elective Courses	2	**4**
Programme Courses	SIL2002	3	SIK2003	3	**27**
	SIL2009	3	SIK2004	3	
	SIH2004	2	SIH2010	3	
	SIV2001	3	SIP3006	2	
	SIP3005	2	PIX2001	3	
TOTAL CREDITS		**15**		**16**	**31**

COMPONENT	SPECIAL SEMESTER (YEAR 3)		TOTAL CREDIT
	COURSE	CREDIT	
Programme Courses	SIP3001 Teaching Practice I	4	**4**
TOTAL CREDITS		**4**	**4**

COMPONENT	SEMESTER 7		SEMESTER 8		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
Faculty Elective Courses	Faculty Elective Courses	4	-	-	**4**
Programme Courses	SIO2004	3	SIH3008	2	**26**
	SIR2008	3	SIR2004	3	
	SIH3003	3	SIP4006	3	
	SIK3004	2	SIP4007	4	
	SIP4004	3	-	-	
	-	-	-	-	
TOTAL CREDITS		**18**		**12**	**30**

COMPONENT	SPECIAL SEMESTER (YEAR 4)		TOTAL CREDIT
	COURSE	CREDIT	
Programme Core Courses	SIP4001 Teaching Practice II	4	**4**
TOTAL CREDITS		**4**	**4**

TOTAL CREDIT: 141

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE WITH EDUCATION
(MATHEMATICS)

COMPONENT	SEMESTER 1		SEMESTER 2		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GLT^{xxxx}	3	GLT^{xxxx}	3	14
	GIG1004	2	GIG1013	2	
	-	-	GIG1012	2	
	-	-	GIG1005	2	
Faculty Core Courses	-	-	SIX1001	3	5
	-	-	SIX1002	2	
Programme Core Courses	SIM1001	4	SIN1002	2	18
	SIM1002	4	SIP1003	2	
	PIX1002	3	-	-	
	SIP1001	3	-	-	
TOTAL CREDITS		**19**		**18**	**37**

COMPONENT	SEMESTER 3		SEMESTER 4		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GIG1003	2	GKA/GKI/GKK/GKP/GKS/GKU	2	8
	GIA-GIX^{xxxx} *(Except courses with GISxxxx code)*	4	-	-	
Faculty Core Courses	SIX1004	3	-	-	3
Programme Core Courses	SIM1003	4	SIN1003	4	27
	SIT1001	4	SIT2001	4	
	SIP1002	2	PIX2001	3	
	SIP2003	2	SIP2002	2	
	-	-	SIP2004	2	
TOTAL CREDITS		**21**		**17**	**38**

COMPONENT	SPECIAL SEMESTER (YEAR 2)		TOTAL CREDITS
	COURSE	CREDIT	
Programme Core Courses	SIP2001 School Experience	2	2
TOTAL CREDITS		**2**	**2**

COMPONENT	SEMESTER 5		SEMESTER 6		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
Faculty Elective Courses	Faculty elective course	5	Faculty elective course	3	8
Programme Core Courses	SIM2003	4	SIM2001	4	28
	SIN2001	4	SIM2002	4	
	SIQ2003	4	SIN2002	4	
	SIP3002	2	SIP3003	2	
TOTAL CREDITS		**19**		**17**	**36**

COMPONENT	SPECIAL SEMESTER (YEAR 3)		TOTAL CREDITS
	COURSE	CREDIT	
Programme Core Courses	SIP3001 Teaching Practice I	4	4
TOTAL CREDITS		**4**	**4**

COMPONENT	SEMESTER 7		SEMESTER 8		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
Programme Core Courses	SIN2003	4	SIP4007 Scientific Project	4	20
	SIN2005	4			
	SIM3003	4			
	SIP4002	2			
	SIP4003	2			
TOTAL CREDITS		**16**		**4**	**20**

COMPONENT	SPECIAL SEMESTER (YEAR 4)		TOTAL CREDITS
	COURSE	CREDITS	
Programme Core Courses	SIP4001 Teaching Practice II	4	**4**
TOTAL CREDITS		**4**	**4**

TOTAL CREDIT: 141

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE WITH EDUCATION
(CHEMISTRY)

COMPONENT	SEMESTER 1		SEMESTER 2		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GLT^{XXXX}	3	GLT^{XXXX}	3	14
	GIG1004	2	GIG1013	2	
	-	-	GIG1012	2	
	-	-	GIG1005	2	
Faculty Core Courses	SIX1001	3	-	-	5
	-	-	SIX1002	2	
Programme Courses	SIC1005	3	SIC1001	2	17
	PIX1002	3	SIC1002	4*	
	SIP1001	3	SIP1004	2	
TOTAL CREDITS		**17**		**19**	**36**

COMPONENT	SEMESTER 3		SEMESTER 4		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GIG1003	2	GKA/GKI/ GKK/GKP /GKS/GK U	2	8
	GIA-GIX^{XXXX}	4	-	-	
Faculty Core Courses	SIX1004	3	-	-	3
Faculty Elective Courses	-	-	Faculty Elective Courses	5	5
Programme Courses	SIC1004	4*	SIC1003	4*	19
	SIC2011	2	PIX2001	3	
	SIP1005	2	SIP2010	2	
	SIP2005	2	-	-	
TOTAL CREDITS		**19**		**16**	**35**

COMPONENT	SPECIAL SEMESTER (YEAR 2)		TOTAL CREDITS
	COURSE	CREDIT	
Programme Core Courses	SIP2001 School Experience	2	2
TOTAL CREDIT		**2**	**2**

COMPONENT	SEMESTER 5		SEMESTER 6		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
Faculty Elective Courses	Faculty Elective Courses	3	-	-	3
Programme Courses	SIC2002	4*	SIC2001	4*	32
	SIC2004	3*	SIC2003	4*	
	SIC2007	2	SIC2005	3*	
	SIC2008	2	SIC2012	2	
	SIC2009	2	SIC2013	2	
	SIP2011	2	SIP3004	2	
TOTAL CREDIT		**18**		**17**	**35**

COMPONENT	SPECIAL SEMESTER (YEAR 3)		TOTAL CREDIT
	COURSE	CREDIT	
Programme Courses	SIP3001 Teaching Practice I	4	4
TOTAL CREDIT		**4**	**4**

COMPONENT	SEMESTER 7		SEMESTER 8		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	-	-	-	-	0
Faculty Core Courses	-	-	-	-	0
Faculty Elective Courses	-	-	-	-	0
Programme Courses	SIC2006	3	SIC3002	4*	25
	SIC3001	4*	SIP4007	4	
	SIC3003	4*	SIP4006	3	
	SIP4005	3			
TOTAL CREDIT		**14**		**11**	**25**

COMPONENT	SPECIAL SEMESTER (YEAR 4)		TOTAL CREDIT
	COURSE	CREDIT	
Programme Core Courses	SIP4001 Teaching Practice II	4	4
TOTAL CREDIT		**4**	**4**

TOTAL CREDIT: 141

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE WITH EDUCATION
(PHYSICS)

COMPONENT	SEMESTER 1		SEMESTER 2		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GLT^{xxxx}	3	GLT^{xxxx}	3	14
	GIG1004	2	GIG1013	2	
	-	-	GIG1012	2	
			GIG1005	2	
Faculty Core Courses	SIX1001	3	SIX1004	3	8
	-	-	SIX1002	2	
Programme Courses	SIF1002	2	SIF1001	3	15
	SIP1001	3	SIF1003	2	
	PIX1002	3	SIP2009	2	
TOTAL CREDITS		**16**		**21**	**37**

COMPONENT	SEMESTER 3		SEMESTER 4		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GIG1003	2	GKA/GKI/GKK/ GKP/GKS/GKU	2	8
	GIA-GIX^{xxxx}	4	-	-	
Programme Courses	SIF1004	2	SIF2001	3	26
	SIF1005	2	SIF2002	3	
	SIF1006	2	SIF2004	3	
	SIF2006	2	SIF2005	3	
	SIP1008	2	SIP2008	2	
	SIP1009	2	-	-	
TOTAL CREDITS		**18**		**16**	**34**

COMPONENT	SPECIAL SEMESTER (YEAR 2)		TOTAL CREDITS
	COURSE	CREDIT	
Programme Courses	SIP2001 School Experience	2	**2**
TOTAL CREDIT		**2**	**2**

COMPONENT	SEMESTER 5		SEMESTER 6		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
Faculty Elective Courses	Faculty Elective Courses	5	Faculty Elective Courses	3	**8**
Programme Courses	SIF2003	3	SIF2011	4	**33**
	SIF2007	3	SIF2012	3	
	SIF2009	2	SIF2015	3	
	SIF2010	2	SIF2016	3	
	SIF2014	3	SIP3008	2	
	SIP3007	2	PIX2001	3	
TOTAL CREDITS		**20**		**21**	**41**

COMPONENT	SPECIAL SEMESTER (YEAR 3)		TOTAL CREDITS
	COURSE	CREDIT	
Programme Courses	SIP3001 Teaching Practice I	4	4
TOTAL CREDIT		**4**	**4**

COMPONENT	SEMESTER 7		SEMESTER 8		TOTAL CREDITS
	COURSE	CREDIT	COURSE	CREDIT	
Programme Courses	SIF3001	3	SIP4007	4	**19**
	SIF3002	3	-	-	
	SIF3003	3	-	-	
	SIP4004	3	-	-	
	SIP4005	3			
TOTAL CREDITS		**15**		**4**	**19**

COMPONENT	SPECIAL SEMESTER (YEAR 4)		TOTAL CREDITS
	COURSE	CREDIT	
Programme Core Courses	SIP4001 Teaching Practice II	4	**4**
TOTAL CREDIT		**4**	**4**

TOTAL CREDIT: 141

COURSE SYNOPSIS

Note: The synopses for the major program courses can be found under respective departments' sections.

PIX1002 BASIC OF PHYSICAL EDUCATION, HEALTH AND CO-CURRICULUM

This course gives an exposure for students to basic anatomy, human physiology, exercise (or practice) principle and some concepts in motor learning and biomechanics sports. Among the topics being discussed including philosophy, concept, and exercise (or practice) in Sports Education, Health, and Co-curriculum especially in contexts of education. Other areas such as administration, management, accomplishment of Sports Education and Co-curriculum in secondary schools are also being highlighted. Besides that, the type of disease, healthy (or balanced) diet, particular dietary, sport activities and appropriate co-curriculum and modification in approaches and teaching materials to those who are in special needs are also discussed.

Assessment Methods:
Continuous assessment: 50%
Final examination: 50%

PIX2001 EDUCATIONAL PSYCHOLOGY

This course aims to provide knowledge to students on theories of development and factors affecting the learning process. This will cover topics such as the process of development, intelligence, individual differences, self-concepts, and motivation. The course will also highlight theories of learning and basic teaching strategies including classroom management.

Assessment Methods:
Continuous assessment: 40%
Final examination: 60%

SIP1001 INTEGRATING STEM IN SCIENCE AND MATHEMATICS EDUCATION

Teaching the 21st century learner to think from multiple perspectives integrating STEM in Science and Mathematics Education. Students will be exposed to the concept and underpinning theories in STEM education. They will learn instructional strategies in integrating STEM into science and mathematics curriculum. The students will learn to apply their strategies in STEM education that they can use to foster critical thinking and problem-solving skills in their class using real-world, place-based problems. This interdisciplinary approach blurs the boundaries across content areas which is critical to fostering innovative and creative thinking

in the students and preparing educators as STEM leaders.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP1002 ASSESSMENT IN MATHEMATICS EDUCATION

In this course the students will be exposed to the various types of assessment and its purpose and functions. Students will learn how to create higher order thinking tasks that enhances student learning. Technical aspect of assessment will also be learned. Students will be taught on how to make educational decisions based on students' assessment performance.

Assessment Methods:
Continuous assessment: 60%
Final examination: 40%

SIP1003 PSYCHOLOGY IN LEARNING MATHEMATICS

The purpose of this course is to expose students to the usage of concepts and principles of psychology and cognitive science as a core to develop deeper understanding about how children learn mathematics and the various ways they construct and build on their abstract scheme. The influence of theories of learning on adult mathematics education will be discussed in depth. In addition, theories and principles of learning such as process of active participation in reflection, abstraction, and appreciation will be linked to the learning of specific topics in mathematics.

Assessment Methods:
Continuous assessment: 60%
Final examination: 40%

SIP1004 TRENDS AND ISSUES IN CHEMISTRY EDUCATION

This course exposes students to the various trends, issues, and challenges in chemical education. Students are also taught cognitive science and learning theories in chemistry education. Students will learn about Piaget, Vygotsky, and contemporary learning theories. Students give opportunities to conduct simple action research that can contribute ideas to implement meaningful and relevant chemistry teaching.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP1005 PRACTICAL WORK IN CHEMISTRY

This course helps students to understand what scientific inquiry is as well as the roles and types of practical work. This course encourages students to conduct open-ended / guided inquiry in the secondary school laboratory environment. Students are taught

good laboratory management knowledge and skills.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP1006 COGNITION IN BIOLOGY EDUCATION

This course will introduce the students to principal ideas of cognitive science relevant to biology education which includes cognitive theories of past educational psychologists such as Piaget and others to contemporary models of thinking such as by Howard Gardner and neurocognitive perspectives for transformational learning in the digital era. These will be related to the attributes and acquisition of scientific skills and pedagogical strategies related to biology education. Emphasis will be given to cognitive operation for each level of Bloom's taxonomy, SAPA science process skills, concrete and formal reasoning in Piaget Model, scientific inquiry assignment, cognitive process that involves critical thinking skills, and problem-solving strategies. The implication of all these skills will be discussed for the enhancement of teaching and learning quality in Biology.

Assessment Methods:
Continuous assessment: 100%

SIP1007 HISTORY, PHILOSOPHY AND CURRICULUM IN BIOLOGY EDUCATION

This course will introduce the students to the history and philosophy of the current trend, theory and practice of Biology education in Malaysia. Topics that will be discussed include reformation effort in Biology education, the need to change, changing model in Biology education, support system, reflection of the current practice and the future direction. The influence of the history and philosophy of science to the practice of biology education worldwide and in Malaysia will also be discussed. This course will also introduce the main aspects in curriculum planning of Biology education, which include curriculum, curriculum design, development of Biology curriculum internationally and locally, Biology curriculum models and innovation in biology education, issues in implementing the curriculum and curriculum assessment

Assessment Methods:
Continuous assessment: 100%

SIP1008 TEACHING OF MATTER, FORCE AND ENERGY

This course assists students to build knowledge, techniques and skills for teaching the concept of matter, force and energy effectively. This course comprises of three sections,

namely the theory, planning and practice. The theory section will discuss knowledge and skills which is required for the acquisition of the concept of matter, force and energy. The planning section will guide the trainee teachers in teaching the concept of matter, force and energy and its application in everyday life by implementing strategies, skills and values that can be implemented in the classroom and laboratory. Finally, the practical section will focus on the effective implementation of teaching the concept of matter, force and energy effectively through consolidated pedagogies and create alternative exemplary teaching.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP1009 TEACHING OF OPTICS AND SOUND

This course assists students to acquire the concept of wave in light and sound easily by building knowledge and skills that are inter-related. This course comprises of theory, planning and practice. The theory section will discuss knowledge and skills which is required for the acquisition of the domain of light and factors that influence the type of reflection and refraction. Together with this, sound will be explored to calculate the frequency and amplitude in various situations. The planning section will guide the trainee teachers in implementing strategies, skills and values for teaching light and sound which can be applied in the classroom and laboratory. Finally, the practical section will focus on the implementation that is related to the teaching of light and sound through consolidated pedagogies and to create alternative exemplary teaching.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP2001 SCHOOL EXPERIENCE

This is the first practical component in the professional education of teachers that is conducted for four weeks in the Special Semester of the Second Year of the program. The purpose for this component is to provide student teachers opportunities to observe lessons in the secondary classrooms. From the classroom observation, student teachers will get to reflect on the roles and responsibilities of a teacher, identify the various teaching approaches and identify the challenges of classroom teaching and the problems faced by students in learning mathematics / physics / chemistry / biology. During this period, student teachers will follow a cooperating teacher in going through his or her duties inside and outside the classroom and observe several different teachers in their classroom teaching. Students are also

required to gather information about the school management system and the school climate. In this course student teachers will write a report of their observation and reflection of their school experience

Assessment Methods:
Continuous assessment: 100%

SIP2002 TECHNOLOGY IN MATHEMATICS EDUCATION

The course is designed to enable students to acquire knowledge on various digital technologies for the investigation of significant mathematical ideas. Emphasis will be on the use of digital technology in the secondary mathematics classroom for the development of understanding of fundamental mathematical concepts, enhancement of students mathematical thinking and promoting students' interest in mathematics learning. In this course, students will develop worthwhile mathematical tasks that integrate various digital technologies.

Assessment Methods:
Continuous assessment: 60%
Final examination: 40%

SIP2003 TEACHING OF NUMBERS

The course offers the opportunity for students to be exposed to the important concepts in the teaching and learning of numbers. In addition, the focus will be on the common errors and learning difficulties faced in the learning of numbers. The experience will be used as the foundation to discuss the assessment and problem solving in numbers. Techniques in teaching numbers will be covered and the design of tasks that involve students using digital technology will be discussed

Assessment Methods:
Continuous assessment: 40%
Final examination: 60%

SIP2004 TEACHING OF ALGEBRA

The course offers the opportunity for students to be exposed to the important concepts in teaching and learning of algebra. In addition, the focus will be on the common errors and learning difficulties faced in the learning of algebra. The experience will be used as the foundation to discuss the assessment and problem solving in arithmetic and algebra. Teaching and learning techniques in teaching arithmetic and algebra at secondary and pre-university will be covered and the design of tasks that involve students using digital technology at primary and secondary school levels will be discussed

Assessment Methods:
Continuous assessment: 40%
Final examination: 60%

SIP2005 TEACHING IN PHYSICAL CHEMISTRY

Students will analyze and understand the curriculum of physical chemistry in upper secondary and pre-university level. This course also introduces students to theories related to physical chemistry learning. The course also provides students to develop their own principled understanding and practices of appropriate teaching of physical chemistry in upper secondary and pre-university level. Students will learn to use appropriate teaching approaches and strategies, planning of lessons, methods of presentations and innovative use of instructional aids.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP2006 TECHNOLOGY IN BIOLOGY EDUCATION

The focus of this course is to assist students to integrate technologies into biology education in order to create a hypermedia learning environment that will be stimulating and interactive for digital natives. Among the topics that will be given emphasis are information retrieval skills, and information management skills using latest software. Students will also be exposed to appropriate technological tools to design and create teaching and learning materials.

Assessment Methods:
Continuous assessment: 100%

SIP2007 TEACHING AND ASSESSMENT OF ABSTRACT CONCEPT IN BIOLOGY

This course deepens students' understanding of the principles and practices of teaching and learning which involves the mastery of abstract concepts in Biology such as the concepts of cellular respiration and photosynthesis. The course will examine appropriate teaching and assessment strategies concepts in Biology. The instructional strategies include experimentation

Assessment Methods:
Continuous assessment: 100%

SIP2008 TEACHING OF ELECTRICITY

This course assists students to build knowledge, skills and values regarding the concept of electricity. This course comprises of three sections, namely the theory, planning and practice. The theory section will discuss knowledge and skills which are required to master the concept of electricity. The planning section will guide the trainee teachers in implementing strategies, skills and values that can be applied in the classroom and laboratory. Finally, the practical section will focus on the contextual implementation of

teaching electricity through consolidated pedagogies and create alternatives to enable exemplary teaching.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP2009 CURRICULUM IN PHYSICS EDUCATION

The course will include a critical examination of all aspects of the design, implementation, and assessment of the Physics curricula. First, the philosophy of Physics and goals in the development of the Physics curriculum will be discussed. Early curriculum models such as those put forward by Tyler, as well as alternative designs in curriculum such as the problem-based and brain-based learning models will also be debated upon. In addition, Curriculum Theory, Practice and Development in Physics will also be examined. A review of Physics curricula of various nations to seek alternatives in designing a dynamic curriculum will also be considered.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP2010 TEACHING IN INORGANIC CHEMISTRY

Students will analyse and understand the curriculum of inorganic chemistry in upper secondary and pre-university level. This course also introduces students to theories related to inorganic chemistry learning. The course also provides students to develop their own principled understanding and practices of appropriate teaching of inorganic chemistry in upper secondary and pre-university level. Students will learn to use appropriate teaching approaches and strategies, planning of lessons, methods of presentations and innovative use of instructional aids.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP2011 TEACHING IN ORGANIC CHEMISTRY

Students will analyse and understand the curriculum of organic chemistry in upper secondary and pre-university level. This course also introduces students to theories related to organic chemistry learning. The course also provides students to develop their own principled understanding and practices of appropriate teaching of organic chemistry in upper secondary and pre-university level. Students will learn to use appropriate teaching approaches and strategies, planning of lessons, methods of presentations and

innovative use of instructional aids.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP3001 TEACHING PRACTICE I

This is the second practical component in the professional education of teachers that is conducted in 8 weeks in the Special Semester of the Third Year of the program. The purpose for this component is to provide student teachers opportunities to observe two Cooperating Teachers teach and to reflect on the roles, responsibilities, and challenges of a classroom teacher. During this period, student teachers will be provided opportunities to work with their Cooperating Teachers in planning lessons, preparing resources, managing students and to co-teach with the Cooperating Teachers. Student teachers will also identify one learning problem faced by students and diagnose the possible causes to this problem. Apart from working together with the Cooperating Teachers on teaching duties, students have to be involved in the co-curricular activities at school, or whatever classroom administrative duties, special services and school management as requested by the school. Whenever possible, students have to be fully involved in important events at school.
Assessment Methods:
Continuous assessment: 100%

SIP3002 TEACHING OF GEOMETRY

The course offers the opportunity for students to be exposed to the important concepts in Euclidean geometry. In addition, the focus will be on the common errors and learning difficulties faced in the learning of geometry. The experience will be used as the foundation to discuss the assessment and problem solving in geometry. Teaching and learning techniques in teaching geometry at secondary and pre-university will be covered and the design of tasks that involve students using digital technology will be discussed.

Assessment Methods:
Continuous assessment: 40%
Final examination: 60%

SIP3003 TEACHING OF PROBABILITY AND STATISTICS

The course offers the opportunity for students to be exposed to the important concepts in the teaching and learning of probability and statistics. In addition, the focus will be on the common errors and learning difficulties faced in the learning of probability and statistics. The experience will be used as the foundation to discuss the assessment and problem solving in probability and statistics. Teaching and learning

techniques at secondary and pre-university will be covered and the design of tasks that involve students using digital technology will be discussed.

Assessment Methods:
Continuous assessment: 40%
Final examination: 60%

SIP3004 ASSESSMENT IN CHEMISTRY EDUCATION

In this course the students will be exposed to the various types of assessment and its purpose and functions. Students will learn how to create higher order thinking tasks that truly enhances student learning. Technical aspect of assessment will also be learned. Students will be taught on how to make educational decisions based on students' assessment performance.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP3005 TEACHING AND ASSESSMENT OF FIELD WORK IN BIOLOGY

This course deepens students' understanding of the principles and practices of teaching and learning that involves field work in Biology education. The course will examine appropriate instructional and assessment strategies for Biology concepts which related to field work component of Biology, such as in understanding the concepts of evolution, diversity, ecology and ecosystem. Students will involve in actual field studies and learn to plan and conduct a field trip to resource centre/nature reserve.

Assessment Methods:
Continuous assessment: 60%
Final examination: 40%

SIP3006 TEACHING AND ASSESSMENT OF PRACTICAL WORK IN BIOLOGY

This course deepens students' understanding of the principles and practices of teaching and learning which involves practical work in Biology. The course will examine appropriate teaching and assessment strategies for the of Biology syllabus which related to practical work component in the laboratory such as in understanding the concepts of cell structure and function, and genetic. Science process skills and manipulative skills that are important to be acquired in practical work will be determined. The most suitable approach to in acquiring the skills will also be emphasized in this course.

Assessment Methods:
Continuous assessment: 60%
Final examination: 40%

SIP3007 TECHNOLOGY IN PHYSICS EDUCARION

The focus of this course is to assist students to integrate existing technologies in learning Physics. Critical perspectives towards theories, experiences in the use of technology can be applied in a variety of educational contexts will be discussed. Specifically, this course enables students to use technology namely CAI, CD-ROMS, data loggers, interfaces, word processors and graphical presentations including surfing the websites, e-mails and WWW in learning abstract and difficult concepts in Physics. Human-computer interaction will be explored. Collaborative learning using computer will be investigated form the aspects of science process skills and manipulative skills.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP3008 ASSESSMENT CHALLENGES IN PHYSICS EDUCATION

The aim of this course is to provide exposure to students regarding the basic concepts, theory and overall practices of the assessment principles. Various assessments that are emphasized in physics will be discussed. The basic theory of developing an assessment instrument in learning, for learning and in learning will be the focus. The methodology used to determine the validity and reliability of the assessment instrument in various contexts as well as emerging issues will be emphasized. Challenges towards alternative assessment instruments namely the use of portfolios, authentic assessment, assessment of learning outcomes and achievement will be rationalised in physics education.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP4001 TEACHING PRACTICE II

This is the third practical component in the professional education of teachers to be conducted in 8 weeks in the Special Semester of the Final Year of the program. Students are required to teach under the supervision of an assigned supervisor (at a secondary school). During this period, students will integrate what they have learned about educational theories and methods of teaching in their subjects of specialization in real classroom teaching and learning. Apart from teaching duties, students have to be involved in the co-curricular activities at school, or whatever classroom administrative duties, special services and school management as requested by the school. Students have to make complete lesson plans, teaching aids, assessment materials and keep students' record of learning. Students will also be required to conduct a classroom action

research project during this Teaching Practice. Whenever possible, students have to be fully involved in important events at school.

Assessment Methods:
Continuous assessment: 100%

SIP4002 TEACHING OF DISCRETE MATHEMATICS

The course offers the opportunity for students to be exposed to the important concepts in the teaching and learning of discrete mathematics. In addition, the focus will be on the common errors and learning difficulties faced in the learning of discrete mathematics. The experience will be used as the foundation to discuss the assessment and problem solving in discrete mathematics. Teaching and learning techniques at secondary and pre-university will be covered and the design of tasks that involve students using digital technology will be discussed

Assessment Methods:
Continuous assessment: 40%
Final examination: 60%

SIP4003 TEACHING OF CALCULUS

The course offers the opportunity for students to be exposed to the important concepts in the teaching and learning of calculus. In addition, the focus will be on the common errors and learning difficulties faced in the learning of calculus. The experience will be used as the foundation to discuss the assessment and problem solving in calculus. Teaching and learning techniques in teaching calculus at secondary and pre-university will be covered and the design of tasks that involve students using digital technology will be discussed.

Assessment Methods:
Continuous assessment: 40%
Final examination: 60%

SIP4004 TEACHING AND ASSESSMENT OF CHEMISTRY COMPONENTS IN SCIENCE

This course will introduce the students to approaches and strategies associated with teaching and learning of the chemistry component in science. The students are also taught to create effective lesson plans and to implement effective theoretical and practical work for the chemistry component in core science. The students will learn on how to assess student understand of the chemistry component in science using meaningful and relevant tasks.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

SIP4005 TEACHING AND ASSESSMENT OF BIOLOGY COMPONENTS IN SCIENCE

This course will introduce the students to theories associated with teaching and learning of biological components in science subject, approaches and strategies in teaching at secondary school, development of effective lesson plans, and approaches in assessing students understanding. The safety practices in biology laboratory will also be learned in this course.

Assessment Methods:
Continuous assessment: 60%
Final examination: 40%

SIP4006 TEACHING AND ASSESSMENT OF PHYSICS COMPONENT IN SCIENCE

This course enables students to identify physics concepts that are significant in general science. The course covers concepts ranging from processes in the change of state of matter, density, dispersion of light and colours, types of cells, space and gravity. The current approaches and methods in teaching secondary school science will be emphasized. Theories of physics in general science, a range of approaches and methods for teaching the component of physics at secondary level, how to formulate the lesson plans in a creative manner, implementing the lesson optimising existing resource effectively are open avenues for opportunities to tap on during this course. Thus, students can develop their own principled understanding and practice of appropriate physics teaching in science at secondary level.

Assessment Methods:
Continuous assessment: 70%
Final examination: 30%

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BACHELOR OF SCIENCE IN BIOTECHNOLOGY
ACADEMIC SESSION 2024/2025
(133 CREDITS)

1. UNIVERSITY COURSES (14 CREDITS)

COURSE CODE	COURSE NAME	CREDITS
GIG1003	Basic Entrepreneurship Enculturation	2
GIG1013	Appreciation of Ethics and Civilization	2
GIG1012/ *GLT1049	Philosophy and Current Issues / Malay Language Communication (*only for international students)	2
GKA1001/ GKI1001/ GKK1001/ GKP1001/ GKS1001/ GKU1001	Co-Curriculum	4
GLTxxxx	English Language / Foreign Language (**student whose native language is English)	4

2. CORE COURSES (87 CREDITS)

COURSE CODE	COURSE NAME	PRE-REQUISITES	CREDITS
LEVEL 1 (22 Credits)			
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3
SIE1003	Cell Biology		2
SIJ1002	Fundamentals of Chemistry		3
SIJ1003	Biochemistry of Cells		3
SIO1001	Basic Physics		2
SIO1002	Fundamental Techniques in Biological Sciences		3
SIO1003	Bioinformatics Concepts		2
SIO1004	Introduction to Computer Programming in Bioinformatics		2
LEVEL 2 (35 Credits)			
SIJ2002	Structure and Function of Biomolecules	SIJ1002	3
SIJ2007	Enzymes: Mechanism and Control	SIJ1002, SIJ2002	2
SIJ2012	Nutritional Biochemistry		3
SIO2001	Applied Microbiology	SIO1002, SIJ1003	3
SIO2002	Animal Biotechnology	SIE1003, SIO1002	3
SIO2003	Higher Plant Physiology	SIJ1002, SIJ1003	3
SIO2012	Bioinformatics Data Management	SIO1003	2
SIO2013	Bioprocess Design Principles	SIO1001, SIJ1002	3
SIO2014	Public Speaking and Oral Communication	SIO1002	3
SIO2015	Plant Biotechnology	SIE1003, SIJ1003	3
SIO2016	Plant Cell and Tissue Culture	SIJ1003	3
SIO2017	Scientific Writing	SIO1002	2
SIR1004	Concepts of Genetic Engineering		2
LEVEL 3 (13 Credits)			
SIO3016	Biological Data Analytics	SIO1004	2
SIO3017	Food Biotechnology	SIO2001, SIJ2012	3
SIO3018	Research Project in Biotechnology	SIO2001, SIO2002, SIO2015, SIO2017	8
LEVEL 4 (17 Credits)			
SIJ3009	Design Thinking and Knowledge Transfer	SIJ1003	3
SIO4001	Bioproduct Business and Supply Chain	SIO3017	2
SIO4003	Industrial Training in Biotechnology	SIO3018	12

3. ELECTIVE COURSES (32 CREDITS)

(I) PROGRAMME ELECTIVE COURSES (24 CREDITS) [EP]
Choose from all elective courses that are offered

COURSE CODE	COURSE NAME	PRE-REQUISITES	CREDITS
Innovative Bioprocessing Module Take minimum 8 credits			
SIO3021	Fermentation and Product Recovery	SIO2001, SIO2013	3
SIO3022	Marine Biotechnology	SIO1002	2
SIO3024	Postharvest Process Engineering and Technology	SIO2003	3
SIO4002	Environmental Biotechnology	SIO2001, SIO2003	2
SIO4004	Enzyme Technology	SIO2013, SIJ2007	3
Biotechnology for Agriculture and Future Crop Module Take minimum 8 credits			
SIE2017	Animal Physiology		3
SIJ3005	Cellular and Molecular Immunology	SIJ1003	3

SIO3019	Animal Nutrition and Feed Technology	SIJ2012	3
SIO3020	Aquaculture Biotechnology		2
SIO3023	Plant Genetics and Breeding		2
SIO3025	Secondary Metabolites and Metabolomics	SIJ2002	2
SIO3026	Sustainable Food Systems		2
SIO3027	Animal Cell and Tissue Culture	SIO2002	2
SIO4005	Microbial Technologies for Soil and Plant Health		2
SIR3034	Applied Genomics in Animal Breeding		3
(II) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS) [SHE] Choose one course from each cluster			
CLUSTER	**CLUSTER TITLE**		**CREDITS**
Cluster 1	Thinking Matters: Mind & Intellect		2
Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul GQX0056 Integrity and Anti-Corruption		2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: i-Technie		2
Cluster 4	Global Issue and Community Sustainability: Making the World a Better Place		2

PROGRAMME GOAL

To produce graduates who have strong fundamental knowledge in biotechnology and capable in various fields that can contribute to the nation's development, and balance the needs of human and environment development in ethical and professional ways.

PROGRAMME LEARNING OUTCOMES

At the end of B.Sc in Biotechnology programme, graduates are able to:-

1. Gain a wealth of knowledge in the fields of basic biology and biotechnology.
2. Apply the knowledge gained to solve complex problems through comprehensive review and corrective action.
3. Demonstrate ability to apply knowledge in the field of biotechnology, especially biology, to solve problems through practical, safe and efficient approaches.
4. Able to communicate clearly and effectively, both verbally and in writing, especially when working in groups as well as demonstrating responsible and productive social skills.
5. Use a variety of information, media and technology applications to explain work-in-progress solutions or research.
6. Demonstrate leadership, professionalism and decision making to be independent in order to achieve certain goals.
7. Demonstrate efficient and effective management and entrepreneurship skills.
8. Demonstrate the importance of ethics and the need for professionalism in technology, especially biotechnology.

SUGGESTED LIST OF COURSES ACCORDING TO SEMESTER, 2024/2025 SESSION
(PLANNING OF COURSES)

BACHELOR OF SCIENCE IN BIOTECHNOLOGY

COMPONENT	YEAR 1				TOTAL CREDIT
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	**GIG1003** Basic Entrepreneurship Enculturation	2	**GIG1012 / GLT1049*** Philosophy and Current Issues / Malay Language Communication*	2	12
	GLTxxxx English Language / Foreign Language**	2	**GLTxxxx** English Language / Foreign Language**	2	
	GKA1001/GKI1001/ GKK1001/GKP1001/ GKS1001/GKU1001 Co-Curriculum	2	**GKA1001/GKI1001/ GKK1001/GKP1001/ GKS1001/GKU1001** Co-Curriculum	2	
Core Courses	**SIX1015** Science, Technology and Society	2	**SIX1016** Statistics	3	22
	SIE1003 Cell Biology	2	**SIJ1002** Fundamentals of Chemistry	3	
	SIJ1003 Biochemistry of Cells	3	**SIO1001** Basic Physics	2	
	SIO1002 Fundamental Techniques in Biological Sciences	3	**SIO1004** Introduction to Computer Programming in Bioinformatics	2	
	SIO1003 Bioinformatics Concepts	2			
TOTAL CREDITS		**18**		**16**	**34**

*only for international students; **student whose native language is English

COMPONENT		YEAR 2				TOTAL CREDIT
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
University Courses		**GIG1013** Appreciation of Ethics and Civilisations	2			
Core Courses		**SIJ2002** Structure and Function of Biomolecules	3	**SIJ2007** Enzymes: Mechanism and Control	2	35
		SIJ2012 Nutritional Biochemistry	3	**SIO2013** Bioprocess Design Principles	3	
		SIO2001 Applied Microbiology	3	**SIO2015** Plant Biotechnology	3	
		SIO2002 Animal Biotechnology	3	**SIO2016** Plant Cell and Tissue Culture	3	
		SIO2003 Higher Plant Physiology	3	**SIO2017** Scientific Writing	2	
		SIO2012 Bioinformatics Data Management	2	**SIR1004** Concepts of Genetic Engineering	2	
		SIO2014 Public Speaking and Oral Speaking	3			
Elective Courses	Student Holistic Empower-ment (SHE)			**SHE Cluster 2** Emotional & Spiritual Intelligence: Heart & Soul **GQX0056** Integrity and Anti-Corruption	2	2
TOTAL CREDITS			**22**		**17**	**39**

COMPONENT		YEAR 3				TOTAL CREDIT
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
Core Courses		**SIO3016** Biological Data Analytics	2	**SIO3017** Food Biotechnology	3	13
		SIO3018 Research Project in Biotechnology	4	**SIO3018** Research Project in Biotechnology	4	
Elective Courses	Program (EP)	*Choose from:* **SIO3019 (3)** Animal Nutrition and Feed Technology **SIO3021 (3)** Fermentation and Product Recovery **SIO3022 (2)** Marine Biotechnology **SIO3023 (2)** Plant Genetics and Breeding **SIO3025 (2)** Secondary Metabolites and Metabolomics	8/9	*Choose from:* **SIJ3005 (3)** Cellular and Molecular Immunology **SIO3020 (2)** Aquaculture Biotechnology **SIO3024 (3)** Post-Harvest Process Engineering and Technology **SIO3026 (2)** Sustainable Food Systems **SIO3027 (2)** Animal Cell and Tissue Culture **SIO4004 (3)** Enzyme Technology	8/9	16-18
	Student Holistic Empower-ment (SHE)	**SHE Cluster 1** Thinking Matters: Mind & Intellect	2	**SHE Cluster 3** Technology/Artificial Intelligence and Data Analytics: i-Technie	2	4
TOTAL CREDITS			**16-17**		**17-18**	**33-35**

COMPONENT	YEAR 4						TOTAL CREDIT
	SEMESTER 1		SEMESTER 2		SPECIAL SEMESTER		
	COURSE	CREDIT	COURSE	CREDIT	COURSE	CREDIT	
Core Courses	**SIJ3009** Design Thinking and Knowledge Transfer	3	**SIO4003** Industrial Training in Biotechnology	8	**SIO4003** Industrial Training in Biotechnology	4	17
	SIO4001 Bioproduct Business and Supply Chain	2					
Elective Courses – Program (EP)	*Choose from:* **SIE2017 (3)** Animal Physiology **SIR3034 (3)** Applied Genomics in Animal Breeding **SIO4002 (2)** Environmental Biotechnology **SIO4005 (2)** Microbial Technology for Soil and Plant Health	8					8
Elective Courses – Student Holistic Empower-ment (SHE)	**SHE Cluster 4** Global Issue and Community Sustainability: Making the World a Better Place	2					2
TOTAL CREDITS		**15**		**8**		**4**	**27**

MINIMUM CREDITS FOR GRADUATION: 133

BACHELOR OF SCIENCE IN BIOCHEMISTRY
ACADEMIC SESSION 2024/2025
(134 CREDITS)

1. UNIVERSITY COURSES (14 CREDITS)

COURSE CODE	COURSE NAME	CREDITS
GIG1012 / GLT1049*	Philosophy and Current Issues (local students) / Malay Language Communication (*only for international students)	2
GIG1013	Appreciation of Ethics and Civilisations	2
GIG1003	Basic Entrepreneurship Enculturation	2
GKA1001/ GKI1001/ GKK1001/ GKP1001/ GKS1001/ GKU1001	Co-Curriculum	4
GLTxxxx	English Language / Foreign Language (**student whose native language is English)	4

2. CORE COURSES (80 CREDITS)

COURSE CODE	COURSE NAME	PRE-REQUISITES	CREDITS
LEVEL 1 (21 Credits)			
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3
SIE1002	Bioethics and Safety		2
SIJ1002	Fundamentals of Chemistry		3
SIJ1003	Biochemistry of Cells		3
SIJ1004	Introduction to Computational Biology		3
SIJ1005	Principles of Biochemical Techniques		3
SIO1001	Basic Physics		2
LEVEL 2 (27 Credits)			
SIJ2002	Structure and Function of Biomolecules	SIJ1002	3
SIJ2004	Metabolism and Regulation of Amino Acids and Nucleotides	SIJ1003	2
SIJ2005	Molecular Biology	SIJ1003	3
SIJ2006	Protein Biochemistry	SIJ1002	3
SIJ2007	Enzymes: Mechanism and Control	SIJ1002, SIJ2002	2
SIJ2008	Biochemistry Practical I		4
SIJ2009	Biochemistry Practical II	SIJ2008	4
SIJ2021	Metabolism and Regulation of Carbohydrate and Lipids	SIJ1003	3
SIJ2022	Scientific and Research Communication	SIJ1003	3
LEVEL 3 (32 Credits)			
SIJ3001	Research Project In Biochemistry	SIJ2008, SIJ2009	10
SIJ3004	Clinical Biochemistry and Physiology	SIJ1003	3
SIJ3005	Cellular and Molecular Immunology	SIJ1003	3
SIJ3006	Membrane Biochemistry and Cell Signalling	SIJ2002	2
SIJ3008	Advanced Molecular Biology	SIJ2005	3
SIJ3009	Design Thinking and Knowledge Transfer	SIJ1003	3
SIJ3019	Industrial Attachment and Training	SIJ3001	8

3. ELECTIVE COURSES (40 CREDITS)

(I) PROGRAMME ELECTIVE COURSES or/and MINOR PACKAGE**
(32 CREDITS)
Choose from all elective courses or/and Minor Packages that are offered

COURSE CODE	COURSE NAME	PRE-REQUISITES	CREDITS
SIJ2012	Nutritional Biochemistry		3
SIJ2014	Toxicology		3
SIJ2015	Toxinology		2
SIJ2016	Food Process Biochemistry		2
SIJ2017	Microbial Biochemistry		2
SIJ2018	Functional Anatomy and Physiology		3
SIJ2019	Biochemistry of Hormones		2
SIJ2020	Neurochemistry	SIJ1003	2
SIJ3003	Plant Molecular Biology	SIJ2005	3
SIJ3011	Post-Genomic Technologies and Bioinformatics	SIJ2005, SIJ3008	3
SIJ3013	Natural Product Biochemistry and Drug Discovery		3
SIJ3016	Biochemistry of Cancer	SIJ2005	3
SIJ3017	Glycobiology		3
SIJ3018	Computational Biochemistry		3
SIJ3020	Fundamentals of Biochemical Pharmacology		2
SIJ3021	Structural Biology Techniques	SIJ2006	2

SIJ3022	Epigenetics and RNA Biology	SIJ2005	3
(II) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS) [SHE] Choose one course from each cluster			
CLUSTER	**CLUSTER TITLE**		**CREDITS**
Cluster 1	Thinking Matters: Mind & Intellect		2
Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul GQX0056 Integrity and Anti-Corruption		2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: i-Technie		2
Cluster 4	Global Issues and Community Sustainability: Making the World a Better Place		2

** Minor package
(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, student can refer to UMSItS Guide via this link : https://umsitsguide.um.edu.my/

PROGRAMME GOALS

To ensure the graduates instilled with high integrity, competency and becoming influential and impactful individuals to the society, the programme aims at observing perspectives as below by:-

1. Strengthening of graduates' prospects as professionals in the field of Biochemistry and other relevant areas
2. Continuation of graduates' personal development, participation in life-long learning activities and learning of biochemistry and various other disciplines
3. Contribution of graduates to development of biochemical-based technology in everyday life and society well-being

PROGRAMME LEARNING OUTCOMES

At the end of the Bachelor of Science in Biochemistry programme, graduates are able to:-

