

UNDERGRADUATE HANDBOOK

**FACULTY OF BIOSCIENCES AND MEDICAL
ENGINEERING**
UNIVERSITI TEKNOLOGI MALAYSIA

ATTENTION

The content of this book is true and accurate at the time of publication. The faculty reserves the right to make the appropriate changes without any prior notification. This guide book is a reference for the undergraduate students enrolled in the 2013/2014 session and will be used until graduation.

For more information, please contact:

The Dean
Faculty of Biosciences and Medical Engineering (FBME)
Universiti Teknologi Malaysia
81310 Skudai
JOHOR DARUL TAKZIM

Telephone : +6(07)5558400
Telefax : +6(07)5558515
Website : <http://www.fbme.utm.my>

CONTENTS

	Page
Foreword By The Dean	4
Institutional Profile: Universiti Teknologi Malaysia	5
Philosophy, Vision, Mission, Theme, Motto, Core Values	9
Faculty Profile: Faculty of Biosciences and Medical Engineering	10
Faculty in Brief, Vision, Mission and Motto	11
Faculty Map	12
Faculty Administration	13
Undergraduate Studies Committee	15
Research Facilities	16
Undergraduate Programmes	19
Programmes Offered	20
Admission Requirements	20
Regulations and Academic System Guideline	22
Bachelor of Science in Biology	36
Program Features	37
Curriculum	39
Bachelor of Science in Industrial Biology	43
Program Features	44
Curriculum	46
Bachelor of Engineering in Biomedical	50
Program Features	51
Curriculum	54

Bachelor of Science in Equine Management	58
Program Features	59
Curriculum	61
Tuition Fees (Academic Year 2013/2014)	64
Appendices	65
Appendix A: Synopsis of Courses for Biology and Industrial Biology	66
Appendix B: Synopsis of Courses for Biomedical Engineering	78
Appendix C: Synopsis of Courses for Equine Management	88
Appendix D: Synopsis of University Required Courses and English Electives	93
Appendix E: Academic Staff Information	100
Appendix F: Programme Specification	107
Appendix G: UTM Student Attributes	161
Do's and Don'ts for International Students	163

FOREWORD BY THE DEAN



Welcome to the Faculty of Biosciences and Medical Engineering

Welcome to Faculty of Biosciences and Medical Engineering (FBME), a newly established faculty in UTM to champion teachings and research in Biosciences & Medical Engineering. The faculty offers innovative programs for both undergraduates and post-graduates with a balance course in Biosciences and Medical Engineering, and a special emphasis on clinical and industrial applications.

Faculty of Biosciences and Medical Engineering (FBME) was established in the year 2012 by merging the Faculty of Biosciences and Bioengineering (FBB) and Faculty of Health Science and Biomedical Engineering (FKBSK) to promote and strengthen the interdisciplinary research in the fields of Biosciences, Medical Engineering and Health science. Therefore, we believe strongly in the value of interdisciplinary pursuits in this emerging field where the techniques and technologies from Biosciences and Engineering disciplines are used to address needs within the Biotechnology, Medical and Healthcare industries. Our vision is to ensure that UTM and the country as a whole would be fully equipped with the manpower and technologies in this emerging and demanding field of engineering.

FBME is committed to excellence in both undergraduate and graduate education. Opportunities for education and research exist in areas of biomechanics, biomaterials, tissue engineering, medical devices, bio-signal processing, MEM implantable systems, physiological modeling and simulation, monitoring and control, medical robotics as well as renewable energy, plant biotechnology to industrial biotechnology, environmental engineering, biosensor technology and bioinformatics.

FBME offers students unparalleled access to engineering experts in the fields of mechanical, electrical & electronics, biological, and computer science. The demands for Biosciences and Biomedical Engineers are increasing every year in tandem with the increasing demand for healthcare services, and the faculty is committed to produce graduates in the fields of BIOSCIENCES and ENGINEERING with industrial leadership capability especially in the healthcare industry.

This handbook contains important information about the faculty and academic programmes offered. Please use this handbook wisely and as a main source of reference to plan your success in your studies. Finally, I wish you all the best and good luck in your studies.

Prof. Dr. Jasmy Yunus

Dean

Faculty of Biosciences and Medical Engineering (FBME)

Universiti Teknologi Malaysia

INSTITUTION PROFILE



INSTITUTION PROFILE

UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

RESEARCH UNIVERSITY



Universiti Teknologi Malaysia (UTM), a premier university in engineering, science and technology located in Johor Bahru, the southern city in Iskandar Malaysia which is a vibrant economic corridor in the south of Peninsular Malaysia.