1. Have an in-depth knowledge via the understanding of the concepts, principles and ideas in field of biochemistry and other relevant fields.
2. Relate skilled thinking or intellectual capability to basic biochemistry and scientific methodology in problem-solving and idea generation
3. Master practical skills and relevant techniques for application in evaluation and analysis in various situations, designing and implementation of assigned projects systematically
4. Convey the knowledge and ideas clearly and effectively using various media, communicating interactively, establishing team-work, social interaction and collaborative networking ethically.
5. Apply the acquired skills using digital information technology to support projects or learning, besides of understanding, mastering quantitative basic skills, numeration or statistics
6. Develop leadership quality, capability to establish connection and co-operation in a team and making responsible decision
7. Use soft skill to plan effectively, apply knowledge, manage resources and time, implement project creatively or embark in the entrepreneurial areas
8. Demonstrate the importance of ethics and moral values in various situations especially in implementing tasks professionally

SUGGESTED LIST OF COURSES ACCORDING TO SEMESTER, 2024/2025 SESSION (PLANNING OF COURSES)

BACHELOR OF SCIENCE IN BIOCHEMISTRY

COMPONENT		YEAR 1				TOTAL CREDITS
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
University Courses		**GIG1003** Basic Entrepreneurship Enculturation	2	**GIG1012 / GLT1049*** Philosophy and Current Issues / Malay Language Communication*	2	12
		GLTxxxx English Language / Foreign Language**	2	**GLTxxxx** English Language / Foreign Language**	2	
		GKA / GKI / GKK/ GKP/ GKS / GKU Co-Curriculum	2	**GKA / GKI / GKK/ GKP/ GKS / GKU** Co-Curriculum	2	
Core Courses		**SIX1015** Science, Technology and Society	2	**SIX1016** Statistics	3	21
		SIE1002 Bioethics and Safety	2	**SIJ1002** Fundamentals of Chemistry	3	
		SIJ1003 Biochemistry of Cells	3	**SIJ1004** Introduction to Computational Biology	3	
		SIJ1005 Principles of Biochemical Techniques	3	**SIO1001** Basic Physics	2	
Elective Courses	Student Holistic Empowerment (SHE)	**SHE Cluster 4** Global Issues and Community Sustainability: Making the World a Better Place	2	**SHE Cluster 3** Technology/Artificial Intelligence and Data Analytics: i-Technie	2	4
TOTAL CREDITS			**18**		**19**	**37**

*only for international students; **student whose native language is English

COMPONENT		YEAR 2				TOTAL CREDITS
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
University Courses		**GIG1013** Appreciation of Ethics and Civilisations	2			2
Core Courses		**SIJ2002** Structure and Function of Biomolecules	3	**SIJ2004** Metabolism and Regulation of Amion Acids and Nucleotides	2	27
		SIJ2021 Metabolism and Regulation of Carbohydrate and Lipids	3	**SIJ2005** Molecular Biology	3	
		SIJ2006 Protein Biochemistry	3	**SIJ2007** Enzymes: Mechanism and Control	2	
		SIJ2008 Practical Biochemistry I	4	**SIJ2009** Biochemistry Practical II	4	
				SIJ2022 Scientific and Reseach Communication	3	
Elective Courses	Student Holistic Empower-ment (SHE)			**SHE Cluster 2** Emotional & Spiritual Intelligence: Heart & Soul **GQX0056** Integrity and Anti-Corruption	2	7
	Program (EP)	**SIJ2012** Nutritional Biochemistry **/ SIJ2014** Toxicology **/ SIJ2018** Functional Anatomy and Physiology	3	**SIJ2015** Toxinology **/ SIJ2016** Food Process Biochemistry/ **SIJ2017** Microbial Biochemistry	2	
TOTAL CREDITS			**18**		**18**	**36**

COMPONENT		YEAR 3				TOTAL CREDITS
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
Core Courses		**SIJ3001** Research Project in Biochemistry	5	**SIJ3001** Research Project in Biochemistry	5	21
		SIJ3006 Membrane Biochemistry and Cell Signalling	2	**SIJ3004** Clinical Biochemistry and Physiology	3	
		SIJ3008 Advanced Molecular Biology	3	**SIJ3005** Cellular and Molecular Immunology	3	
Elective Courses	Student Holistic Empowerment (SHE)			**SHE Cluster 1** Thinking Matters: Mind & Intellect	2	4
	Program (EP)	**SIJ2019** Biochemistry of Hormones **SIJ3013** Natural Product Biochemistry and Drug Discovery **/** **SIJ3020** Fundamentals of Biochemical Pharmacology**/** **SIJ3021** Structural Biology Techniques **/** **SIJ3022** Epigenetics and RNA Biology	Min. 7	**SIJ3011** Post-Genomic Technologies and Bioinformatics **/** **SIJ3016** Biochemistry of Cancer **/** **SIJ2020** Neurochemistry	Min. 5	10
TOTAL CREDITS			**17**		**18**	**35**

COMPONENT		YEAR 4				TOTAL CREDITS
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
Core Courses		**SIJ3009** Design Thinking and Knowledge Transfer	3	**SIJ3019** Industrial Attachment and Training	8	11
Elective Courses	Program (EP)	**SIJ3003** Plant Molecular Biology **/** **SIJ3013** Natural Product Biochmistry and Drug Discovery **/** **SIJ3017** Glycobiology **/** **SIJ3018** Coputational Biochemistry **/** **SIJ3020** Fundamentals of Biochemical Pharmacology **/** **SIJ3021** Structural Biology Techniques **/** **SIJ3022** Epigenetics and RNA Biology	Min. 15			15
TOTAL CREDITS			**18**		**8**	**26**

MINIMUM CREDITS FOR GRADUATION: 134

BACHELOR OF SCIENCE IN ECOLOGY & BIODIVERSITY
ACADEMIC SESSION 2024/2025
(134 CREDITS)

1. UNIVERSITY COURSES (14 CREDITS)

COURSE CODE	COURSE NAME	CREDITS
GIG1012 / GLT1049*	Philosophy and Current Issues (local students) / Malay Language Communication (*only for international students)	2
GIG 1013	Appreciation of Ethics and Civilisations	2
GIG 1003	Basic Entrepreneurship Enculturation	2
GLTxxxx	English Language / Foreign Language (**student whose native language is English)	4
GKA1001/ GKI1001/ GKK1001/ GKP1001/ GKS1001/ GKU1001	Co-Curriculum	4

2. CORE COURSES (80 CREDITS)

COURSE CODE	COURSE NAME	PRE-REQUISITES	CREDITS
LEVEL 1 (15 Credits)			
SIX 1015	Science, Technology and Society		2
SIX 1016	Statistics		3
SIE1002	Bioethics and Safety		2
SIE1003	Cell Biology		2
SIH1004	Environmental Sustainability		2
SIO1003	Bioinformatics Concepts		2
SIO1004	Introduction to Computer Programming in Bioinformatics		2
LEVEL 2 (30 Credits)			
SIE2001	Principles of Systematics		4
SIE2002	Plant Diversity		4
SIE2004	Mycology		3
SIE2005	Vertebrate Biology		4
SIE2006	Phycology		3
SIE2007	Population and Community Ecology		4
SIE2014	Protozoa and Invertebrate I		3
SIE2015	Invertebrate II		3
SIO2012	Bioinformatics Data Management	SIO1003	2
LEVEL 3 (35 Credits)			
SIE3004	Quantitative Ecology	SIX1016	3
SIE3005	Behavioural Ecology and Ethology	SIE2005 and SIE2015	3
SIE3017	Scientific Communication		2
SIE3018	Molecular Ecology and Applications	SIE1003 and SIE2001	4
SIE3019	Nature and Society		2
SIE3023	Research Project for Ecology and Biodiversity	SIX1016 and SIE2001	8
SIE3024	Industrial Training for Ecology and Biodiversity	SIE3025 and SIE3004	8
SIE3025	Biodiversity Governance and Conservation		3
SIO3016	Biological Data Analytics	SIO1004	2

3. ELECTIVE COURSES (40 CREDITS)

(I) PROGRAMME ELECTIVE COURSES or/and MINOR PACKAGE ** (32 CREDITS)

Choose from all elective courses or/and Minor Packages that are offered

COURSE CODE	COURSE NAME	PRE-REQUISITES	CREDITS
SIE1004	Introductory Microbiology		2
SIE2010	Urban Zoology		3
SIE2011	Terrestrial Ecology		3
SIE2012	Aquatic Ecology		3
SIE2016	Plant Physiology		3
SIE2017	Animal Physiology		3
SIE3006	Economic Botany		3
SIE3007	Ecology and Management of Weeds		3
SIE3009	Plant Pathology	SIE2002	3
SIE3010	Horticulture and Landscape	SIE2002	3
SIE3012	Parasitology		3
SIE3013	Economic Entomology	SIE2015	3

SIE3014	Integrated Pest Management		3
SIE3015	Ecotoxicology		3
SIE3016	Soil Ecology and Management		3
SIE3020	Fisheries Ecology and Management	SIX1016	3
SIE3021	Ecotourism		2
SIE3022	Bioimage Processing and Analysis	SIX1016	3
SIH2021	Key Issues in Climate Change		2
SIH2022	Ecosystem-based Management		2
SIH2025	Renewable Energy Transition and Society		2
SIH3009	Slope Eco-engineering Techniques		3
SIH3027	Green Agriculture		3
SIO3020	Aquaculture Biotechnology		2
SIO3026	Sustainable Food Systems		2
SIR2041	Population Genetics		3

(II) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS) [SHE]
Choose one course from each cluster

CLUSTER	CLUSTER TITLE	CREDITS
Cluster 1	Thinking Matters: Mind & Intellect	2
Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul GQX0056 Integrity and Anti-Corruption	2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: i-Technie	2
Cluster 4	Global Issue and Community Sustainability: Making the World a Better Place	2

** Minor package
(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, student can refer to UMSItS Guide via this link : https://umsitsguide.um.edu.my/

PROGRAMME GOALS

Programme graduates are knowledgable in biological diversity and ecological values enabling the conservation and sustainable management of our natural resources as national heritage. Objectives of the Ecology Biodiversity programme are to:-

1. Able to build professions related to ecology and biodiversity and/or related fields.
2. Engage in lifelong learning and interdisciplinary learning related to industrial and academic careers.
3. Able to contribute to the sustainable development and well-being of society and nation.

PROGRAMME LEARNING OUTCOMES

At the end of the B.Sc in Ecology and Biodiversity programme, graduates are able to:-

1. Master the knowledge of ecology and biodiversity to assess issues related to global climate change, biodiversity degradation, ecological community stability, food security, natural resource management and the environment.
2. Employ self-learning skills critically and innovatively in solving problems related to biodiversity and ecology.
3. Design and implement ecology and biodiversity related projects systematically using appropriate technical and practical skills.
4. Communicate information and ideas clearly and effectively, especially on topics related to ecological and biodiversity.
5. Utilize the latest scientific methods and technology in managing natural resources.
6. Understand and carry out the obligations effectively in managing biodiversity resources.
7. Demonstrate entrepreneurial skills in carrying out projects or assignments related to ecology and biodiversity.
8. Take into account the sustainable, professional and ethical use and management of natural resources.

SUGGESTED LIST OF COURSES ACCORDING TO SEMESTER, 2024/2025 SESSION
(PLANNING OF COURSES)

BACHELOR OF SCIENCE IN ECOLOGY & BIODIVERSITY

COMPONENT		YEAR 1				TOTAL CREDIT
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
University Courses		**GLTxxxx** English Language / Foreign Language**	2	**GLTxxxx** English Language / Foreign Language**	2	14
		GIG1013 Appreciation of Ethics and Civilisations	2	**GIG1012/GLT1049*** Philosophy and Current Issues (local students) / Malay Language Communication	2	
		GIG1003 Basic Entrepreneurship Enculturation	2	**GKA1001/GKI1001/ GKK1001/GKP1001/ GKS1001/GKU1001** Co-Curriculum	2	
		GKA1001/GKI1001/ GKK1001/GKP1001/ GKS1001/GKU1001 Co-Curriculum	2			
Core Courses		**SIX1015** Science, Technology and Society	2	**SIX1016** Statistics	3	15
		SIE1003 Cell Biology	2	**SIE1002** Bioethics and Safety	2	
		SIO1004 Introduction to Computer Programming in Bioinformatics	2	**SIH1004** Environmental Sustainability	2	
				SIO1003 Bioinformatics Concepts	2	
Elective Courses	Student Holistic Empowerment (SHE)	**SHE Cluster 1** Thinking Matters: Mind & Intellect	2	**SHE Cluster 3** Technology/Artificial Intelligence and Data Analytics: i-Technie	2	8
		SHE Cluster 4 Global Issue and Community Sustainability: Making the World a Better Place	2	**SHE Cluster 2** Emotional & Spiritual Intelligence: Heart & Soul **GQX0056** Integrity and Anti-Corruption	2	
TOTAL CREDIT			**18**		**19**	**37**

*only for international students; **student whose native language is English

COMPONENT		YEAR 2				TOTAL CREDIT
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
Core Courses		**SIE2002** Plant Diversity	4	**SIE2001** Principles of Systematics	4	26
		SIE2005 Vertebrate Biology	4	**SIE2004** Mycology	3	
		SIE2006 Phycology	3	**SIE2015** Invertebrate II	3	
		SIE2014 Protozoa and Invertebrate I	3	**SIO2012** Bioinformatics Data Management	2	
Elective Courses	Program (EP)	**SIE2010** Urban Zoology **/ SIE2011** Terrestrial Ecology / **SIE2016** Plant Physiology / **SIH2021**	6	**SIE1004** Introductory Microbiology/ **SIE2012** Aquatic Ecology / **SIE2017** Animal Physiology / **SIH2025**	6	12

		Key Issues in Climate Change / **SIH2022** Ecosystem-based Management		Renewable Energy Transition and Society / **SIH3027** Green Agriculture / **SIO3026** Sustainable Food Systems		
TOTAL CREDIT			**20**		**18**	**38**

COMPONENT		**YEAR 3**				**TOTAL CREDITS**
		SEMESTER 1		**SEMESTER 2**		
		COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses		**SIE3023** Research Project for Ecology and Biodiversity	4	**SIE3023** Research Project for Ecology and Biodiversity	4	26
		SIE3005 Behavioural Ecology and Ethology	3	**SIE2007** Population and Community Ecology	4	
		SIE3004 Quantitative Ecology	3	**SIE3017** Scientific Communication	2	
		SIO3016 Biological Data Analytics	2	**SIE3018** Molecular Ecology and Applications	4	
Elective Courses	Program (EP)	**SIE3006** Economic Botany / **SIE3007** Ecology and Management of Weeds / **SIE3012** Parasitology **/** **SIE3013** Economic Entomology / **SIO3020** Aquaculture Biotechnology	6	**SIE3009** Plant Pathology / **SIE3010** Horticulture and Landscape / **SIE3014** Integrated Pest Management / **SIE3015** Ecotoxicology / **SIH3009** Slope Eco-engineering Techniques	6	12
TOTAL CREDIT			**18**		**20**	**38**

COMPONENT		**YEAR 4**				**TOTAL CREDIT**
		SEMESTER 1		**SEMESTER 2**		
		COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses		**SIE3025** Biodiversity Governance and Conservation	3	**SIE3024** Industrial Training for Ecology and Biodiversity	8	13
		SIE3019 Nature and Society	2			
Elective Courses	Program (EP)	**SIE3016** Soil Ecology and Management / **SIE3020** Fisheries Ecology and Management / **SIE3021** Ecotourism / **SIE3022** Bioimage Processing and Analysis / **SIR2041** Population Genetics	8			8
TOTAL CREDIT			**13**		**8**	**21**

MINIMUM CREDITS FOR GRADUATION: 134

BACHELOR OF SCIENCE IN ENVIRONMENTAL MANAGEMENT ACADEMIC SESSION 2024/2025 (132 CREDITS)			
1. UNIVERSITY COURSES (14 CREDITS)			
COURSE CODE	**COURSE NAME**		**CREDITS**
GIG1012 / GLT1049*	Philosophy and Current Issues (local students) / Malay Language Communication (*only for international students)		2
GIG1013	Appreciation of Ethics and Civilisations		2
GIG1003	Basic Entrepreneurship Enculturation		2
GKA/ GKI/ GKK/ GKP/ GKS/ GKU 1001	Co-Curriculum		4
GLTxxxx	English Language / Foreign Language (**student whose native language is English)		4
2. CORE COURSES (80 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITES**	**CREDITS**
LEVEL 1 (15 Credits)			
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3
SIE1002	Bioethics and Safety		2
SIH1004	Environmental Sustainability		2
SIH1005	Analytical Environmental Chemistry		2
SIO1003	Bioinformatics Concepts		2
SIO1004	Introduction to Computer Programming in Bioinformatics		2
LEVEL 2 (16 Credits)			
SIH2007	Principles of Waste Management		3
SIH2015	Soil Science and Community	SIH1005	5
SIH2016	Environmental Monitoring	SIH1004	3
SIH2017	Applied Ecology		3
SIH2018	Research Methods and Scientific Writing		2
LEVEL 3 (19 Credits)			
SIH3005	Environmental Impact Assessment	SIH2016	3
SIH3006	Environmental Management System	SIH1004	3
SIH3007	Integrated Waste Management	SIH2007	3
SIH3022	Environmental Management Research Project	SIH2018	8
SIH3023	Introduction to Administrative Management		2
LEVEL 4 (30 Credits)			
SIH4001	Industrial Training	SIH3022 & SIH3023	30
3. ELECTIVE COURSES (38 CREDITS)			
(I) PROGRAMME ELECTIVE COURSES or/and MINOR PACKAGE ** (30 CREDITS) Choose from all elective courses or/and Minor Packages that are offered			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITES**	**CREDITS**
SIH2008	Environmental Health and Safety		2
SIH2014	Environmental Forensics		2
SIH2019	Environmental Risk Assessment and Management		2
SIH2020	Environmental Governance	SIH1004	3
SIH2021	Key Issues in Climate Change		2
SIH2022	Ecosystem-Based Management		2
SIH2023	Energy Saving Culture		2
SIH2024	Environmental Informatics	SIO1004	2
SIH2025	Renewable Energy Transition and Society		2
SIH2026	Water Management		2
SIH2028	Air Pollution Control		2
SIH2029	Disaster Management		2
SIH2030	Organisms and Environment		2
SIH3009	Slope Eco-engineering Techniques		3
SIH3017	Technology and Management of Hazardous Waste	SIH3007	3
SIH3018	Environmental Microbiology	SIH1004	3
SIH3019	Tourism and Environment		3

SIH3025	Introduction to Bioremediation	SIH3018	3
SIH3026	Environmental Well-Being		2
SIH3027	Green Agriculture		3
SIE2012	Aquatic Ecology		3
SIE3025	Biodiversity Governance and Conservation		3
SIO2012	Bioinformatics Data Management	SIO1003	2
SIO3016	Biological Data Analytics	SIO1004	2
SIO3026	Sustainable Food Systems		2
(II) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS) [SHE] Choose one course from each cluster			
CLUSTER	**CLUSTER TITLE**		**CREDITS**
Cluster 1	Thinking Matters: Mind & Intellect		2
Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul GQX0056 Integrity and Anti-Corruption		2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: i-Technie		2
Cluster 4	Global Issue and Community Sustainability: Making the World a Better Place		2

** Minor package

(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, student can refer to UMSItS Guide via this link : https://umsitsguide.um.edu.my/

PROGRAMME GOAL

To produce knowledgeable and competent graduates in Environmental Managment.

PROGRAMME LEARNING OUTCOMES

At the end of the B.Sc in Environmental Management Programme, graduates are able to:-

1. Acquire and comprehend basic biological principles that contribute to expertise in environmental management.
2. Use intellectual skills to find and understand new scientific information that are useful in environmental management for industries.
3. Apply technical and design skills to solve environmental problems related to environmental management research and industry.
4. Communicate information and ideas clearly and effectively regardless of oral or written, presenting them in the manner that are confident, accurate, coherent and in context.
5. Use various forms of information, media and application technology that combine numerical and visual data to support learning.
6. Be independent, responsible and show leadership in making decisions to achieve organizational goals.
7. Actively engage in lifelong learning in addition to strengthening management and entrepreneurial abilities by emphasizing environmental, social, political, economic and cultural interests.
8. Inculcate values, ethics, codes of good practice, regulations and legislation learnt during the study of environmental science and management in the work-place and local community.

SUGGESTED LIST OF COURSES ACCORDING TO SEMESTER, 2024/2025 SESSION
(PLANNING OF COURSES)

BACHELOR OF SCIENCE IN ENVIRONMENTAL MANAGEMENT

COMPONENT		YEAR 1				TOTAL CREDIT
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
University Courses		**GLTxxxx** English Language / Foreign Language**	2	**GLTxxxx** English Language / Foreign Language**	2	12
		GIG1003 Basic Entrepreneurship Enculturation	2	**GIG1012** / **GLT1049*** Philosophy and Current Issues / Malay Language Communication*	2	
		GKA/GKI/GKK/GKP/ GKS/GKU1001 Co-Curriculum	2	**GKA/GKI/GKK/GKP/ GKS/GKU1001** Co-Curriculum	2	
Core Courses		**SIX1015** Science, Technology and Society	2	**SIX1016** Statistics	3	15
		SIO1003 Bioinformatics Concepts	2	**SIE1002** Bioethics and Safety	2	
		SIO1004 Introduction to Computer Programming in Bioinformatics	2	**SIH1004** Environmental Sustainability	2	
				SIH1005 Analytical Environmental Chemistry	2	
Elective Courses	Student Holistic Empower-ment (SHE)	**SHE Cluster 1** Thinking Matters: Mind & Intellect	2	**SHE Cluster 3** Technology/Artificial Intelligence and Data Analytics: i-Technie	2	6
		SHE Cluster 4 Global Issue and Community Sustainability: Making the World a Better Place	2			
TOTAL CREDITS			**16**		**17**	**33**

*only for international students; **student whose native language is English

COMPONENT		YEAR 2				TOTAL CREDIT
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
University Courses		**GIG1013** Appreciation of Ethics and Civilisations	2			2
Core Courses		**SIH2007** Principles of Waste Management	3	**SIH2016** Environmental Monitoring	3	16
		SIH2015 Soil Science and Community	5	**SIH2017** Applied Ecology	3	
				SIH2018 Research Methods and Scientific Writing	2	
Elective Courses	Program (EP)	**SIH2008** Environmental Health and Safety/ **SIH2014** Environmental Forensics/ **SIH2019** Environmental Risk Assessment and Management/	9	**SIH2020** Environmental Governance/ **SIH2024** Environmental Informatics/ **SIH2025** Renewable Energy Transition and Society/ **SIH2028** Air Pollution Control/	9	18

		SIH2021 Key Issues in Climate Change/ **SIH2022** Ecosystem-Based Management/ **SIH2023** Energy Saving Culture/ **SIH2026** Water Management/ **SIO2012** Bioinformatics Data Management		**SIH2029** Disaster Management/ **SIH2030** Organisms and Environment/ **SIE2012** Aquatic Ecology/		
	Student Holistic Empower-ment (SHE)			**SHE** **Cluster 2** Emotional & Spiritual Intelligence: Heart & Soul **GQX0056** Integrity and Anti-Corruption	2	2
TOTAL CREDITS			**19**		**19**	**38**

COMPONENT		**YEAR 3**				**TOTAL CREDIT**
		SEMESTER 1		**SEMESTER 2**		
		COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses		**SIH3006** Environmental Management System	3	**SIH3005** Environmental Impact Assessment	3	19
		SIH3007 Integrated Waste Management	3	**SIH3022** Environmental Management Research Project (P)	4	
		SIH3022 Environmental Management Research Project (P)	4	**SIH3023** Introduction to Administrative Management	2	
Elective Courses	Program (EP)	**SIH3009** Slope Eco-engineering Techniques/ **SIH3018** Environmental Microbiology/ **SIH3027** Green Agriculture/ **SIE3025** Biodiversity Governance and Conservation/ **SIO3016** Biological Data Analytics/	6	**SIH3017** Technology and Management of Hazardous Waste/ **SIH3019** Tourism and Environment/ **SIH3025** Introduction to Bioremediation/ **SIH3026** Environmental Well-Being/ **SIO3026** Sustainable Food Systems	6	12
TOTAL CREDITS			**16**		**15**	**31**

(P) Progressive

COMPONENT	**YEAR 4**				**TOTAL CREDIT**
	SEMESTER 1		**SEMESTER 2**		
	COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses	**SIH4001** Industrial Training (P)	15	**SIH4001** Industrial Training (P)	15	30
TOTAL CREDITS		**15**		**15**	**30**

(P) Progressive

MINIMUM CREDITS FOR GRADUATION: 132

BACHELOR OF SCIENCE IN MICROBIOLOGY AND MOLECULAR GENETICS ACADEMIC SESSION 2024/2025 (133 CREDITS)			
4. UNIVERSITY COURSES (14 CREDITS)			
COURSE CODE	**COURSE NAME**		**CREDITS**
GIG1012 / GLT1049*	Philosophy and Current Issues (local students) / Malay Language Communication (*only for international students)		2
GIG1013	Appreciation of Ethics and Civilisations		2
GIG1003	Basic Entrepreneurship Enculturation		2
GKA/ GKI/ GKK/ GKP/ GKS/ GKU 1001	Co-Curriculum		4
GLTxxxx	English Language / Foreign Language (**student whose native language is English)		4
5. CORE COURSES (73 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITES**	**CREDITS**
LEVEL 1 (24 Credits)			
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3
SIC1001	Principle of Chemistry		2
SIE1002	Bioethics and Safety		2
SIJ1004	Introduction to Computational Biology		3
SIR1001	Fundamental Microbiology		3
SIR1002	Fundamental Genetics		2
SIR1003	Biochemistry		2
SIR1004	Concepts of Genetic Engineering		2
SIR1005	Genetics and Molecular Biology Practical I		3
LEVEL 2 (23 Credits)			
SIR2011	Bacteriology		2
SIR2012	Immunology	SIR1001	2
SIR2013	Virology	SIR1001	2
SIR2014	Microbiology Practical	SIR1001	3
SIR2015	Microbial Physiology	SIR1001	2
SIR2016	Eukaryotic Microorganisms	SIR1001	3
SIR2017	Microbial Ecology	SIR1001	2
SIR2018	Molecular Genetics	SIR1002	2
SIR2019	Genomes	SIR1002	2
SIR2020	Genetics and Molecular Biology Practical II	SIR1002	3
LEVEL 3 and 4 (26 Credits)			
SIR3018	Biosafety and Biosecurity		2
SIR3019	Human Molecular Genetics	SIR2018	3
SIR4001	Research Project	SIR3018	10
SIR4002	Industrial Training	SIR2014 & SIR2020	8
SIR4003	Science Communication		3
6. ELECTIVE COURSES (46 CREDITS)			
(I) PROGRAMME ELECTIVE COURSES or/and MINOR PACKAGE ** (38 CREDITS) Choose from all elective courses or/and Minor Packages that are offered			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITES**	**CREDITS**
SIE2004	Mycology		3
SIE2006	Phycology		3
SIE3012	Parasitology		3
SIH3027	Green Agriculture		3
SIM1001	Basic Mathematics		4
SIM1002	Calculus I		4
SIO1003	Bioinformatics Concepts		2
SIO1004	Introduction to Computer Programming in Bioinformatics		2
SIO2012	Bioinformatics Data Management	SIO1003	2
SIO3016	Biological Data Analytics	SIO1004	2
SIO3023	Plant Genetics and Breeding		2
SIO4005	Microbial Technologies for Soil and Plant Health		2
SIR2031	Food Microbiology	SIR1001	2
SIR2041	Population Genetics		3

SIR3020	Public Health Microbiology	SIR1001	3
SIR3021	Diagnostic Microbiology	SIR2014	2
SIR3022	Advanced Immunology	SIR2012	3
SIR3023	Advanced Virology	SIR2013	3
SIR3024	Microbial Pathogenesis	SIR1001	2
SIR3025	Cytogenetics		3
SIR3026	Developmental Genetics	SIR2018	2
SIR3027	Epigenetics and Gene Regulation	SIR2018	3
SIR3028	Eukaryotic Cell Signalling	SIR2018	3
SIR3029	Genetic Basis of Cancer	SIR2018	3
SIR3031	Advanced Food Microbiology	SIR2031 & SIX1016	3
SIR3032	Agricultural Microbiology	SIR1001	3
SIR3033	Applied and Environmental Microbiology	SIR1001	3
SIR3034	Applied Genomics in Animal Breeding		3
SIR3035	Animal Genetics and Gene Manipulation	SIR1004	3
SIR3036	Fermentation Technology	SIR1001	3
SIR3037	Pharmaceutical Microbiology	SIR2011 & SIR2012	3
SIR3041	Marine and Estuarine Microbiology	SIR2017	3
SIR3042	Plant Molecular and Cellular Biology	SIR1002	2
SIR3043	Conservation Genetics	SIR2019	3
SIR3044	Molecular Evolution and Phylogenetics	SIR1002	3
SIR3045	Advanced Mycology	SIR2016	2

(II) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS) [SHE]
Choose one course from each cluster

CLUSTER	CLUSTER TITLE	CREDITS
Cluster 1	Thinking Matters: Mind & Intellect	2
Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul GQX0056 Integrity and Anti-Corruption	2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: i-Technie	2
Cluster 4	Global Issue and Community Sustainability: Making the World a Better Place	2

** Minor package
(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, student can refer to UMSItS Guide via this link : https://umsitsguide.um.edu.my/

PROGRAMME GOAL

To produce knowledgeable and competent graduates in the science of Microbiology and Molecular Genetics, who will contribute to local or international workforce.

PROGRAMME LEARNING OUTCOMES

At the end of the B.Sc in Microbiology and Molecular Genetics Programme, graduates are able to:-

1. Acquire knowledge and understanding in Microbiology and Genetics as well as related fields.
2. Demonstrate scientific reasoning and critical thinking skills for problem solving in Microbiology and Genetics as well as related fields.
3. Apply technical and practical skills required in Microbiology and Genetics.
4. Communicate effectively in teamwork activities in both oral and written forms in Microbiology and Genetics.
5. Exhibit information management and digital skills in Microbiology and Genetics as well as related fields.
6. Able to execute responsibilities professionally in Microbiology and Genetics as well as related fields.
7. Exhibit management and lifelong learning skills.
8. Exhibit social responsibility as well as appreciation of nature and sustainability of natural resources.

SUGGESTED LIST OF COURSES ACCORDING TO SEMESTER, 2024/2025 SESSION (PLANNING OF COURSES)

BACHELOR OF SCIENCE IN MICROBIOLOGY AND MOLECULAR GENETICS

COMPONENT	YEAR 1				TOTAL CREDIT
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	**GLTxxxx** English Language / Foreign Language**	2	**GLTxxxx** English Language / Foreign Language**	2	12
	GIG1003 Basic Entrepreneurship Enculturation	2	**GIG1012** / **GLT1049*** Philosophy and Current Issues / Malay Language Communication*	2	
	GKA/GKI/GKK/GKP/ GKS/GKU1001 Co-Curriculum	2	**GKA/GKI/GKK/GKP/ GKS/GKU1001** Co-Curriculum	2	
Core Courses	**SIX1015** Science, Technology and Society	2	**SIC1001** Principle of Chemistry	2	24
	SIE1002 Bioethics and Safety	2	**SIR1003** Biochemistry	2	
	SIJ1004 Introduction to Computational Biology	3	**SIR1005** Genetics and Molecular Biology Practical I	3	
	SIR1001 Fundamental Microbiology	3	**SIX1016** Statistics	3	
	SIR1002 Fundamental Genetics	2			
	SIR1004 Concepts of Genetic Engineering	2			
TOTAL CREDITS		**20**		**16**	**36**

*only for international students; **student whose native language is English

COMPONENT		YEAR 2				TOTAL CREDIT
		SEMESTER 1		SEMESTER 2		
		COURSE	CREDIT	COURSE	CREDIT	
University Courses		**GIG1013** Appreciation of Ethics and Civilisations	2			2
Core Courses		**SIR2011** Bacteriology	2	**SIR2012** Immunology	2	25
		SIR2013 Virology	2	**SIR2014** Microbiology Practical	3	
		SIR2015 Microbial Physiology	2	**SIR2017** Microbial Ecology	2	
		SIR2016 Eukaryotic Microorganisms	3	**SIR2019** Genomes	2	
		SIR2018 Molecular Genetics	2	**SIR2020** Genetics and Molecular Biology Practical II	3	
				SIR3018 Biosafety and Biosecurity	2	
Elective Courses	Program (EP)	**SIE2006** Phycology / **SIM1001** Basic Mathematics / **SIO1003** Bioinformatics Concepts / **SIR2031** Food Microbiology **SIR2041** Population Genetics / **SIR3025** Cytogenetics	6	**SIE2004** Mycology / **SIE3012** Parasitology / **SIM1002** Calculus I / **SIO1004** Introduction to Computer Programming in Bioinformatics / **SIR3031** Advanced Food Microbiology / **SIR3044** Molecular Evolution and Phylogenetics	3	9

	Student Holistic Empower-Ment (SHE)	**SHE Cluster 3** Technology/Artificial Intelligence and Data Analytics: i-Technie	2	**SHE Cluster 2** Emotional & Spiritual Intelligence: Heart & Soul **GQX0056** Integrity and Anti-Corruption	2	4
TOTAL CREDITS			**21**		**19**	**40**

COMPONENT		**YEAR 3**				**TOTAL CREDIT**
		SEMESTER 1		**SEMESTER 2**		
		COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses		**SIR4001** Research Project	5	**SIR4001** Research Project	5	10
Elective Courses	Program (EP)	**SIO2012** Bioinformatics Data Management / **SIR3020** Public Health Microbiology / **SIR3021** Diagnostic Microbiology / **SIR3022** Advanced Immunology / **SIR3028** Eukaryotic Cell Signalling / **SIR3033** Applied and Environmental Microbiology / **SIR3034** Applied Genomics in Animal Breeding / **SIR3042** Plant Molecular and Cellular Biology / **SIR3043** Conservation Genetics	11	**SIO3023** Plant Genetics and Breeding / **SIR3023** Advanced Virology / **SIR3024** Microbial Pathogenesis / **SIR3026** Developmental Genetics / **SIR3027** Epigenetics and Gene Regulation / **SIR3032** Agricultural Microbiology / **SIR3035** Animal Genetics and Gene Manipulation / **SIR3041** Marine and Estuarine Microbiology / **SIR3045** Advanced Mycology	11	22
TOTAL CREDITS			**16**		**16**	**32**

COMPONENT		**YEAR 4**				**TOTAL CREDIT**
		SEMESTER 1		**SEMESTER 2**		
		COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses		**SIR4003** Science Communication	3	**SIR4002** Industrial Training	8	14
		SIR3019 Human Molecular Genetics	3			
Elective Courses	Program (EP)	**SIH3027** Green Agriculture / **SIO3016** Biological Data Analytics / **SIO4005** Microbial Technologies for Soil and Plant Health / **SIR3029** Genetic Basis of Cancer / **SIR3036** Fermentation Technology / **SIR3037** Pharmaceutical Microbiology	7			11
	Student Holistic Empower-Ment (SHE)	**SHE Cluster 1** Thinking Matters: Mind & Intellect **SHE Cluster 4** Global Issue and Community Sustainability: Making the World a Better Place	4			
TOTAL CREDITS			**17**		**8**	**25**

MINIMUM CREDITS FOR GRADUATION: 133

INSTITUTE OF BIOLOGICAL SCIENCES

Biological science teaching and research in Malaysia can be traced back to the early days of 1959, when the Universiti Malaya was instituted with two Divisions: the Kuala Lumpur and the Singapore Divisions. The Kuala Lumpur Division at the Universiti Malaya was officially opened on January 15, 1959. Lessons began in the Department of Zoology and Botany on the 25th of May 1959 in borrowed premises until the Faculty of Science building was officially opened in 1961.

On the 1st of April 1967, the two Departments of Zoology and Botany became one as the School of Biological Sciences with five divisions: zoology, botany, ecology, genetics and physiology. Eight years later on April 1975, the School of Biological Sciences was separated into the Departments of Botany, Zoology, and Genetics and Cellular Biology. The other two divisions of Ecology and Physiology were managed by the Department of Zoology. Physiology was discontinued in 1978 while Ecology continued to flourish under the management of the Department of Zoology. In 1980, the Division of Microbiology was formed under the management of the Department of Genetics and Cellular Biology. On June 1st 1997, the amalgamation of these three departments led to the formation of the Institute of Biological Sciences (*Institut Sains Biologi, ISB*).

These changes were necessary to cater to changing needs and demands of the nation. The changes within the biological sciences reflect current global trends in research evolving away from basic disciplines of botany and zoology. As the ISB keeps up with current technological developments, we continue to document and unravel the rich biodiversity available in our own tropical ecosystems. This is because fundamental sciences form the bases for biotechnology and information science. Our philosophy is to keep up with the latest advances in science and at the same time not lose sight of the need for basic studies on our rich biodiversity. The courses in our degree programmes reflect this philosophy. More changes are to be expected within the coming years to ensure that the study of biological sciences in the Universiti Malaya is geared towards meeting future challenges.

The academic staff members in ISB are involved in a diverse range of biological research areas. There are basic studies in taxonomy, biology and ecology of plants, animals, parasites and other microorganisms, as well as applied sciences such as biotechnology, plant and animal breeding, screening for novel products, and the development of diagnostic kits using molecular biology, electron microscopy, computers and various other tools. For more details, please refer to the profiles of the academic staff available at **http://biology.um.edu.my**. Some members of the Institute are actively involved in research at Sungai Selai, the Endau-Rompin National Park, Johor, while another group is active in the National Antartica Initiative.

Objectives

The ISB aims to advance scientific and technological knowledge in the field of biology, through the establishment of research and scientific links with institutions in and outside the country. In the process of doing so, we hope that high quality graduates will be produced. These young men and women will play important roles in the development of our nation and the world in the future.

Research Funds and Facilities

Research projects in ISB are funded mainly by research and development grants from the Government of Malaysia and special votes from the university. Our researchers are actively seek funding from various international sources such as DANCED, CICHE, Wellcome Trust Foundation, French Embassy at Kuala Lumpur, Japanese International Research Centre for Agricultural Sciences, CIDA and JIRCAS for research and other educational activities. The university and institute also provide a number of facilities to assist researchers in their projects.

Facilities for Teaching and Research

The ISB has research and teaching facilities housed in 13 buildings, spread throughout the campus; two sites are outside of the campus. Within the campus are laboratories for teaching and research, offices for lecturers and administration, seminar rooms and a small lecture theatre in the Rimba Ilmu complex. The seminar rooms and lecture theatres are self-contained, with LCD, slide and overhead projectors. There are also specialised laboratories dedicated to special functions such as microtechniques (plant and animal studies), molecular biology (DNA sequencers and other related paraphernalia), scanning electron microscopy, water analysis, animal house, aquarium, greenhouses and computing facilities. The Institute has excellent research grade microscopes equipped for image analysis. There are also drawing equipments and a laser dissecting microscope. Ten vehicles are available for field research and teaching. The Institute has also accumulated large collections of plant and animal specimens for teaching and research. These are housed in the Herbarium at Rimba Ilmu and the Zoological Museum, respectively. Each lecturer has their respective laboratories dedicated to their research field.

ACADEMIC STAFF

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Dr. Farahaniza Supandi, *BSc(UM), MSc(Leiden), PhD(Vu)*
Dr. Gokula Mohan Duchiyanda Mohan, *BSc(UM), PhD(Glasgow)*
Dr. Jasmine Elanie Khairat, *BSc(Adelaide), PhD(Monash)*
Dr. Lau Beng Fye, *BSc(UM), PhD(UM)*
Dr. M Vijayan a/l Manickam Achari, *BSc(UKM), MSc(UKM), PhD(UM)*
Dr. Muhamad Afiq Aziz *BSc(MUST), MSc(Sussex), PhD(Glasgow)*
Dr. Mohd Zuwairi Saiman, *BSc(UM), MSc(Leiden), PhD(Leiden)*
Dr. Nikman Adli Nor Hashim, *BSc(Manchester), MSc (London), PhD(London)*
Dr. Noorhidayah Mamat, *BAScIStud(UM), MSc(UM), PhD(UM)*
Dr. Norhidayah Mohd Taufek, *BSc(UPM), MSc(UPM), PhD(UM).*
Dr. Nuradilla Mohamad Fauzi, *BSc(UC-Davis), PhD(UC-Davis)*
Dr. Nur Airina Muhamad, *BSc(UM), MSc(UM), PhD(Cantab)*
Dr. Nur Ardiyana Rejab, *BSc(UM), MSc(East Anglia), PhD(NAIST)*
Dr. Nur Kusaira Khairul Ikram, *BSc (UNIMAS), MSc (USM), PhD(Copenhagen)*
Dr. Nurul Ashikin Abdullah, *BSc(UM), PhD(UM)*
Dr. Nurul Amalina Mohd Zain, *BSc(UPM), PhD(UPM)*
Dr. Nurul Shamsinah Mohd Suhaimi, *BSc(UPM), PhD(UM)*
Dr. Pozi Anak Milow, *BSc(UM), MSc(UM), PhD(UM)*
Dr. Sarah Abdul Razak, *BSc(UMT), MSc(Korea), PhD(UM)*
Dr. Shamsul Azlin Ahmad Shamsuddin, *BSc(UM), MPhil(UM), PhD(Sheffield)*
Dr. Sorayya Bibi Malek, *BIT(UM), MCompSc(UM), PhD(UM)*
Dr. Sujatha Ramasamy, *BSc(UM), MSc(UM), PhD(UM)*
Dr. Syarifah Aisyafaznim Sayed Abdul Rahman, *BSc(UM), PhD(UM)*
Dr. Taznim Begam Mohd Mohidin, *BSc(UPM), MSc(UPM), PhD(UM)*
Dr. Tang Swee Seong, *BSc(UM), MSc(UM), PhD(ANU)*
Dr. Tiong Yin Xin Sheena, *BSc(UM), PhD(Glasgow)*
Dr. Yong Kien Thai, *BSc(UKM), MSc(UKM), PhD(UM)*
Dr. Yusrizam Sharifuddin, *BSc(Wales), PhD(Swansea)*
Dr. Zuliana Razali, *BSc(UM), PhD(UM)*

BACHELOR OF SCIENCE PROGRAMME

The Institute of Biological Sciences (ISB) offers degrees in BSc for 5 programmes (132-134): Biochemistry, Biotechnology, Ecology and Biodiversity, Environmental Management. Microbiology and Molecular Genetics, Students are accepted into one of these programmes on the following criteria: (1) merit; (2) capacity; (3) completion of all pre-requisites for year 1 courses.

RESEARCH AREAS

Researchers in ISB carry out research in many different areas. Examples include biodiversity and plant conservation, plant and environmental ecology, genetics (human and biochemical), plant and animal breeding, cytogenetics, immunology, biohealth sciences, bioassays, cancer studies, genetic engineering and recombinant DNA technology, animal and plant virology, bacteriology, microbiology (industrial, food, medical, environmental), animal biotechnology, neurobiology, biosystematics, applied entomology, pest control, fresh and marine water management, applied toxicology.

JOB OPPORTUNITIES

Our BSc graduates are employed in the education, business, management, administration sectors. Some choose to further their studies either locally or abroad, and may one day return to ISB to become academicians or researchers. Others are gainfully employed in local or overseas research institutes.

COURSE SYNOPSES

LEVEL 1 COURSES

SIX 1015 SCIENCE, TECHNOLOGY AND SOCIETY

This course examines the interaction between science, technology and society from various perspectives. It provides discussion on the impacts of science and technology (S&T) progress on society, and vice versa. The discussions comprise the various main aspects of S&T Studies, namely scientific research and development, sustainable development, ethics and values, history and philosophy, economics, policy and management. Such combination encourages communication of diverse diciplines and students will better appreciate the complex ways in which science, technology and society interact. Based on this understanding, students will debate on the status, issues and challenges of selected S&T activities in the local context.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIX 1016 STATISTICS

Introduction to statistics; Experimental and observational studies; Display and organisation of data; Descriptive statistics; Population and samples; Sampling methods; Basic probability theory; Useful probability distributions: binomial, Poisson and normal; Sampling distributions; Central Limit Theorem; Point estimation and confidence interval; Hypothesis testing for mean and proportion in one and two populations; Chi-square tests; Simple linear regression and correlation analysis.

Assessment Methods:
Continuous Assessment: 100%

BACHELOR OF SCIENCE IN BIOTECHNOLOGY PROGRAMME

Career Prospects
Upon graduation, graduates with BSc in Biotechnology can occupy positions such as scientist, research officer, product content strategist, marketing officer, business development officer, QA/QC assistant, research assistant, QA executive in pharmaceutical industry, research associate officer and operation executive in Government Agencies, Private Agencies (Local / Multinational), Non-Governmental Organisations (NGO) and International Bodies.

SIO 1001 BASIC PHYSICS

Introduction to physical concepts present in Biosciences. Physical principles that are used to understand the biological systems.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIO 1002 FUNDAMENTAL TECHNIQUES IN BIOLOGICAL SCIENCES

Introduction to the basic techniques that are used in the field of biochemistry, molecular biology and microbiology.

Assessment Methods:
Continuous Assessment: 100%

SIO 1003 BIOINFORMATICS CONCEPTS

This course aims to introduce the fundamental concepts in bioinformatic such as genome sequencing, pairwise and multiple molecular sequence alignment, database similarity search, molecular phylogenetic and structural bioinformatics. It also covers the utilization of internet biological databases to extract and analyse genomic, proteomic and protein structural data. The importance of ontology in bioinformatics will also be emphasized. Various bioinformatics problems and issues will be discussed on bioinformatics data analysis and applications.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIO 1004 INTRODUCTION TO COMPUTER PROGRAMMING IN BIOINFORMATICS

This course provides an introduction to computer programming with an emphasis on bioinformatics data. In this course, students will learn the fundamental aspects of computer programming including analysis, design, coding using the C++ programming language and testing. This course will address the topics such as flow chart, data structures, data types, variables, Boolean logic, control flows and functions. By the end of the course, students will be able to write and develop computer programs for solving common bioinformatics tasks using a procedural programming style.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIO 2001 APPLIED MICROBIOLOGY

This course covers the topics including role and application of industrial importance microorganisms in medicine, industry, agriculture, waste management and environment.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIO 2002 ANIMAL BIOTECHNOLOGY

This course covers the principles, techniques and applications of animal biotechnology, including assisted reproductive technologies, breeding, and genetic engineering. This course also discusses the ethics and safety of animal biotechnology as well as implications on sustainability and animal welfare.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 2003 HIGHER PLANT PHYSIOLOGY

This course covers explaination on how plants function and grow. This includes metabolism (photosynthesis, respiration, mineral nutrition), water relations, gas exchange, response to environmental stresses, growth and development in response to environmental cues and biochemical control of growth.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 2012 BIOINFORMATICS DATA MANAGEMENT

This course provides an introduction to data management with an emphasis on biological data. In this course students will learn all of the fundamental aspects of data management including acquisition, modelling, storage, integration, analysis and interpretation of diverse data types including structured and unstructured data that necessary for managing biological data using software. By the end of the course students will be able to practice a systematic and efficient methodology in managing biological data.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIO 2013 BIOPROCESS DESIGN PRINCIPLES

The course is designed for instruction in basic principles involved in bioprocess design and associated technology. Among the topics included are introduction to engineering calculation, analysis and presentation of data, mass and energy balances, fluid flow, mixing, heat and mass transfer, and unit operations.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 2014 PUBLIC SPEAKING AND ORAL COMMUNICATION

This course is an introduction to speech communication which emphasizes the practical skill of public speaking, including techniques to enhance speaker presentations. Topics will include cultural conventions and speech, perceptions of others, verbal and nonverbal messages, and techniques of oral presentation and persuasion. Students will learn how to research, outline, and deliver short, informal presentations and also sharpen their skills in critical thinking and listening.

Assessment Methods:
Continuous Assessment: 100%

SIO 2015 PLANT BIOTECHNOLOGY

This course introduces the fundamental concepts and principles of plant biotechnology that are applicable to crop improvement. It covers an array of topics such as gene expression and advanced methods in plant biotechnology. Students will be given a group assignment focusing on a specific case related to plant biotechnology, which requires literature searches and understanding of recent advances in plant biotechnology.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIO 2016 PLANT CELL AND TISSUE CULTURE

This course covers explanation on how to regenerate complete plants from various plant cells, tissues and organs using tissue culture system. Various topics such as media preparation and factors affecting cell's, tissue's and organ's growth and ultimately plant regeneration are covered. Other than that, production of disease-free plants through meristem culture, various culture pathways such as organogenesis and somatic embryogenesis, production of haploid and triploid plants as well as in vitro production of secondary plant metabolites are also discussed in this course.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 2017 SCIENTIFIC WRITING

This course will teach students to become more effective writers, using practical examples and exercises. Topics include: principles of good writing, the format of a scientific manuscript, and issues in publication and peer review. It will also introduce students to basic research writing skills including aspects of a high-impact manuscript or proposal, how to write clearly, editing and the submission process.

Assessment Methods:
Continuous Assessment: 100%

SIO 3016 BIOLOGICAL DATA ANALYTICS

This course provides a practical introduction to the writing of R and Python programs for beginners. Students are introduced to the statistical analysis using R and are lead through the core aspects of Python illustrated by a series of example programs for solving bioinformatics problems. An introduction to machine learning is also included. Upon completion of the course, students will be able to write simple R and Python programs and customize more complex code to fit the needs of bioinformatics problem solving. At the end, students will be able to create stand alone Python programs to process biological data.

Assessment Methods:
Continuous Assessment: 60%
Final Examinations: 40%

SIO 3017 FOOD BIOTECHNOLOGY

Introduction to food biotechnology and its application will be focused for Malaysian food industry. The role of fungi in fermented food and Asian delicacies as local functional food. In terms of problem solving, food invention product development is presented at the end of the course. The principle and technique of food microbiology in laboratory scale for simple quality control is also included.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIO 3018 RESEARCH PROJECT IN BIOTECHNOLOGY

The student will carry out a research project and then write a thesis, guided by one or two supervisors. The student is encouraged to write a project proposal which includes sections on literature review and materials and methods, before commencing the actual research. The project covers two semesters (I and II or II and III). The thesis should be submitted in either semester II or semester III, respectively.

Assessment Methods:
Continuous Assessment: 100%

SIO 3019 ANIMAL NUTRITION AND FEED TECHNOLOGY

This course is designed to provide students the fundamental concept of nutrition for farm animals including aquatic animals, ruminants and poultry. Focus will be given on dietary aspects for the animals incuding their nutrition requirement and metabolisms. This course also emphasize on ways to maximise the quality of animal feed for productive manufacturing and healthier animals.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIO 3020 AQUACULTURE BIOTECHNOLOGY

This course address the aspects of genetics and biotechnology application in aquaculture. Students will learn the basic reproduction physiology of aquatic animals, the importance of selective breeding, and new approach of gene transfer including transgenic application.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIO 3021 FERMENTATION AND PRODUCT RECOVERY

Introduction to bioseparation and characteristics of biological products. Methods of recovery, isolation, purification and polishing of bioproducts.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIO 3022 MARINE BIOTECHNOLOGY

Marine Biotechnology is defined as “the use of marine organisms or their parts in industrial products, medicine or processes”. Topics taught include the application of biotechnology in marine resource, environment and ecosystem management, the development and discovery of marine natural and biotechnological products, as well as the application of current technologies such as omics technologies in ensuring marine sustainability in the face of climate change and other marine-related issues.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 3023 PLANT GENETICS AND BREEDING

This course introduces the fundamental principles of plant genetics and breeding that are applicable to agricultural systems. It covers an array of topics such as plant reproduction system, breeding methods for self-pollinated and cross-pollinated crops, and the strategies in developing breeding objectives to maximize selection and improve the key traits of crops.

Assessment Methods:
Continuous Assessment: 100%

SIO 3024 POSTHARVEST PROCESS ENGINEERING AND TECHNOLOGY

This course provides an overview of the issue of postharvest losses by exploring essential physical, technical, and social dimensions of postharvest supply chains and loss prevention methods globally. It is well known fact that more than a third of what is produced in the farm is lost even before it reaches the consumer. This issue is a core problem that is a critical global food security and sustainability issue.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 3025 SECONDARY METABOLITES AND METABOLOMICS

This course describes the classification of secondary metabolites, its biosynthetic pathways, and relationship between primary and secondary metabolites. The importance and application of secondary metabolites will be discussed. It also explains the methods of extraction and identification of secondary metabolites. Moreover, this course will introduce students to metabolomics and biotechnological approaches to increase secondary metabolites production.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 3026 SUSTAINABLE FOOD SYSTEMS

This course introduces the main components of food systems, demonstrating the complexity and relationships of different food system types that connect society to the environment in various ways within a globalized world. Students will learn the issues surrounding food security through the lens of biology, agroecology, anthropology, environmental sociology, and nutrition. This will help

develop their capacity to assess the sustainability of food production systems amid climate change.

Assessment Methods:
Continuous Assessment: 100%

SIO 3027 ANIMAL CELL AND TISSUE CULTURE

This course covers the principles and the practical skills in the in vitro culture of animal cells and tissues, which includes the aseptic technique, isolation and culture of primary cells, manipulation of reproductive cells, stem cells, reprogramming, and applications in animal biotechnology as well as regenerative medicine.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 4001 BIOPRODUCT BUSINESS AND SUPPLY CHAIN

This course will introduce students to the business aspects of biological products. By combining topics in advanced biology/biotechnology with business tools and methods, students will learn what is required to translate scientific research and patents into innovative products and viable business opportunities. It will also touch on some of the regulatory processes involved.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 4002 ENVIRONMENTAL BIOTECHNOLOGY

Importance of biological system in the management and processing of waste. Characterization of various wastes including xenobiotics from the industrial sector. Introduction to a convenient system for treating waste and sewage. Innovation in the processing of waste by microbes and plants. The use of waste for valuable material extraction.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIO 4003 INDUSTRIAL TRAINING IN BIOTECHNOLOGY

The students will be conducting internship in an industry or research institute related to biotechnology. The students will be exposed and practice the real work culture of the company or industry. At the end of the training, the students are required to report in writing and oral of their industrial training activities, experiences, and suggestions.

Assessment Methods:
Continuous Assessment: 100%

SIO 4004 ENZYME TECHNOLOGY

The course is designed to give balance instruction in both fundamental and applied aspects of enzymology for biotechnology students. Among topics covered are elementary rate laws, temperature and pH effects, theory of reaction rates, characterization of enzyme activity, enzyme inhibition, two-substrate reactions, immobilized enzyme, interfacial enzyme, enzyme in organic solvent/ionic liquid, enzyme reactors, design equations/modelling and transport phenomena. The course is complemented by laboratory practical in so that the students can put kinetic principles into practice.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIO 4005 MICROBIAL TECHNOLOGIES FOR SOIL AND PLANT HEALTH

The course covers topics including the interaction between microbial communities and plant and how the microbiome beneficial for soil health and plant growth. Beside, this course covers on the development and application of microbial consortium to improve crop production.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

BACHELOR OF SCIENCE IN BIOCHEMISTRY PROGRAMME

Career Prospects
Upon graduation, graduates with BSc in Biochemistry can become scientists, researchers in related fields, lecturers or administrative officers in either government or private (local or multinational) agencies, non-governmental organisations (NGO) and international bodies.

SIJ 1002 FUNDAMENTALS OF CHEMISTRY

This course covers the basic principles of physical and organic chemistry with application to biological problems. This course is intended primarily for biochemistry majors. This course will discuss topics on the fundamental principles of physical chemistry which include chemical equilibrium, acidity and basicity, kinetics, thermodynamics and ligand-protein interaction.Basic principles of organic chemistry, including fundamental aspects of organic and biological structures and bonding, stereochemistry, the effect of structure on physical and chemical properties will be discussed. A detailed analysis of organic chemical reactivity, including reactive intermediates and mechanistic principles of the various groups of organic compounds like alkanes and cycloalkanes, alkenes, alkynes, aromatics, alkyl halides, alcohols, ethers, thiols, amines, carbonyls and derivatives will be covered.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 1003 BIOCHEMISTRY OF CELLS

This course introduces students to the basic principles of cell biochemistry and develops students' understanding of how the cell works. Students will learn about the structure and function of essential molecules that are the building blocks of cells as well as the energetic and metabolic processes of the cell. The Central Dogma will also be explored to understand the role and regulation of the genetic code in synthesizing functional proteins.

Assessment Methods:
Continuous Assessment: 50%

Final Examination: 50%

SIJ 1004 INTRODUCTION TO COMPUTATIONAL BIOLOGY

This course will introduce the basic concepts of computational biology. Student will be expose to the Linux operating system, Python and R programming for biological data analysis. Students will also be introduced to biological data mining based on the public biological databases.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIJ 1005 PRINCIPLES OF BIOCHEMICAL TECHNIQUES

This course is meant to introduce basic laboratory techniques that being use in most biochemical laboratories. It is also providing insights to the availability of variety of methods adapted in analyzing biomolecules. It also intended to introduce student to a better data management and able to critically evaluate and summarise.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2002 STRUCTURE AND FUNCTION OF BIOMOLECULES

This course will discuss the structure, formation, the chemical properties and functions of important macromolecules in life including simple and complex carbohydrates, fatty acids and lipids, amino acids and peptides, nucleotides and nucleic acid. This course will also discuss the properties of enzyme and its activity, enzyme inhibition as well as regulation of enzyme activity.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2004 METABOLISM AND REGULATION OF AMINO ACIDS AND NUCLEOTIDES

The objectives and content of the course are designed to provide students with a comprehensive understanding of the metabolic pathways involving the amino acids and nucleotides; and the manner by which metabolism is regulated. This course stresses both the normal metabolic function, and why disease states occur if normal metabolic processes are disrupted.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 2005 MOLECULAR BIOLOGY

This course explores in detail the theories of transcription, translation and the regulation involved. This course also looks at gene regulation both prokaryotes and eukaryotes. Students will also be introduced to mutation, recombination and transposition.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 2006 PROTEIN BIOCHEMISTRY

Levels of protein structures - Primary structure, its importance and its determination; Secondary structures and their prediction; Super- secondary structures; Tertiary structure and forces involved in its stabilization; Quaternary structure; Protein folding and denaturation; Protein engineering; Protein purification and characterization.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2007 ENZYMES: MECHANISM AND CONTROL

Introduction to enzymes, Activation energy and biocatalysts, Terminology used, Enzyme kinetics (Effect of enzyme concentration, substrate concentration, pH & temperature), Enzyme inhibitions (Competitive, Noncompetitive, Uncompetitive & Irreversible), Enzyme regulation (Zymogen activation, Covalent modification, Physiological control & Allosteric regulation), Active site mapping & intermediate detection, Enzyme mechanisms with special reference to lysozyme & chymotrypsin; Catalytic antibodies, Ribozymes.

Assessment Methods:
Continuous Assessment : 40%
Final Examination : 60%

SIJ 2008 BIOCHEMISTRY PRACTICAL I

This course is to introduce to students fundamental techniques used in Biochemistry to analyse biomolecules especially proteins and nucleic acids. This is inclusive of appreciation of basic instrumentations useful for performing biochemical fractionation, assays and separation. Students will also be exposed to ways to communicate scientifically using writing, verbal and graphical methods.

Assessment Methods:
Continuous Assessment: 100%

SIJ 2009 BIOCHEMISTRY PRACTICAL II

This course will further expore techniques and research methodology in biochemistry. The practicals will cover techniques/ methods in HPLC, DNA quatification, serology, lipid chemistry and many others. This course will also strengthen report writing and laboratory skills.

Assessment Methods:
Continuous Assessment: 100%

SIJ 2012 NUTRITIONAL BIOCHEMISTRY

This subject develops on the understanding of biochemistry and explores the biochemical activity of nutrients and food constituents in the human body. Students will appreciate the importance of food groups and healthy eating, and the influence of dietary modification and nutritional intervention on physiology and physiological dysfunction. Integral biochemical pathways are explored in relation to the nutritional influences that moderate those pathways. Students will further develop their understanding of the role that biological oxidation and the metabolic regulation of carbohydrate, protein and fat play in disease processes. These will necessitate prior student understanding of the influence of nutritional biochemistry in liver detoxification, neurotransmitter synthesis, antioxidant pathways and immune function. Taken together this subject deepens

students' understanding of nutrition and diet therapy towards supporting a healthy living.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2014 TOXICOLOGY

The course is structured to provide the students with the fundamental concepts of toxicology as they relate to specific organ and tissue systems. And thus introduce students to the principles, concepts and terminology utilized in the field of toxicology and how the area has found its application in food, forensic, clinical and occupational sectors.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2015 TOXINOLOGY

This course will introduce Biochemistry students to animal, plant, and microbial toxins. Topics will cover the structure of these toxins, its mechanism of action, origin, effects on humans, and how these effects can be countered. Possible exploitation of these toxins and therapeutics will also be discussed.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2016 FOOD PROCESS BIOCHEMISTRY

In this course, students are given the opportunity to explore the principles of food biochemistry and learn about the various processing methods involved in the production of fresh and processed foods. Students will understand how the principles of biology, chemistry and microbiology apply in food quality, nutrition and safety. Students will gain an in depth understanding of current trends in food processing and how these methods affect food composition, property and safety. Furthermore, students will be exposed to hands-on food analytical methods as well as develop innovative skills in the creation of a food product. At the end of this course, students will be able to apply the scientific principles to solve problems and create products related to the food industry.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 2017 MICROBIAL BIOCHEMISTRY

This course introduces students to basic biology of microorganisms. This includes the diversity, its requirement for nutrition and subsequently the pattern of growth which very much related to the mechanism of metabolism of the cell. It also looks into the mechanisms of phatogenicity and its biochemical response towards antimicrobial agents. The understanding of the biochemistry of the microorganism has led to number of success in microbial application to agriculture, food and medicine.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2018 FUNCTIONAL ANATOMY AND PHYSIOLOGY

This course presents a systemic, functional approach to the study of the human anatomy and physiology. Course starts with an introduction of anatomical terminology, organisation and an overview of cellular processes and tissue classification. Students will learn the gross and microscopic functional anatomy and physiology of the following systems: skeletal, muscular, nervous, endocrine, circulatory, lymphatic, urinary and reproductive. The practical component of the course is designed as parallels to reinforce concepts taught in lectures. Although the subject is generally descriptive, students will be guided to explore dynamic changes to normal structure and functions of different body systems and their components due to diseases.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIJ 2019 BIOCHEMISTRY OF HORMONES

This module focuses on the endocrine system responsible for monitoring changes in an animal's internal and external environments, and directing the body to make any necessary adjustments to its activities so that it adapts itself to these environmental changes. The underlying principles of endocrinology, the central importance of the hypothalamic-pituitary axis and the mechanisms involved in regulating hormone levels within tight parameters in an integrated manner will be discussed. Each major endocrine gland will be explored in turn and specific clinical disorders will be used to illustrate the role of the endocrine organs in the maintenance of whole body homeostasis. The systems studied will include thyroid gland, parathyroid gland and bone metabolism, adrenal gland, renal hormones (water and salt balance), pancreatic hormones, gut hormones and multiple endocrine neoplasia, gonadal function and infertility. The role of the endocrine system in integrating metabolic pathways will be emphasised throughout the module and particular scenarios such as infertility, diabetes mellitus.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 2020 NEUROCHEMISTRY

This course is intended to introduce students to the field of neurochemistry. Basic neurochemistry includes study of the chemical composition of the brain, brain metabolism and the chemistry of neurotransmission. The major part of the course will cover the chemistry of neural transmission and chemical composition and metabolism. The discipline of behavioral neurochemistry includes topics that range from study of the neurochemical mechanisms that underlie behaviour that result from severe neurochemical abnormalities. Throughout the course, the functional aspects of all neurochemical mechanisms will be discussed.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 2021 METABOLISM AND REGULATION OF CARBOHYDRATE AND LIPIDS

The students will learn the principles in bioenergetics, biosynthesis and catabolism of the primary

macromolecules, and regulatory mechanisms involved in intermediary metabolism.
The course encompasses the following topics: (1) Concept of energy in metabolism and energy production by aerobic and anaerobic respiration, and fermentation; (2) Biosynthesis and catabolism of primary macromolecules (carbohydrate, lipid); (3) Regulation and integration of metabolic processes.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 2022 SCIENTIFIC AND RESEARCH COMMUNICATION

This course is intended to equip students with effective communication skills and sharpen their critical thinking skills. The course content will include effective communication techniques. Students will also be exposed to techniques of critical thinking and lateral thinking. Effective scientific writing and reading will also be introduced.

Assessment Methods:
Continuous Assessment: 100%

SIJ 3001 RESEARCH PROJECT IN BIOCHEMISTRY

This course is intended to introduce practical aspects of the principles of Biochemistry. Students will be exposed to research methodology in Biochemistry, critical scientific thinking, methods for problem solving, research ethics, record keeping, presentation and scientific writing skills. Students are required to carry out experiments in the laboratory, analyse data, write a thesis and present the results of the research.

Assessment Methods:
Continuous Assessment: 100%

SIJ 3003 PLANT MOLECULAR BIOLOGY

This course starts with molecular biology of plant organelles with emphasis on unique plant genomes, genes and gene expression. Topics on plant development processes will also be discussed which include photosynthesis, senescence as well as plant defence. Gene transfer and genetic engineering in plants will also be discussed with emphasis on both the technology as well as the issues surrounding genetically engineered plants.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 3004 CLINICAL BIOCHEMISTRY AND PHYSIOLOGY

This course will discuss the basic mechanisms of diseases, alterations of the biochemical aspects and symptoms that are shown due to diseases in relation to metabolic disorders or changes in the body's physiological systems. Clinical and diagnostic tests, suitable treatment and prevention methods will also be discussed using a specific disease as example.
Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 3005 CELLULAR AND MOLECULAR IMMUNOLOGY

This course introduces the importance of immune system, components of the immune system, different categories of immune responses and their general properties. For adaptive immune response, in depth explanation will be given on the development of the lymphocytes, the receptor gene rearrangement, the selection process and the activation mechanisms of the lymphocytes. The role of MHC molecules in antigen presentation will also be covered. This will be followed by the effector functions of the activated lymphocytes, integrated with the innate immune responses, which also includes the mechanisms of inflammation, phagocytosis and complement. Application of immunological techniques will also be covered. Short presentation will be done by the student on the topics of immune reactions against selected diseases.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 3006 MEMBRANE BIOCHEMISTRY AND CELL SIGNALLING

This course discusses the organization and structure of membranes, their functions and importance to cells. Students will be exposed to the types and roles of membrane proteins and then the cell transportation mechanisms on the membrane. The components and mechanisms of signal transduction, its function and importance will also be discussed. Then, the students will associates between malfunction of signal transduction with diseases.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 3008 ADVANCED MOLECULAR BIOLOGY

In the first half of the course, students will be thought techniques used in the manipulation of DNA and the basics of recombinant DNA technology. Topics covered would include recombinant technologies, the use of recombinant technologies in gene manipulation and the basic principles of the methods used. In the second half of the course, the use of these approaches in scientific research will be explored.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 3009 DESIGN THINKING AND KNOWLEDGE TRANSFER

Competitive business and entrepreneurship environments are increasingly prioritising professionals trained in Design Thinking and innovation. The word 'design' has been traditionally associated with visual aesthetics of objects but increasingly since the last decades, the definition of design has expanded to include experiences, innovative services and systems.
As the challenges and opportunities facing businesses and societies grow more complex with increasingly diverse stakeholders, Design Thinking is playing a greater role in finding meaningful paths forward. Design Thinking is an action-oriented problem-solving methodology that employs various design-based techniques to gain insight and yield creative solutions for complex challenges. Methodologies

are drawn from engineering and design, and combines them with ideas from the arts, tools from the social sciences as well as insights from the business world. At the heart of this approach is a deep sensitivity to the needs of community. This course aims to offer an immersive experience in Design Thinking as a tool for innovative idea and strategy development in Knowledge Transfer processes.
In this course, students will be encouraged to work with local businesses and develop continuing relationships with local community members, effectively contributing to the Quadruple Helix model of university functions in society.

Assessment Methods:
Continuous Assessment: 100%

SIJ 3011 POST-GENOMIC TECHNOLOGIES AND BIOINFORMATICS

This course will introduce students to post-genomic era technologies and how they are used in scientific research. The course will focus on three main platforms – transcriptomics, proteomics and metabolomics. Students will be exposed to bioinformatics tools to allow them to understand, analyse, integrate and correlate data from the three platforms. The use of these technologies in studying biological systems will also be explored. A brief introduction to other post-genomic technologies (e.g. lipidomics, glycomics, etc) will also be included. Throughout the course, students will also be introduced to Bioinformatics in data analysis and management.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 3013 NATURAL PRODUCT BIOCHEMISTRY AND DRUG DISCOVERY

This course is designed to provide an overview to the field of natural product and drug discovery. This course covers the different types of natural product and their usages, positive/negative effects of its usage, important classes of chemical compounds, mechanism of reaction, methods and suitable experimental techniques that can be applied to isolate and identify bioactive/lead compound. Drug discovery component will emphasis on how to bring a drug from concept to market, introduction to drug approval process, clinical trials, drug safety guidelines, and ethical issues. Research and development that will lead to the invention of potentially commercial product will also be discussed using selected examples.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 3016 BIOCHEMISTRY OF CANCER

This course will cover the origins of cancer and the genetic and cellular basis for cancer. It will examine the factors that have been implicated in triggering cancers; the intercellular interactions involved in cancer proliferation; current treatments for cancer and how these are designed; and future research and treatment directions for cancer therapy.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 3017 GLYCOBIOLOGY

The first part of this course is the deliberation of glycan structures and the linkages between monosaccharides units until the formation of functional glycans. Topics on glycan-binding proteins/lectins will also be coverd since these proteins is closely associate with the biological roles of glycans. Abnormality of glycan structure will hinder the interaction and consequently leads to disease formation. Lastly, students will be given samples of data for them to carry out glycomic analysis by using ChemSketch and online glycan database search engine.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIJ 3018 COMPUTATIONAL BIOCHEMISTRY

This course describes the application of computational tools to analyze biological problems. Students will be exposed to the analysis of big data including enzyme kinetics simulation using COPASI, transcriptomics analysis (microarray and RNA-seq using R and Linux), genomics analysis (genotyping microarray using R and Linux), biomolecular modelling (using FORTRAN) and metabolic network analysis (using R). At the end of the course, students will be able to use programming tools and analytical approach to analyze various omics data.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIJ 3019 INDUSTRIAL ATTACHMENT AND TRAINING

This industrial training module will provide students with real life working experience and hands-on practical skills related to biochemistry. Students will undergo 16 weeks of industrial training in the final semester.

Assessment Methods:
Continuous Assessment: 100%

SIJ 3020 FUNDAMENTALS OF BIOCHEMICAL PHARMACOLOGY

This course will examine the molecular basis of drug action and how cutting edge technology contribute to the advancement of pharmacological knowledge and increase understanding of mechanisms of drug action. The following areas will be studied in detail; variability in drug action, drug structure-activity relationships, receptor-ligand interactions, signal transduction, biochemical and molecular aspects of G-protein coupled receptors and their signalling mechanisms.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 3021 STRUCTURAL BIOLOGY TECHNIQUES

The course will introduce to students the structure of proteins at all levels, and how this relates to function. A non-mathematical introduction of the basic principle of X-ray crystallography and other techniques used in structural studies. Nuclear magnetic resonance (NMR) is the second most important technique for determining the three-dimensional structure of macromolecules. Electron Microscopy (EM) is a technique that is complementary to X-

ray crystallography as it enables the study of non-crystalline, very large or transient macromolecular structures. This course also introduces some methodologies for protein purification for structural studies. It also examines the importance of protein-protein interactions and some techniques used for the study.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIJ 3022 EPIGENETICS AND RNA BIOLOGY

This course explores in detail the theories of epigenetics and RNA biology in the various organisms and how it regulates gene expression. The main topics include chromatin structures, histone modification, chromatin remodelling, genomic imprinting and split genes, RNA splicing. This course will also cover in depth learning and application of RNAi discovery, biogenesis, mechanism of small RNAs, structure and function of long non-coding.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

BACHELOR OF SCIENCE IN ECOLOGY & BIODIVERSITY PROGRAMME

Career Prospects

Government sector: Research officer (Q41), fisheries/agriculture officer / garden manager (G41), Science officer (C41), administrative / publishing / planning officer (N41), training officer (E41), academic staff, curator (S41), medical officer (U41), maritime officer (X41), sea officer (A41) dan administrative and diplomatic officer (M41), and others

Private sector: Technical research staff / science officer (NGO), researcher/consultant (industry, consultation firms), marketing executive, academic staff, writer/researcher/journalist (mass media), environment control officer (industry, firms), audit officer (corporate farms), technical/management officer (agriculture / aquaculture companies), entrepreneur (industry) and others.

SIE 1002 BIOETHICS AND SAFETY

To make aware on the importance of ethics and safety that arises within the scientific profession and scientific research, especially the Life Science. A special focus on bioethics and biosafety. Real cases of scientific bioethical misconduct, as well as the relevant principles and standards of ethics in life sciences will be discussed.
The importance of lab safety and accreditation will also be explored.

Assessment Methods:
Continuous Assessment: 100%

SIE 1003 CELL BIOLOGY

This course is divided into three components namely Genetics, Cell Biology and Molecular Biology. Content of each is stated below:
Cell Biology
This component will discuss on the basic structures and functions of organelles and also processes involving mitosis and meiosis.Students will also be introduced to prokaryotic and eukaryotic cells; and the differences between these two types of cells.
Molecular Biology
In this component, students will first be refreshed on basic aspects of molecular genetics (historical account, direct and indirect evidences of DNA as genetic materials, structure and properties of DNA, DNA replication, transcription and translation in prokaryotes and how to decipher genetics codes). The component will later discusses on regulation of gene expression in prokaryotes (lac operon, catabolite repression and trp operon and attenuation), control by sigma factor, anti-termination, post-transcriptional control of RNA (trans- and cis-acting regulators), and finally the applications of these knowledge in DNA recombinant technology.
Genetics
This component comprises of quick introduction of Mendel's Law, the concept of alleles, loci, genes and chromosomes and test crosses. Students will be first refreshed on probability calculations, the Punnet square and genetic linkage & mapping methods. The component will later discusses deeper topics of inheritance which include Extensions to Mendelian Inheritance Concept (Epistasis, Sex linkage), Sex influenced inheritance and Pedigree analyses. At the end of this component students will be exposed to topics such as Human Genetics, Genetic Counselling and finally a brief introduction to Population Genetics and Hardy-Weinberg Equilibrium.

Assessment Methods:
Continuous assessment: 50%
Final examination: 50%

SIE 1004 INTRODUCTORY MICROBIOLOGY

Introduction to Microbiology, concepts and basic knowledge in microbiology, evolution, structure and function of the parts of prokaryotic, diversity and importance of microorganisms including archaea, bacteria, fungi and viruses. Besides this, student will be exposed to the development in microbiology in Malaysia.

Assessment Methods:
Continuous assessment: 50%
Final examination: 50%

SIE 2001 PRINCIPLES OF SYSTEMATICS

This course is to develop the students skill in classification of organisms by understanding the concepts of systematics and the philosophy behind systematics (classification, taxonomy and nomenclature). Taxonomy in particular and systematics are generally essential in scientific research and are fundamental to the study of population genetics.

Assessment Methods:
Continuous assessment: 60%
Final examination: 40%

SIE 2002 PLANT DIVERSITY

Introduction to the morphology, development and reproductive biology of bryophytes, pteridophytes, gymnosperms and angiosperms. The economic and ecological importance of different plant groups will be discussed. Training on identification of different plant groups will be addressed through practical sessions and fieldwork.

Assessment Methods:
Continuous Assessment : 60%
Final Examination : 40%

SIE 2004 MYCOLOGY

An introductory to fungal classification, biology, diversity, ecology and taxonomy. This course will discuss sampling and culture techniques in mycology, inventory and documentation aspects for conservation purpose and importance of fungi in biotechnology.
Assessment Methods:
Continuous Assessment : 60%
Final Examination: 40%

SIE 2005 VERTEBRATE BIOLOGY

An introduction to vertebrate biology including fish, amphibians, reptiles, birds, and mammals. The course will explore the evolution of these vertebrates and their adaptations that allow them to live in almost every habitat on Earth. Lecture materials will emphasize on phylogeny, taxonomy, morphology, evolution, ecology, and selected aspects of the natural history and behaviour. Laboratory exercises will utilise natural history museum collections to focus on taxonomy and identification of local fishes, amphibians, reptiles, birds, and mammals.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 2006 PHYCOLOGY

This course covers the diversity and ecology of algae. Characteristic features of major groups of algae will be discussed together with their ecological and economic importance.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIE 2007 POPULATION AND COMMUNITY ECOLOGY

Introduction to population growth and dynamics of age-structured populations, population control, theory of competition, herbivory, predation, community, trophic structure and control, community diversity, and maintenance of diversity. Identify the processes affecting abundance of organisms and how population abundance changes through time, demographic characteristics of a population and the techniques used for quantifying these characteristics. The impact of abiotic factors on the nature of population change at small and large scale will be discussed.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 2010 URBAN ZOOLOGY

Natural history of urban area. Ecosystems: natural and man-made, their main features and differences. The urban ecosystem: a classification of the habitats. The animal component in urban areas: biodiversity and adaptations. Pest types and control strategies. Nature conservation in urban habitats. Animal species and habitat fragmentation. Alien species and related problems (invasive species). Feral species and wildlife. Animal Welfare Act 2015. Methods for pest control and wildlife animal. Zoological data and urban planning. Case studies: the fauna of Kuala Lumpur, the insect fauna of residential area. Involvement of government and private agencies in wildlife management and pests.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 2011 TERRESTRIAL ECOLOGY

Major elements of terrestrial ecology: the physical world, plants, animals, microbes. Energy and trophic levels. Time as a dimension.
General vegetation categories and dependent organismal assemblages. Life forms and general adaptations among terrestrial organisms: autotrophs and heterotrophs in different environments; light, water and nutrition. Diurnal and seasonal variations and cycles.
Types and characteristics of tropical forests. Diversity of life in various environments. Reproduction in plants and animals: comparative traits. Reproductive rhythms in plants: flowering, pollination, dispersal. Behavioural aspects of animal reproduction in rain forests. Other rainforest adaptations and interactions among organisms: herbivory and plant defences, myrmecophily, parasitism, saprophytism. The relationship among soils, climate and forest type. The forest growth cycle and dynamic equilibrium. The ecology of nutrient cycling and importance of the hydrological system in forest growth. Relationships among nutrients, growth, structure and biological diversity. Key characteristics of biodiversity and biogeography for rainforest species. The concepts of carrying capacity and environmental pressure. Degradation and regrowth of forests. Consequences of various logging systems, rainforest fragmentation and environmental catastrophes. The rain forest as a renewable resource; the concept of sustainable forest management. Carbon sequestration by vegetation. Timber, non-wood forest products and other forest functions as management objectives. Non-forest tropical landscapes: review of types, comparisons in terms of productivity.

Assessment Methods:
Continous Assessment: 60%
Final Examination: 40%

SIE 2012 AQUATIC ECOLOGY

Introduction to physical and chemical aspects of aquatic systems, and their importance to organisms. A review of

marine and freshwater organisms with a focus on their ecological role. The basic principles of aquatic ecology are discussed at the community and ecosystem level, followed by major marine and freshwater ecosystem studies. Types and exploitation of aquatic resources. Human impact on aquatic ecosystems.

Assessment Methods:
Continuous Assessments: 60%
Final Examination: 40%

SIE 2014 PROTOZOA AND INVERTEBRATES I

Introduction to protozoa and invertebrate: classification, diversity, ecology and evolution will be explained in general. Groups of invertebrate being discussed are Protozoa, Porifera, Cnidaria, Ctenophora and Lophotrochozoa. The biology, diversity, ecology, structure, function, importance etc. for each group of these animal will be discussed in details.

Assessment Methods:
Continuous Assessments: 50%
Final Examination: 50%

SIE 2015 INVERTEBRATE II

Introduction and detail discussion on Nematoda. Introduction to Arthropoda –biology, diversity, ecology, structure and function, etc.; Detail discussion of the arthropod group – Trilobitomorpha, Chelicerata, Crustacea, Myriapoda, Hexapoda. Introduction to Deuterostomia and Hemichordata - biology, diversity, ecology, structure and function, etc. Detail discussion of the deuterostome group – Echinodermata.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIE 2016 PLANT PHYSIOLOGY

This course begins with the basic concepts in plant physiology of cells, energy and enzymes. Next, mechanisms in water absorption, water transport, phloem translocation, photosynthesis in C3, C4 and CAM plants, transpiration and the role of stomata in transpiration and leaf gaseous exchange. The basic morphology and development of reproductive organs (flowers, fruits and seeds), diversity of shapes and adaptations (including propagation strategies) been relate to assimilate partitioning and plant adaptation.

Assessment Methods:
Continuous Assessement: 50%
Final examination: 50%

SIE 2017 ANIMAL PHYSIOLOGY

Introduction and concept of physiology. Understanding basic animal physiology such as importance of oxygen, food and energy, temperature adaptation, water, reproduction and movement, information and integration.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIE 3004 QUANTITATIVE ECOLOGY

Principles of ecological sampling and data collection. Experimental and sampling designs, sample size, sampling layout, etc. Biotic sampling methods. Population analysis such as age structure, survivorship, life tables and growth. Methods for population analysis, including capture-recapture methods. Community analyses including measurements of diversity, similarity and distance, and cluster analysis. Multivariate methods and ordination techniques such as principal components analysis.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 3005 BEHAVIOURAL ECOLOGY AND ETHOLOGY

Behavioural concepts, historical perspectives of behavioural studies, behavioural diversity inclusive of social habits and ecoethology illustrating the functional aspects and adaptibility of various groups of animal examples, aspects of applied ethology.

Assessment Methods:
Continuous Assessment: 50%
Final examination: 50%

SIE 3006 ECONOMIC BOTANY

Introduction to the origin of agriculture and the history of distribution of present-day agricultural crops. The importance of fungi, algae & plants as sources for food, beverage, medicine and others. Plant-based industries such as producing perfumes, furniture products, spices, cosmetics, landscaping plants and etc.

Assessment Methods:
Continuous Assessment: 60%
Final Examination : 40%

SIE 3007 ECOLOGY AND MANAGEMENT OF WEEDS

Introduction to ecology and population biology of weeds with emphasis on weed-crop plant interaction. Weed science in the contextof integrated weed management. Weed management in agro-ecosystems and non-crop environments. Introduction to herbicides. Herbicide usage, actions in plants and soil, and effect to the environment.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 3009 PLANT PATHOLOGY

Introduction to plant pathology and its importance. Concept of plant diseases. Plant diseases caused by abiotic factors and non-infectious diseases. Interactions between pathogens and plant hosts. Koch Postulate. Plant diseases from infections by viruses, bacteria, mycoplasm-like organisms, fungi, algae / lichens, higher plants,

protozoa, nematodes and insects. Principles, management practices and control of plant diseases including biological control using viruses, bacteria and fungi.

Assessment Methods:
Continuous Assessment : 50%
Final Examination : 50%

SIE 3010 HORTICULTURE AND LANDSCAPING

Introduction to Horticulture and landscapes. Importantly, horticultural crops are food and non-food crops. Propagation, cultivation, growth medium, environmental parameters, plant diseases and their control, and others will be discussed. Various aspects of the landscape will be discussed..

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIE 3012 PARASITOLOGY

This course will introduce macroparasites with focus on the identification and classification of endo- and ectoparasites, the biology, life-cycle, and preservation of specimens.

Assessment Methods:
Continuous assessment: 50%
Final examination: 50%

SIE 3013 ECONOMIC ENTOMOLOGY

This course will provide a solid foundation in economic entomology, emphasizing life-history, ecological and evolutionary factors which make certain species pests or beneficial insects. The course will cover insect diversity, taxonomy and classification, beneficial insects, medically important insects, urban pest, agricultural pests, insects as models in science and conservation.

Assessment Methods:
Continuous Assessment : 60%
Final Examination: 40%

SIE 3014 INTEGRATED PEST MANAGEMENT

Introduction to pest species. The needs of pest management. Definition of the integrated pest management. The history and basic of the integrated pest management. Pest control methods – Biological, chemical, physical, mechanical, interference and host resistance. Pesticides crisis. Implementation method of integrated pest management. Examples of the integrated pest management usage in various fields, particularly in agriculture.

Assessment Methods:
Continuous assessment: 50%
Final examination: 50%

SIE 3015 ECOTOXICOLOGY

This course will provide a solid foundation in ecotoxicology, including principle study methods in ecotoxicology, distribution of chemicals in the environment, transformation of chemicals in the environment, exposure and uptake by organisms, and effects on population, community and ecosystem. Case studies and the procedures for Ecological Impact Assessments will be studied in detail with an emphasis on the limitations of studies in a constantly changing natural system.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 3016 SOIL ECOLOGY AND MANAGEMENT

Introduction to the major soil type in Malaysia and its vegetation. Soil biotic and abiotic factors that sustain different vegetations on various soil types. Functions and inter-relationships between organisms in soil, including bacteria, fungi, protista, arthropod and other organisms. Effects of human and/or nature on soil habitat.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 3017 SCIENTIFIC COMMUNICATION

The course gives an opportunity for students to discuss research studies based on selective topics on ecology and biodiversity. Students will be introduced to basic guidelines of scientific writing and editing particularly for literature review (term papers and current topics), scientific papers (laboratory reports, dissertations, theses, and experimentation or survey), and critique of research papers. Techniques on oral presentation in scientific research will be introduced. The elements of writing that are important to develop the clarity and precision required of effective scientific communication will be emphasized.

Assessment Methods:
Continuous Assessment: 100%

SIE 3018 MOLECULAR ECOLOGY AND APPLICATIONS

The introduction and history of molecular ecology, issues in ecological and evolution studies, molecular genetic indicators, allozyme / DNA, molecular genetic engineering, molecular genetic indicator applications for ecological and evolutionary problems, systematic molecular and phylogenetic, evolution and decomposition, genetic structure of the population to communities, microsatellite and genetic populations, structures and functions of microbial communities, ancient DNA, molecular approaches in conservation.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 3019 NATURE AND SOCIETY

This course exposes students to community service and volunteerism. Students need to plan and implement a community program in groups. Students are also required to produce a reflection journal to record self-transformation before, during and after the community program as well as group reports and presentations based on experiences with the local communities.

Assessment Methods:
Continuous Assessment: 100%

SIE 3020 FISHERIES ECOLOGY AND MANAGEMENT

Introduction and overview of local and global fisheries and aquaculture. Basis of fisheries . Linkage between fisheries production and primary productivity. Single species versus multi species stock assessment . Estimation of key fish stock parameters. Ecosystem based fisheries management. Sustainable practices and future areas of research. Socio-economics and management of fisheries and aquaculture. Latest issues in fisheries

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 3021 ECOTOURISM

This course provides a theoretical and applied understanding of ecotourism within Malaysia and internationally and important examples of sustainable tourism practices in natural settings. Topics that will be discussed in this course including the best practice in ecotourism, ecotourism management policies and ecotourism strategies which are culturally sensitive and economically, environmentally and socially sustainable.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIE 3022 BIOIMAGE PROCESSING AND ANALYSIS

This course aims to introduce the concepts in image processing and analysis, specifically on biological images. It covers the introduction of the digital image representation, processing and analysis. Various problems related to biological images are considered to be solved using programming language such as R and C++, as well as image processing and analysis software such as MorphoJ, ImageJ and Adobe Photoshop.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIE 3023 RESEARCH PROJECT FOR ECOLOGY AND BIODIVERSITY

The student chooses a research title and carries it out according to the supervision of his/her supervisor. A research proposal detailing literature review, objectives, methodology and research design, schedule table of research and research budget, needs to be submitted to the supervisor within a month. Research work and thesis writing are carried out in Semester I and semester II. The completed thesis must be submitted at the end of semester I and semester II for examination by the supervisor. A presentation of the research work in the form of seminar or poster is needed before the thesis submission.

Assessment Methods:
Continuous Assessment: 100%

SIE 3024 INDUSTRIAL TRAINING FOR ECOLOGY AND BIODIVERSITY

The content of this training depends on where the student is placed and usually involves field work and on the job training related to issues of biology and diversity.

Assessment Methods:
Continuous Assessment: 100%

SIE 3025 BIODIVERSITY GOVERNANCE AND CONSERVATION

Topics on biodiversity governance will discuss policy and legislation, international treaties, laws and species protection covering biodiversity and its importance. In addition, the course will also discuss the threats to diversity; the causes of the decline in biological diversity. The description of global initiatives for species / habitat / landscape protection will be explained based on CITES, RAMSAR, UNESCO WHS and CBD. Details on the National Biodiversity Policy, Protected Areas, Forestry and Wildlife Act will be covered in this topic. The implementation of local CITES and other international agreements will also be emphasized. Whereas on the topic of conservation, identity, values and ethics will be discussed in depth including information on introduced species, species invaders and species migration.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

BACHELOR OF SCIENCE IN ENVIRONMENTAL MANAGEMENT PROGRAMME

Career Prospects
Graduates of this Programme can work either in the government or private sectors as environmental managers or consultants, academicians, scientists and researchers, health and safety officers, sustainable city planners, and environmental auditors and law enforcers. They can also work with the non-governmental organisations as environmental activists.

SIH1004 ENVIRONMENTAL SUSTAINABILITY

Environmental science explores the interaction and relationships between humans and the environment. Students will be introduced to concepts that are relevant to environmental management such as ecosystems, biomes, the human population, renewable and non-renewable resources, energy, pollution and environmental issues. This course will also address the challenge of balancing short-

term human needs with the long-term health of environmental systems, and how to move towards a sustainable future. Sustainable Development Goals will be highlighted.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH1005 ANALYTICAL ENVIRONMENTAL CHEMISTRY

The course is designed to introduce students the knowledge of analytical environmental chemistry and principles of instrumental analysis relevant to environmental monitoring. Topics within general organic and inorganic chemistry, calculations, calibration and method validation will give students insight in the analytical process from raw sample to final result. Sample storage, sample preparation and quality assurance will be discussed.

Assessment Methods:
Continuous Assessment: 100%

SIE1002 BIOETHICS AND SAFETY

To make aware on the importance of ethics and safety that arises within the scientific profession and scientific research, especially the Life Science. A special focus on bioethics and biosafety. Real cases of scientific bioethical misconduct, as well as the relevant principles and standards of ethics in life sciences will be discussed.
The importance of lab safety and accreditation will also be explored.

Assessment Methods:
Continuous Assessment: 100%

SIE2012 AQUATIC ECOLOGY

Introduction to physical and chemical aspects of aquatic systems, and their importance to organisms. A review of marine and freshwater organisms with a focus on their ecological role. The basic principles of aquatic ecology are discussed at the community and ecosystem level, followed by major marine and freshwater ecosystem studies. Types and exploitation of aquatic resources. Human impact on aquatic ecosystems.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIE3025 BIODIVERSITY GOVERNANCE AND CONSERVATION

Topics on biodiversity governance will discuss policy and legislation, international treaties, laws and species protection covering biodiversity and its importance. In addition, the course will also discuss the threats to diversity; the causes of the decline in biological diversity. The description of global initiatives for species / habitat / landscape protection will be explained based on CITES, RAMSAR, UNESCO WHS and CBD. Details on the National Biodiversity Policy, Protected Areas, Forestry and Wildlife Act will be covered in this topic. The implementation of local CITES and other international agreements will also be emphasized. Whereas on the topic of conservation, identity, values and ethics will be discussed in depth including information on introduced species, species invaders and species migration.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIH2007 PRINCIPLES OF WASTE MANAGEMENT

Introduction to types and sources of integrated waste management. Management of waste through its quantity and quality. Modern and conservative techniques in integrated waste management. Organisation in waste management. Waste hierarchy. Recycling activities and laws and regulations of the solid waste management.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH2008 ENVIRONMENTAL HEALTH AND SAFETY

This module will introduce students to the concept of health and safety for occupational and environment. It will include the regulatory framework to identify, evaluate and control the risk at work. Basic method for investigation of accidents will also be covered.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH 2014 ENVIRONMENTAL FORENSICS

Environmental pollution had caused many environmental effect. This involves the quality and biodiversity of the environment. Therefroe, this course will expose students in investigation of environemntal evidence do identify the causes of any pollution episode.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH2015 SOIL SCIENCE AND COMMUNITY

This course is designed to introduce students to the fundamentals of soil science which are soil formation, soil properties (physical, chemical and biological), soil description and soil classification and suitability for land use. This course exposes students on the implementation of sustainable soil management. This course emphasizes on the techniques to restore degraded soils and improve soil health. Case studies of soil health are also conducted with the community.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIH2016 ENVIRONMENTAL MONITORING

This course emphasizes the monitoring of both aquatic and terrestrial ecosystems using three approaches of environmental monitoring techniques i.e., physical, chemical, and biological monitoring. Environmental sampling and data analysis techniques will also be taught.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH2017 APPLIED ECOLOGY

This course is a continuation to the basic ecology courses taught at lower level i.e., secondary school and matriculation or equivalent. History, origin and definition of ecology will be discussed. Issues such as definitions and problems in ecological study and its relationship with other disciplines like climate change are brainstormed. Terrestrial and marine ecological sampling techniques will be highlighted. In depth topics include biodiversity, populations, community, ecosystem, conservation and ecological restoration.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH2018 RESEARCH METHODS AND SCIENTIFIC WRITING

Part I.
Introduction to research basics and theory. Key features of research such as research ethics, structuring the research project, finding and reviewing the literature. Attention paid to data collection techniques and data analysis which focus on qualitative and quantitative data.

Part II.
Main components and purposes of different forms of scientific communication with an emphasis on scientific articles and posters. Writing skills will include basic elements of grammar, style and organization. The elements of writing that are important to develop the clarity and precision required for scientific communication will be emphasized. Presentation skills will focus on clarity, logical sequence and verbal expression.

Assessment Methods:
Continuous Assessment: 100%

SIH2019 ENVIRONMENTAL RISK ASSESSMENT AND MANAGEMENT

This course covers three main areas of environmental risk assessments i.e., human health risk assessment, ecological risk assessment, and industrial risk assessment. Emphasis is given on risk management versions and techniques.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH2020 ENVIRONMENTAL GOVERNANCE

In pursuing vast and rapid development in any countries, one cannot avoid sacrificing its natural resources. Environmental problems and disasters could only give negative impacts to livelihood and environment. Only those who have awareness towards sustainable development would have appropriate vision and mission in applying and implementing ethics, policy and law to save the nature. It is crucial to possess the right environmental ethics that lead to appropriate governance via effective policies and law enforcement. Environmental ethics, and governance (policy and legislation) are crucial in all fields including biotechnology socio-economy, and environmental protection.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH2021 KEY ISSUES IN CLIMATE CHANGE

This course introduces you to the key concepts, theories, issues, challenges and debates within climate change, which is a multidisciplinary subject. Primary emphasis will be given to causes, impacts and possible solutions for climate change as well as insights from innovation studies and policy development.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH2022 ECOSYSTEM-BASED MANAGEMENT

Ecosystem-based management (EBM) is an environmental management that recognizes the cumulative interactions within an ecosystem, i.e. biotic and abiotic factors including humans and its socio economic dependency on ecosystem, rather than considering single issues, species, or ecosystem services in isolation. This course will cover application of EBM to terrestrial, coastal zone and marine ecosystems. Students will be exposed to management techniques of forest ecosystems for timber production, as well as coastal and marine resources like fisheries. Problems like development and over exploitation will also be discussed.

Assessment Methods:
Continuous Assessment: 100%

SIH2023 ENERGY SAVING CULTURE

Focusing on the current local scenarios of energy sector including the policies, programmes and international involvements. The element of energy saving culture is based on energy triangle approach and interrelated factors in achieving efficient use of energy in building. The building performance evaluation is based on two mechanisms which are Post-occupancy Evaluation and energy audit.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH2024 ENVIRONMENTAL INFORMATICS

This course covers principles and application of computer and information technology in environmental management. Emphasis is the given to spatial data analysis and development of application software for environmental monitoring.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH2025 RENEWABLE ENERGY TRANSITION AND SOCIETY

This course addresses the science and engineering on renewable energy with special emphasis on bioenergy. Renewable resources (“biomass” - plant matter, waste) can be converted into fuels and chemicals using a variety of cutting-edge technologies. It covers new thoughts, new methods and new achievements that have emerged in renewable energy field in recent years. Related information with regards to optimized process design, process control, pre-treatment of substrates for higher conversion rates, operational and energy efficiency, improvement of the

environmental benefits as well as impacts on society will be introduced.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH2026 WATER MANAGEMENT

Students will engage with the comprehension of policies and legal aspects especially for the technical requirement which is stated in Environmental Quality Act, Water Act and Water Services Industrial Act. Technical design for the planning of water and wastewater management for domestic and industrial requirements is also being included in this course.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH2028 AIR POLLUTION CONTROL

This course is designed to provide a comprehensive understanding of the causes and effects of air pollution, and the management measures and engineering technologies available for its control. This is a recognised and sought-after knowledge within the professional environmental field in Malaysia and abroad.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH2029 DISASTER MANAGEMENT

The course for disaster management is introduced as part of fulfilling the required component in environmental management module. This course shall elaborate on the standard phases in disaster management cycle in order to enable students in relating such standard phases with hazard, risk and vulnerability of natural and man-made disasters. Students are also expected able to outline of disaster management plan for series of given case studies. Opportunities to have experiential learning with National Disaster Mangement Agency (Malaysia) or any other relevant organization will be seeked from time to time.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH2030 ORGANISMS AND ENVIRONMENT

This course focuses on the diversity of living organisms including the prokaryotes, protists, fungi, plants and animals. Main characteristics and examples from each group will be highlighted. Interactions between various organisms and between organisms and the environment will be described. Adaptation of organisms to different environments will also be discussed.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH3005 ENVIRONMENTAL IMPACT ASSESSMENT

This course shall engage students to the experiential learning of carrying out environmental impact assessment (EIA) in accordance to the guideline given by Department of Environment (Malaysia). Fundamental practises of preparing the budget and report, including the assessment techniques and environmental management plan (EMP) are the main components for this course. Universal principles and techniques which are practised in the developed country are also included.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH3006 ENVIRONMENTAL MANAGEMENT SYSTEMS

This course prepare students to the development of environmental management system (EMS) which follows ISO14000 template. Students shall comprehend by undergoing the EMS documentation process for selected organization, in which their core operational activities could affect the environmental component. Identification of environmental aspects and its impact assessment for each operational activity are to be carried out within the organization.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH3007 INTEGRATED WASTE MANAGEMENT

In pursuing vast and rapid development in any country, one cannot avoid sacrificing its natural resources. Production of waste is inevitable that waste management strategies need to be improved from the 'out-of-sight-out-of-mind' concepts into an integrated waste management system. It is imperative for countering public health impacts of uncollected waste and environmental impacts of open dumping and burning. Besides, due to the exhaustion of natural resources and issues pertaining to climate change, a linear economy needs to be tuned-into a circular economy.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH3009 SLOPE ECO-ENGINEERING TECHNIQUES

This course is designed to introduce students to eco-engineering techniques, as an alternative approach to stabilize and sustain slope. This course emphasizes on the techniques and succession management mechanisms in stabilizing slope. Procedure for plant screening and performance, and slope monitoring is described. This course also exposes students to practical exercises in applying the plant propagation techniques on slope. Case studies of eco-engineered slopes is also demonstrated.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIH3017 TECHNOLOGY AND MANAGEMENT OF HAZARDOUS WASTES

The technology and management of hazardous waste has developed rapidly and dynamically. Technology transfers have made the compliance of the existing regulations and environmental policy achievable. However it is very crucial in managing the hazardous waste, one possesses an

overview of the field. It includes identification, handling, treatment and disposal of hazardous waste including e-waste. This course is intended to provide sufficient exposure to the varied and complex problems of hazardous waste, as well as, discussing the legislation, regulation, and local and foreign impacts pertaining to its management. Case studies will be provided to assist student to relate to actual environmental situation globally and locally, and current issues of the management of hazardous waste.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIH3018 ENVIRONMENTAL MICROBIOLOGY

The course focuses on the basic and applied concepts of environmental microbiology. Fundamental concepts in microbiology such as microbial diversity, ecology and metabolism, will be explained. Microbial diversity in terrestrial and aquatic environments as well as their roles in the ecosystems will be described. Further, applications of microorganisms in wastewater treatment, bioremediation of polluted and deteriorated environments, and others will be discussed. Students will also gain practical skills in basic microbiological techniques.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH3019 TOURISM AND ENVIRONMENT

Introduction to tourism and ecotourism. Tourism and environment in Malaysian scenario including law, policy and guidelines. Principles of economic valuation on environmental resources, in relation to tourism, e.g. Willingness to Pay (WTP) and Travel Cost Method (TCM). Students will be able to conduct a survey on WTP and TCM via field visits and construct their own set of questionares. Impacts of tourism to environment and how to achieve sustainable tourism, in which SWOT analysis will be used. Case study on selected ecotourism areas, like Protected Areas, World UNESCO Heritage and Ramsar sites.

Assessment Methods:
Continuous Assessment: 100%

SIH3022 ENVIRONMENTAL MANAGEMENT RESEARCH PROJECT

Students will conduct a research project individually on environmental issues under at least one supervisor. The student needs to propose a research proposal and present the research findings scientifically through verbal presentation and a writing of an academic journal article.

Assessment Methods:
Continuous Assessment: 100%

SIH3023 INTRODUCTION TO ADMINISTRATIVE MANAGEMENT

This course prepares students the necessary knowledge and skills on administrative management for a working environment in an organization. It covers theories of management, planning, organising and management of meetings.
Assessment Methods:
Continuous Assessment: 100%

SIH3025 INTRODUCTION TO BIOREMEDIATION

Bioremediation is the use of living organisms to accumulate, detoxify, degrade, or remove environmental contaminants. This course provides an overview of the bioremediation process including the main sources of contaminants and environments where bioremediation can be used, type of remediation strategies as well as the factors that influence the bioremediation rates. The application of various microorganisms and plants in bioremediation will be discussed. Case studies on the use of bioremediation strategies in contaminated soil and groundwater will be reviewed.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH3026 ENVIRONMENTAL WELL-BEING

This course will discuss the positive and negative effects from human-environment interactions. By understanding the roles of the environment and biospheres, and the effect on human health and wellbeing, we are able to improve our quality of life and provide a sustainable approach to the design and management of our environment.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH3027 GREEN AGRICULTURE

This course is designed to introduce students on agriculture and environment from the perspective of sustainable agriculture. This course exposes students on the source, impacts and control of environmental problems in agriculture. Project based learning approach will be conducted to expose students on the solving environmental issues that are related to agriculture using green technology.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIH4001 INDUSTRIAL TRAINING

The industrial training is providing students with learning opportunities in the actual working environment for the duration 19 weeks. In this course, students will gain practical skill and experiences in solving environmental issues during their industrial attachment. Students will be attached to various organization/ industries and companies that are related to the environmental sustainability sector including the aspect of management and technology.

Assessment Methods:
Continuous Assessment: 100%

BACHELOR OF SCIENCE IN MICROBIOLOGY AND MOLECULAR GENETICS PROGRAMME

Career Prospects
The career prospects for graduates of this program are wide. Graduates will have opportunities to be employed in the public or private sector.

Public sector:
Research Officer (Q41) in various ministries/ departments;
Science Officer (C41) in various ministries/ departments;
Adminitrative Officer (N41) in various ministries/ departments;
Training Officer (E41) in various ministries/ departments;
Quality controller in various ministries/ Department of Environment / Department of Agriculture;
Postgraduates in Public Institutions of Higher Learning;
Graduate school teachers in government schools.

Private sector:
Researchers in public or private institutions; Laboratory officers in public or private hospitals or diagnostic/ pathology/ forensic laboratories; Researchers in biotechnology and pharmaceutical industries; Marketing executives in companies retailing reagents, scientific equipments, and medical equipments; Quality controller in food production industries or restaurants; Postgraduates in Private Institutions of Higher Learning; Writer / Researcher in the media industry; Graduate school teachers in private schools/ colleges.

Core Courses

SIR1001 FUNDAMENTAL MICROBIOLOGY

Introduction to concepts and basic techniques of microbiology, evolution, structure and function of prokaryotic, dissemination, control and identification of microorganisms. Exposure to aseptic laboratory techniques for the transfer, isolation and stain of microorganisms.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR1002 FUNDAMENTAL GENETICS

This is a fundamental course covering the following topics of Gametogenesis; Mendelian Principles; Complete, incomplete, and co-dominance; Multiple alleles; Pedigree analysis; Chi-square test; Probability and Statistics (Binomial expansion and factorial); Gene Interactions; Epistatic ratios; Sex determination; Sex linkage; Linkage map (2-point cross; 3-point cross); From genotypes to phenotypes; Introduction of Human Genetics; Counselling; Population genetics and Hardy- Weinberg Equilibrium; Historical account of Molecular Genetics: Direct and indirect evidence of DNA as genetic materials; Chemical composition of nucleic acids; Structure; properties of DNA; DNA replication in prokaryotes, polymerase activity; Transcription: promoter function and specificity, termination of transcription; Translation, ribosome and tRNA specificity. Amino acid charging. Deciphering the genetic code; Regulation of gene expression in prokaryotes: lac operon; catabolite repression; trp operon and attenuation; Control by sigma factor, anti-termination; Molecular basis of mutations and DNA repair; Spontaneous and inducible; Introduction to DNA Recombinant Technology.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR1003 BIOCHEMISTRY

This course encompasses structure and physical characteristic of water, acid and base, pH and pK; classification, structure and function of carbohydrates, lipids, amino acids and proteins; nucleic acids and molecular biology; characteristic of enzyme and the regulation of enxyme activity; Biological Metabolism Fundamentals, catabolism and anabolism of macromolecules in cell.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR1004 CONCEPTS OF GENETIC ENGINEERING

This course emphasise on the isolation of DNA and RNA, vector for gene cloning; various techniques on the transformation of eukaryotic and prokaryotic cells, identification of transformants, PCR technique, Southern & Northern hybridisations, Sanger sequencing, NGS, mutagenesis, genome editing techniques.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR1005 GENETICS AND MOLECULAR BIOLOGY PRACTICAL I

The practical classes emphasize on learning laboratory approaches to both classical Mendelian Genetics and Genetic engineering problems requiring hands-on bench-work and biological data analysis. The introductory lecture prior to the wet lab covers the theory behind the experiment and some of the techniques. This practical module focuses on the prokaryotic system. Techniques will include crossing (testcross, backcross), plasmid extraction, restriction enzyme digestion, ligation, agarose gel electrophoresis and transformation

Assessment Methods:
Continuous Assessment: 100%

SIR2011 BACTERIOLOGY

Introduction to identification and classification of main Bacteria and Archaea. Role and impact of bacteria and Archaea in daily life.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2012 IMMUNOLOGY

This course introduces the importance of the immune system, components of the immune system, different categories of immune responses and their general properties. For adaptive immune response, in depth explanation will be given on the development of the lymphocytes, the receptor gene rearrangement, the selection process and the activation mechanisms of the lymphocytes. The role of MHC molecules in antigen presentation will also be covered. This will be followed by the effector functions of the activated lymphocytes, integrated with the innate immune responses, which also includes the mechanisms of inflammation, phagocytosis and complement.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2013 VIROLOGY

Structure and Characteristics of Viruses: Building of viral capsid structures, the types of viral capsids and nucleocapsids, virus envelope, the types of viral proteins and nucleic acids. The principles of viral taxonomy; replication: The structure of viruses and their replicative cycle, the rationale behind the Baltimore classification system of viruses and example viruses for each Baltimore group, genome expression (RNA transcription and protein translation) based on Baltimore groups, viral genome replication, and assembly of viral components to form new viruses. Virus pathogenesis: Virus transmission, virus infection phases, virus entry into
cells, the interaction virus-host and mechanisms of disease, and measurements for prevention and control of viral diseases.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2014 MICROBIOLOGY PRACTICAL

In this course, students will be introduced to principles of laboratory techniques related to virology, immunology and bacteriology such as serological and molecular assays. Discussion on the current technologies used to further enhance knowledge in the above fields will be conducted. This course will provide the necessary knowledge and specific skills to have hands-on experience in microbiology laboratories.

Assessment Methods:
Continuous Assessment: 100%

SIR2015 MICROBIAL PHYSIOLOGY

Growth, stress response, injuries, starvation and death. Morphogenesis. Structure and function of membranes, movement and chemotaxis. Aggregation and biofilm formation. Energy production: aerobic and anaerobic. Anapleurotic pathways. Photosynthesis.
Biosyntesis of macromolecules. Storage materials secondary metabolites. Microbs and metals.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2016 EUKARYOTIC MICROORGANISMS

This course will cover the origin and evolution of eukaryotic microorganisms, diversity and classification of fungi, importance of fungi to plant and animal health, the economy and environment, symbiotic relationship of fungi as mycorrhizae and lichen, diversity and importance of algae to health and the environment, diversity of protozoa and their importance to human health.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2017 MICROBIAL ECOLOGY

Microorganism and ecological theory. Microbial population and community dynamics. Role of microorganisms in elemental cycles. Microorganisms in natural environments; growth, interaction and adaptation. Marine microbial food web and climate change.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2018 MOLECULAR GENETICS

This course includes topics involved in eukaryotic DNA replication, gene transcription and translation. The topics covered: Eukaryotic genome, C-value paradox, histones and non-histone proteins, heterochromatin and euchromatin, classes of DNA, DNA replication in eukaryotes, transcription, RNA polymerases I, II and III, gene regulation in eukaryotes, various control and regulatory elements, pre-mRNA processing and alternative splicing, RNA processing events (rRNA, tRNA, trans-splicing, RNA-editing), posttranscriptional control of gene expression, transcriptional regulation (DNA binding domains), and transcriptional regulation through signal transduction pathway.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2019 GENOMES

This course introduces prokaryotic, eukaryotic and viral genomes and techniques for studying these genomes. The topics of this course include: Genome sequencing technologies, genome assembly and annotations, genome sequencing projects, genome anatomies, genome functional identification, transcriptomics, proteomics, epigenomics and other –omics technologies.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR2020 GENETICS AND MOLECULAR BIOLOGY PRACTICAL II

The practical classes emphasize on learning laboratory approaches to DNA, RNA and protein assays requiring hands-on bench-work and biological data analysis. The introductory lectura prior to the wet lab covers the theory behind the experiment and some of the techniques. This practical module focuses on the eukaryotic system in animal and plant cells. Techniques will include the principles of DNA extraction, RNA extraction, protein extraction, Sanger sequencing, multiple sequence alignment, BLAST, oligonucleotide design; synthesis, quantitative polymerase chain reaction analysis, western blotting, one and two dimensional electrophoresis. Recent advances in Genomics analysis will also be briefly taught.

Assessment Methods:
Continuous Assessment: 100%

SIR3018 BIOSAFETY AND BIOSECURITY

Awareness on the importance of biosafety and biosecurity that arises within the profession and scientific research of microbiology and genetics. Case studies of biosafety and biosecurity and relevant biorisk management will be discussed. The importance of lab safety and accreditation will also be explored.

Assessment Methods:
Continuous Assessment: 100%

SIR3019 HUMAN MOLECULAR GENETICS

This course starts by looking at the content and organization of the human genome. It involves describing the gene related sequences (genes, introns, exons, regulatory regions, pseudogenes etc.)and non-gene related sequences. The student is then introduced to the Human Genome Project and the processes involved. It includes physical and genetic mapping. The second part will focus on the methods of medical genetic research, with old and new techniques. This includes functional cloning, positional cloning and candidate gene approaches. At the end of the course, students will be familiarised with current issues and research technology including SNP, microarray, proteomics and NGS technologies.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIR4001 RESEARCH PROJECT

This course is intended to introduce practical aspects of the principles of Microbiology/ Molecular Genetics. Students will be exposed to research methodology in Microbiology/ Molecular Genetics field, critical scientific thinking, methods for problem solving, research ethics, record keeping, presentation and scientific writing skills. Students are required to: 1) write a project proposal and carry out literatura review; 2) carry out experiments in the laboratory; 3) analyse data; 4) write a mini thesis; 5) present the results of the research orally.

Assessment Methods:
Continuous Assessment: 100%

SIR4002 INDUSTRIAL TRAINING

This industrial training module will provide students with real on-the-job experience and hands on practical skills in the fields of microbiology and genetics. Students are able to put into practice the knowledge and skills gathered during degree studies in a professional environment during the industrial attachment. Students will undergo 16 weeks of industrial training in the final semester.

Assessment Methods:
Continuous Assessment: 100%

SIR4003 SCIENCE COMMUNICATION

This module will cover how science is communicated to the public and in different media, with regards to science-related issues in society. Topics on the roles and responsibilities of scientists in communicating scientific research and science-related issues and the public understanding of science; and how science is communicated on media will be covered. This module aims to develop students' communication and teamwork skills by showcasing their skills in science communication through various activities.

Assessment Methods:
Continuous Assessment: 100%

Elective courses

SIR2031 FOOD MICROBIOLOGY

Understanding the sources of microorganisms in food, intrinsic and extrinsic parameters that affect microbial growth and food spoilage. Microbiology of fermented food. Characteristics of major foodborne pathogens. Methods in detecting microorganisms in food using conventional and molecular approaches.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIR2041 POPULATION GENETICS

The course is a course that covers how population genetics concepts (empiral, theoretical and experimental methods) which are based on mathematical models, can be applied in various fields of study. The students will use their knowledge, and learn to think logically and solve genetic problems in a systematic manner. The introduction of coding in line with IR 4.0 with the use of R programming and other analytical skills will be enhanced in this course. Lastly the knowledge should be applied and communicated to address problem solving in the community such as conservation, ecological, medical and management of resources.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIR3020 PUBLIC HEALTH MICROBIOLOGY

Science of epidemiology including methods in epidemiological study. Disease transmission, types of reservoirs of infectious agents, emerging and re-emerging infectious diseases, microbiology of water supply and public health. Prevention and control of infectious diseases especially foodborne infections. Concepts and applications of molecular epidemiology. Practical component on laboratory skills.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIR3021 DIAGNOSTIC MICROBIOLOGY

In this course, students will consolidate their understanding of microorganisms of importance in human health and disease in a series of lectures, laboratory sessions and lab visit to develop skills on the detection and identification of infectious agents in the clinical laboratory. Topics include the preanalytical collection and processing of clinical specimens as well as the analytical morphology, isolation, and identification of pathogens, with a focus on colonial, microscopic, biochemical and molecular characteristics and additionally the post-analytical interrelationships of microorganisms and human hosts and the correlation, prevention and control of infectious diseases. Bacteriology is emphasized but the course includes a survey of mycology, parasitology, and virology. This course will provide the necessary knowledge and skills to engage in profesional practice in microbiology laboratories.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3022 ADVANCED IMMUNOLOGY

This module covers topics on the concepts and consequences of the failure mechanism and deficiency of the immune system in providing protection. Topics on

concepts, mechanisms and immunotherapies in autoimmune diseases, hypersensitivity, transplantation immunology and tumour immunity will also be focused, as well as the emerging roles of human microbiota and immunity.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3023 ADVANCED VIROLOGY

This module covers topics on viral infection, transmission and mechanisms of viral pathogenesis. The roles of viruses in causing plant and human diseases as well as the current interventions that exploit viruses in prevention and treatment of diseases will be discussed.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3024 MICROBIAL PATHOGENESIS

The course covers host defences against infection and the bacterial strategies in overcoming host response: virulence factors that promote colonization of host surfaces and invasion of host cells. Regulation of virulence genes. Characteristics of Pathogenicity Islands, endotoxin, exotoxin- characteristics of exotoxins, toxin types, secretion and excretion systems, roles of toxins in diseases; Mechanism of antimicrobial resistance and how bacteria become resistant to antibiotics. Examples of specific bacterial pathogens.
Practical component on laboratory skills.

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIR3025 CYTOGENETICS

This course focuses on structure and function of chromosomes, movement of chromosomes during mitosis, modifications of mitosis, movement of chromosomes during meiosis, correlation between meiosis and Mendelian laws, aberrant meiosis, methods in cytogenetics, karyotype analysis and nomenclature, variation in chromosome types, variation in chromosome number and structure.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIR3026 DEVELOPMENTAL GENETICS

This course focuses on basic concepts and general principles in embryonic development, genetic approach to development, genetic toolkit for Drosophila development, spatial regulation of gene expression in development, post-transcriptional regulation of gene expression in development, the many roles of individual toolkit genes, development and disease.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3027 EPIGENETICS AND GENE REGULATION

This course will provide a basic understanding of the role of epigenetics in gene regulation. Topics will include chromatin remodelling, histone modifications, DNA methylation, the importance of epigenetics in normal cellular functions, evidence for epigenetics involvement in disease.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3028 EUKARYOTIC CELL SIGNALLING

This is an advanced course covering the following topics of cellular and molecular biology of eukaryotes: in the mammalian system, topics covered are revision of the cell cycle and the molecular basis of cell cycle regulation, apoptosis pathways, modes of cell signalling, signalling molecules and their receptors including G protein coupled receptors, enzyme linked receptors, non- receptor enzymes in signalling and second messengers. In plant system, topics covered are signal perception, transduction and integration in plants; intracellular signal transduction, amplification and integration via second messenger and MAPK cascades; signal transduction from phytochromes; seedling development; stomatal aperture; cell senescence and apoptosis; and cell senescence metabolism.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3029 GENETIC BASIS OF CANCER

The course gives an understanding on cancer and why it is seen as a much feared disease worldwide. The etiology, development and treatment of cancer will be discussed focusing on the genetic and molecular aspect.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3031 ADVANCED FOOD MICROBIOLOGY

Advanced food microbiology is a follow-up course of food microbiology. The students are required to have basic knowledge in food microbiology to understand this course. Advanced food microbiology covers various food protection methods and approaches used in the food industry to prolong shelf life and ensure food safety. Also, students will be exposed to HACCP and ISO systems used widely in the food industry nowadays, food safety objectives (FSO) and risk analysis as a widely used risk managing system in ensuring global safe food trading. In this course, hands-on practical to measure and analyse the efficiency of various food protection methods and establishment of FSO and risk assessment model will be conducted.

Assessment Methods:
Continuous Assessment: 70%
Final Examination: 30%

SIR3032 AGRICULTURAL MICROBIOLOGY

The importance of microorganisms in recycling nutrients to reduce the use of chemicals in agriculture, biogeochemical cycles, biological processes for controlling plant pest & diseases, soil fertility management.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3033 APPLIED AND ENVIRONMENTAL MICROBIOLOGY

Understanding the role of microbes and its biochemistry for processing industrial products, microbiological principles in biogeochemical cycle, use of biosensors and biochips in industrial and environmental microbiological processes, application of intellectual property principles in industrial and environmental microbiology.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3034 APPLIED GENOMICS IN ANIMAL BREEDING

The course covers how genomic tools with emphasis using molecular genetic markers are to be applied in various animal breeding programmes as an aid for genetic identification, monitoring inbreeding effects, parentage identification, stock assignment and construction of genetic maps for animal improvement for selected traits in domesticated animals which is preferred in livestock production.

Assessment Methods:
Continuous Assessment: 100%

SIR3035 ANIMAL GENETICS AND GENE MANIPULATION

The course is an introduction to the genetic principles, mining functional animal traits using genomic selection, manipulation of genes for genetic improvement of animals and biosafety regulations related to animal research. The students develop skills in collecting, analysing and disseminating information and data related to animal genetics and gene manipulation.

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIR3036 FERMENTATION TECHNOLOGY

Elaborate microbial and biochemical aspects in fermentation processing, principles and kinetics of fermentation, types of bioreactors and generation of fermentation products

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3037 PHARMACEUTICAL MICROBIOLOGY

Antimicrobial agents: types of antibiotic, mode of action, resistance and other problems in antibiotics utilisation. New sources of antibiotics.Vaccines: mode of action, pro and cons of vaccines utilisation. Disinfectants and preservatives. Introduction to Pharmacopeias. Commercial production of antibiotics. Sterility testing. Good practices for pharmaceutical microbiology labs. Quality assurance

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3041 MARINE AND ESTUARINE MICROBIOLOGY

Sampling techniques and seawater analysis. Characteristics of marine and estuarine habitats. Bacteria, algae, protozoa, zooplankton, virus and fungi in seas. Microbial interactions in marine and estuarine ecosystems. Nutrient cycles (C, N, P, Si) in marine ecosystems. Microbiology and geochemistry of mangrove and coral reef ecosystems

Assessment Methods:
Continuous Assessment: 60%
Final Examination: 40%

SIR3042 PLANT MOLECULAR AND CELLULAR BIOLOGY

An introduction to the basic principles and current development on plant molecular biology. Covering theoretical and practical aspects that are important for current approaches in plant improvement and plant biotechnology. This course also introduces basic principles of plant genetic engineering and the techniques involved. Issues related to GMO will be discussed.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

SIR3043 CONSERVATION GENETICS

This course covers the following topics: Biological diversity (ecosystem, species, genetics), resources and ownership of the Malaysian forest, estimating and characterizing genetic diversity, inbreeding depression, population fragmentation, genetic management in the wild and captivity, units of conservation, use genetic tools in forensic and conservation management, climate change

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIR3044 MOLECULAR EVOLUTION AND PHYLOGENETICS

This course will give an overview of processes in molecular evolution and how past evolutionary events and processes can be understood from the analysis and interpretation of molecular data. This course covers the following topics: evolutionary processes in populations, evolution of genes and genome, concept of species, speciation, evolution of genetic systems, homology and sequence alignment, models of evolution, phylogenetic, neutral evolution, coalescent theory, rate of evolutionary change and concept of molecular dating

Assessment Methods:
Continuous Assessment: 40%
Final Examination: 60%

SIR3045 ADVANCED MYCOLOGY

Fungi are important decomposer in ecosystem and also play role in human lives. This course covers the evolutionary genetics, recent developments and application of fungi.

Assessment Methods:
Continuous Assessment: 50%
Final Examination: 50%

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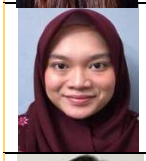	Assoc. Prof. Dr. Jamilah Syafawati Yaacob	jamilahsyafawati@um.edu.my	7967 4090
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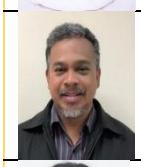	Assoc. Prof. Dr. Saharuddin Mohamad	saharuddin@um.edu.my	7967 6732
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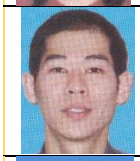
	Dr. Syarifah Aisyafaznim Sayed Abdul Rahman	aisyafaznim@um.edu.my	7967 5830
	Dr. Tang Swee Seong	sstang@um.edu.my	7967 7022 ext. 2350
	Dr. Taznim Begam Mohd Mohidin	taznim@um.edu.my	7967 2587

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	Dr. Tiong Yin Xin Sheena	stiong@um.edu.my	7967 7022 (ext. 2540)

References:

Official Handbook for 2024/2025:
Accessible via the official website for Faculty of Science:
fs.um.edu.my

Official website for Institute of Biological Sciences (ISB):
biology.um.edu.my

Buku Kaedah dan Peraturan Universiti Malaya at myUM website:
myum.um.edu.my

Academic staff profiles at UMExpert website:
umexpert.um.edu.my

INSTITUTE OF MATHEMATICAL SCIENCES
Student Handbook

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Fax : +603-79674143
Email Address: ketua_ism@um.edu.my
Home Page: https://ism.um.edu.my

INSTITUTE OF MATHEMATICAL SCIENCES

The Institute of Mathematical Sciences, abbreviated ISM, was established as a department in the Faculty of Science when the University of Malaya was founded in Kuala Lumpur in 1959. It has grown into three branches: pure mathematics, applied mathematics, and statistics. For the 2024/2025 session, ISM offers the following three first degree programs:

- Bachelor of Science in Mathematics.
- Bachelor of Science in Statistics.
- Bachelor of Actuarial Science.

The three Bachelor of Science programs are set up to provide more opportunities for an undergraduate to major in the field of mathematics according to his or her interests. All these programs will assist to fulfill the vacancies of skilled workforce in science and technology in the public and private sectors in line with Malaysia's aspiration to become a developed nation.

STAFF

ISM has a group of experienced lecturers in teaching. They are also active in doing research and have been publishing many writings in local and international journals. The research activities encompass a broad spectrum, from findings and knowledge that are abstract in nature to those with direct applications in the industry. ISM also strives to establish and forge a close relationship with industry and other research institutions. This strengthens the quality of teaching and supervising of projects/theses for students in bachelor's, Master's and doctoral levels.

HEAD:
Prof. Dr. Wong Kok Bin, *BSc, MSc, PhD(UM)*

DEPUTY HEADS:
Associate Prof. Dr. Adriana Irawati Nur Ibrahim, *BSc(USM), MSc(UM), PhD(Bath)*
Associate Prof. Dr. Noor Fadiya Mohd Noor, *BSc(UTM), MSc(UTM), PhD(UKM)*
Associate Prof. Dr. Zailan Siri, *BSc(UM), MSc(UPM), PhD(UKM)*
Dr. Siti Suzlin Supadi, *BSc, MSc, PhD(UM)*

MATHEMATICS UNIT

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Dr. Wang Kah Lun, *BSc(UM), MSc(UKM), PhD(UM)*

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Dr. Zailan Siri, *BSc(UM), MSc(UPM), PhD(UKM)*

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Dr. Chng Zhi Yee, *BSc (UM), MSc, PhD(UNSW Sydney)*
Dr. Kohilavani Naganthran, *BSc(UNISEL), MSc, PhD(UKM)*
Dr. Kwa Kiam Heong, *BSc, MSc(UM), PhD(Ohio State)*
Dr. Loo Tee How, *BSc, MSc, PhD(UM)*
Dr. Mohd Zahurin Mohamed Kamali, *BSc, MSc, PhD(UM)*
Dr. Muhamad Hifzhudin Noor Aziz, *BSc(UM), MSc, PhD(Glasgow)*
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Dr. Ong Siew Hui, *BSc,MSc, PhD(UM)*
Dr. Oon Shea Ming, *BSc, MSc, PhD(UHP)*
Dr. Qua Kiat Tat, *BSc, MSc, PhD(UM)*
Dr. Ruhaila Md. Kasmani, *BSc(UKM), MSc(UTM), PhD(UM)*
Dr. Shahizat Amir, *BSc(UKM), MPhil, PhD(UM)*
Dr. Siti Suzlin Supadi, *BSc, MSc, PhD(UM)*
Dr. Tan Ta Sheng, *BA, CASM, MMath, MA, PhD(Cambridge)*
Dr. Wang Kah Lun, *BSc(UM), MSc(UKM), PhD(UM)*

STATISTICS UNIT

COORDINATOR (B.Sc. in STATISTICS):
Dr. Nur Anisah Mohamed, *BSc, MSc(UM), PhD(Newcastle)*

PROFESSORS:
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Dr. Ng Kok Haur, *BSc(UPM), MSc(UPM), PhD(UM)*

ASSOCIATE PROFESSORS:
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SENIOR LECTURERS:
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Dr. Ng Choung Min, *BSc(UTM), MSc, PhD(UM)*
Dr. Nur Anisah Mohamed, *BSc, MSc(UM), PhD(Newcastle)*

ACTUARIAL SCIENCE UNIT

COORDINATOR (B. ACTUARIAL SCIENCE):
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ASSOCIATE PROFESSORS:
Mr. Ravee Menon, *B.Eng (Hons) (UM), M. Actuarial Sc (Georgia State US), ASA, AIAA*

SENIOR LECTURERS:
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Dr. Mohd Azmi Haron, *BSc, MBA(UPM), PhD(UPM)*
Mdm. Nadiah Zabri, *BSc(UW Madison), MSc(Kent), FIA*
Dr. Shaiful Anuar Abu Bakar, *BSc(UiTM), MSc(Heriot-Watt), PhD(Manchester)*
Dr. Syaza Nawwarah Zein Isma, *BSc(UM), MSc(IIUM), PhD(ANU)*

COORDINATOR (B.Sc. Ed. Mathematics):
Dr. Shahizat Amir, *BSc(UKM), MPhil, PhD(UM)*

RESEARCH AREAS

Research areas at ISM include: differential geometry, group theory, ring theory, linear preserver problems, functional identities, linear and multilinear algebra, matrix theory, combinatorial graph theory, graph theory, social network analysis, supply chain management, operational research, atomic collision physics, image processing and pattern recognition, chaos theory and simulation, communication protocols, data security, mathematical modelling, fluid dynamics, computational fluid dynamics, boundary layer, heat and mass transfer, numerical analysis, cryptography, demography, Bayesian statistics, spatial, analysis, computational statistics, robust statistics, probability distribution theory, nonlinear time series, regression analysis, statistical quality control, mathematical biology,

education economics, economics and applied statistics, Islamic finance, social security, finance and actuarial modelling.

COMPUTER FACILITIES

Currently, ISM has three computer labs equipped with visualizers and a total of 154 Intel Core i5/i7 desktops. The latest releases of the following software are readily available on the desktops: Dev-C++ bundled with the most recent TDM-GCC, MATLAB Online, Microsoft Office, R, RStudio Desktop, Thonny (Python IDE for beginners). Besides, there are three lecture halls and four tutorial rooms which are also equipped with either LCD projectors or visualizers.

BACHELOR OF SCIENCE PROGRAMS

Please refer to the Program Structure for courses.

FURTHER DEGREE

Apart from teaching and supervising at the bachelor's level, the staff members of the institute also supervise research projects that lead to Master's and doctorate degrees in the three branches of mathematics.

JOB OPPORTUNITIES

The learning of mathematics will help increase one's skills in problem solving and analysis. It trains one's mind to manipulate information, to form accurate, complicated and abstract ideas and to enable one to discern complicated arguments. The training to think quantitatively, logically and analytically in problem solving may prove valuable in one's chosen career.

Since the use of mathematics is all encompassing in human endeavour, a graduate's career opportunities are almost limitless and not only confined to teaching and research. Many graduates from this Institute have been employed in the financial sectors (banking, accountancy and insurance for instance), management, business, industry and computing sectors.

BACHELOR OF SCIENCE IN MATHEMATICS ACADEMIC SESSION 2024/2025 (134 CREDITS)			
1. UNIVERSITY COURSES (12 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
GLT^{xxxx}	English Courses (subject to MUET bands)	-	4
GKA/GKI/ GKK/GKP/ GKS/GKU	Co-curriculum	-	2
GIG1012/ GLT1049	Philosophy and Current Issues / Malay Language Communication (only for international students)	-	2
GIG1013	Appreciation of Ethics and Civilisations	-	2
GIG1003	Basic Entrepreneurship Culture	-	2
2. CORE COURSES (79 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
LEVEL 1 (30 Credits)			
SIX1015	Science, Technology and Society	-	2
SIX1016	Statistics	-	3
SIM1001	Basic Mathematics	-	4
SIM1002	Calculus I	-	4
SIM1003	Calculus II	SIM1002	4
SIM1004	Fundamentals of Computing	-	3
SIM1005	Fundamentals of Spreadsheets	-	2
SIM1006	Ordinary Differential Equations	SIM1002	4
SIT1001	Probability and Statistics I	SIM1002	4
LEVEL 2 (41 Credits)			
SIM2001	Advanced Calculus	SIM1003	4

SIM2002	Linear Algebra	SIM1001	4
SIM2007	Appreciation of Mathematics	SIM1003	2
SIM2010	Numerical Computation	SIM1003	4
SIM2011	Structured Programming	SIM1002	4
SIM2012	Basic Operations Research	SIM1001	4
SIM2013	Introduction to Combinatorics	SIM1001	3
SIM2014	Algebra I	SIM1001	3
SIM2015	Introduction to Analysis	SIM1003	3
SIM2016	Complex Variables	SIM1003	3
SIM2018	Partial Differential Equations	SIM1006	4
SIT2007	Foundations of Data Science	SIT1001	3
LEVEL 3 (8 Credits)			
SIM3020	Industrial Training	SIM2007	8

3. ELECTIVE COURSES (43 CREDITS)

(I) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS)

‡ **ONE COMPULSORY** course is taken from each cluster.

CLUSTER		**CREDITS**
CLUSTER 1	Thinking Matters: Mind and Intellect	2
CLUSTER 2	Emotional, Physical and Spiritual Intelligence: Heart, Body and Soul	2
CLUSTER 3	Technology/Artificial Intelligence and Data Analytics: I-techie	2
CLUSTER 4	Global Issues and Community Sustainability: Making the World a Better Place	2

(II) PROGRAM ELECTIVE COURSES or/and MINOR PACKAGE **
(at least 35 CREDITS)

Choose from all elective courses or/and Minor Packages that are offered

MATHEMATICAL SCIENCE

COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
SIM2017	Geometry	SIM1001	3

SIM2019	Systems of Ordinary Differential Equations	SIM1006	4
SIM2021	Optimization Techniques	SIM2001	4
SIM3001	Graph Theory	SIM2013	4
SIM3002	Combinatorial Mathematics	SIM2013	4
SIM3003	Number Theory	SIM2002	4
SIM3004	Advanced Linear Algebra	SIM2002	4
SIM3005	Matrix Theory	SIM2002	4
SIM3006	Algebra II	SIM2014	4
SIM3007	Ring Theory	SIM2014	4
SIM3008	Group Theory	SIM2014	4
SIM3009	Differential Geometry	SIM2001	4
SIM3010	Topology	SIM2001	4
SIM3011	Complex Analysis	SIM2016	4
SIM3012	Real Analysis	SIM2015	4
SIM3021	Mathematical Science Project	SIM2011	4
SIM3022	Cryptography	SIT1001 and SIM2011	4
SIQ1001	Introduction to Accounting	-	3
SIQ2001	Microeconomics	-	3
SIQ2002	Macroeconomics	-	3
SIQ2003	Financial Mathematics and Derivatives	SIM1002	4
SIT2001	Probability and Statistics II	SIT1001	4

APPLIED MATHEMATICS			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
SIM2019	Systems of Ordinary Differential Equations	SIM1006	4
SIM2020	Management Mathematics	SIM1002	4
SIM2021	Optimization Techniques	SIM2001	4
SIM3021	Mathematical Science Project	SIM2011	4

SIM3022	Cryptography	SIT1001 and SIM2011	4
SIM3023	Numerical Methods and Analysis	SIM2010	4
SIM3024	Computational Geometry	SIM2011	4
SIM3025	Scientific Computing	SIM2011	4
SIM3026	Production and Inventory Control	SIM2012 and SIM2020	4
SIM3027	Mathematical Programming	SIM2012	4
SIM3028	Industrial Operations Research	SIM2012	4
SIM3029	Computational Fluid Dynamics	SIM2018	4
SIM3030	Dynamical Systems Theory	SIM2019	3
SIQ2001	Microeconomics	-	3
SIQ2002	Macroeconomics	-	3
SIT2001	Probability and Statistics II	SIT1001	4
SIT2010	Stochastic Processes	SIT2001	3
SIT3005	Times Series and Forecasting Methods	SIT2001	4
NON SPECIALISATION			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
SIM2017	Geometry	SIM1001	3
SIM2019	Systems of Ordinary Differential Equations	SIM1006	4
SIM2020	Management Mathematics	SIM1002	4
SIM2021	Optimization Techniques	SIM2001	4
SIM3001	Graph Theory	SIM2013	4
SIM3002	Combinatorial Mathematics	SIM2013	4
SIM3003	Number Theory	SIM2002	4
SIM3004	Advanced Linear Algebra	SIM2002	4
SIM3005	Matrix Theory	SIM2002	4

SIM3006	Algebra II	SIM2014	4
SIM3007	Ring Theory	SIM2014	4
SIM3008	Group Theory	SIM2014	4
SIM3009	Differential Geometry	SIM2001	4
SIM3010	Topology	SIM2001	4
SIM3011	Complex Analysis	SIM2016	4
SIM3012	Real Analysis	SIM2015	4
SIM3021	Mathematical Science Project	SIM2011	4
SIM3022	Cryptography	SIT1001 and SIM2011	4
SIM3023	Numerical Methods and Analysis	SIM2010	4
SIM3024	Computational Geometry	SIM2011	4
SIM3025	Scientific Computing	SIM2011	4
SIM3026	Production and Inventory Control	SIM2012 and SIM2020	4
SIM3027	Mathematical Programming	SIM2012	4
SIM3028	Industrial Operations Research	SIM2012	4
SIM3029	Computational Fluid Dynamics	SIM2018	4
SIM3030	Dynamical Systems Theory	SIM2019	3
SIQ1001	Introduction to Accounting	-	3
SIQ2001	Microeconomics	-	3
SIQ2002	Macroeconomics	-	3
SIQ2003	Financial Mathematics and Derivatives	SIM1002	4
SIT2001	Probability and Statistics II	SIT1001	4
SIT2010	Stochastic Processes	SIT2001	3
SIT3005	Times Series and Forecasting Methods	SIT2001	4

Students who wish to take SIM3020 are advised to have passed at least 90 credits of the listed courses in the program.

** Minor package
(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, students can refer to UMSItS Guide via this link: https://umsitsguide.um.edu.my/

PROGRAM GOAL

To produce graduates with a sound knowledge of mathematics, capable of analysing and solving problems and thinking critically, able to adapt to diverse environments and contribute significantly in various professions.

PROGRAM EDUCATIONAL OBJECTIVES

1. Graduates are able to work in professions related to mathematical sciences or related fields.
2. Graduates are able to practice continuous learning in their careers.
3. Graduates are able to communicate and leverage learned concepts/methods effectively and ethically.

PROGRAM LEARNING OUTCOMES

At the end of the program, graduates with Bachelor of Science in Mathematics are able to:
1. Explain the principles and concepts of mathematics.
2. Demonstrate the ability to apply mathematical knowledge critically and analytically in related fields.
3. Apply the principles of mathematics in solving mathematical and real-world problems.
4. Communicate mathematical concepts effectively, accurately and coherently in written and oral forms.
5. Use suitable information, graphical and computational strategies in solving mathematical problems.
6. Work independently and demonstrate leadership quality and a sense of responsibility in achieving goals and outcomes.
7. Engage in lifelong learning to advance knowledge and applications of mathematics.
8. Act professionally and ethically to solve practical problems in mathematical professions.

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE IN MATHEMATICS

COMPONENT	YEAR 1				TOTAL CREDITS
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GLT^{xxxx} English Courses (subject to MUET bands)	2	GLT^{xxxx} English Courses (subject to MUET bands)	2	**8**
	GIG1012 / GLT1049* Philosophy and Current Issues / Malay Language Communication*	2	GIG1013 Appreciation of Ethics and Civilisations	2	
Core Courses	SIX1016 Statistics	3	SIX1015 Science, Technology and Society	2	**26**
	SIM1001 Basic Mathematics	4	SIM1006 Ordinary Differential Equations	4	
	SIM1002 Calculus I	4	SIM1003 Calculus II	4	
	SIM1004 Fundamentals of Computing	3	SIM1005 Fundamentals of Spreadsheets	2	
Elective Courses	Student Holistic Empowerment (SHE) Cluster 2: Emotional, Physical	2	Student Holistic Empowerment (SHE) Cluster 1: Thinking	2	**4**

	and Spiritual Intelligence: Heart, Body and Soul GQX0056 Integrity and Anti-Corruption Course		Matters: Mind and Intellect		
TOTAL CREDITS		**20**		**18**	**38**

*Only for international students.

COMPONENT	**YEAR 2**				**TOTAL CREDITS**
	SEMESTER 1		**SEMESTER 2**		
	COURSE	**CREDIT**	**COURSE**	**CREDIT**	
University Courses	GIG1003 Basic Entrepreneur-ship Culture	2			**4**
	GKA/GKI/GKK/ GKP/GKS/GKU Co-Curriculum	2			
Core Courses	SIT1001 Probability and Statistics I	4	SIT2007 Foundations of Data Science	3	**31**
	SIM2001 Advanced Calculus	4	SIM2015 Introduction to Analysis	3	
	SIM2002 Linear Algebra	4	SIM2016 Complex Variables	3	

	SIM2007 Appreciation of Mathematics	2	SIM2010 Numerical Computation	4	
			SIM2011 Structured Programming	4	
Elective Courses	Student Holistic Empowerment (SHE) Cluster 3: Technology/Artificial Intelligence and Data Analytics: I-techie	2	Student Holistic Empowerment (SHE) Cluster 4: Global Issues and Community Sustainability: Making the World a Better Place	2	**4**
TOTAL CREDITS		**20**		**19**	**39**

COMPONENT	**YEAR 3**				**TOTAL CREDITS**
	SEMESTER 1		**SEMESTER 2**		
	COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses	SIM2013 Introduction to Combinatorics	3			**14**
	SIM2014 Algebra I	3			
	SIM2012 Basic Operations Research	4			

	SIM2018 Partial Differential Equations	4			
Elective Courses	Elective Course 1	4	Elective Course 2	4	**20**
			Elective Course 3	4	
			Elective Course 4	4	
			Elective Course 5	4	
TOTAL CREDITS		**18**		**16**	**34**

COMPONENT	**YEAR 4**				**TOTAL CREDITS**
	SEMESTER 1		**SEMESTER 2**		
	COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses			SIM3020 Industrial Training	8	**8**
Elective Courses	Elective Course 6	4			**15**
	Elective Course 7	4			
	Elective Course 8	4			
	Elective Course 9	3			
TOTAL CREDITS		**15**		**8**	**23**

BACHELOR OF SCIENCE IN STATISTICS ACADEMIC SESSION 2024/2025 (134 CREDITS)			
1. UNIVERSITY COURSES (12 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
GLT^{xxxx}	English Courses (subject to MUET bands)	-	4
GKA/GKI/GKK/ GKP/GKS/GKU	Co-curriculum	-	2
GIG1012 / GLT1049	Philosophy and Current Issues / Malay Language Communication (only for international students)	-	2
GIG1013	Appreciation of Ethics and Civilisations	-	2
GIG1003	Basic Entrepreneurship Culture	-	2
2. CORE COURSES (76 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
LEVEL 1 (26 Credits)			
SIX1015	Science, Technology and Society	-	2
SIM1001	Basic Mathematics	-	4
SIM1002	Calculus I	-	4
SIM1003	Calculus II	SIM1002	4
SIT1001	Probability and Statistics I	SIM1002	4
SIT1002	Statistical Programming	-	4
SIT1003	Analysis of Data and Statistical Report Writing	-	4
LEVEL 2 (28 Credits)			
SIM2001	Advanced Calculus	SIM1003	4
SIM2002	Linear Algebra	SIM1001	4

SIT2001	Probability and Statistics II	SIT1001	4
SIT2007	Foundations of Data Science	SIT1001	3
SIT2008	Further Mathematical Statistics	SIT2001	4
SIT2009	Regression Analysis	SIT1001	4
SIT2010	Stochastic Processes	SIT2001	3
SIT2011	Statistics and Community	SIT1003	2
LEVEL 3 (22 Credits)			
SIT3005	Time Series and Forecasting Methods	SIT2001	4
SIT3015	Introduction to Multivariate Analysis	SIT2001	3
SIT3016	Generalized Linear Models	SIT2001 and SIT2009	4
SIT3017	Statistical Learning and Data Mining	SIT2007	3
SIT3021	Industrial Training	SIT3017	8

3. ELECTIVE COURSES (46 CREDITS)

(I) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS)

‡ **ONE COMPULSORY** course is taken from each cluster.

CLUSTER		**CREDITS**
CLUSTER 1	Thinking Matters: Mind and Intellect	2
CLUSTER 2	Emotional, Physical and Spiritual Intelligence: Heart, Body and Soul GQX0056 Integrity and Anti-Corruption Course	2
CLUSTER 3	Technology/Artificial Intelligence and Data Analytics: I-techie	2
CLUSTER 4	Global Issues and Community Sustainability: Making the World a Better Place	2

(II) PROGRAM ELECTIVE COURSES or/and MINOR PACKAGE **

(at least 38 CREDITS)

Choose from all elective courses or/and Minor Packages that are offered

COURSE CODE	COURSE NAME	PRE-REQUISITE	CREDITS
SIM2010	Numerical Computation	SIM1003	4
SIM2012	Basic Operations Research	SIM1001	4
SIQ1001	Introduction to Accounting	-	3
SIQ2001	Microeconomics	-	3
SIQ2002	Macroeconomics	-	3
SIQ2003	Financial Mathematics and Derivatives	SIM1002	4
SIT3003	Computer Intensive Methods in Statistics	SIT2001	4
SIT3004	Applied Stochastic Processes	SIT2010	4
SIT3008	Introduction to Survey Sampling	SIT2001	4
SIT3009	Statistical Process Control	SIT2001	4
SIT3012	Design and Analysis of Experiments	SIT1001 and SIT2009	4
SIT3013	Analysis of Failure and Survival Data	SIT2001	4
SIT3018	Non-Parametric Statistics	SIT1001	4
SIT3019	Introduction to Bayesian Statistics	SIT2001	4
SIT3020	Python for Data Science	SIT3017	4
SIT3022	Probability Theory	SIM2001 and SIT2008	4
SIT3023	Statistical Laboratory	SIT1002 and SIT2007	3
SIT3024	Statistical Consultancy and Data Analysis	SIT3021	3
SIT3025	Statistical Science Project	SIT1002 and SIT2007	4
The exact number of program elective courses offered in each year may differ			

** Minor package
(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, students can refer to UMSItS Guide via this link: https://umsitsguide.um.edu.my/

PROGRAM GOAL

To produce graduates who have sound knowledge in statistics and mathematics, strong problem-solving skills and capability to adapt to diverse environment, with life-long learning habits.

PROGRAM EDUCATIONAL OBJECTIVES

To produce:
1. Graduates who work in a profession directly related to statistics or any other related field;
2. Graduates who are involved in continuous learning in statistics or other related fields;
3. Graduates who are able to communicate statistical concepts and methods effectively and ethically.

PROGRAM LEARNING OUTCOMES

At the end of the program, graduates with Bachelor of Science in Statistics are able to:
1. Explain the principles and concepts of statistics and mathematics as the foundation for data-driven decision-making;
2. Demonstrate the ability to apply statistical and mathematical knowledge critically and analytically to complete a task;
3. Apply the principles of statistics and mathematics in solving real world problems;
4. Communicate statistical and mathematical concepts effectively, accurately and coherently in written and oral forms;
5. Access, manage and process data effectively and efficiently using suitable graphical and computational strategies;
6. Work in teams, and demonstrate leadership quality and sense of responsibility in achieving goals and outcomes;
7. Engage in life-long learning to advance knowledge and applications of statistics and mathematics;
8. Act professionally and ethically in the course of analysis and decision-making to solve problems.

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE IN STATISTICS

COMPONENT	YEAR 1				TOTAL CREDITS
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GLT^{XXXX} English Courses (subject to MUET bands)	2	GLT^{XXXX} English Courses (subject to MUET bands)	2	**8**
	GIG1012 / GLT1049* Malay Language Communication / Basic Malay Language*	2	GIG1013 Appreciation of Ethics and Civilisations	2	
Core Courses	SIT1002 Statistical Programming	4	SIM1003 Calculus II	4	**26**
	SIM1001 Basic Mathematics	4	SIT1001 Probability and Statistics I	4	
	SIM1002 Calculus I	4	SIT1003 Analysis of Data and Statistical Report Writing	4	
			SIX1015 Science, Technology and Society	2	
Elective Courses	Student Holistic Empowerment (SHE)	2			**2**

	Cluster 2: Emotional, Physical and Spiritual Intelligence: Heart, Body and Soul GQX0056 Integrity and Anti-Corruption Course				
TOTAL CREDITS		**18**		**18**	**36**

*Only for international students.

COMPONENT	**YEAR 2**				**TOTAL CREDITS**
	SEMESTER 1		**SEMESTER 2**		
	COURSE	**CREDIT**	**COURSE**	**CREDIT**	
University Courses	GIG1003 Basic Entrepreneurship Culture	2			**2**
Core Courses	SIM2001 Advanced Calculus	4	SIT2008 Further Mathematical Statistics	4	**31**
	SIM2002 Linear Algebra	4	SIT2010 Stochastic Processes	3	
	SIT2001 Probability and Statistics II	4	SIT2009 Regression Analysis	4	
	SIT2007	3	SIT3015	3	

	Foundations of Data Science		Introduction to Multivariate Analysis		
	SIT2011 Statistics and Community	2			
Elective Courses	Student Holistic Empowerment (SHE) Cluster 1: Thinking Matters: Mind and Intellect	2	Student Holistic Empowerment (SHE) Cluster 3: Technology/ Artificial Intelligence and Data Analytics: I-techie	2	**8**
			Elective Course 1	4	
TOTAL CREDITS		**21**		**20**	**41**

COMPONENT	YEAR 3				TOTAL CREDITS
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GKA/GKI/GKK/ GKP/GKS/GKU Co-Curriculum	2			**2**
Core Courses	SIT3005 Time Series and Forecasting Methods	4	SIT3021 Industrial Training	8	**19**
	SIT3016 Generalized Linear Models	4			
	SIT3017 Statistical Learning and Data Mining	3			
Elective Courses	Elective Course 2	4			**6**
	Student Holistic Empowerment (SHE) Cluster 4: Global Issues and Community Sustainability: Making the World a Better Place	2			
TOTAL CREDITS		**19**		**8**	**27**

COMPONENT	YEAR 4				TOTAL CREDITS
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
Elective Courses	Elective Course 3	4	Elective Course 7	4	**30**
	Elective Course 4	4	Elective Course 8	4	
	Elective Course 5	4	Elective Course 9	4	
	Elective Course 6	3	Elective Course 10	3	
TOTAL CREDITS		**15**		**15**	**30**

BACHELOR OF ACTUARIAL SCIENCE ACADEMIC SESSION 2024/2025 (145 CREDITS)			
1. UNIVERSITY COURSES (12 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
GLT^{xxxx}	English Courses (subject to MUET bands)	-	4
GKA/GKI/ GKK/ GKP/GKS/ GKU	Co-curriculum	-	2
GIG1012 / GLT1049	Philosophy and Current Issues / Malay Language Communication (only for international students)	-	2
GIG1013	Appreciation of Ethics and Civilisations	-	2
GIG1003	Basic Entrepreneurship Culture	-	2
2. CORE COURSES (87 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
LEVEL 1 (24 Credits)			
SIX1015	Science, Technology and Society	-	2
SIX1016	Statistics	-	3
SIM1001	Basic Mathematics	-	4
SIM1002	Calculus I	-	4
SIM1003	Calculus II	SIM1002	4
SIQ1001	Introduction to Accounting	-	3
SIT1001	Probability and Statistics I	SIM1002	4
LEVEL 2 (31 Credits)			
SIM2001	Advanced Calculus	SIM1003	4
SIM2002	Linear Algebra	SIM1001	4

SIM2007	Appreciation of Mathematics	SIM1003	2
SIM2011	Structured Programming	SIM1002	4
SIQ2001	Microeconomics	-	3
SIQ2002	Macroeconomics	-	3
SIQ2003	Financial Mathematics and Derivatives	SIM1002	4
SIT2001	Probability and Statistics II	SIT1001	4
SIT2007	Foundations of Data Science	SIT1001	3
LEVEL 3 (32 Credits)			
SIQ3001	Actuarial Mathematics I	SIQ2003	4
SIQ3002	Portfolio Theory and Asset Models	SIQ2003	4
SIQ3003	Actuarial Mathematics II	SIQ3001	4
SIQ3004	Mathematics of Financial Derivatives	SIQ2003	4
SIQ3005	Life Insurance and Takaful	-	4
SIQ3006	Risk Theory	SIT2001	4
SIQ3007	Industrial Training	SIQ3001	8
3. ELECTIVE COURSES (46 CREDITS)			
(I) STUDENT HOLISTIC EMPOWERMENT (8 CREDITS) ‡ **ONE COMPULSORY** course is taken from each cluster.			
CLUSTER			**CREDITS**
CLUSTER 1	Thinking Matters: Mind and Intellect		2
CLUSTER 2	Emotional, Physical and Spiritual Intelligence: Heart, Body and Soul GQX0056 Integrity and Anti-Corruption Course		2
CLUSTER 3	Technology/Artificial Intelligence and Data Analytics: I-techie		2
CLUSTER 4	Global Issues and Community Sustainability: Making the World a Better Place		2

(II) PROGRAM ELECTIVE COURSES or/and MINOR PACKAGE ** **(at least 38 CREDITS)** Choose from all elective courses or/and Minor Packages that are offered			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDITS**
SIM1004	Fundamentals of Computing	-	3
SIM1005	Fundamentals of Spreadsheets	-	2
SIM1006	Ordinary Differential Equations	SIM1002	4
SIM2010	Numerical Computation	SIM1003	4
SIM2012	Basic Operations Research	SIM1001	4
SIM3021	Mathematical Science Project	SIM2011	4
SIQ3008	Foundation of Islamic Finance	-	4
SIQ3009	Pension Mathematics	SIQ3001	4
SIQ3010	Survival Models	SIT2001	4
SIQ3011	Business Finance	-	3
SIQ3012	Financial and Business Management	-	3
SIQ3013	Stochastic Models	SIT2001	4
SIT2008	Further Mathematical Statistics	SIT2001	4
SIT2009	Regression Analysis	SIT1001	4
SIT2010	Stochastic Processes	SIT2001	3
SIT3003	Computer Intensive Methods in Statistics	SIT2001	4
SIT3004	Applied Stochastic Processes	SIT2010	4
SIT3005	Time Series and Forecasting Methods	SIT2001	4
SIT3015	Introduction to Multivariate Analysis	SIT2001	3
SIT3016	Generalized Linear Models	SIT2001 and SIT2009	4

SIT3017	Statistical Learning and Data Mining	SIT2007	3
SIT3018	Non-Parametric Statistics	SIT1001	4
SIT3019	Introduction to Bayesian Statistics	SIT2001	4
SIT3020	Python for Data Science	SIT3017	4
SIT3022	Probability Theory	SIM2001 and SIT2008	4
Students who wish to take SIQ3007 are advised to have passed at least 110 credits of the listed courses in the program.			

** Minor package

(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, students can refer to UMSItS Guide via this link: https://umsitsguide.um.edu.my/

PROGRAM GOAL

To produce graduates with sound knowledge in the actuarial field through exploration in the theoretical and application of mathematics, statistics, economics and finance, able to think critically in problem solving as well as capable to increase competitiveness in the national and international levels.

PROGRAM EDUCATIONAL OBJECTIVES

1. Graduates build professions related to actuarial science or related fields.
2. Graduates engage in lifelong learning and interdisciplinary learning in industry or academic institutions based on actuarial science in industry.
3. Graduates contribute to the sustainable development and well-being of the community.

PROGRAM LEARNING OUTCOMES

At the end of the program, graduates with a Bachelor of Actuarial Science are able to:

1. Explain the principles and concepts of actuarial science, finance, economics, statistics and mathematics;
2. Demonstrate the ability to apply actuarial, financial, economical, statistical and mathematical knowledge critically and analytically in actuarial or related fields;
3. Apply the principles of actuarial science, finance, economics, statistics and mathematics in solving real-world problems;
4. Communicate actuarial, financial, economical, statistical and mathematical concepts effectively, confidently, accurately and coherently in written and oral forms;
5. Use a broad range of information, media and technology applications in solving problems;
6. Work in teams and demonstrate leadership quality and a sense of responsibility in achieving goals and outcomes;
7. Engage in lifelong learning to advance knowledge and applications of actuarial science, finance, economics, statistics and mathematics;
8. Act professionally and ethically in the course of analysis and decision-making to solve problems.

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF ACTUARIAL SCIENCE

COMPONENT	YEAR 1				TOTAL CREDITS
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
University Courses	GLT^{XXXX} English Courses (subject to MUET bands)	2	GLT^{XXXX} English Courses (subject to MUET bands)	2	**12**
	GIG1012 / GLT1049* Philosophy and Current Issues / Malay Language Communication*	2	GIG1013 Appreciation of Ethics and Civilisations	2	
	GIG1003 Basic Entrepreneurship Culture	2	GKA/GKI/GKK/ GKP/GKS/GKU Co-Curriculum	2	
Core Courses	SIM1001 Basic Mathematics	4	SIQ1001 Introduction to Accounting	3	**24**
	SIM1002 Calculus I	4	SIM1003 Calculus II	4	
	SIX1016 Statistics	3	SIT1001 Probability and Statistics I	4	
			SIX1015	2	

			Science, Technology and Society		
Elective Courses	Student Holistic Empowerment (SHE) Cluster 2: Emotional, Physical and Spiritual Intelligence: Heart, Body and Soul GQX0056 Integrity and Anti-Corruption Course	2			**2**
TOTAL CREDITS		**19**		**19**	**38**

*Only for international students.

COMPONENT	**YEAR 2**				**TOTAL CREDITS**
	SEMESTER 1		**SEMESTER 2**		
	COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses	SIM2011 Structured Programming	4	SIM2001 Advanced Calculus	4	**31**
	SIQ2001 Microeconomics	3	SIM2002 Linear Algebra	4	
	SIQ2003 Financial Mathematics and Derivatives	4	SIM2007 Appreciation of Mathematics	2	

	SIT2001 Probability and Statistics II	4	SIQ2002 Macroeconomics	3	
	SIT2007 Foundations of Data Science	3			
Elective Courses	Student Holistic Empowerment (SHE) Cluster 1: Thinking Matters: Mind and Intellect	2	Elective Course 1	4	**9**
			Elective Course 2	3	
TOTAL CREDITS		**20**		**20**	**40**

COMPONENT	YEAR 3				TOTAL CREDITS
	SEMESTER 1		SEMESTER 2		
	COURSE	CREDIT	COURSE	CREDIT	
Core Courses	SIQ3001 Actuarial Mathematics I	4	SIQ3003 Actuarial Mathematics II	4	**24**
	SIQ3002 Portfolio Theory and Asset Models	4	SIQ3004 Mathematics of Financial Derivatives	4	
	SIQ3005 Life Insurance and Takaful	4	SIQ3006 Risk Theory	4	
Elective Courses	Elective Course 3	4	Student Holistic Empowerment (SHE) Cluster 3: Technology/Artificial Intelligence and Data Analytics: I-techie	2	**16**
	Elective Course 4	4	Student Holistic Empowerment (SHE) Cluster 4: Global Issues and Community Sustainability: Making the World a Better Place	2	

			Elective Course 5	4	
TOTAL CREDITS		**20**		**20**	**40**

COMPONENT	**YEAR 4**				**TOTAL CREDITS**
	SEMESTER 1		**SEMESTER 2**		
	COURSE	**CREDIT**	**COURSE**	**CREDIT**	
Core Courses	SIQ3007 Industrial Training	8			**8**
Elective Courses			Elective Course 6	4	**19**
			Elective Course 7	4	
			Elective Course 8	4	
			Elective Course 9	4	
			Elective Course 10	3	
TOTAL CREDITS		**8**		**19**	**27**

SYNOPSIS OF COURSES

SIX1016
STATISTICS (FACULTY OF SCIENCE)

Introduction to statistics; Experimental and observational studies; Display and organisation of data; Descriptive statistics; Population and samples; Sampling methods; Basic probability theory; Useful probability distributions: binomial, Poisson and normal; Sampling distributions; Central Limit Theorem; Point estimation and confidence interval; Hypothesis testing for mean and proportion in one and two populations; Chi-square tests; Simple linear regression and correlation analysis.

Assessment:
Continuous Assessment:100%

SIM1001
BASIC MATHEMATICS

Introductory logic. Mathematical statements. Quantifiers. Rules of inference. Mathematical induction, binomial theorem. Sets, Cartesian products, equivalence relations, functions, bijections, inverse functions. Integers, rational numbers, real numbers. Complex numbers. De Moivre's theorem and roots of unity. Polynomials and equations. Remainder theorem, fundamental theorem of algebra, conjugate roots.

Systems of linear equations, row reduction, echelon forms. Matrix operations, algebraic properties of matrices, inverses, elementary matrices, linear independence and homogeneous linear systems, matrices with special forms. Determinants, cofactor expansion, properties of determinants, Cramer's rule, eigenvalues, eigenvectors, and diagonalization.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM1002
CALCULUS I

Functions and their graphs, combining functions, trigonometric functions. Rate of change and tangent lines to curves, limits of functions and limit laws, the precise definition of a limit, one-sided limits, continuity, limits involving infinity and asymptotes of graphs. Tangent lines and the derivative at a point, the derivative as a function, differentiation rules, derivatives of trigonometric functions, the

chain rule, implicit differentiation. Extreme values of functions, the mean value theorem, monotonic functions and the first derivative test, concavity and curve sketching, antiderivatives. Sigma notation and limits of finite sums, the definite integral, the fundamental theorem of calculus, indefinite integrals and the substitution method, the definite integrals substitution and the area between curves, logarithms functions, exponential functions, indeterminate forms and L'hopital's Rule.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM1003
CALCULUS II

Inverses trigonometric functions, hyperbolic functions, inverses hyperbolic functions. Basic integration formulas, integration by parts, trigonometric integrals, trigonometric substitutions, integration of rational functions by partial fractions, improper Integrals. Sequence, infinite series, the integral test, comparison tests, absolute convergence, the ratio and root tests, alternating series test, conditional convergence, power series, Taylor and Maclaurin series. Calculus with parametric curves, polar coordinates. Three-dimensional coordinate systems, vectors, the dot product, the cross product, triple product, lines and planes, cylinder and quadric surfaces. Vector-valued functions, space curves, derivatives and integrals of vector functions.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM1004
FUNDAMENTALS OF COMPUTING

MATLAB - Matlab environment, matrices, constants and variables, operations, built-in functions, formatted output, plotting graphs, expressions and logical data, branches and loops, scripting, user-defined functions. Applications to selected mathematical problems.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIM1005
FUNDAMENTALS OF SPREADSHEETS

Basics of worksheets, entering labels, numbers and formulae.

Absolute and relative addressing, Excel functions. Graph plotting. Use of Excel Solver. Applications to some selected mathematical problems.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIM1006
ORDINARY DIFFERENTIAL EQUATIONS

First-order ODEs: Definitions, solution concepts, valid solution intervals. Solutions to separable equations, linear equations, Bernoulli, exact and non-exact, homogeneous equations. Some applications of first-order ODEs.

Linear ODEs of second and higher orders: Definitions, solution concepts, linear independence, Wronskian. Solutions to homogeneous and non-homogeneous equations. Method of undetermined coefficients, Variation of parameters. Series solutions. Frobenius's method, Legendre and Bessel's equations.
Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2001
ADVANCED CALCULUS

Partial derivatives. Differentiability and continuity. Linearization and differentials. The Chain Rule, Partial derivatives with constrained variables. Directional derivatives. Gradient, divergence and curl. Tangent planes. Taylor's Theorem. Extremum problems of functions of two variables. Lagrange multipliers.

Double integrals, iterated integrals and Fubini's Theorem. Applications to areas and volumes. Double integrals in polar form. Triple integrals, iterated integrals. Volumes and masses. Triple integrals in cylindrical and spherical coordinates forms. Substitution in multiple integrals, Jacobians.

Basic set theory. Functions, bijective functions, inverse functions. Finite and infinite sets, countable and uncountable sets. The Real Number system. Bounds, supremum and infimum. Archimedean property. Rational and irrational numbers. Properties of real numbers. Sequences of real numbers, convergence. Limit Theorems. Monotone sequences, Cauchy sequences and subsequences. Basic topology of the real line:

Open and closed sets, accumulation points.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2002
LINEAR ALGEBRA

Vector spaces and subspaces, null spaces, sums and direct sums of subspaces. Linear independences, bases, dimension, the subspaces dimension theorem, row and column spaces, rank, ordered bases, coordinates, changes of basis. Linear transformations, kernel and range, the rank-nullity theorem, isomorphisms, matrix representations. Eigenvalues, eigenvectors, characteristic polynomials, diagonalizability, the Cayley-Hamilton Theorem.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2007
APPRECIATION OF MATHEMATICS

This course exposes students to some aesthetic aspects of mathematics that they may not have encountered in other mathematics courses. The main aim is to promote appreciation of the beauty of mathematics and the role mathematics plays in society. The topics chosen for this course come from a variety of different areas, for example, mathematical puzzles and games, famous solved or unsolved mathematical problems and their history, mathematicians and their work, mathematics and music, mathematics and origami, mathematics in technology and mathematics in nature. Students will be put into groups and each group will work on a project related to any of the topics discussed in the lectures. Students collectively will use elements of mathematics to undertake the project. Each group is also required to identify and plan activities for a community partnership that will not only help them to enhance their understanding or gain a different perspective of their project but will also be beneficial to the community partner. Each student will be required to record a reflection of their experiences before, during and after the fieldwork at the community partner and to submit their record with the group project report at the end of the semester. Students are also required to do a group presentation based on the project.

Assessment:
Continuous Assessment:100%

SIM2010
NUMERICAL COMPUTATION

Computer arithmetic: floating-point numbers, round-off error, machine precision, overflow/underflow, numerical cancellation, truncation error.

Taylor polynomials and limits.

Interpolation: Lagrange interpolation, divided difference method, Hermite interpolation, cubic spline interpolation.

Roots of nonlinear equation: bisection method, fixed-point iteration, Newton–Raphson method, secant method.

Numerical differentiation: Forward, backward and central finite difference methods.

Numerical Integration: trapezoidal, Simpson's, Romberg's methods. Composite methods.

System of linear equations. Matrix factorization, LU factorization.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2011
STRUCTURED PROGRAMMING

Algorithms: Structured programming – sequence, decision statement and loops. Object-oriented design.

Programming: fundamental data types – int, double, char. Operators, precedence order. Pre-processor directives. In-built functions. User-defined functions – pass by value and reference. One- and two-dimensional arrays.

Introduction to user-defined data types – structures and classes.

Applications of numerical methods: integer and floating point arithmetic, root finding, solutions of ordinary differential equations. Use of random number generator.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIM2012
BASIC OPERATIONS RESEARCH

Introduction to the problems in operations research, modelling, formulation and examples. Linear programming, transportation

and assignment problems. Integer programming, game theory and dynamic programming.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2013
INTRODUCTION TO COMBINATORICS

Ordered and equivalence relations, binomial and multinomial theorems, recurrence relations, principle of inclusion and exclusion, generating functions, Latin squares, magic squares, basic properties of graphs, circuits and cycles in graphs, trees and their applications.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2014
ALGEBRA I

Group Theory - abstract groups, subgroups, cyclic and dihedral groups; order of an element and of a subgroup, Lagrange's theorem; cosets, normal subgroups and factor groups; group homomorphisms.

Ring Theory – rings, integral domains and fields; subrings, ideals and quotient rings; ring homomorphisms; polynomial rings, the Division algorithm and Euclidean algorithm in polynomial rings.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2015
INTRODUCTION TO ANALYSIS

Sequences. Topology of the real line. Compactness. Properties of continuous functions. Uniform continuity. Derivative of a function. Properties of differentiable functions. Mean Value Theorems. Higher order derivatives. L'Hospital's Rules.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2016
COMPLEX VARIABLES

Complex numbers, complex functions, limits, continuity. Differentiable and analytic functions, Cauchy-Riemann equations, harmonic functions. Sequences and series of complex numbers, convergence tests, power series. Elementary functions:

the complex exponential function, complex logarithms, complex exponents, trigonometry functions. Complex integrals, contour integrals, the Cauchy-Goursat theorem, the fundamental theorems of integration, Cauchy's integral formula, Cauchy's integral formula for derivatives and Morera's theorem.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2017
GEOMETRY

Euclidean Geometry, congruence, parallelism, similarity, isometry, Incidence geometry of the hyperbolic plane, motions of the sphere.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2018
PARTIAL DIFFERENTIAL EQUATIONS

Fourier series, introduction to partial differential equations, method of characteristics, separation of variables, Laplace transform method.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2019
SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

Linear systems of first-order equations. Homogeneous linear systems. Nonhomogeneous linear systems.

Nonlinear autonomous systems. Stability. Locally linear systems. Liapunov's method. Applications

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2020
MANAGEMENT MATHEMATICS

Output function: Theory and some concepts. Break-even model. Maximum profit for monopoly and oligopoly markets. Inventory model. EOQ Model, reordering point, finite input rate, shortage and discount quantity. Probabilistic model, safety stock and efficiency level.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM2021
OPTIMIZATION TECHNIQUES

Unconstraint optimization, necessary and sufficient conditions for an extremum point. Constraint optimization. Type of constraint. A variation of techniques for solving nonlinear problems.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3001
GRAPH THEORY

Graph theory and its applications.

Topics will be selected from the following: Eulerian graphs, trees, planar graphs, graph colouring and chromatic polynomials, Hamiltonian graphs, matching theory, directed graphs and the shortest path problem, network theory.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3002
COMBINATORIAL MATHEMATICS

Enumerative combinatorics: permutations and combinations, Catalan numbers, Stirling numbers and partition numbers.

Existential combinatorics: pigeonhole principle, Ramsey theory of graphs and systems of distinct representatives.

Combinatorial designs: block designs, balanced incomplete block designs, Steiner triple systems and Hadamard matrices.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3003
NUMBER THEORY

Prime numbers. The division algorithm and unique factorization theorem for integers. Linear diophantine equations. Theory of congruence and the Chinese Remainder Theorem. RSA encryption. Quadratic reciprocity and the Legendre symbol. Arithmetic functions. Primitive roots.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3004
ADVANCED LINEAR ALGEBRA

Inner product spaces, the Cauchy-Schwarz inequality, the Gram-Schmidt orthogonalization process, orthogonal complements, orthogonal projections. Adjoint operators, normal operators, self-adjoint operators, unitary operators, positive definite operators. Bilinear forms, congruence, rank, Sylvester's law of inertia, classification of symmetric bilinear forms, real quadratic forms. The Schur triangularization theorem, the primary decomposition theorem, the Jordan canonical form.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3005
MATRIX THEORY

Rank and nullity of matrices, Sylvester's law inequality, the Frobenius inner product, the Gram-Schmidt process, the continuity argument. Rank and full rank decompositions, LU and QR decompositions, spectral decompositions, singular value decompositions, polar decompositions, Cholesky decompositions. Generalized inverses, Moore-Penrose inverses, the best approximation solutions, least squares solutions. Kronecker products of matrices, permutations, matrix functions of Kronecker products, Schmidt rank and decompositions.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3006
ALGEBRA II

This is a second course in abstract algebra and will cover more advanced topics on groups and rings. Topics on groups include the isomorphism theorems, various subgroups such as the centre and commutator subgroups, finitely generated abelian groups, automorphism groups, permutation groups, and p-groups.

For rings, the focus is on commutative rings. Topics on rings include the maximal and prime ideals, polynomial rings, irreducible polynomials and the unique factorization theorem.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3007
RING THEORY

This course includes both commutative and non-commutative rings. Topics that will be discussed include subrings, subfields and ideals; internal direct sum and external direct product; nil ideals, nilpotent ideals; modules and submodules; prime ideals, maximal ideals; prime radical and Jacobson radical; semiprime and semiprimitive rings; rings with chain conditions; group rings.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3008
GROUP THEORY

The three isomorphism theorems. Cyclic groups. Direct product of groups. Introduction to the three Sylow's Theorems. Classification of groups up to order 8. Finitely generated abelian groups. Permutation groups.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3009
DIFFERENTIAL GEOMETRY

Vector algebra on Euclidean space. Lines and planes. Change of coordinates. Differential geometry of curves. Frenet Equations. Local theory of surfaces in Euclidean space. First and second fundamental forms. Gaussian curvatures and mean curvatures. Geodesics. Gauss-Bonnet Theorem.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3010
TOPOLOGY

Topological Spaces. Continuity, connectedness and compactness. Separation axioms and countability. Metric spaces. Product spaces.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3011
COMPLEX ANALYSIS

Infinite series expansions: convergence and divergence and region of convergence. Taylor and Laurent theorems. Classification of isolated singularities. Zeroes and poles.

Calculus of residues; calculation of definite integrals. Residue Theory. Evaluation of certain integrals. Argument principle, Rouche's Theorem. Maximum modulus principle. Conformal mappings.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3012
REAL ANALYSIS

Infinite series, convergence. Tests of convergence. Absolute and conditional convergence. Rearrangement of series. Pointwise and uniform convergence. Properties of uniform convergence. Superior limit and inferior limit. Power series, radius of convergence. Taylor series. Riemann integral. Integrable functions. Properties of the Riemann integral. Integration in relation to differentiation. Differentiation of integrals. Improper integrals. Sequences and series of functions.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3020
INDUSTRIAL TRAINING

Candidates are required to spend a minimum of 16 weeks working with selected companies in selected areas of industry.

Assessment:
Continuous Assessment:100%

SIM3021
MATHEMATICAL SCIENCE PROJECT

Subject to supervising lecturer.

Assessment:
Continuous Assessment:100%

SIM3022
CRYPTOGRAPHY

Basic concept of cryptography, data security, complexity theory and number theory. Encryption algorithms, secret key cryptography, public key cryptography, hash functions. Quantum cryptography. Applications of cryptography.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3023
NUMERICAL METHODS AND ANALYSIS

Approximation methods: discrete, linear and nonlinear least square, orthogonal polynomials, Chebyshev polynomials, Gram-Schmidt process.

Eigenvalue problem: Gershgorin circle, power method, Householder's methods, QR algorithm.

Initial value problems of ordinary differential equations: Euler, high order Taylor, Runge-Kutta and multistep methods. Analysis of convergence, stability and error control.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3024
COMPUTATIONAL GEOMETRY

Vector algebra, introduction to differential geometry, design of surfaces for Bezier surfaces, triangular Bezier surfaces, rational B-splines for Bezier and Coons surfaces.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3025
SCIENTIFIC COMPUTING

Functions. Data structures. Pointers/References. Classes and objects.

Programmatic modeling and analysis of selected problems from, but not limited to algebra, data processing and analysis, dynamical systems, graph theory, interpolation, linear algebra, linear and nonlinear equations, mathematical physics, optimization, and statistics.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIM3026
PRODUCTION AND INVENTORY CONTROL

Introduction
The importance of inventory in management.

Inventory model
Advanced EOQ models.
Inventory model for time-dependent demand: linear increase or decrease cases.
Solutions
Exact and approximate methods by minimizing ordering and holding costs.

Applications
Applications to real-world

problems.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3027
MATHEMATICAL PROGRAMMING

Introduction of linear programming in matrix form. The simplex method in matrix form, two-phase simplex method in matrix form. Revised simplex method in matrix form. Two phase revised simplex method in matrix form. Sensitivity analysis. Dual simplex. Integer linear programming (cutting plane algorithms, binary (0-1)). Parametric linear programming. Upper bounded variables method. Goal programming (graphical method, simplex method), Karmarkar's interior point algorithm, Dantzig-Wolf decomposition principle.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3028
INDUSTRIAL OPERATIONS RESEARCH

Introduction
Definition of a network. Node, branch and path.

Network flow
Shortest path (distance), decision tree, maximum flow, maximum flow-minimum cost.

Activity network
Critical path model method (cpm), Project valuation. Optimal path. Project scheduling. Probability analysis.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3029
COMPUTATIONAL FLUID DYNAMICS

Concepts of fluid dynamics: types of fluids and flows. Solution approaches to fluid dynamics. Forces, laws governing fluid motion and conservation of momentum. Dynamics in one dimension and motion on a plane.

Derivation of stream function and equations of Euler, Bernoulli and Navier-Stokes. Dimensional analysis and dimensionless parameters.

Dynamic similarity and boundary layer approximation.

Solutions of flow problems and initial/boundary conditions using computational fluid dynamics methods.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIM3030
DYNAMICAL SYSTEMS THEORY

Flows on the line. Flows on the circle. Two-dimensional flows. Phase plane. Limit cycles. Bifurcations. Three- and higher dimensional flows. Phase space. Chaos. Numerical simulations. Applications.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIQ1001
INTRODUCTION TO ACCOUNTING

Basic principles of accounting – including the role of accounting standards. Different types of business entity. Basic structure of company accounts. Interpretation and limitation of company accounts.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ2001
MICROECONOMICS

Fundamental principles of economics; price theory which covers the demand model, supply model and equilibrium point; shape of demand curve and consumer behavior; substitution effects and income; shape of supply curve and behavior of firms; theory of production and cost of production; analysis of competitive markets in the short term; monopoly and oligopoly.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ2002
MACROECONOMICS

Macroeconomic issues and problems; fundamental concepts of national income; method of calculating national income; simple Keynesian model; derivation of IS curve, LM curve, aggregate demand curve, and aggregate supply curve; relationship between interest rates, monetary demand, consumption and investments; relationship

between price levels, monetary demand, aggregate demand and aggregate supply in a Keynesian model.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ2003
FINANCIAL MATHEMATICS AND DERIVATIVES

Time Value of Money: simple interest, compound interest, present and accumulated values, nominal rate of interest, force of interest, equation of value.

Annuities: annuity immediate, annuity due, perpetuity, m-thly annuity, continuous type annuity, deferred annuities, varying annuities.

Loans: Amortization, sinking funds, amortization with continuous payments.

Bonds: Types of bonds, pricing formula, callable and serial bonds, other securities.

Cash flows: Discounted cash flows, internal rate of return, money-weighted and time weighted rate of return.

Term Structure of Interest Rate: Yield curves, spot and forward rates, duration, convexity, immunization.

Introduction to Derivatives: Forward and futures, short and long positions, arbitrage, put and call options, interest rate and currency swaps, put-call parity, hedging.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3001
ACTUARIAL MATHEMATICS I

Survival distributions: lifetime probability functions, force of mortality, moments and variance, parametric survival models, percentiles, recursions, fractional ages, select and ultimate life tables.

Life Insurances: continuous type life insurances, discrete type life insurances, probabilities, percentiles, recursive formula, m-thly payments, varying insurance.

Life Annuities: continuous type life annuities, discrete type life annuities, expectation and variance, probabilities, percentiles, recursive formulas, m-thly payments, varying annuities.

Premiums: expectation and variance of loss random variable, fully continuous and discrete premiums, semicontinuous premiums, m-thly premiums, gross premiums, probabilities, percentiles.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3002
PORTFOLIO THEORY AND ASSET MODELS

Utility theory: Features of utility functions, expected utility theorem, risk aversion.

Stochastic dominance: Absolute, first and second order stochastic dominance.

Measures of investment risk: Variance, semi-variance, probability of shortfall, value-at-risk, expected shortfall.
Portfolio theory: Mean-variance portfolio, diversification, efficient frontier, optimal portfolio selection, efficient portfolio identification.

Models of asset returns: Single-index models, fitting a single index model, multi-index models.
Asset Pricing Model: Capital Asset Pricing Model, Arbitrage Pricing Theory.

Efficient market hypothesis.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3003
ACTUARIAL MATHEMATICS II

Reserves: fully continuous and discrete reserves, semicontinuous reserves, prospective and retrospective reserves, expense reserves, variance of loss, special formulas, recursive formulas.

Markov Chains: discrete and continuous Markov chains, Kolmogorov's forward equations, premiums and reserves using Markov chains, multiple-state models.

Multiple Decrement Models: discrete and continuous decrement models, probability functions, fractional ages, multiple and associated single decrement tables, uniform assumption.

Multiple Life Models: joint life, last survivor and contingent probabilities, moments and variance of multiple life models, multiple life insurances and annuities.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3004
MATHEMATICS OF FINANCIAL DERIVATIVES

Introduction to derivatives: Call and put options, forwards, futures, put-call parity.

Binomial models: one-step model, arbitrage, upper and lower bounds of options prices, construction of multi-step binomial tree.

The Black-Scholes model: Pricing formula, options Greeks, trading strategies, volatility.

Hedging: Market making, delta hedging, Black-Scholes partial differential equation, delta-gamma-theta approximation.

Exotic options: Asian options, barrier options, compound options, gap options, all-or-nothing options, exchange options.

Brownian motion and Itô's lemma: Brownian motion, Itô's lemma, Sharpe ratio, martingale representation theorem,

Term structure of interest rate: Vasicek model, Cox-Ingersoll-Ross model, Black-Derman-Toy binomial tree.

Models for credit risk: Structural, reduced form and intensity based models, Merton model, valuing credit risky bonds.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3005
LIFE INSURANCE AND TAKAFUL

Insurance products and unit-linked insurance; Group Life insurance; Operation of a Life Insurance company: underwriting, claims, marketing and distribution methods; Profit testing; Takaful insurance; Regulations: Insurance Act, taxation and role of Bank Negara in Insurance Industry.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3006
RISK THEORY

Loss distributions: Claim frequency and claim severity distributions, creating new distributions, parameter estimation methods,

goodness-of-fit tests, risk sharing arrangements.
Aggregate risk models: Individual risk models, collective risk models, reinsurance.

Run-off triangle: Chain ladder method, average cost per claims method, Bornheutter-Ferguson method.

Credibility theory: Bayesian credibility methods, credibility premium formula, empirical Bayes credibility theory.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3007
INDUSTRIAL TRAINING

Candidates are required to spend a minimum of 16 weeks working with selected companies in selected areas of industry.

Assessment:
Continuous Assessment:100%

SIQ3008
FOUNDATION OF ISLAMIC FINANCE

Introduction to Islamic finance and its practices; Riba, gharar and maisir; Musharkah, mudharabah and murabahah; Ijarah, salam and istisna'; Çomparison of Islamic and conventional financial systems; Islamic financial institutions and products, Islamic banking and takaful, Islamic investment instruments; Capital market in an Islamic framework, leasing, securitization and sukuk; Modeling Islamic financial products using mathematical software; Regulatory framework for Islamic financial institutions in Malaysia.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3009
PENSION MATHEMATICS

Pension benefit: defined benefits, defined contributions

Valuation of pension plan: unit credit, entry age normal, individual level, frozen initial liability, aggregate

Ancillary benefits: disability pensions, survivor pensions, death benefits, temporary early-retirement pensions and severance benefits
Asset valuations: market value, smoothed market values, group annuity contracts and individual life insurance contracts.

Actuarial assumptions: the Service Table, secondary decrements, interest, inflation, and salary Increases.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3010
SURVIVAL MODELS

Estimation of lifetime distributions: lifetime distributions, cohort studies, censoring, Kaplan-Meier estimates, Cox regression model and its estimation.

Markov models: Multi-state Markov models, Kolmogorov forward equations, estimation of the force of mortality, estimation of multi-state model transition intensities.

Binomial and Poisson models of mortality: Binomial model of mortality, uniform and constant force of mortality assumptions, maximum likelihood estimator for the rate of mortality, Poisson models.

Graduation and statistical tests: methods of graduating crude estimates, Chi-square test, standardised deviation test, sign test, grouping of sign test, serial correlations test.

Exposed to risk: Exact exposed to risk, approximate exposed to risk using census data.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3011
BUSINESS FINANCE

This course enables the students to understand and deepen their knowledge of business finance theories. In addition, it will enable them to understand various advance techniques related to risk and return capital structure, dividend policy, long-term financing instruments such as bonds and equities, risk management and mergers and acquisitions.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3012
FINANCIAL AND BUSINESS MANAGEMENT

This course discusses the various financial tools employed to effectively manage a company's financial condition and strategic thinking in financial management. Other topics discussed are financial statement and analysis, time

value of money, bonds and stocks, capital budgeting and its techniques and short-term working capital management and basic legal principles relevant to the work of actuary and practical implications.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIQ3013
STOCHASTIC MODELS

Introduction to probability theory, conditional probability and expectation.

Markov chains: Chapman–Kolmogorov equations random walk models, classification of states, limiting probabilities, mean time spent in transient states, branching processes and time reversible Markov chains.

Poisson process: exponential distribution, counting processes, distribution of inter-arrival time and waiting time, conditional distribution of the arrival time, nonhomogeneous Poisson process and compound Poisson process.

Continuous time Markov chains: birth-and-death process, transition probabilities and transition rates, limiting probabilities and time reversibility.

Brownian motion and stationary processes: Brownian motion, martingale, hitting time and maximum variable, maximum of Brownian motion with drift, geometric Brownian motion, white noise, Gaussian processes and stationary, weakly stationary Processes.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT1001
PROBABILITY AND STATISTICS I

Axioms of probability. Counting techniques. Conditional probability. Independent events. Bayes Theorem.

Discrete random variables and its mathematical expectation. Discrete distributions: uniform, hypergeometric, Bernoulli, binomial, geometric, negative binomial and Poisson.

Continuous random variables and its mathematical expectation. Continuous distributions: uniform, exponential, gamma, chi-square and normal.

Moment generating functions. Distributions of functions of one random variable. Independent random variables. Distributions of sum of independent random variables. Functions related to normal random variables. Central limit theorem. Approximation for discrete distributions. Limiting moment generating functions.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT1002
STATISTICAL PROGRAMMING

Introduction to the statistical programming software. Logical operations. Vector, matrices and arrays. Sequence, decision statement and loops. Writing functions. Data inputs. Data frames. Graphics. Random number generation. Applications to statistics.

Assessment:
Continuous Assessment: 70%
Final Examination: 30%

SIT1003
ANALYSIS OF DATA AND STATISTICAL REPORT WRITING

Descriptive statistics. Hypothesis testing, confidence interval and tests of independence. Regression and Correlation: continuous response data, simple and multiple linear model.

Statistical tests: Goodness of fit tests, ANOVA, Nonparametric test.

Statistical Report Writing.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIT2001
PROBABILITY AND STATISTICS II

Distributions of two and more dimensional random variables. Correlation coefficient. Conditional distributions. Bivariate normal distribution. Transformation of two random variables. Distributions of order statistics.

Biased and unbiased estimators. Method of moments. Method of maximum likelihood. Confidence interval for: mean, proportion and variance of single population; difference between two means, difference between two proportions and ratio of variances.

Hypothesis testing for: mean, proportion and variance of

single population; difference between two means, difference between two proportions and ratio of variances. Chi-square goodness-of-fit tests and contingency tables.

Power of a statistical test. Best critical region. Likelihood ratio test. Chebyshev's inequality. Convergence in probability and distribution. Asymptotic distribution of maximum likelihood estimator. Rao-Cramer's inequality.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT2007
FOUNDATIONS OF DATA SCIENCE

Introduction to data science; Differences between experimental and observational data; Characteristics of big data sets; Sources of biases in data sets; Introduction to industry-level, open source computing tools such as R; Data management; Graphical visualisation including spatial data; Analysis and interpretation of real data sets with varying degrees of complexity using appropriate statistical methods.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIT2008
FURTHER MATHEMATICAL STATISTICS

The exponential family; sufficient, complete and ancillary statistics; minimum variance unbiased estimators; Bayesian estimation; Delta method for asymptotic approximation; distributions of certain quadratic forms-one and two factors analysis of variance; probability measure space; law of large numbers; Borel-Cantelli lemma.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT2009
REGRESSION ANALYSIS

Simple linear regression: Estimation, hypothesis testing, analysis of variance, confidence intervals, correlation, residuals analysis, prediction. Model inadequacies, diagnostics, heterogeneity of variance, nonlinearity, distributional assumption, outliers, transformation. Selected topics from matrix theory and multivariate normal distribution.

Multiple linear regressions: Estimated multiple linear regression. Hypothesis testing, ANOVA, Confidence Interval, Model selection criteria, Diagnostics for influential observations and multicollinearity. Introduction to logistic and Poisson regression.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT2010
STOCHASTIC PROCESSES

Definition and examples of stochastic processes: Gambler's ruin problem, Brownian motion and Poisson process. Introduction to simple random walk. Discrete time Markov Chains. Transition probability. Properties of class. Transience and recurrence properties. Absorbing probability. Stationary distribution and limiting probability. Markov chain simulations and applications.
Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT2011
STATISTICS AND COMMUNITY

This course exposes students to some aspects of statistics in community. The main aim is to highlight the role of official statistics in society. The topics chosen for this course come from a variety of different areas, for example, statisticians and their work, statistics and technology, and statistics and society. Students will work in groups on projects related to the topics discussed in lectures. Students will use elements of statistics in the planning a community project including designing questionnaire, collecting/ managing/analyzing data and reporting the findings. Each group is required to identify and plan activities for a community partnership that will not only help them to enhance their understanding or gain a different perspective of their project but will also be beneficial to the community partner. Each student will be required to record a reflection of their experiences before, during and after the field work at the community partner and to submit their record with the group project report at the end of the semester. Students are also required to do a group presentation based on the project.

Assessment:
Continuous Assessment:100%

SIT3003
COMPUTER INTENSIVE METHODS IN STATISTICS

Computer generation of uniform and non-uniform random variables. Monte Carlo evaluation of integrals. Variance reduction techniques. Bootstrap and jackknife methods; Applications in confidence interval construction. Maximum likelihood estimation of model parameters via the Expectation-Maximization (EM) algorithm. The Markov Chain Monte Carlo method.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3004
APPLIED STOCHASTIC PROCESSES

Time reversible Markov chains. Poisson processes. Continuous-time Markov chains and birth and death processes. Brownian motion. Application to real-world phenomena, such as in finance.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3005
TIME SERIES AND FORECASTING METHODS

Introduction to time series and forecasting. Time series graphics. Simple forecasting methods. Transformation and adjustments. Fitted values, residuals and prediction intervals. Time series regression. Time series decomposition. Exponential smoothing. ARIMA models. ARCH and GARCH models.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3008
INTRODUCTION TO SURVEY SAMPLING

This course focuses on statistical sampling methods with applications in the analysis of sample survey data. The sampling methods include simple random sampling, stratified random sampling, systematic sampling and cluster sampling. Estimation of population parameters for different sampling methods will be fully discussed. Special

estimation techniques, including ratio and regression estimations, will be introduced in the context of simple random sampling and stratified random sampling. Areas of application may include social science and official statistics.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3009
STATISTICAL PROCESS CONTROL

Methods and philosophy of statistical process control. Control charts for variables and attributes. Time-weighted control charts. Process capability analysis. Multivariate control charts. Acceptance sampling plans.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3012
DESIGN AND ANALYSIS OF EXPERIMENTS

Philosophy related to statistical designed experiments. Completely randomized one-factor design. Randomized block designs. Latin squares. Incomplete block designs. Factorial designs. Confounding. Fractional factorial designs.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3013
ANALYSIS OF FAILURE AND SURVIVAL DATA

Survival distributions, hazard models. Reliability of systems, stochastic models. Censoring and life-tables. The product-limit estimator. Parametric survival models under censoring. Cox proportional hazards model and other models with covariates.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3015
INTRODUCTION TO MULTIVARIATE ANALYSIS

Matrix algebra and random vectors. Multivariate normal distribution. Wishart distribution and Hotelling distribution. Multivariate linear regression, canonical correlation analysis. Dimensional reduction methods: principal component analysis, and linear discriminant analysis. Clustering methods for

unsupervised learning. Application of linear discriminant analysis, classification and regression trees for supervised learning.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3016
GENERALIZED LINEAR MODELS

Introduction to generalized linear model based on the exponential family. For example, multiple linear regression for normal data, logistic regression for binary data, Poisson regression for counts, log linear for contingency table, and gamma regression for continuous non-normal data.
Study the theory of GLM including estimation and inference.

Introduction to fitting GLM in R.

Focus on the analysis of data: binary, count and continuous, model selection, model evaluation, interpretation, prediction and residual analysis.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3017
STATISTICAL LEARNING AND DATA MINING

This course prepares students for applied work in data science by building on students' foundations of data science skills. Students will learn advanced methods in statistical learning and data mining, using appropriate computing tools such as R. The strengths of the diversity of approaches are illustrated through analyses of real world data sets covering commonly encountered data types.

Exploratory analyses: dimensional reduction methods such as principal components analysis and linear discriminant analysis. Feature selection.
Supervised learning: artificial neural networks, k-nearest neighbours, logistic regression, naïve-Bayes, classification and regression trees, or support vector machine. Ensemble methods: bagging, random forest, and boosting.
Unsupervised learning: K-means and hierarchical clustering.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIT3018
NON-PARAMETRIC STATISTICS

Introduction to hypothesis testing, sign test and signed rank test, Mann-Whittney test, Kruskal-Wallis test, runs test, contingency tables, median test, goodness of fit test, Spearman's rank test, Kolmogorov Smirnov test, permutation test, kernel density estimation, spline regression estimation.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3019
INTRODUCTION TO BAYESIAN STATISTICS

Bayes' Theorem. Bayesian framework and terminology. Bayesian inference. Prior formulation. Implementation via posterior sampling. Bayesian decision theory. Hierarchical models. Application to real-world problems.

Assessment:
Continuous Assessment: 40%
Final Examination: 60%

SIT3020
PYTHON FOR DATA SCIENCE

Description: Introduction to Python programming; Control statement and program development; Python data structures, strings and files; Functions; Lists and Tuples; Dictionaries and sets; Array-oriented programming with NumPy; Pandas series and DataFrame; Data wrangling; Object-oriented programming; Python libraries for data analysis such as Jupyter Notebook, SciPy, mglearn and matplotlib.

Data science: Basic descriptive statistics; Simulation and static/dynamic visualisation; data mining tools such as principal component analysis and discriminant analysis.

Big Data and Cloud case study: Deep learning; convolutional and recurrent neural networks; Reinforcement learning; Network analysis.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIT3021
INDUSTRIAL TRAINING

Candidates are required to spend a minimum of 16 weeks

working with selected companies in selected areas of industry.

Assessment:
Continuous Assessment:100%

SIT3022
PROBABILITY THEORY

Probability measure and space, sigma field. Lebesgue integration. Random variables, measurability, independence. Distribution functions. Inequalities, characteristic functions. Various modes of convergence of sequences of random variables. Classical limit theorems. Examples of applications.
Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIT3023
STATISTICAL LABORATORY

Use of functions and commands in statistical packages for exploratory data analysis, modelling and statistical inferences. Coding and programming using statistical software to solve statistical problems.

Assessment:
Continuous Assessment: 50%
Final Examination: 50%

SIT3024
STATISTICAL CONSULTANCY AND DATA ANALYSIS

Introduction to consultancy activities and consulting methods. Related problems and issues. Exposure to the use of primary and secondary data from various sources. Application of suitable statistical methods such as multivariate analysis, regression and time series in the analysis of real data. Producing report and presenting the findings that suit the needs of the client.

Assessment:
Continuous Assessment:100%

SIT3025
STATISTICAL SCIENCE PROJECT

Subject to supervising lecturer.

Assessment:
Continuous Assessment:100%

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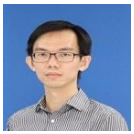
	Dr. Oon Shea Ming	oonsm@um.edu.my	7967 4321	125
	Dr. Qua Kiat Tat	----------	7967 4337	145
	Dr. Ruhaila Binti Md Kasmani	ruhaila@um.edu.my	7967 4339	202
	Dr. Shahizat Amir	shahizat@um.edu.my	7967 4310	112

	Dr. Siti Suzlin Binti Supadi	suzlin@um.edu.my	7967 4345	124
	Dr. Tan Ta Sheng	tstan@um.edu.my	7967 7134	114
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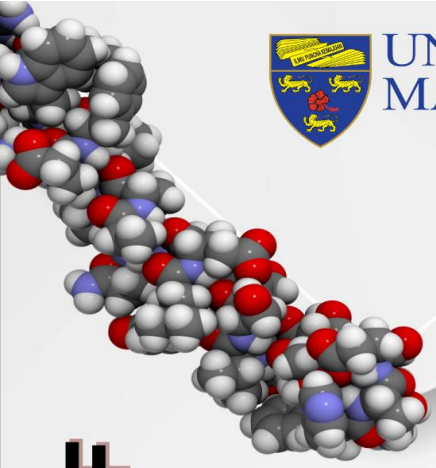
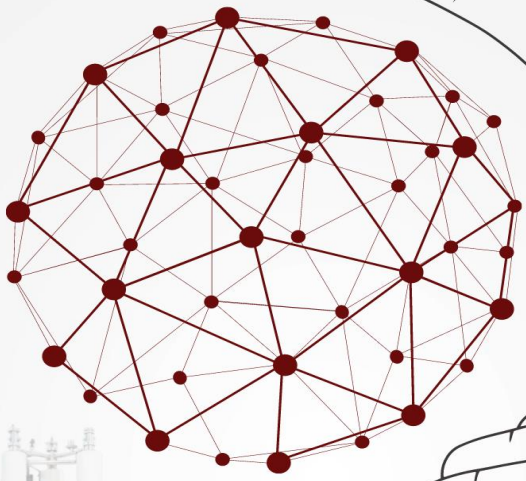
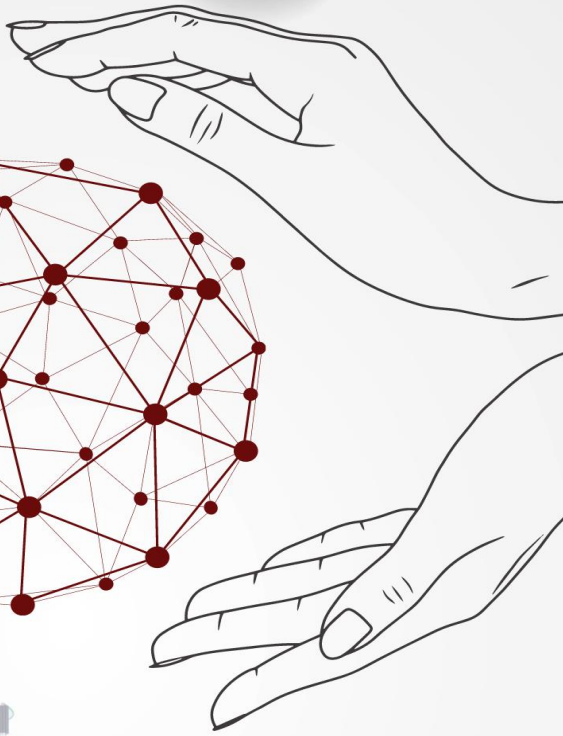
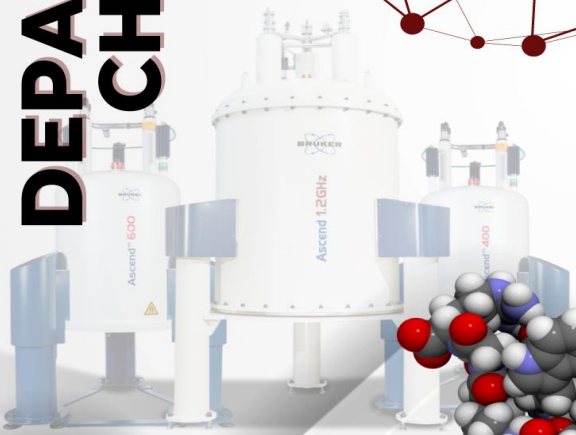
UNIVERSITI MALAYA

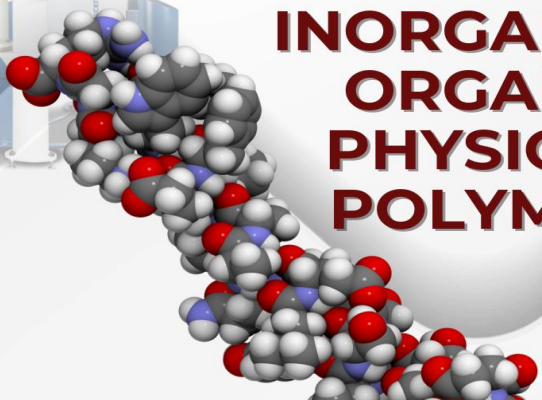
DEPARTMENT OF CHEMISTRY











ANALYTICAL
INORGANIC
ORGANIC
PHYSICAL
POLYMER

DEPARTMENT OF CHEMISTRY

The Department of Chemistry is the largest department in the Faculty of Science. The Department started operation in the academic year 1959/1960 and is one of the oldest departments in the faculty. The Department is the first institution of higher learning in Malaysia to receive the prestigious Royal Society of Chemistry, UK accreditation for its BSc (Chemistry) and BSc (Applied Chemistry) programme since August 2012.

One of the objectives of the Department is to provide a centre of excellence in chemical education and research in Malaysia. Students from the Department are trained to develop their critical, creative, and innovative thinking. The Department is proud to produce graduates who are highly regarded, and much sought after in the workforce market.

Presently, the Department has 56 academic staff, several of whom are from abroad, and 1 Emeritus Professor. Apart from teaching at both undergraduate and postgraduate degree levels, the staff also conduct quality research in fundamental and applied chemistry. Although the academic staff have different research interests, they adhere to the same philosophy in solving chemical-related problems and in the development of expertise in chemistry.

In addition to the undergraduate programme, the department also offers MSc by research and coursework, and PhD programmes. Since the establishment, the Department has produced many MSc and PhD graduates who assume high positions in both government and private organizations locally and internationally.

BACHELOR OF SCIENCE IN CHEMISTRY SESSION 2024/2025 (132 CREDIT)			
UNIVERSITY COURSES (14 CREDITS)			
Course Code	**Course Name**		**Credit**
GIG1012 / GLT1049*	Philosophy and Current Issues (local students) / Malay Language Communication (*only for international students)		2
GIG1013	Appreciation of Ethics and Civilisations		2
GIG1003	Basic Entrepreneurship Enculturation		2
GKA/GKI/GKK/GKP/GKS/GKU 1001	Co-Curriculum		4
GLTxxxx	English Course (subject to MUET bands)		4
CORE COURSES (77 CREDITS)			
Course Code	**Course Name**		**Credit**
LEVEL 1 (26 CREDITS)			
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3
SIC1001	Principles of Chemistry		2
SIC1006	Computer Programming for the Sciences		3
SIC1007	Inorganic Chemistry I		3
SIC1008	Organic Chemistry I		3
SIC1009	Physical Chemistry I		3
SIC1010	Mathematics in Chemistry		2
SIC1011	Safety and Basic Laboratory Techniques***		3
Course Code	**Course Name**	**Pre-Requisite(s)**	**Credit**
SIC1012	Laboratory Skills**	*SIC1011*	2
LEVEL 2 (25 CREDITS)			
SIC2016	Inorganic Chemistry II	*SIC1001 and SIC1007 Taken concurrently with SIC2017*	3
SIC2017	Practical of Inorganic Chemistry II**	*SIC1007 and SIC1012 Taken concurrently with SIC2016*	2
SIC2018	Organic Chemistry II	*SIC1001 and SIC1008 Taken concurrently with SIC2019*	3
SIC2019	Practical of Organic Chemistry II**	*SIC1008 and SIC1012 Taken concurrently with SIC2018*	2

SIC2020	Physical Chemistry II	*SIC1001, SIC1009 and SIC1010 Taken concurrently with SIC2021*	3
SIC2021	Practical of Physical Chemistry II**	*SIC1009 and SIC1012 Taken concurrently with SIC2020*	2
SIC2022	Basic Analytical Chemistry***	*SIC1001, SIC1007 and SIC1012*	3
SIC2023	Molecular Spectroscopy	*SIC1001, SIC1009 and SIC1010*	3
SIC2024	Spectroscopic Methods in Organic Chemistry	*SIC1008 Taken concurrently with SIC2018*	2
SIC2025	Chemistry and Society	*SIC1001, SIC1007, SIC1008, SIC1009, and SIC1010*	2
LEVEL 3 (26 CREDITS)			
SIC3020	Inorganic Chemistry III	*SIC2016 Taken concurrently with SIC3021*	2
SIC3021	Practical of Inorganic Chemistry III**	*SIC2016 and SIC2017 Taken concurrently with SIC3020*	2
SIC3022	Organic Chemistry III	*SIC2018 Taken concurrently with SIC3023*	2
SIC3023	Practical of Organic Chemistry III**	*SIC2018 and SIC2019 Taken concurrently with SIC3022*	2
SIC3024	Physical Chemistry III	*SIC2020 Taken concurrently with SIC3025*	2
SIC3025	Practical of Physical Chemistry III**	*SIC2020 and SIC2021 Taken concurrently with SIC3024*	2
SIC3026	Industrial Training	*SIC2016, SIC2018, SIC2020 and SIC2022*	8
SIC3027	Research Project	*SIC2016, SIC2018, SIC2020 and SIC2022*	6

*For non-Malaysian
**Practical course
***With practical component

PURE CHEMISTRY PACKAGE			
ELECTIVE COURSES (41 CREDITS)			
(I) PROGRAMME ELECTIVES or/and MINOR PACKAGE#** **(33 Credit)** Choose from programme courses or/ and Minor Packages that are offered			
Course Code	**Course Name**	**Pre-Requisite(s)**	**Credit**
SIC3028	Advanced Analytical Chemistry***	*SIC2022*	3
SIC3029	Polymer Chemistry***	*SIC2020 and SIC2021*	3
SIC3030	Heterocyclic and Medicinal Chemistry	*SIC2018*	3
SIC3031	Electrochemistry	*SIC2016*	3
SIC3032	Environmental Chemistry***	*SIC2022*	3
SIC3033	Natural Products and Biosynthesis	*SIC2018*	3
SIC3034	Organic Synthesis	*SIC2018*	2
SIC3035	Mechanistic Organic Chemistry	*SIC2018*	3
SIC3036	Physical Organic Chemistry	*SIC2018*	3
SIC3037	Bioinorganic Chemistry	*SIC2016*	2
SIC3038	Nuclear Chemistry	*SIC2016*	2
SIC3039	Materials Chemistry	*SIC2016 and SIC2020*	3
SIC3040	Chemometrics***	*SIC2020*	3
SIC3041	Computational Chemistry***	*SIC2020*	3
SIC3042	Colloid Chemistry***	*SIC2020 and SIC2021*	3
(II) ELECTIVE UNIVERSITY COURSES (8 CREDITS) **Student Holistic Empowerment [SHE]** Choose one course from each cluster			
Cluster	**Cluster Title**		**Credits**
Cluster 1	Thinking Matters: Mind and Intellect		2
Cluster 2	Emotional, Physical and Spiritual Intelligence: Heart, Body & Soul. GQX0056 Integrity and Anti-Corruption		2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: I-Technie		2
Cluster 4	Global Issues and Community Sustainability: Making the World a Better Place		2

APPLIED CHEMISTRY PACKAGE

ELECTIVE COURSES (41 CREDITS)

(I) PROGRAMME ELECTIVES or/and MINOR PACKAGE#**
(33 Credit)
Choose from programme courses or/ and Minor Packages that are offered

Course Code	Course Name	Pre-Requisite(s)	Credit
SIC3040	Chemometrics***	*SIC2020*	3
SIC3041	Computational Chemistry***	*SIC2020*	3
SIC3042	Colloid Chemistry***	*SIC2020 and SIC2021*	3
SIC3043	Analytical Chemistry and Instrumentation***	*SIC2022*	3
SIC3044	Industrial Chemistry	*SIC2016*	3
SIC3045	Industrial Polymer Chemistry***	*SIC2020 and SIC2021*	3
SIC3046	Oleochemistry	*SIC2018*	3
SIC3047	Petrochemistry	*SIC2016 and SIC2018*	3
SIC3048	Process Chemistry	*SIC3044*	3
SIC3049	Food Chemistry	*SIC2018*	2
SIC3050	Natural Products and Biotechnological Processes	*SIC2018*	2
SIC3051	Applied Electrochemistry	*SIC2020*	3
SIC3052	Catalysis	*SIC2016*	2
SIC3053	Quality Assurance in Chemical Laboratory	*SIC2022*	2
SIC3054	Environmental Pollution and Waste Management***	*SIC2022*	3
SIC3055	Liquid Crystals	*SIC2020*	2

(II) ELECTIVE UNIVERSITY COURSES (8 CREDITS)
Student Holistic Empowerment [SHE]
Choose one course from each cluster

Cluster	Cluster Title	Credits
Cluster 1	Thinking Matters: Mind and Intellect	2
Cluster 2	Emotional, Physical and Spiritual Intelligence: Heart, Body & Soul. GQX0056 Integrity and Anti-Corruption	2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: I-Technie	2
Cluster 4	Global Issues and Community Sustainability: Making the World a Better Place	2

* For non-Malaysian

** Practical course

*** With practical component

#Minor package

(1) Students must complete at least 18 credits under the same minor package to be displayed on the transcript.
(2) For further information, students can refer to the UMSItS Guide via this link: https://umsitsguide.um.edu.my/

Programme Planning – Group 1
List of Courses According to Semester
Bachelor of Science in Chemistry

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
1	University courses	GIG1012/ GLT1049	Philosophy and Current Issues/ Malay Language Communication*	2	GIG1013	Appreciation of Ethics and Civilisations	2
		GLTxxxx	English Language/ Foreign Language**	2	GLTxxxx	English Language/ Foreign Language**	2
					GIG1003	Basic Entrepreneurship Enculturation	2
					GKA/GKI/ GKK/ GKP/ GKS/GKU 1001	Co-Curriculum	2
	Core courses	SIX1015	Science, Technology & Society	2			
		SIX1016	Statistics	3	SIC1007	Inorganic Chemistry I	3
		SIC1001	Principles of Chemistry	2	SIC1009	Physical Chemistry I	3
		SIC1008	Organic Chemistry I	3	SIC1010	Mathematics in Chemistry	2
		SIC1011	Safety and Basic Laboratory Techniques	3	SIC1012	Laboratory Skills	2
	Elective courses		Student Holistic Empowerment (SHE) Cluster 1: Thinking Matters: Mind & Intellect	2		Student Holistic Empowerment (SHE) Cluster 2: Emotional & Spiritual Intelligence: Heart & Soul	2
	Total Credit			**19**			**20**

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
2	University courses				GKA/GKI/ GKK/GKP/ GKS/GKU 1001	Co-Curriculum	2
	Core courses	SIC2016	Inorganic Chemistry II	3	SIC2022	Basic Analytical Chemistry	3
		SIC2017	Practical of Inorganic Chemistry II	2	SIC2023	Molecular Spectroscopy	3
		SIC2018	Organic Chemistry II	3	SIC2020	Physical Chemistry II	3
		SIC2019	Practical of Organic Chemistry II	2	SIC2021	Practical of Physical Chemistry II	2
		SIC1006	Computer Programming for the Sciences	3	SIC2025	Chemistry and Society	2
		SIC2024	Spectroscopic Methods in Organic Chemistry	2			
	Elective courses		Student Holistic Empowerment (SHE) Cluster 3: Technology/ Artificial Intelligence and Data Analytics: I-technie	2		Student Holistic Empowerment (SHE) Cluster 4: Global Issue and Community Sustainability: Making the World a Better Place	2
	Total Credit			**17**			**17**

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
3	University courses						
	Core courses	SIC3020	Inorganic Chemistry III	2	SIC3022	Organic Chemistry III	2
		SIC3021	Practical of Inorganic Chemistry III	2	SIC3023	Practical of Organic Chemistry III	2
					SIC3024	Physical Chemistry III	2
					SIC3025	Practical of Physical Chemistry III	2
		SIC3027	Research Project (*Progressive*) -OPTION 1	3	SIC3027	Research Project (*Progressive*) -OPTION 1	3
	Elective courses		Programme Elective***	9		Programme Elective***	6
	Total Credit			**16**			**17**

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
4	University courses						
	Core courses	SIC3026	Industrial Training -OPTION 1	8			
	Elective courses					Programme Elective***	18
	Total Credit			**8**			**18**
OVERALL TOTAL CREDIT		**132**					

*For non-Malaysian.
**Student whose native language is English.
***Elective courses should be selected according to the packages below.

Programme Planning – Group 2
List of Courses According to Semester
Bachelor of Science in Chemistry

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
1	University courses	GIG1012/ GLT1049	Philosophy and Current Issues/ Malay Language Communicatio*	2	GIG1013	Appreciation of Ethics and Civilisations	2
		GLTxxxx	English Language/ Foreign Language**	2	GLTxxxx	English Language/ Foreign Language**	2
					GIG1003	Basic Entrepreneurship Enculturation	2
					GKA/GKI/ GKK/ GKP/ GKS/GKU 1001	Co-Curriculum	2
	Core courses	SIX1015	Science, Technology & Society	2	SIX1016	Statistics	3
		SIC1007	Inorganic Chemistry I	3	SIC1001	Principles of Chemistry	2
		SIC1009	Physical Chemistry I	3	SIC1008	Organic Chemistry I	3
		SIC1010	Mathematics in Chemistry	2	SIC1012	Laboratory Skills	2
		SIC1011	Safety and Basic Laboratory Techniques	3			
	Elective courses		Student Holistic Empowerment (SHE) Cluster 1: Thinking Matters: Mind & Intellect	2		Student Holistic Empowerment (SHE) Cluster 2: Emotional & Spiritual Intelligence: Heart & Soul	2
	Total Credit			**19**			**20**

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
2	University courses	GKA/GKI/ GKK/GKP/ GKS/GKU 1001	Co-Curriculum	2			
	Core courses	SIC2022	Basic Analytical Chemistry	3	SIC2016	Inorganic Chemistry II	3
		SIC2023	Molecular Spectroscopy	3	SIC2017	Practical of Inorganic Chemistry II	2
		SIC2020	Physical Chemistry II	3	SIC2018	Organic Chemistry II	3
		SIC2021	Practical of Physical Chemistry II	2	SIC2019	Practical of Organic Chemistry II	2
		SIC2025	Chemistry and Society	2	SIC1006	Computer Programming for the Sciences	3
					SIC2024	Spectroscopic Methods in Organic Chemistry	2
	Elective courses		Student Holistic Empowerment (SHE) Cluster 3: Technology/ Artificial Intelligence and Data Analytics: I-technie	2		Student Holistic Empowerment (SHE) Cluster 4: Global Issue and Community Sustainability: Making the World a Better Place	2
	Total Credit			**17**			**17**

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
3	University courses						
	Core courses	SIC3022	Organic Chemistry III	2	SIC3020	Inorganic Chemistry III	2
		SIC3023	Practical of Organic Chemistry III	2	SIC3021	Practical of Inorganic Chemistry III	2
		SIC3024	Physical Chemistry III	2	SIC3027	Research Project (*Progressive)* -OPTION 2	3
		SIC3025	Practical of Physical Chemistry III	2			
	Elective courses		Programme Elective***	9		Programme Elective***	9
	Total Credit			**17**			**16**

Year	Component	Semester I			Semester II		
		Code	Course	Credit	Code	Course	Credit
4	University courses						
	Core courses	SIC3027	Research Project (*Progressive)* -OPTION 2	3	SIC3026	Industrial Training -OPTION 2	8
	Elective courses		Programme Elective***	15			
	Total Credit			**18**			**8**
OVERALL TOTAL CREDIT		**132**					

*For non-Malaysian.
**Student whose native language is English.
***Elective courses should be selected according to the packages below.

Programme Elective Courses should be selected according to the packages below (Pure Chemistry or Applied Chemistry Packages)
For Minor Package courses offered please refer to UMSItS Guide via this link: https://umsitsguide.um.edu.my/

Programme Elective Courses (33 Credits)

Programme Elective Courses (Pure Chemistry or Applied Chemistry Packages)** or/and Minor Package# (33 Credits)

Choose from Programme Elective Courses or/and Minor Packages that are offered

Pure Chemistry Package		
***Programme Elective Courses (33 Credit)		
Course Code	**Course Name**	**Credit**
SIC3028	Advanced Analytical Chemistry	3
SIC3029	Polymer Chemistry	3
SIC3030	Heterocyclic and Medicinal Chemistry	3
SIC3031	Electrochemistry	3
SIC3032	Environmental Chemistry	3
SIC3033	Natural Products and Biosynthesis	3
SIC3034	Organic Synthesis	2
SIC3035	Mechanistic Organic Chemistry	3
SIC3036	Physical Organic Chemistry	3
SIC3037	Bioinorganic Chemistry	2
SIC3038	Nuclear Chemistry	2
SIC3039	Materials Chemistry	3
SIC3040	Chemometrics	3
SIC3041	Computational Chemistry	3
SIC3042	Colloid Chemistry	3

Applied Chemistry Package		
***Programme Elective Courses (33 Credit)		
Course Code	**Course Name**	**Credit**
SIC3040	Chemometrics	3
SIC3041	Computational Chemistry	3
SIC3042	Colloid Chemistry	3
SIC3043	Analytical Chemistry and Instrumentation	3
SIC3044	Industrial Chemistry	3
SIC3045	Industrial Polymer Chemistry	3
SIC3046	Oleochemistry	3
SIC3047	Petrochemistry	3
SIC3048	Process Chemistry	3
SIC3049	Food Chemistry	2
SIC3050	Natural Products and Biotechnological Processes	2
SIC3051	Applied Electrochemistry	3
SIC3052	Catalysis	2
SIC3053	Quality Assurance in Chemical Laboratory	2
SIC3054	Environmental Pollution and Waste Management	3
SIC3055	Liquid Crystals	2

#Minor package

(1) Students must complete at least 18 credits under the same minor package to be displayed on the transcript.

(2) For further information, students can refer to the UMSItS Guide via this link: https://umsitsguide.um.edu.my/

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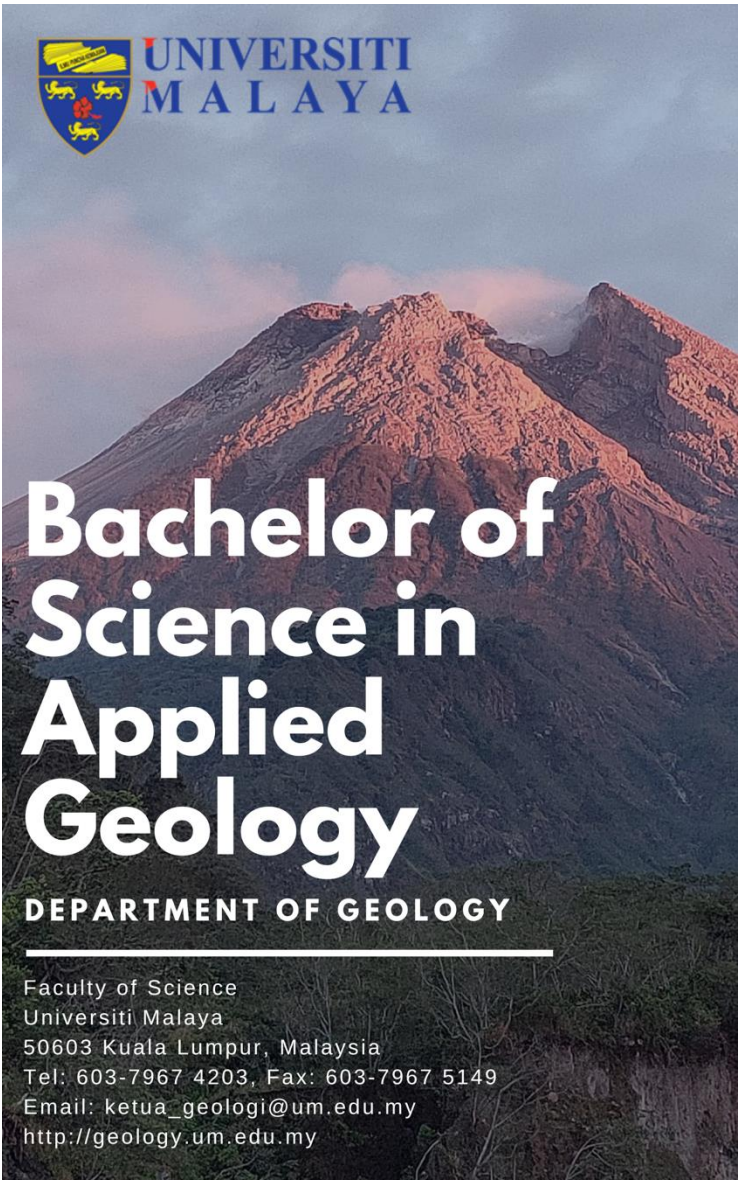

UNIVERSITI MALAYA

Bachelor of Science in Applied Geology

DEPARTMENT OF GEOLOGY

Faculty of Science
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DEPARTMENT OF GEOLOGY

The Department of Geology is the oldest geology department in the country. It was founded in Singapore in 1956 and relocated to Kuala Lumpur in 1960. From its modest beginning, the Department has expanded and evolved into a multidisciplinary department, committed to the development of academic excellence in teaching and research with 14 academic staffs, and 18 supporting staffs. From early on in its history, the Department has been actively engaged in postgraduate research. Master and doctorate graduates have gone on to become leaders in industries, government agencies and universities. Currently there are more than 30 local and foreign postgraduate students in the department. The fields of research being pursued range from fundamental geology to more applied fields such as geophysics, geochemistry, hydrogeology, and petroleum geology. The department also offers MSc. Petroleum Geoscience by coursework every year.

In line with the Department's pursuit of educational excellence, the facilities are continuously being upgraded. In 1998, a new wing was built to house new laboratories and additional lecturer offices. The Department has a computer laboratory, a map laboratory, a library with a comprehensive collection of geological and geophysical books, and a range of modern and sophisticated equipment to aid in our teaching, research, and consultancy work. The Department also houses a Geological Museum showcasing diverse collection of geological items ranging from common rocks and fossils found in Malaysia to tektites and replicas of skulls.

The Department is also the hub for the exchange, discussion, and dissemination of geological knowledge in the country and the region. It houses the Secretariat of the Geological Society of Malaysia (GSM). GSM is a body that actively organizes workshops, seminars, conferences, and fieldworks to promote geology and geophysics both regionally and internationally. The Department also engage with

Institute Geology Malaysia (IGM) to improve professional practice in geology.

Through the academic staff and alumni, the Department have established a good rapport with the petroleum, mining, and engineering industries as well as with other universities (local and foreign). Apart from excellent career opportunities for our graduates, these efforts and contacts have opened avenues for joint research, funding, industrial training and consultancy work for our staff and students.

Latest information about the Department, including research activities and publications of the academic staff can be obtained through the web site: http://geology.um.edu.my

ACADEMIC STAFF

HEAD:

Assoc. Prof. Dr. Meor Hakif Amir Hassan, *BSc, MSc (Mal). PhD (Lond), DIC.*
Sedimentology.

PROFESSOR:

Prof. Dr. Azman Abdul Ghani, *BSc (Mal), PhD (Liverpool).*
Mineralogy, Igneous Petrology.

ASSOCIATE PROFESSOR:

Assoc. Prof. Dr. Ahmad Farid Abu Bakar, *BSc, MSc, PhD (Mal)*. Environmental Geology.
Assoc. Prof. Dr. Khairul Azlan Bin Mustapha, *BSc, MSc, PhD (Mal)*. Petroleum Geology.
Assoc. Prof. Dr. Masatoshi Sone, *BSc (Deakin), PhD (New England)* Palaeontogy, Micropalaeontology & Regional Geology.

SENIOR LECTURER:

Dr. Arindam Chakraborty, *BSc (India), MSc (India), PhD (India)*.
Marine Biology, Marine Micropaleontology, Paleoclimate

Dr. Elanni Md. Affandi, *Bsc (UM), PhD (UM)*.
Urban Geology, Geohazard

Dr. Harry Telajan Anak Linang, *BSc (UofA), MSc (IPGP), PhD (Cambridge)*.
Seismology, Tectonics

Dr. Hijaz Kamal Hasnan, *BEng, MEng (Adelaide). PhD (Mal/ANU),* Petroleum Geology, Digital Rock Physics

Dr. Lin Chin Yik, *BSc (UMS), MSc (UMS). PhD (Cambridge),* Carbonate Sedimentology

Dr. Mohd Talha Anees, *BSc, MSc, Post Graduate Diploma (AMU), PhD (USM).*
Remote Sensing, GIS, Hydrology, Environmental Geology

Dr. Muhammad Hatta Roselee, *BSc, MSc (Mal). PhD (UKM)*.
Igneous Petrology, Geochemistry, Geochronology

Dr. Noer El Hidayah Ismail, *BSc, MSc, PhD (USM).* Geophysics

Dr. Ros Fatihah Hj. Muhammad, *BSc, PhD (Mal).* Geomorphology, Environmental Geology.

BACHELOR OF SCIENCE IN APPLIED GEOLOGY ACADEMIC SESSION 2024/2025 (134 CREDITS)			
1. UNIVERSITY COURSES (14 CREDITS)			
COURSE CODE	**COURSE NAME**		**CREDIT**
GIG1012/ GLT1049	Philosophy and Current Issues/ Malay Language Communication (only for international students)		2
GIG1013	Appreciation of Ethics and Civilisations		2
GIG1003	Basic Entrepreneurship Culture		2
GLT[XXXX]	English Language		4
GKA/GKI/GKK /GKP/GKS/ GKU1001	Co-Curriculum		4
2. CORE PROGRAMME COURSES (80 CREDITS)			
(I) FACULTY CORE COURSES (8 CREDITS) [TF]			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDIT**
SIC1006	Computer Programming for the Sciences		3
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3
(II) PROGRAMME CORE COURSES (72 CREDITS) [TP]			
LEVEL 1 (14 CREDITS)			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDIT**
SII1001	Introduction to the Earth		2
SII1002	Earth surface processes		2
SII1003	Geological Structures and Maps		3
SII1004	Mineralogy		3
SII1005	Fundamental of Field Geology		2
SII1006	Safety and Geology Code of Practice		2
LEVEL 2 (36 CREDITS)			
SII2002	Applied Geology Field Course	*SII1005*	8
SII2003	Structural Geology	*SII1003*	3
SII2004	Sedimentology	*SII1002*	4
SII2005	Igneous and Metamorphic Petrology	*SII1004*	3
SII2006	Paleontology	*SII1001 & SII1002*	3

SII2007	Introduction to Geophysics	*SII1001 & SII1002*	3
SII2008	Geology and Community	*SII1001 & SII1002*	3
SII2009	Geochemistry	*SII1001 & SII1004*	3
SII2010	GIS Applications in Geosciences	*SII1003*	3
SII2011	Geology Laboratory Analytical Techniques	*SII1004*	3
LEVEL 3 (22 CREDITS)			
SII3009	Mineral Resources	*SII1004*	3
SII3010	Geology Research Project	*SII2002 & SII2011*	8
SII3011	Geology of Malaysia	*SII1001*	3
SII3012	Industrial Attachment	*SII2002 & SII2011*	8
3. ELECTIVE COURSES (40 CREDITS)			
(I) ELECTIVE STUDENT HOLISTIC EMPOWERMENT [SHE] (8 CREDITS) *** ONE course MUST be taken from each cluster**			
CLUSTER			**CREDIT**
Cluster 1	Thinking Matters: Mind & Intelect		2
Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul. GQX0056 Integrity and Anti-Corruption Course		2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: I-technie		2
Cluster 4	Global Issue and Community Sustainability: Making the World A Better Place		2
(II) PROGRAMME ELECTIVE COURSES or/and MINOR PACKAGE ** (32 CREDITS) Choose from all elective courses or/and Minor Packages that are offered			
LEVEL 2			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDIT**
SII2012	Geological Data Analysis	*SIX1016*	3
SII2013	Marine Geology	*SII1002*	2
SII2014	Karst Geomorphology and Conservations	*SII1002*	2
SII2015	Climate Change and Adaptation	*SII1002*	3
SII2016	Engineering Geology	*SII1003*	3
SII2017	Earth Water Resources	*SII1002*	3
SII2018	Environmental Geology	*SII1001*	3

LEVEL 3			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDIT**
SII3013	Advanced Geophysics	*SII2007*	3
SII3014	Geohazard	*SII1001*	3
SII3015	Quaternary Geology	*SII1002*	3
SII3016	Stratigraphic Methods	*SII2004*	3
SII3017	Geology of South East Asia	*SII1001*	2
SII3018	Petroleum Geology	*SII2004*	4
SII3019	Organic Petrology	*SII2004*	3
SII3020	Industrial Minerals	*SII3009*	2
SII3021	Tectonics and Earth History	*SII2006*	2
SII3022	Mineral and Mining Exploration	*SII2009*	3
SII3023	Geological Site Investigation	SII2016	2
SII3024	Unconventional Oil and Gas Resources	SII2004	3
SIM1001	Basic Mathematics		4
SIM1002	Calculus I		4

** Minor package

(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.

(2) For further information, student can refer to UMSItS Guide via this link : https://umsitsguide.um.edu.my/

PROGRAM EDUCATION OBJECTIVE

The education objectives of B.Sc. in Applied Geology program are to produce graduates who are:

1. Professional in the practice of geology and related fields.
2. Involved in lifelong learning activities for the development of personal knowledge whether in the academic or industrial field.
3. Contribute to the development and well-being of society.

PROGRAM LEARNING OUTCOME

At the end of the program, the graduate with a B.Sc. in Applied Geology degree will be able to:

1. Acquire and apply basic geological concepts and principles in geological practice.
2. Demonstrate intellectuality and professionalism in the application of knowledge in solving geological problems.
3. Use appropriate methods and practical skills in the planning and implementation of geological projects.
4. Manage and deliver information clearly and effectively, orally and in written form, as well as be a responsible and productive team member.
5. Use digital technology and mathematical knowledge to improve the quality of geological practice.
6. Demonstrate leadership, independence and responsibility in the workplace and in the classroom.
7. Engage effectively in community activities or explore entrepeneurial opportunities.
8. Ethical and maintain integrity in geological practice.

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE IN APPLIED GEOLOGY

COMPONENT	YEAR 1						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE NAME	CREDIT	CODE	COURSE NAME	CREDIT	
University courses	GIG1003	Basic Entrepenuership Culture	2	GIG1012/ GLT1049	Philosophy and Current Issues/ Malay Language Communication*	2	12
	GKA/ GKI/ GKK/ GKP/ GKS/ GKU1001	Co-curriculum	2	GKA/ GKI/ GKK/ GKP/ GKS/ GKU1001	Co-curriculum	2	
	GLTxxx	English Language	2	GLTxxx	English Language	2	
Core courses	SIX1016	Statistics	3	SIX1015	Science, Technology and Society	2	22
	SII1001	Introduction to the Earth	2	SIC1006	Computer Programming for the Sciences	3	
	SII1002	Earth Surface Processes	2	SII1004	Mineralogy	3	
	SII1003	Geological Structures and Maps	3	SII1005	Fundamental of Field Geology	2	
				SII1006	Safety and Geology Code of Practice	2	
Elective Courses		Student Holistic Empowerment (SHE) Cluster 2: Emotional & Spiritual Intelligence: Heart & Soul GQX0056 Integrity and Anti-Corruption Course	2				2
TOTAL CREDIT			18			18	36

COMPONENT	YEAR 2						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE NAME	CREDIT	CODE	COURSE NAME	CREDIT	
University courses	GIG1013	Appreciation of Ethics and Civilasations	**2**				**2**
Core courses	SII2002	Applied Geology Field Course	**4**	SII2002	Applied Geology Field Course	**4**	**36**
	SII2003	Structural Geology	**3**	SII2006	Paleontology	**3**	
	SII2004	Sedimentology	**4**	SII2008	Geology and Community	**3**	
	SII2005	Igneous and Metamorphic Petrology	**3**	SII2009	Geochemistry	**3**	
	SII2007	Introduction to Geophysics	**3**	SII2010	GIS Applications in Geosciences	**3**	
				SII2011	Geology Laboratory Analytical Techniques	**3**	
Elective Courses							
TOTAL CREDIT			**19**			**19**	**38**

COMPONENT	YEAR 3						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE NAME	CREDIT	CODE	COURSE NAME	CREDIT	
University courses							
Core courses	SII3009	Mineral Resources	**3**	SII3010	Geology Research Project	**4**	**10**
	SII3011	Geology of Malaysia	**3**				
Elective Courses		Student Holistic Empowerment (SHE) Cluster 1: Thinking Matters: Mind & Intellect	**2**		Student Holistic Empowerment (SHE) Cluster 3: Technology/ Artificial Intelligence and Data Analytics: I-technie	**2**	**4**
		Program Electives	**10**		Program Electives	**12**	**22**
TOTAL CREDIT			**18**			**18**	**36**

COMPONENT	YEAR 4						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE NAME	CREDIT	CODE	COURSE NAME	CREDIT	
University courses							
Core courses	SII3010	Geology Research Project	**4**	SII3012	Industrial Attachment	**8**	**12**
Elective Courses		Student Holistic Empowerment (SHE) Cluster 4: Global Issue and Community Sustainability: Making the World a Better Place	**2**				
		Program Electives	**10**				**10**
TOTAL CREDIT			**16**			**8**	**24**

COURSE SYNOPSIS

LEVEL 1 COURSES

SII1001 INTRODUCTION TO THE EARTH

Origins and structure of the Earth. Mineral and rocks. Rock cycle and geological time. Plate tectonics as a force in the formation of earthquakes, volcanoes, mountain ranges and continental drift.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII1002 EARTH SURFACE PROCESSES

Processes that change the earth's surface. Weathering. Erosion and deposition by natural agents. Rock cycle. Diagenesis and sedimentary rocks. Principles of stratigraphy, correlation, and facies.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII1003 GEOLOGICAL STRUCTURES AND MAPS

The principles of structural geology and geological map interpretation. Nature and morphology of geologic structures, including folds, faults, foliations, and igneous bodies. Description, identification, and interpretation of structures on geologic maps. Construction of cross-sections and interpretations of geologic history

Assessment Methods:
Continuous assessment: 60%
Examination : 40%

SII1004 MINERALOGY

Examination of mineral hand specimens. The study of primary characteristics of minerals such as crystal systems, crystal habits, hardness, lustre, colour etc. The use of petrographic microscope for the identification of minerals based on optical properties. The course introduces some of the concepts used in crystallography, and some of the chemistry behind mineralogy. Students are also introduced to the rock forming minerals in a systematic way and learn to identify them using the petrographic microscope and standard reference texts.

Assessment Methods:
Continuous assessment: 100%

SII1005 FUNDAMENTAL OF FIELD GEOLOGY

Introduction to geological fieldwork, field equipment and basic field safety. Field methods and techniques used in geological mapping and data acquisition. Preparation of geological map, cross-sections, and report.

Assessment Methods:
Continuous assessment: 100%

SII1006 SAFETY AND GEOLOGY CODE OF PRACTICE

This course is designed to expose students to the importance of ethics and safety in the practice of geology. Students will be introduced to the concept of geoethics, the responsibilities of geologists to the public, and ethics in research and professional practice. This course also covers safety in the practice of geology including in the field, laboratory and workplace.

Assessment Methods:
Continuous assessment: 100%

LEVEL 2 COURSES

SII2002 APPLIED GEOLOGY FIELD COURSE

Principles and techniques of geological fieldwork and field data acquisition. Preparing geological maps using manual and digital methods. The course involves four weeks of fieldwork covering general geological mapping, structural geology, sedimentology, and economic geology.

Assessment Methods:
Continuous assessment: 100%

SII2003 STRUCTURAL GEOLOGY

Principles of deformation. Morphology and classification of geological structures. Mechanism of faulting, folding and related structures. Stereographic projections of geological data. Description, interpretation and analysis of geological structures and structural geology maps.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2004 SEDIMENTOLOGY

This course touches on methods of describing and classifying sediments and sedimentary rocks, including siliciclastic, carbonates etc. This course also discusses the origin and processes of formation, transportation and deposition of sediments, and the process of transformation of sediments into sedimentary rocks via diagenesis. The method of interpretation of interpreting past depositional history using facies analysis is also taught.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2005 IGNEOUS AND METAMORPHIC PETROLOGY

Classification of igneous rocks. Magma evolution and petrogenetic processes. Diversity of igneous rock. Definition, Types of metamorphism and their limitations. Depth zones, facies, and reaction in metamorphism. Microscope study of Igneous and metamorphic rock.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2006 PALEONTOLOGY

Study of invertebrate macrofossils, trace fossils, and plant fossils in terms of morphology, taxonomy, palaeoecology, biostratigraphy, evolution and palaeobiogeography.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2007 INTRODUCTION TO GEOPHYSICS

Theory of geophysical methods (seismic gravity magnetic and electrical). Data acquisition and reduction of data. Problems in data acquisition and reduction. Sources of geophysical anomalies. Analysis and interpretation of anomalies and modeling. Application in exploration and industries.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2008 GEOLOGY AND COMMUNITY

This course exposes students to community service related to geological field. Students need to plan and implement community engagement programs related to geology in groups. Students are also

required to create a reflection journal to record self-transformation before, during and after the community engagement program as well as group reports and presentations based on experiences with the communities.

Assessment Methods:
Continuous assessment: 100%

SII2009 GEOCHEMISTRY

The course begins with a general overview of geochemistry, and a review of concepts the student should have come across already, such as cosmology, nuclear reactions, and calculations involving atomic mass, equilibrium constants, and reactions involving minerals. Then, two and three dimensional chemographies are introduced, together with their association with phase diagrams, and their uses within metamorphic petrology and understanding weathering processes. Radiometric dating, and the use of stable isotopes conclude the course.

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Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2010 GIS APPLICATIONS IN GEOSCIENCES

Fundamentals of GIS theory and data formats. Importance of map projection, scale, resolution, accuracy, and precision. Techniques in preparing, locating, acquiring, inputting, and translating geological data into a GIS system. Web resources for acquiring GIS data and tools. Visualization, query, and analysis of geospatial data.

Assessment Methods:
Continuous assessment: 100%

SII2011 GEOLOGY LABORATORY ANALYTICAL TECHNIQUES

This is a practical course teaching chemical analysis technique which are widely used to solve problems in geology and hydrogeology. Students will use up-to-date scientific instruments and techniques such as X-Ray Diffraction (XRD), X-Ray Fluorescence (XRF), Inductively Coupled Plasma (ICP) and Gas Chromatography-Mass Spectrometry (GCMS) to conduct analyses on a range of samples often encountered in geochemistry, hydrogeology, and organic geochemistry.

Assessment Methods:
Continuous assessment: 100%

SII2012 GEOLOGICAL DATA ANALYSIS

In this course, student will learn how to use the different method of data analysis, and how to use ICT, graphics software and programming software to analyze geological and geoscience data.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2013 MARINE GEOLOGY

Many of the processes that impact the Earth system occur completely or partly below the oceans. Some of these processes act on geologic time scales, affecting mountain belts and their shapes, forming ore deposits, changing Earth's climate, and depositing rock units that we use as aquifer or that trap hydrocarbons. Other processes act more quickly, causing earthquakes and tsunamis, or possibly affecting Earth's climate on the timescale of a human lifespan.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2014 KARST GEOMORPHOLOGY AND CONSERVATIONS

Karst characteristics from scientific and management perspective. Karst geomorphology and lithological control that gives karst landscape its specific characteristics including the global distribution. Issues pertaining karst area such as sinkholes and rockfalls, and engineering problems associated with karst are emphasized. Geochemistry of karst waters are studied in conjunction with environmental issues. Karst landscape and deposit are used to examine for the evidence of environmental and climatic change. Case studies are used throughout the course and emphasis is placed on the challenges faced by people living in karst areas and conservation value of karst landscapes.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2015 CLIMATE CHANGE AND ADAPTATION

This course provides a fundamental insight on our global climate systems. The concept of climate models and the role of Earth's carbon

cycle on climate will be introduce. This course also explores why climate change adaptation is important to human development, case study of Bangladesh, Europe US and Africa will be discussed. The course ends with discussing the consequences of climate change to our society, and relates the linkage between the world's economy, politics and ethics so that the students may appreciate and have a good knowledge/update on the urgency of solving the current and future climate issues.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2016 ENGINEERING GEOLOGY

Engineering geological characterization of earth materials and masses. Unified soil classification system. Compaction and consolidation of soil. Shear strength of soil. Physical and mechanical properties of rock materials. Description of rock mass. Weathering and quantitative description of discontinuities. Rock slope stability. Geomechanics classification of rock masses. Engineering geological characterization of earth materials and masses. Unified soil classification system. Compaction and consolidation of soil. Shear strength of soil. Physical and mechanical properties of rock materials. Description of rock mass. Weathering and quantitative description of discontinuities. Rock slope stability. Geomechanics classification of rock masses.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII2017 EARTH WATER RESOURCES

This subject presents an overview of current understanding of the earth water resources that circle around the interaction of ground water and surface water, in terms of both quantity and quality, as applied to a variety of geological condition. It is apparent that developments of water resources combined with water pollution affect the quantity and quality of the other. Thus, effective water management requires a clear understanding of the linkages between ground water and surface water as it applies to any given hydrologic setting.

Assessment Methods:
Continuous Assessment: 100%

SII2018 ENVIRONMENTAL GEOLOGY

Geological features associated with man's physical environment, including landforms as well as internal and external geological processes. Impacts of man's activities and structures on the dynamic earth. Environmental Impact Assessments. Exposure to students on aspects of sampling and analysis of environmental geological samples.

Assessment Methods:
Continuous assessment: 100%

LEVEL 3 COURSES

SII3009 MINERAL RESOURCES

Evolution of important ore deposits and geological environment including lithology, stratigraphy and tectonic. Study of ore minerals. Usage and principles of reflectance microscope. Ore mineral identification (optical and physical properties). Interpretation of paragenesis with certain texture.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3010 GEOLOGY RESEARCH PROJECT

Some 3 weeks of fieldwork in a specified area followed by laboratory studies and submission of a report containing a geological map and cross-section as well as relevant illustrations and literature reviews. Prior to fieldwork, a research proposal must be submitted and approved. In some cases, there can be laboratory-based studies on a specific geological problem or topic. Results of the field and/or laboratory studies and interpretation will be presented at an initial viva and seminar, as well as defended at a final viva.

Assessment Methods:
Continuous assessment: 100%

SII3011 GEOLOGY OF MALAYSIA

The geology of Peninsular Malaysia, Sarawak and Sabah including the stratigraphy, igneous and metamorphic events, structure, tectonics,

geologic history, and economic resources of each region.
Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3012 INDUSTRIAL ATTACHMENT

Student will be placed in a geology or related industry of their choice for a duration of 16 weeks. Students will be exposed to everyday working activities as instructed by their supervisor(s) at the industry. Students are required to record their daily activities in a logbook, prepare a presentation and a report for evaluation. The training program will be briefed by the industrial training program supervisor.

Assessment Methods:
Continuous assessment: 100%

SII3013 ADVANCED GEOPHYSICS

Theory of geophysical methods (seismic reflection, gravity and borehole geophysics). Data acquisition and reduction of data. Problems in data acquisition and reduction. Sources of geophysical anomalies. Analysis and interpretation of anomalies and modeling. Application in exploration and industries.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3014 GEOHAZARDS

Perspectives on natural disasters such as earthquakes, volcanic activity, tsunamis, landslides, floods and sinking. Steps on how to identify and assess the effects of geological disasters will be discussed. Mitigation measures to reduce the impact of disasters will also be discussed.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3015 QUATERNARY GEOLOGY

Climatic and sea-level changes during the Quaternary Period. Classical models of Quaternary geology and processes that form the landscape. Quaternary record in oceans and oxygen isotope stratigraphy. Classification and dating of Quaternary sediments. Practical classes on identification of Holocene landforms. Interpretation of borehole logs to determine the stratigraphy and physical

features of Quaternary sediments in Malaysia.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3016 STRATIGRAPHIC METHODS

This course teaches the principles of chronostratigraphy, seismic stratigraphy and sequence stratigraphy and its application in interpreting, correlating, and mapping subsurface data. Through practical exercises, the students are exposed to the applications of Walther's Law, well log interpretation, well log correlation and seismic interpretation.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3017 GEOLOGY OF SOUTH EAST ASIA

Systematic learning of South East Asia regional geology, distribution of geological resources, tectonic history through geological time, and the formation of today's South East Asia.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3018 PETROLEUM GEOLOGY

Description and discussion of the different elements and processes that constitute the petroleum system. The petroleum industry. Sedimentary basins and depositional systems. Characteristics of source rocks and reservoir rocks. Subsurface mapping, methods, tools and petrophysical evaluation in hydrocarbon exploration & production. Main hydrocarbon provinces and selected case studies.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3019 ORGANIC PETROLOGY

Study of organic matter from the perspective of sedimentology and petroleum geology which include coal formation, petrographic composition of coal, origin of macerals, correlation of coal facies with depositional environment, coalification process, vitrinite reflectance analysis and kerogen typing. This also includes studies on visual kerogen typing. Findings of this course will be used for applications in

petroleum exploration and coal-related industries.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3020 INDUSTRIAL MINERALS

Knowledge and awareness about the important and development of various industrial mineral and other related mineral-based industries including clay mineral. Broad aspects of industrial mineral in term of geological occurrence, distribution, marketing, economic and application technology.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3021 TECTONICS AND EARTH HISTORY

Introduction to the theory of Plate Tectonic. Extensional, compressional and strike-slip tectonic regimes and their associated regional structures.
Evolution of Earth's atmosphere, lithosphere, biosphere, and hydrosphere. Introduction to Archean, Proterozoic and Phanerozoic sequences, and their inferences about the conditions of Earth. The changing paleogeography and the events that occurred during the respective geologic times. The relationship between life and the sediments, the oceans, and the atmosphere of the planet.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3022 MINERAL AND MINING EXPLORATION

In this course, various types of mineral and mining exploration techniques are introduced. The course also covers geochemical prospecting, mining policy and act. Industrial applications are illustrated using case studies.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3023 GEOLOGICAL SITE INVESTIGATION

Description, classification and characteristics of rock material, rock mass and aggregates. Methods of engineering geological site investigation. Geological terrain mapping and analysis. Site investigations for various engineering structures and works.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

SII3024 UNCONVENTIONAL OIL AND GAS RESOURCES

Unconventional resources reside in tight formations and are of lower reservoir quality and more difficult from which to extract hydrocarbons. Unconventional resources represent a variety of geological formations, including tight gas sands, gas shales, heavy oil sands, coalbed methane, oil shales, and gas hydrates.

Assessment Methods:
Continuous assessment: 40%
Examination : 60%

HEAD OF DEPARTMENT

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PROGRAMME COORDINATOR

Dr. Lin Chin Yik
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PANEL OF ACADEMIC ADVISOR

BACHELOR OF SCIENCE IN APPLIED GEOLOGY

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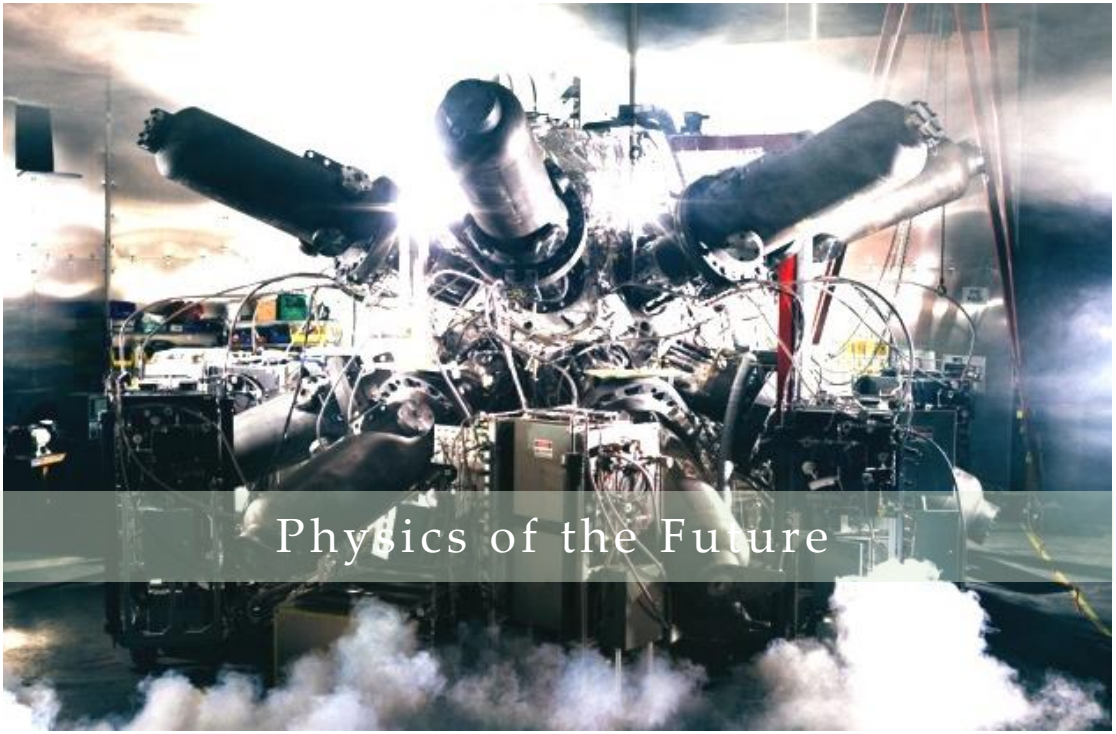
DEPARTMENT OF PHYSICS



DEPARTMENT OF PHYSICS
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DEPARTMENT OF PHYSICS

The Department of Physics in the Faculty of Science, Universiti Malaya was established in 1961. From the beginning, education in Physics was meant to be a union of theoretical and practical aspects. The Department of Physics, under the current leadership of the Head of Department, Prof. Dr. Zamri bin Zainal Abidin, endeavours to impart a thorough knowledge of the fundamental principles of Physics, as mathematically and experimentally demonstrated to the younger generation. Academics and researchers of the Department of Physics are conducting internationally relevant and competitive research, they also collaborate on joint projects with the industry to contribute to the development of knowledge and innovation-based economy, as well as other components to strengthen multidisciplinary and inter-disciplinary research. Their scientific work is connected with innovative teaching techniques, thus providing a creative and stimulating environment for the education of future generations of physicists.

The Department offers a Bachelor of Science in Physics Program. Our academics are committed to the flexible delivery of learning and teaching methods. Depending on the course, students will enjoy a variety of teaching modes, such as tutorials, problem-based learning, online learning, practical experience and laboratory work. At level three, students will also undergo industrial training and complete a final year project to strengthen the knowledge and skills obtained and adapt to the ever-advancing knowledge in science and technology.

The Department offers graduate study leading to the Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D.). Details are available in the Graduate Program Guidebook of Faculty of Science. Students who graduate with the Bachelor of Science degree from the Department of Physics are encouraged to pursue their studies to the higher degree levels in the field of Physics or other related fields.

Research facilities determine how nature can be understood. The Department of Physics has a centralised facilities laboratory to support various research activities. Major facilities include TEM, FE-SEM, SEM-EDX, XRD, AFM, FT-IR, PL, TLD Reader, OMA, ^{60}Co irradiator and HpGe Gamma spectrometer, TGA, DSC, DMA, UV-VIS-NIR Spectrometer, Field Emission Auger Microprobe, Flame Hydrolysis Deposition system, Mask Aligner, 1 m grazing incidence Spectrometer, DC sputtering system etc.

ACADEMIC STAFF DIRECTORY

HEAD OF DEPARTMENT:
Prof. Dr. Zamri Zainal Abidin,
PhD(Manc.),MSc(UM), BSc(UM) (Astrophysics, Cosmology, Radio Astronomy)

DISTINGUISHED PROFESSOR:
Datuk Harith Ahmad,
PhD(Wales), MSc(Wales), BSc (UM), FASc (Photonics)

EMERITUS PROFESSORS:
Lee Sing,
PhD(ANU), MSc(UM), BSc(UM) (Plasma Physics)

Wong Chiow San,
PhD(UM), MSc(UM), BSc(UM) (Plasma Devices and Applications)

PROFESSORS:
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PhD(UM), BSc (UM),
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PhD(UM), MTech (Mat. Sc) (UM), BSc (UM), FASc, FRSC, CChem, FMIC, FIMM, FMSA (Polymer Electrolytes, Advanced Materials)

Ramesh Kasi,
PhD(UM), MS(ANNA), BE(ANNAMALAI) (Corrosion coatings, antifouling coatings, polymer electrolytes)

Raymond Ooi Chong Heng,
PhD (Konstanz), MEng(NTU), BSc(USM) (Quantum and Nonlinear Optics, Ultrafast Laser Spectroscopy & Microscopy, Photonic Materials)

Sithi Vinayakam Muniandy,
DPhil(Oxford), MSc(UKM), BSc(Hons)(UKM), (Statistical Physics, Quantum Dynamics, Physics of Information)

Siti Rohana Majid,
PhD(UM), BSc(UM) (Polymer Electrolytes, Supercapacitors, Batteries, Electrochemical devices, Advanced Materials)

Wan Haliza Abd. Majid,
PhD(Sheffield), MSc(UM), BSc(Aberystwyth), FIPM, (Low Dimensional Materials, Organic Electronics, Advanced Materials)

Vengadesh Periasamy,
PhD(UM), MSc(UM), BSc(UM) DNA Electronics, Langmuir-Blodgett, Biophotovoltaics(BPV)

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PhD(UM), MSc(UM), BSc(UM) (Plasma Physics and Technology, Parallel Processes and Innovative Technology)

Zurina Osman,
PhD(UM), BSc(UM) (Advanced Materials, Polymeric Materials, Battery)

ASSOCIATE PROFESSORS:
Ahmad Shuhaimi Abu Bakar,
DEng(NITech, Japan), MEng(NITech, Japan), BEng(NITech, Japan) (III-V Nitride Semiconductors, Optoelectronics Fabrication)

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PhD (Australia), MSc(UM), BSc(UPM) (Organic & Inorganic Semiconductors, Organic Electronic Devices, Optical & Electronic Materials)

Goh Boon Tong,
PhD(UM), MSc(UM), BSc(UM) (Semiconductor Physics, Inorganic Nanomaterials, Optical and x-ray Spectroscopies)

Mohd Hamdi Bin Ali,
PhD(UM), BSc(UM) (Polymer Electrolytes, Electrochemical Devices)

Siti Fairus Abdul Sani,
PhD (Surrey), BSc (Surrey) (Radiation and Medical Physics, Radiation Detection and Measurement, Applied Nuclear and Radiation Physics)

Thamil Selvi Velayutham,
PhD(UM), MSc(UM), BSc(UM) (Material Science, Functional Materials)

Woo Haw Jiunn,
PhD(UM), MSc(UM), BSc(UM) (Polymer Electrolytes, Batteries, Solid State Ionics, Relaxation Behaviours)

Woon Kai Lin,
PhD(Hull), BSc(Hull) (Carbon based electronics machine learning, molecular dynamics, quantum chemical calculation, Applied Physics)

Zul Hazrin Zainal Abidin,
PhD(UM), BSc(UM) (Advanced Material, Coatings Technology)

SENIOR LECTURERS:

Amirul Syafiq Abdul Jaafar,
PhD(UM), MSc(UKM), BSc(UKM) (Nano-Materials, Nanotechnology, Polymer Materials)

Chiu Wee Siong,
PhD(Nottingham), MSc(UKM), BSc(UKM) (Magnetic Nano-materials, Semiconductor Photocatalysis, Materials Characterization)

Izlina Supaat
PhD (UM), MSc (UM), BSc (UM) (Advanced Materials, Biodegradable Materials)

Juan Carlos Algaba
PhD(Cork), BSc(Valencia) (Radio Interferometric Observations of Active Galactic Nuclei)

Lim Lian Kuang,
PhD(UM), MSc(UM), BSc(UM) (Plasma Physics and Technology)

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PhD(Southampton), MSc(London), BSc(London) (Optoelectronics, Nonlinear Fiber Optics, Photonics)

Nazhatulshima Ahmad,
PhD(UM), MSc(UM), BSc(UM) (Stellar Astrophysics, Optical Instrumentation Astronomy)

Norazriena Yusoff
PhD(UM), MSc(UM), BSc(UM) (Electrochemical Materials, Nano-matreials, Photonics Materials)

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Norhasliza Yusof,
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LECTURER:

Helen Petrakou
PhD, MSc (Demokritos, Greece), BSc (Patras) (Solar physics, Space weather, Experimental particle physics beyond the Standard Model)

DEGREE PROGRAM

The Bachelor of Science in Physics Program consists of three levels: Introductory, Intermediate and Advanced. The program starts with introductory courses in Physics, while the Intermediate level builds strong fundamentals in Physics through courses such as Mechanics, Quantum Mechanics, Electromagnetism, Mathematical Methods, Statistical Physics, Optics, Numerical and Computation Methods etc. At the Advanced level, students choose ten elective courses from at least seventeen electives of specialised fields. Eight focus fields offer various respective elective courses. These are Plasma Physics, Laser and Optoelectronics, Semiconductor Physics, Nuclear Physics and Elementary Particle Physics, Space Physics, Radiation Physics, Physics of Materials and Electronics. Students must carry out a final-

year project in any of these fields. Industrial training is also a compulsory course.

AREAS OF RESEARCH

There are six research centres in the Department of Physics

1 Centre for Theoretical Physics (CTP)
2 Low Dimensional Materials Research Centre (LDMRC)
3 Centre For Ionics University of Malaya (CIUM)
4 Plasma Technology Research Centre (PTRC)

and fifteen core areas:

1. Applied Materials
2. Solid-State Physics
3. Microprocessor and Computational Physics
4. Theoretical Physics
5. Elementary Particle Physics
6. Corrosion and Coatings
7. Magnetic Devices and Instrumentation
8. Applied Optics and High Temperature Density Physics
9. Materials Science and Polymer Physics
10. Applied Radiation
11. Radio astronomy
12. Optical Astronomy
13. Nuclear Physics
14. Nuclear Astrophysics
15. Stellar Astrophysics

Research facilities determine how nature can be understood. The Department of Physics has a laboratory for centralised facilities to support various research activities. Major facilities include TEM, FE-SEM, SEM-EDX, XRD, AFM, FT-IR, PL, TLD Reader, OMA, Co-60 irradiator and HPGe Gamma spectrometer, TGA, DSC, DMA, UV-VIS-NIR Spectrometer, Field Emission Auger Microprobe, Flame Hydrolysis Deposition system, Mask Aligner, 1 m grazing incidence Spectrometer, DC sputtering system etc.

Other research facilities available in the Department include high-speed diagnostic systems such as streak cameras, fast digital oscilloscopes, spectrum analyzers, thin film preparation systems, clean room and gas handling facilities, high-power laser, picosecond

laser, high voltage and high current discharge systems, rf ionization plasma sources, pulsed neutron source, high dose radiation source and materials testing laboratory.

Research topics currently active in the Physics Department include:

1. Studies on polymer electrolytes for lithium air proton batteries.
2. Studies on alkaline solid polymer electrolyte and mechanically alloyed polycrystalline Mg_2Ni for metal hydride-air batteries.
3. Studies on silicone-acrylic paints.
4. Fast pulsed capillary discharge as coherent XUV and soft X-ray source.
5. Digital holography and speckle pattern interferometry.
6. Development and applications of vacuum UV excimer laser and high-power industrial CO_2 laser systems.
7. Development of nano-ribbons as thermoluminescence dosimeters.
8. Use of Ge-doped optical fibre as radiation dosimeter.
9. Study of naturally occurring and technically enhanced naturally occurring radioactive materials.
10. Particle production from high-energy electron–proton collision (ZEUS collaboration at the HERA accelerator in DESY, Germany).
11. Study on high Q^2 refraction, resonance and decay of particles.
12. Mechanical studies of polymer based on polyurethane.
13. Design and characterization of super-capacitors.
14. Studies on composite materials.
15. Fabrication of fused couplers, fibre Bragg gratings.
16. Developing optical fibre preform and planar waveguides devices.
17. C-band and L-band erbium-doped fibre amplifiers.
18. Plasma focus as the pulsed radiation source.
19. Pulsed exploding wire for syntheses of nanoparticles.
20. RF ICP and AC capacitively coupled plasma sources and applications.
21. Electronic and electro-optical properties of silicon and carbon-based materials.
22. Organic light emitting device.
23. Solar devices based on organic semiconducting materials.
24. Stellar Astrophysics of Emission line stars.
25. Visibility study of a young crescent moon.
26. Nuclear reaction rates in astrophysics.
27. Condensed matter physics study of glasses.
28. Stellar and neutrino astrophysics.
29. Experimental Fabrication Techniques in Materials Science.
30. High power ion beam and X-ray source and their application.

31. Design and implementation of neuron networks.
32. Intelligent circuit.
33. IT usage and physics education.
34. Vacuum spark discharge as a EUV source for next-generation lithography.
35. Complex dynamics in dusty plasmas.
36. Anomalous transports in disordered materials.
37. Transports phenomena in nanostructures.
38. Quantum Brownian motion.
39. Stochastic field theories using fractional calculus.
40. Description of electroweak interactions of hadrons.
41. Transport mechanism, spectroscopic and morphological studies of gel polymer electrolytes.
42. Studies of ion-conducting polymers.
43. Structural and electrical characterization of Langmuir-Blodgett organic thin films of photosynthetic biomaterials (PBMs) reconstituted into “artificial membranes”.
44. Development of biomaterials-based nano-gaps, nano-patterning and device fabrication.
45. Algae-derived biophotovoltaic studies.
46. Hierarchical nanostructured metal oxide dye-sensitized solar cells.
47. Low defect density pristine graphene.
48. Graphene/metal oxide nanocomposites for solar energy conversion.
49. Magnetic properties of graphene.
50. Construction of noise measurement system for magnetic thin film samples.
51. Description of Electroweak Interactions of Hadrons.
52. Epitaxial growth of III-V nitride-based semiconductors and fabrications of nano-electronic devices.
53. Gravitational field around Galaxies, Stars and Planets with Elliptical shape.
54. Femtosecond Laser Science.
55. DNA electronics research to enable detection of DNA base pairs conductivity to enable genomic sequencing, detection of blood borne pathogens etc.
56. Preparation of graphene thin film for application as anodes for fuel cells and as transparent conductive film using the Langmuir-Blodgett method.
57. Research into the antipathogenic/anticancer properties of riboflavin.
58. Preparation of inorganic nanoparticles (Ag, Au etc.) through the normal and green synthesis process and their antimicrobial/anticancer properties.

59. Biophotovoltaic (BPV) fuel cell research in the production of green energy.

JOB OPPORTUNITIES

Courses offered in the Department of Physics, Universiti Malaya are suited for those who wish to be scientists and professional technologists in research institutions and industries. Physicists are in high demand, especially those trained in new and advanced materials, device fabrication, nano-technology, testing and measurements. Today's industrial sector and research institutions need physicists who can integrate new and advanced technology into existing systems. Physics graduates are highly sought after in the electronics industries, space industry, computer and information technology, telecommunication, and various electrical and mechanical manufacturing industries. They often serve as materials process engineers, quality control engineers in the production division or researchers in the division of research and development (R&D). Many Physics graduates have also made excellent marketing and sales executives for modern, sophisticated scientific equipment.

Other opportunities include those in the medical field. Laser technology, x-ray, NMR, radiation and ultrasound are commonly used in various medical fields; hence, Physics graduates are suited to assist medical officers in operating and managing these systems and data analysis.

There is an excellent opportunity for Physics graduates to become academicians and researchers in Institutions of Higher Learning upon furthering their studies to the PhD level. Besides, Physics lecturers and teachers are also in high demand in schools and public and private colleges.

POST-GRADUATE DEGREE (FIELDS OF RESEARCH)

Post-graduate candidates may pursue the MSc and PhD programs (by research) in various areas such as Plasma Physics, Laser Physics, Photonics, Semiconductor Physics and Devices, Display Devices, Thin Film Technology, Materials Science, Polymer Physics, Conducting Polymer, Environmental Radiation, Neuron Network, Complex Systems, Elementary Particle Physics, Nuclear Theory, Condensed Matter Theory, Space Physics, Astronomy and Cosmology and Stellar Astrophysics.

The Department of Physics also offers MSc in Applied Physics program by coursework covering areas in Semiconductor Technology, Plasma Technology, Quantum Technology, Optical Fibre Technology, Applied Radiation and Energy Materials.

BACHELOR OF SCIENCE IN PHYSICS SESSION 2024/2025 (135 CREDITS)			
University Courses (14 Credits)			
Course Code	**Course Title**		**Credits**
GIG1003	Basic Entrepreneurship Culture		2
GIG1012/ GLT1049	Philosophy & Current Issue (Local students) / Malay Language Communication (only for international students)		2
GIG1013	Ethical Appreciation and Civilization		2
GKA/GKI/GKK/GKP/ GKS/GKU1001	Co-Curriculum		4
GLT####	English 1 & 2		4
Core Courses (83 Credits)			
Course Code	**Course Title**	**Pre-requisite**	**Credits**
LEVEL 1 (25 credits)			
SIF1003	Thermal Physics		2
SIF1005	Electronics I		2
SIF1006	Practical Physics 1		2
SIF1014	Vibrations and Waves		3
SIF1015	Quantum Physics		2
SIF1016	Mechanics I		2
SIF1017	Mathematical Methods I		3
SIF1018	Mathematical Methods II	SIF1017	4
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3
LEVEL 2 (31 credits)			
SIF2001	Quantum Mechanics I	SIF1017 & SIF1015	3
SIF2002	Electromagnetism I	SIF1017 & SIF1014	3
SIF2003	Electromagnetism II	SIF1018 & SIF2002	3
SIF2005	Statistical Physics	SIF1017 & SIF1003	3
SIF2007	Numerical and Computational	SIF1017	3
SIF2009	Electronics Practical	SIF1005	2
SIF2010	Physics Practical II	SIF1006	2
SIF2026	Mechanics II	SIF1016	3
SIF2027	Optics	SIF1014	3
SIF2028	Mathematical Methods III	SIF1018	4
SIF2029	Applied Physics Practical	SIF1006	2
LEVEL 3 (11 credits)			
SIF3001	Nuclear Physics	SIF2001	3

SIF3002	Atomics and Molecular Physics	SIF2001	3
SIF3003	Solid State Physics	SIF2001	3
SIF3018	Physics for Work	SIF2029	2
LEVEL 4 (16 credits)			
SIF4001	Project	SIF2001, SIF2003, SIF2005 & SIF3018	8
SIF4002	Industrial Training	SIF3018, SIF2007 & SIF2009	8
Elective Courses (38 credits)			
(I) Program Elective Courses or/and MINOR PACKAGE ** (30 credits) Choose from all elective courses or/and Minor Packages that are offered			
Course Code	**Course Title**	**Pre-requisite**	**Credits**
SIF2012	Modern Optics and Laser Physics	SIF1014	3
SIF2013	Photonics	SIF1014	3
SIF2015	Astrophysics	SIF1016	3
SIF2016	Materials Science	SIF1003	3
SIF2018	Radiation Physics	SIF1015	3
SIF2019	Gas Discharge Physics	SIF1003	3
SIF2020	Electronics II	SIF1005	3
SIF2021	Digital Electronics	SIF2020	3
SIF3006	Optoelectronics	SIF2027	3
SIF3007	Elementary Particle Physics	SIF2001 & SIF3021	3
SIF3008	Condensed Matter Physics	SIF3003	3
SIF3009	Plasma Physics and Technology	SIF2002	3
SIF3011	Quantum Mechanics II	SIF2001 & SIF2028	3
SIF3012	Computational Physics	SIF2007	3
SIF3019	Semiconductor Devices	SIF1005 & SIF3003	3
SIF3020	Quantum Optics and Technology	SIF2001 & SIF2027	3
SIF3021	Cosmology and General Relativity	SIF1018 & SIF2026	3
(II) University Elective Courses (8 credits) **Student Holistic Empowerment (SHE)** Choose one course from each cluster			
Course Code	**Course Title**		**Credits**
Cluster 1	Thinking Matters: Mind & Intellect		2

Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul. GQX0056 Integrity and Anti-Corruption Course	2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: I-technie	2
Cluster 4	Global Issue and Community Sustainability: Making the World a Better Place	2

** Minor Package

(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.
(2) For further information, student can refer to UMSItS Guide via this link: https://umsitsguide.um.edu.my

PROGRAM GOAL

To produce graduates with broad knowledge and understanding in physics, have effective communication and problem solving skills, highly committed to ethical practise as well as appreciate environmental, societal and safety factors in carrying out their duties.

PROGRAM LEARNING OUTCOMES

At the end of the Degree of Bachelor of Science in Physics program, graduates are able to:

1. Demonstrate proficiency in physics and its applications
2. Apply physics knowledge to solve complex applications, handle issues in various situation through critical thinking, analytical reasoning and problem solving skills
3. Demonstrate practical skills in physics such as designing and setting up experiments, collecting and analyzing data, identifying sources of error, interpreting experimental results and relating the results to physics concepts or scientific theories.
4. Demonstrate communication skills in conveying scientific information in both written and oral presentation, to team members as well as the general public of various backgrounds
5. Employ appropriate mathematical methods, computer modeling, media and software applications to solve physics related problems
6. Demonstrate leadership qualities and accountability in decision making that involves teamwork
7. Engage in self-directed lifelong learning effectively and use their skills and knowledge to explore opportunities in the real world
8. Demonstrate capability in seeking creative and practical solutions to meet the requirements and changes determined by the work environment and current issues in a professional and ethical way

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)

BACHELOR OF SCIENCE IN PHYSICS SESSION 2024/2025

COMPONENT	YEAR 1			
	SEMESTER 1		SEMESTER 2	
	COURSE	CREDIT	COURSE	CREDIT
University Courses	GIG1013 Ethical appreciation and civilization	2	GIG1003 Basic Entrepreneurship Culture	2
	GKA/GKI/GKK/GKP/ GKS/GKU1001 Co-Curriculum	2	GIG1012/ GLT1049 Philosophy & Current Issue (Local students) / Malay Language Communication (only for international students)	2
	GLT#### English 1	2	GKA/GKI/GKK/G KP/ GKS/GKU1001 Co-Curriculum	2
			GLT#### English 2	2
Core Courses	SIF1003 Thermal Physics	2	SIF1015 Quantum Physics	2
	SIF1005 Electronics I	2		
	SIF1006 Practical Physics 1	2	SIF1018 Mathematical Methods II	4
	SIF1014 Vibrations and Waves	3	SIX1016 Statistics	3
	SIF1017 Mathematical Methods I	3	SIF2009 Electronics Practical or SIF2010 Physics Practical II or SIF2029 Applied Physics Practical	2

	SIX1015 Science, Technology and Society	2		
Elective courses			SHE#### Student Holistic Empowerment (SHE) Cluster 2: Emotional & Spiritual Intelligence: Heart & Soul. GQX0056 Integrity and Anti-Corruption Course	2
Total Credits		**20**		**21**

COMPONENT	**YEAR 2**			
	SEMESTER 3		**SEMESTER 4**	
	COURSE	**CREDIT**	**COURSE**	**CREDIT**
University Courses				
Core Courses	SIF1016 Mechanics I	2	SIF2003 Electromagnetism II	3
	SIF2001 Quantum Mechanics I	3	SIF2005 Statistical Physics	3
	SIF2002 Electromagnetism I	3	SIF2007 Numerical and Computational Methods	3
	SIF2009 Electronics Practical or SIF2010 Physics Practical II or SIF2029 Applied Physics Practical	2	SIF2009 Electronics Practical or SIF2010 Physics Practical II or SIF2029 Applied Physics Practical	2

	SIF2028 Mathematical Methods III	4	SIF2026 Mechanics II	3
			SIF2027 Optics	3
Elective Courses	SIF#### Program Elective Course	3	SIF#### Program Elective Course	3
	SHE#### Student Holistic Empowerment (SHE) Cluster 1: Thinking Matters: Mind & Intellect	2		
Total Credits		**19**		**20**

COMPONENT	**YEAR 3**			
	SEMESTER 5		**SEMESTER 6**	
	COURSE	**CREDIT**	**COURSE**	**CREDIT**
University Courses				
Core Courses	SIF3001 Nuclear Physics	3	SIF3002 Atomic and Molecular Physics	3
	SIF3003 Solid State Physics	3	SIF3018 Physics for Work	2
Elective Courses	SIF#### Program Elective Course	12	SIF#### Program Elective Course	12
	SHE#### Student Holistic Empowerment (SHE) Cluster 3: Technology/ Artificial Intelligence and Data Analytic: I-technie	2	SHE#### Student Holistic Empowerment (SHE) Cluster 4: Global Issue and Community Sustainability: Making the World a Better Place	2
Total Credits		**20**		**19**

COMPONENT	**YEAR 4**			
	SEMESTER 7		**SEMESTER 8**	
	COURSE	**CREDIT**	**COURSE**	**CREDIT**

University Courses				
Core Courses	SIF4001 Project	8	SIF4002 Industrial Training	8
Elective Courses				
Total Credits		**8**		**8**

TOTAL CREDITS: 135 CREDITS

** Minor Package

(1) Students are required to complete a minimum of 18 credits under the same minor package in order to be displayed on the transcript.
(2) For further information, student can refer to UMSItS Guide via this link: https://umsitsguide.um.edu.my

B. Sc. Physics

SYNOPSES OF COURSES

CORE COURSES

LEVEL 1

SIF1003 THERMAL PHYSICS (2 CREDITS)

Temperature, heat conduction, diffusion; Zeroth law of thermodynamics; PVT system, Ideal gas, van der Waal gas; Work, heat, internal energy; First, Second and Third laws of thermodynamics; Entropy, enthalpy, thermodynamic potentials; Phase transition, phase diagrams; Kinetic theory for ideal gas; Maxwell-Boltzmann distribution; Real gas。

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF1005 ELECTRONICS I (2 CREDITS)

DC CIRCUIT ANALYSIS TECHNIQUES
Circuit Theory: Ohm's law, Kirchhoff's law, Thevenin's theorem, Norton's theorem, Current and voltage divider. Circuit analysis technique: mesh and nodal analysis methods.
SEMICONDUCTOR DIODES
Energy band diagrams, properties of semiconductor, PN junction, forward and reverse bias conditions, the current-voltage characteristics and simple diode circuits; Diodes Application: Zener diode, half-wave, full-wave, bridge rectifiers; transformer, capacitor-input and choke-input filters, voltage regulators.
Bipolar junction Transistor (BJT): Characteristics of transistor, simple transistor circuit, current and voltage gain, load line concept, biasing requirements, D.C analysis of the BJT circuit。

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF1006 PRACTICAL PHYSICS 1 (2 CREDITS)

Experimental data analysis: precision and accuracy, significant figures, systematic error, statistical error, propagation of uncertainties of measurement, uncertainty analysis, statistical analysis.
Physics experiments on the topics of mechanics.
Physics experiments on the topics of electricity.
Physics experiments on the topics of magnetism.
Physics experiments on the topics of optics and modern physics.

Assessment Method:
Continuous Assessment: 100%

SIF1014 VIBRATIONS AND WAVES (3 CREDITS)

Sinusoidal vibrations: Description of simple harmonic motion, The rotating-vector representation, Rotating vectors and complex numbers, Complex exponential in waves, Superposed vibrations in one dimension, Two superposed vibrations of equal frequency.
Superposed vibrations of different frequency: beats, Many superposed vibrations of the same frequency, Combination of two vibrations at right angles, Perpendicular motions with equal frequencies.
Perpendicular motions with different frequencies: Lissajous figures, Free vibrations of physical systems; basic mass-string problem, Solving the harmonic oscillator equation using complex exponentials, Damped oscillations, Forced vibrations and resonance, Undamped oscillator with harmonic forcing, Complex exponential method for forced oscillations, Forced oscillations with damping, transient phenomena, Power absorbed by a driven oscillator.
Coupled oscillators and normal modes: Two coupled pendulums, Superposition of normal modes, Normal frequencies - general analytical approach, Forced vibration and resonance for two coupled oscillators.
Progressive waves: what is a wave?, Normal modes and travelling waves, Progressive waves in one direction, Superposition of wave pulses.
Dispersion: phase and group velocities

Assessment Method:
Final Examination: 60%
Continuous Assessment: 40%

SIF1015 QUANTUM PHYSICS (2 CREDITS)

History and developement of Physics Quantum
Mathematical background: Complex numbers, second order differential equations, eigenvalues and eigenvectors, integrals
Limitations of classical physics
Basic principles: wave functions, eigen functions, superposition principles, quantum mechanical postulates and probability density, uncertainty in measurements, Heisenberg uncertainty principles, space representation and momentum representation, measurement effect, commutators and constant of motion, equation of flux continuity, probability, Ehrenfest theorem.
Time independent Scrodinger equation : Infinite square well, stationery states, infinite square well, free particle, step potential, square well potential and barrier potential, harmonic oscillator.

Assessment Method:
Final Examination: 60%
Continuous Assessment: 40%

SIF1016 MECHANICS I (2 CREDITS)

Introduction to classical dynamics; Analysis of motion of single particle (Newton's laws of motion, equation of motion, conservation principle, linear momentum, forces depend on time, velocity, force depends on position, work-energy theorem, potential function, simulation of practical examples); Oscillation (simple harmonic oscillation, phase diagram, damped oscillation, forced oscilation, simulation/demonstration of oscillation in various systems); Central forces (reduced mass, equation of orbital motion, effective potential, qualitative analysis, planetary motion and Kepler's laws, gravitational force, stability of circular orbit, orbital mechanics, satellite orbits, search for exoplanets); Dynamics of system of particles (center of mass, example of motion in center of mass coordinates, elastic collision, inelastic collision, Rutherford scattering, simulation of collisions); Motion of systems with variable mass(equation of motion, rocket equation, simulation of rocket-like motion in various real world systems)

Assessment Method:
Final Examination: 60%
Continuous Assessment: 40%

SIF1017 MATHEMATICAL METHODS I (3 CREDITS)

Differentiation: Differentiation from first principle: products; the chain rule; quotients; implicit differentiation; logarithmic differentiation; Leibnitz' theorem; special points of a function; curvature; theorems of differentiation

Integration: Integration from first principles: the inverse of differentiation; by inspection; sinusoidal functions; logarithmic integration; using partial fractions; substitution method; integration by parts; reduction formulae; infinite and improper integrals; plane polar coordinates; integral inequalities; applications of integration

Complex number: Real and imaginary parts of complex number; complex plane; complex algebra; complex infinite series; complex power series; elementary functions of complex numbers; Euler's formula; powers and roots of complex numbers; exponential and trigonometric functions; hyperbolic functions; logarithms; complex roots and powers; inverse trigonometric and hyperbolic functions;

Matrices and solutions for sets of linear equations: matrix and row reduction; Cramer's rule; vectors and their notation; matrix operations; linear combinations, linear functions, linear operators; matrix operators, Linear transformation, orthogonal transformation, eigen value and eigen vector and diagonalization of matrices; special matrices.

Partial differentiation: power series in two variables; total differentials; chain rule; implicit differentiation; stationary values of a function with one variable and two variables; application of partial differentiation to maximum and minimum problems including constraints; Lagrange multipliers, endpoint and boundary point problems; change of variables; differentiation of integrals, Leibniz rule.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF1018 MATHEMATICAL METHODS II (4 CREDITS)

Mutliple integrals: integrated integrals; applications of Integrations; double and triple integrals in cartesian coordinates; double and triple integrals in polar coordinates; change of variables in integrals; Jacobian; surface integrals.

Vector analysis: applications of vector multiplication; triple products; differentiation and partial differentiation of vectors; integration of vectors; scalar and vector fields; directional derivative; unit normal vectors; gradient; divergence of a vector function; curl of a vector function; Laplacian; vector operators in polar coordinates; line integrals: scalars and vectors; Green's Theorem in a plane; divergence and divergence theorem; Curl and Stoke's Theorem.

Tensors: coordinate-system transformation; basis vector transformation; non-orthogonal coordinate systems; dual basis vectors; finding covariant and contravariant components; index notation; quantities that transform contravariantly and covariantly; concepts of covariance and contravariance beyond vectors; covariant, contravariant, and mixed tensors; tensor addition and subtraction; tensor multiplication; metric tensor; general curvilinear coordinates; index raising and lowering; tensor derivatives and Christoffel symbols; covariant differentiation; vectors and one-forms; tensor applications
Ordinary differential equations: separable equations; first-order linear homogenous and non-homogeneous equations; second-order linear homogeneous and nonhomogeneous equations.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIX1015 SCIENCE, TECHNOLOGY AND SOCIETY (2 CREDITS)

This course examines the interaction between science, technology and society from various perspectives. It provides discussion on the impacts of science and technology (S&T) progress on society, and vice versa. The discussions comprise the various main aspects of S&T Studies, namely scientific research and development, sustainable development, ethics and values, history and philosophy, economics, policy and management. Such combination encourages communication of diverse diciplines and students will better appreciate the complex ways in which science, technology and society interact. Based on this understanding, students will debate on the status, issues and challenges of selected S&T activities in the local context.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIX1016 STATISTICS (3 CREDITS)

Introduction to statistics; Experimental and observational studies; Display and organisation of data; Descriptive statistics; Population and samples; Sampling methods; Basic probability theory; Useful probability distributions: binomial, Poisson and normal; Sampling distributions; Central Limit Theorem; Point estimation and confidence interval;
Hypothesis testing for mean and proportion in one and two populations; Chi-square tests; Simple linear regression and correlation analysis.

Assessment Method:

Final Examination:	0%
Continuous Assessment:	100%

LEVEL 2

SIF2001 QUANTUM MECHANICS I (3 CREDITS)

Operators: Hilbert space, observables, eigenfunctions of Hermitian operator, generalised uncertainty principle, Dirac notation.
Quantum mechanics in 3-D: Schrödinger equation in 3-D, hydrogen atom, angular momentum, spin.
Identical Particles: Two-particle system, atoms, solids, quantum statistical mechanics.
Time-Independent Perturbation Theory: Nondegenerate perturbation theory, degenerate perturbation theory, fine structure of hydrogen, Zeeman effect, hyperfine splitting.
Time-Dependent Perturbation Theory: Two-level system, emission and absorption of radiation, spontaneous emission.
Molecules: H_2 molecule, rotation of molecules.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2002 ELECTROMAGNETISM I (3 CREDITS)

Electrostatics: electric charge and force, Coulomb's law, electric field, discrete and continuous charge distributions, Gauss' law, electric potential and electric potential energy, electric conductors, induced charges, capacitance and capacitors.
Electrostatics in matter: electric dipole, dielectric polarization, electric field in dielectric, capacitance with dielectrics, energy density in electric fields.
Electric currents: electric charge conservation, Ohm's law, electrical resistivity and conductivity, microscopic view of electric current, electric power.
Magnetostatics: Lorentz's force on charges and currents in magnetic and electric field, Biot-Savart's law, steady current, stable current magnetic field, Ampere's law.
Magnetostatics in matter: magnetization, diamagnetism, paramagnetism, ferromagnetism and anti-ferromagnetism.
Electrodynamics: Faraday's law and Lenz's law, electromotive force (emf), electromagnetic induction, mutual inductance, self-inductance, inductor, energy stored in magnetic field.
Maxwell's equations: Maxwell's displacement current, the general Maxwell's equations in integral form and differential form, Maxwell's equations in vacuum and electromagnetic waves in vacuum.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2003 ELECTROMAGNETISM II (3 CREDITS)

Revision on electricity and magnetism in derivative forms. Coordinate systems: cylindrical, rectangle and spherical coordinates, Divergence theorem and Stokes' theorem, imaging method, Gauss theorem in derivative form, divergence and curl of magnetic field, Laplace equation in 2 and 3 dimensions, boundary conditions and theorem of uniqueness, boundary conditions for D, E, B and H vectors, Free and bounded charges, Field variation with time, Maxwell's equations in differential and integral forms, Solution to Maxwell's equations in free space, Maxwell equations in matter, Scalar potential, vector potential and Gauge transformation. Electromagnetic waves: In free space, polarization, reflection and transmission in medium, Helmholtz's equation.
Electromagnetic wave propagation: Poynting theorem and Poynting vector, electromagnetic wave in conducting and nonconducting medium, frequency dependence of permittivity and conductivity, dispersion in nonconducting medium, propagation of electromagnetic

wave in between conducting planes, guided rectangular wave and hollow.

Assessment Method:
Final Examination: 60%
Continuous Assessment: 40%

SIF2005 STATISTICAL PHYSICS (3 CREDITS)

Summary of thermodynamics, Statistical thermodynamics, Boltzmann entropy, Shannon entropy; application canonical ensemble approach with examples in paramagnetic solid, specific heat capacity, classical and quantum distribution, Maxwell Boltzmann distribution and ideal classical gas, ideal quantum gas, Bose-Einstein distribution, Fermi-Dirac distribution, Applications covering photon and blalck body radiation, phonon in solid, grand canoncial ensemble, Bose-Einstein condensation, electron gas in metal.

Assessment Method:
Final Examination: 60%
Continuous Assessment: 40%

SIF2007 NUMERICAL AND COMPUTATIONAL METHODS (3 CREDITS)

Scientific Computing : Taylor's Theorem, errors, computer language, simple approximations
Interpolation : Lagrange interpolation, Newton interpolation, piecewise interpolation, least square approximation
Optimisation : Newton optimisation, Golden Search method
Nonlinear equations: Bisection method, Newton method, Secant method. Application and error analysis
Initial value problems for ordinary differential equations : Single-step method : Euler, Runge Kutta Method order 2 and 4, Multistep method; Addams Families
Linear equations : Gaussian elimination, LU factorization, Decomposition method
Numerical integration : Mid-point, basic Trapezoid and basic Simpson's rule, Composite trapezoid and composite Simpson's rule, errors.

Assessment Method:
Final Examination: 60%
Continuous Assessment: 40%

SIF2009 ELECTRONICS PRACTICAL (2 CREDIT)

Experiments that involve electronic components such as diodes, rectifiers, transistors, amplifiers and digital electronics.

Assessment Method:

Final Examination:	0%
Continuous Assessment:	100%

SIF2010 PHYSICS PRACTICAL II (2 CREDITS)

Practical classes for experiments in fundamental physics on topics including electricity, magnetism, thermodynamics, optics, spectroscopy and others.

Assessment Method:

Final Examination:	0%
Continuous Assessment:	100%

SIF2026 MECHANICS II (3 CREDITS)

Brief history of analytical mechanics (force & energy based approach); Newton equation of motion in noninertial frame of reference (linear and angular acceleration, rotating coordinate system, centrifugal force, Coriolis force, Foucault pendulum, modelling of planetary meteorological phenomena); Coupled oscillation (two-coupled oscillator and normal coordinates, vibration of molecules, dissipative systems). Nonlinear oscillation (Nonlinear oscillating systems, qualitative discussion of motion, phase diagrams, bifurcation, chaos, fractal geometry); Lagrangian dynamics (generalized coordinates, D'Alembert principle, Lagrange's equation of motion, problem solving using Lagrange equation, Noether theorem for conservation laws, Lagrange equation for nonnonholonomic constraints and dissipative systems); Hamiltonian dynamics (Hamilton's principle, Hamiltonian, Hamilton's equation of motion, phase space, Liouville's theorem, Poisson bracket); Special theory of relativity (Einstein's postulates, Lorentz transformation, length contraction, time dilation, covariant formulation, four vectors, relativistic dynamics, lagrange and Hamiltonian formulation for relativistic mechanics), Capita Selecta.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2027 OPTICS (3 CREDITS)

Nature of light: brief history; Wave-particle duality; The electromagnetic spectrum; Radiometry & Photometry; Black body radiation; Optical radiation sources.
Matrix methods in paraxial optics; ABCD matrix; Reflection in plane mirrors and refraction through plane surfaces; Reflection and refraction at spherical surface; thin lenses, cylindrical lenses, thick lenses; prisms.
Wave equation; Harmonic waveforms: plane, spherical, and cylindrical; Electromagnetic waves; superposition; two-beam interference & two slit (Young) interference; Interference in dielectric films, multiple-beam interference; Optical interferometry: Michelson interferometer, Fabry-Perot Interferometer.
Huygen-Fresnel principle; Fraunhofer diffraction: diffraction from single slit, multiple slits-diffraction grating.
Polarized light; Polarization by selective absorption, reflection, scattering, birefringence & dichroism; Jones vectors and matrices; Fresnel equations. Fresnel diffraction & Fresnel lens

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2028 MATHEMATICAL METHOD III (4 CREDITS)

Fourier Series and Transformation Series: Periodic functions, Fourier series, average value of a function, Fourier coefficient, Dirichlet condition, complex form of Fourier Series, general interval, even and odd functions, Parseval theorem. Fourier transformation and Parserval Theorem. Laplace Transforms, Solution of differential equations by Laplace transforms, Dirac Delta Function, Laplace transform of a delta function; Fourier transform of a delta function
Special Functions: Factorial functions, Gamma functions, Beta functions, relationship between Beta and Gamma functions, error functions, asymptotic series, Stirling formula and elliptical integrals.
Series Solution for Differential Equations: Legendre equations, Leibnitz rule, Rodriguez formula, generating functions for Legendre polynomial, orthogonal functions, orthogonalization and normalization of Legendre polynomials, Legendre series, Associate Legendre function, Frobenius method, Bessel equation, second solution of Bessel equation, recurrence relationship, general differential equation

with Bessel function as a solution, orthogonalization of Bessel function, Hermite function, Laguerre function, step operator.
Partial Differential Equation: Separation of variables method applied to partial differential equation; applications to Laplace equation, steady state temperature in a square plate, Schrödinger equation, heat and diffusion equation. Wave equation, vibrating string, steady state temperature in a cylinder, steady state temperature in a sphere, Poisson equation.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2029 APPLIED PHYSICS PRACTICAL (2 CREDITS)

Applied physics experiments covering topics in Solid State Physics, Plasma Physics, Optics, Radiation Physics, Materials Science, and Photonics.

Assessment Method:

Final Examination:	0%
Continuous Assessment:	100%

LEVEL 3

SIF3001 NUCLEAR PHYSICS (3 CREDITS)

Nuclear structure and properties, Nuclear scattering, Nuclear force and force exchange.
The physics of nuclear decays (alpha, beta & gamma), isospin.
Physics of nuclear reactions : fission and fusion, Nuclear reactions in astrophysics (big bang nucleosynthesis, stellar nucleosynthesis).

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3002 ATOMICS AND MOLECULAR PHYSICS (3 CREDITS)

Single-electron atoms, magnetic moment, spin-orbit interaction, total angular momentum, relativistic effect, fine structure, identical

particles, two-electron atoms, multi-electron atoms, coupling of angular momentum, periodic table, hyperfine structure, spectral linewidth, time-dependent perturbation theorem, atom and photonic interaction, excited radiation, spontaneous emission, stimulated absorbtion and emission, Einstein A and B coefficients, diatomic molecules and their spectral – vibration, rotation, electronic.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3003 SOLID STATE PHYSICS (3 CREDITS)

Introduction to types of solids, structure of crystalline solids: periodicity, lattice and unit cell, Bravais lattices, directions and planes in crystals, X-ray diffraction, diffraction techniques, reciprocal lattice, Brillouin zone, bonding in solids, dynamics of monoatomic and diatomic lattices (1-D and 3-D), density of states, dispersion of phonons, thermal properties: specific heat capacity, thermal conductivity, free and quantized electron models, D.C. conductivity and electron dispersion, band theory of solids: Bloch function, Kronig-Penney model, band theory of solids: effective mass, density of states and concentration of electrons.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3018 PHYSICS FOR WORK (2 CREDITS)

Scientific methods (past, present and future philosophies driving discoveries and innovations, design-thinking and first principle approach); Examples of case studies: Cavendish Lab, AT&T Bell Lab, MIT Media Lab, SpaceX/ Google Research, NTT, Samsung Research, Huawei R&D; Physics empowering industry revolutions (IR1.0 (mechanics & thermodynamics), IR2.0 (electric, magnets & electromagnetic wave), IR3.0 (semiconductors, computers, optical fibres, internet) – IR4.0 (energy cell/batteries, Internet of Thing (IoT), sensors network, data storage, information processing and AI); Public communication of science and citizen science, Physics for work in manufacturing, healthcare, agriculture, food and beverage, security & surveillence, arts and entertainment industries. Physics for Sustainable Development Goals (SDGs)- case studies: SDG 3 (Good Health & Wellbeing), SDG6 (Clean Water & Sanitation), SDG7

(Affordable and Clean Energy), SDG9 Industry, Innovation and Infrastructure, SDG 13 (Climate Action);

Assessment Method:
Final Examination: 0%
Continuous Assessment: 100%

LEVEL 4

SIF4001 PROJECT (8 CREDITS)

Research project in physics and related fields. Workshop projects. Seminar in selected topics

Assessment Method:
Final Examination: 0%
Continuous Assessment: 100%

SIF4002 INDUSTRIAL TRAINING (8 CREDITS)

This course provides opportunities for students to obtain training and working experience in selected companies/ organization or industries.

Assessment Method:
Final Examination: 0%
Continuous Assessment: 100%

ELECTIVE COURSES

SIF2012 MODERN OPTICS AND LASER PHYSICS (3 CREDITS)

Introduction to laser: Basic laser theory, Characteristics of a laser beam, temporal and spatial coherence, Classical Law of radiation, Cavity modes, Einstein A and B coefficient, Quantum theory of two-level system interaction with light, Light matter interactions: Absorption, spontaneous emission and stimulated emission, 3-level laser system, 4-level laser system, Homogeneous and Inhomogeneous linewidth broadening, Optical resonators (Fabry-Perot cavity), Transverse and longitudinal modes, Mode density and cavity lifetime, Threshold power, small signal gain, gain saturation and

power extraction, TEM00 modes and its propagation, Q-switching, Mode-locking, Examples of solid-state, gas and dye lasers,
Nonlinear optics:, Electro-optic effect, Magneto-optic effect, Acousto-optic effect.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2013 PHOTONICS (3 CREDITS)

Basics of optical fibre waveguides; Total internal reflection; Acceptance angle and Numerical aperture; Skew rays; Electromagnetic mode theory for optical propagation in guided medium; Modes in a planar waveguide; Phase and group velocity; Phase shift with total internal reflection and evanescent field; Goos-Haenchen shift; Multimode optical fibre; Single mode optical fibre; Transmission characteristics of optical fibre; Attenuation, Material absorption losses in silica glass fibre; Linear and nonlinear scattering losses; Fibre bend loss; Mid-IR and Far-IR transmission in optical fibre; Chromatic and intermodal dispersion; Dispersion-modified single-mode fibres; Polarization and nonlinear effects in optical fibres; Fabrication of optical fibres; Fibre and waveguide amplifiers and lasers; Rare-earth doped fibre amplifiers; Raman and Brillouin fibre amplifiers; Telecom network, Waveguide amplifiers; waveguide fabrication, devices and applications.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2015 ASTROPHYSICS (3 CREDITS)

Astronomical Tools : spherical astronomy, optical telescope, radio telescope and space telescope
Atomic spectra, interaction of light and matter
Solar system: Origin of solar system and morphology of solar system. Sun-moon-earth interactions.
Exoplanets and solar-like systems
The sun : atmosphere, solar activity and nuclear fusion
The stars: properties of the stars; brightness, distances, masses, sizes, star formation, stellar structure and evolution; death of the stars

Binary stars: types, mass and mass transfer in close binary systems
Hertzsprung–Russell diagram
The Universe: Milky Way galaxy, galaxies.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2016 MATERIALS SCIENCE (3 CREDITS)

Introduction to materials science. Atomic structure and interatomic bonding: Electronic structure. Structure of materials; Molecular structure, Crystalline structure and Defects. Mechanical properties. Phase diagram. Introduction to polymers, ceramics, composites and biomaterials.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2018 RADIATION PHYSICS (3 CREDITS)

Radiation source, Nuclear Instability and types of radioactivity, Halflife and mean life, Natural radioactive series and radioactive equilibrium (Bateman equation), Branching decay and types of decay, Nuclear activation, X-ray production, Moseley law, X-ray fluorescence, Radiation interaction with matter (elastic and inelastic processes), Bremsstrahlung theory, Dosimetry Equivalent dose, Radon and thoron measurements, Biological effect (somatic and genetic),Radiation detectors Radiation protection: Distance, Time, Dose, Applications of radiation.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2019 GAS DISCHARGE PHYSICS (3 CREDITS)

Basic principles and processes Kinetic theory of gases, Maxwell distribution, Concept of temperature and pressure, Collision cross-

section, Energy transferred due to collision, Processes induced by electron collisions, Ion-neutral collision, Collision involving metastable ion/atom, Processes due to electrode effect
Characteristics of Plasma. Plasma potential, Debye shielding, Plasma sheath, Plasma frequency, Electrical conductivity, Effect of magnetic field, Diffusion. Electrical Discharges in Gases.
I-V characteristics of gaseous discharge, Townsend theory of gaseous discharge, Breakdown criterion, Paschen law, Breakdown potential, Glowing gaseous discharge, Arc discharge, Corona discharge, Pulsed discharge, The structure of glowing discharge, Cathode fall theory of normal glow discharge, Negative glow, Positive column and its theory, Hot cathode discharge. Plasma diagnostic technique. Electric probe. Thermodynamics of ionized gas. Real gas effect, Equation of state, The Law of Mass Action, Departure coefficient, Thermodynamic functions expressed in term of z, Saha equation, Enthalpy equation. Survey of plasma applications.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2020 ELECTRONICS II (3 CREDITS)

The synopsis of Field Effect Transistors (FET) and various FET (JFET & MOSFET). Small-signal A.C. equivalent circuits for BJT & FET. gm A.C. small signal model. Input and output impedances calculation. Voltage and current gains calculation. The frequency response of circuits. The capacitive effects. The definition of dB unit.
The -3dB frequencies. The Bode plot. The operational amplifier topics covering the basic building block circuits of operational amplifiers including the inverting and non-inverting amplifiers. Current to voltage and voltage to current converters. Subtracting and summing circuits. Integrators and differentiators. Analysis and applications to comparators. Oscillators. Active filters. Analogue computers. The power amplifiers including the classification of A, B, AB, C and D. The A.C. load line. The push and pull concept. Cross-over distortion. Efficiency calculations and comparison. Introduction to digital electronics. Basic gates. Multivibrator circuits.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF2021 DIGITAL ELECTRONICS (3 CREDITS)

Digital number system: binary, octal, hexadecimal, binary coded decimal
Logic gates: AND, OR NAND, NOR, XOR, XNOR; logic gates TTL
Logic circuits: Boolean algebra, truth table for Boolean expression, derivation circuit from Boolean expression
Karnaugh map simplification with three, four and five variables
TTL chip specification, CMOS, interface,
Schmitt Trigger: Function and functional
Combinational logic circuit: half adders, full adder, binary multiplication
Sequential logic: SR, JK, D, T flip flops
Register: parallel, series, shifter, ring counter, frequency divider
Memory: RAM, ROM, PROM etc
Digital device, PLD, PAL, PLC, micro-controller
Analog digital interface

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3006 OPTOELECTRONICS (3 CREDITS)

Nature of light; Optical interferometer; Dielectric mirror; Diffraction gratings; P-N junctions; Principles and characteristics of photodetectors; PIN and avalanche photodiodes; Photon counters; Single photon detectors and Photo Multiplier Tube; Light emitting diodes; Semiconductor lasers; Semiconductor optical amplifiers; Electro-optics effect; Acousto-optics effect; Pockels effect; Optical modulators: Phase, polarization and amplitude; Bit rate and bandwidth; Transmitter and receiver modules types for optical communications; Optical storage; Optical imaging (CCD and CMOS); Physics of Solar Cells.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3007 ELEMENTARY PARTICLE PHYSICS (3 CREDITS)

Feynman diagrams, electromagnetic and weak forces, fundamental particles and forces, natural units; Leptons and neutrino oscillations; Quarks and hadrons; Symmetries : C, P and T, C, P and CP violations, and CPT; Quark model: isospin symmetry and bound states; Relativistic kinematics: four-vector and cross section; QCD:

asymptotic freedom, jets and elastic lepton-nucleon scattering; Inelastic lepton-nucleon scattering: parton model, structure functions and scaling violation; Weak interaction: charged and neutral currents, quark mixing, electroweak unification and Higgs boson; Experimental methods

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3008 CONDENSED MATTER PHYSICS (3 CREDITS)

Conducting Materials (electronic & ionic conductivity, mobility, electron dispersion mechanism); Semiconductors: band structure (Intrinsic and extrinsic properties); Electrical properties (conductivity, mobility, electron dispersion mechanism); Optical properties; Photoconductivity; Insulating Materials: dielectric constant, polarization; AC & DC conductivities; hopping mechanism; Piezoelectric; Ferroelectric, Pyroelectric; Magnetic materials: basic theory; magnetic susceptibility; types of magnetic properties, magnetic resonance; ferromagnetism; spintronics. Superconductors: zero resistivity, critical field, Meissner effect, BCS model, Examples of superconducting materials, high temperature superconductors.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3009 PLASMA PHYSICS AND TECHNOLOGY(3 CREDITS)

Fundamentals of Plasma Physics, introduction to plasma theory. Methods of plasma generation in direct current, alternating current and pulsed mode. Plasma diagnostics. Physics and technology of non-thermal plasmas and pulsed plasmas. Application of plasma technology: Plasma processing, plasma-based lighting systems, and plasma fusion.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3011 QUANTUM MECHANICS II (3 CREDITS)

Formal framework: Hilbert space, symmetries and conservation laws, propagators and Green's function.
Approximation methods: Time-dependent perturbation theory, variational principle, WKB approximation, adiabatic approximation.
Scattering theory: Partial wave analysis, Born approximation, S matrix.
Relativistic quantum mechanics: Klein-Gordon equation, Dirac equation and electromagnetic interaction.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3012 COMPUTATIONAL PHYSICS (3 CREDITS)

Ordinary Differential Equations: boundary-value and eigenvalue problems.
Matrices: matrix eigenvalue problems.
Partial Differential Equations: Elliptic, parabolic and hyperbolic equations.
Probabilistic Methods: Random numbers, random walks, Metropolis algorithm, Monte Carlo simulation, Ising model.

Assessment Method:

Final Examination:	0%
Continuous Assessment:	100%

SIF3019 SEMICONDUCTOR DEVICES (3 CREDITS)

Discussion related to semiconductor: p-n junction. Semiconductor devices and their operation principles: p-n diodes, Metal-semiconductor junction: Schottky & Ohmic contact, Schottky diode, Field Effect Transistor, LED, Solid state Laser, photodiode & Solar cell, Microwave devices & diodes (Tunnel diode, IMPATT diode, etc), Device fabrication (photolithography, metallization, etc).

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3020 QUANTUM OPTICS AND TECHNOLOGY (3 CREDITS)

Atom-photon Interactions: Interaction Hamiltonian; Unitary transformation; Transition dipole moment; selection rules,

polarization; Absorption and emission of photons; Weisskopf-Wigner theory of spontaneous emission.
Quantum states and distributions: Density operator for mixed and pure states; Quantization of electromagnetic field and Fock state; Coherent state, squeezed state, thermal state; Entangled states: Bell's states, GHZ states; Generation of entangled states: PDC and beam splitter; Quasi--probability distributions & Schrodinger cat states.
Coherence and photon correlations: Hanbury-Brown-Twiss experiment; Field correlation functions; First and second order coherences; Photon detection and interferometry.
Two-level atom-field interaction: Semiclassical treatment: Rabi flopping, Optical Bloch equation, Bloch sphere and vectors; Full quantum treatment: Jaynes-Cumming model and exact solutions, collapse and revival; Nuclear magnetic resonance and imaging.
Quantum Information: Quantum information theory and entropy; Quantum bits and measurements; No-cloning theorem; Quantum cryptography and eavesdropping; Quantum teleportation.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

SIF3021 COSMOLOGY AND GENERAL RELATIVITY (3 CREDITS)

Frame of reference, postulates of relativity. Galilean transformations, Lorentz transformations. Time dilation, Length contraction, Doppler shift
Minkowski Space, Twin paradox, Spacetime diagrams, lightcones and causality
Mechanics, Invariance, relativistic momentum and kinetic energy. Four-vectors
Tensors, metric, energy-momentum tensor, parallel transport, curvature, Christoffel symbols
Energy-momentum tensor, electromagnetic tensor, perfect fluid tensor Derivation of Einstein’s equations, Cosmological Constant
Schwarzschild metric, gravitational dilation, redshift, motion in Schwarzschild timeline, falling into a Black Hole, Hawking radiation
Tests of general relativity: precession of perihelion of Mercury, deflection of light by the Sun, gravitational lensing, observational black holes, gravitational waves
Cosmology, cosmological principle, Weyl’s postulate, Robertson-Walker metric, energy-momentum of the Universe
Friedmann equations, Universe models, observables

Big bang, proofs of the Big bang, nucleosynthesis, expansion and future of the Universe.

Assessment Method:

Final Examination:	60%
Continuous Assessment:	40%

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