It is renowned for being at the forefront of engineering and technological knowledge and expertise, contributing to the technical and professional workforce of the nation since its inception in 1904.

UTM has also established a reputation for cutting-edge research undertakings and innovative education, proven by becoming the three-time winner of the National Intellectual Property Award for organization category. Its mission is to lead in the development of creative and innovative human capital and advanced technologies that will contribute to the nation's wealth creation.

With a strength of more than 2,000 academic staff, of which more than 200 are foreign graduate faculty members, UTM continuously strives to develop and enhance quality academic and professional programmes of international standard and global recognition. The student population consists of more than 11,000 full-time undergraduate students, more than 6,000 enrolled on distance learning programmes as part-time students and more than 9,000 postgraduate students in various fields of specialization. Out of this, more than 3,000 are foreign students.

Having produced more than 200,000 technical graduates and qualified professionals over the years, UTM has earned its place as Malaysia's premier university in Engineering and Technology which inspires creativity and innovation.

RESEARCH UNIVERSITY

In June 2010, the government has declared UTM as the country's fifth research university and this put UTM playing a bigger role in the development of the nation. Being as one of the research university, UTM seeks to actively participate in new adventures of ideas, experiment with innovative methods, and take intellectual initiatives to further discover and expand the frontiers of knowledge. UTM expect to have an increase in research activities and more students to enrol in the postgraduate programs including the taught Masters programs as well as the Masters and PhD research programs.



LOCATION

Set in a splendid campus, with modern buildings and excellent facilities, UTM main campus is superbly located to take advantage of the best that Johor has to offer. The main Skudai campus is situated on a 1,222 - hectares site that provides a lovely setting of landscape gardens for the bustling academic village and residences. The main campus is easily accessible by road, rail and air. Regular flights from Senai Airport connect the state capital of Johor Bahru to Kuala Lumpur and others domestic destinations. Transport services at the airport are also readily available. Taxis are a popular cheap means of transport. Air-conditioned coaches are also available to and from Johor Bahru to other states in Peninsular Malaysia. The KTM (Malayan Railway) offers numerous train services connecting Singapore and other states in Malaysia through Johor Bahru station. A 18-hectare UTM City Campus is situated at Jalan Semarak, Kuala Lumpur.

INTERNATIONAL STUDENTS

The university encourages the admission of international students, and seeks to serve the aspirations of all with the ability and motivation to benefit from higher education. The university arranges special induction and orientation programmes for international students. There are more than 500 international students from over 24 countries are represented on the campus. An exciting and dynamic learning environment is enhanced by the contributions of students from diverse backgrounds. International schools conveniently situated at the nearby Johor Bahru city permit children of married students for primary and secondary education. The University also provides a full range of admission, welfare and student services to meet the needs of international students.

ACCOMMODATION

Students are guaranteed accommodation in their first year. University housing is available at both campuses. Hostels are available for more than 20,000 students and new colleges are equipped with computer rooms and internet facilities. Apartments for married students are also available.



FACILITIES

UTM provides various facilities to support all kinds of students and staff activities. There are fully air-conditioned lecture halls and rooms, well-equipped auditoriums, seminar rooms, laboratories, a medical centre, student hostels, guest houses, a mosque, banks and a post office. The University has a large and spacious library that can accommodate up to 2,500 students at any one time. The library is with more than 300,000 books, some 5,000 journals, on-line references and internet access. Sporting and recreational facilities in the university are extensive and encompass nearby all interest which include canoeing and horse riding. These are complemented by the varied opportunities for leisure activities in the nearby progressive city of Johor Bahru, and together they make UTM a conducive place for studying.

**PHILOSOPHY, VISION, MISSION, THEME, MOTTO,
CORE VALUES**
UNIVERSITI TEKNOLOGI MALAYSIA

PHILOSOPHY

The divine law of Allah is the foundation for science and technology. Universiti Teknologi Malaysia strives with total and unified to develop excellence in science and technology for universal peace and prosperity, in accordance with His Will.

VISION

To be recognized as a world-class centre of academic and technological excellence.

MISSION

To be a leader in the development of human capital and innovative technologies that will contribute to the nation's wealth creation.

MOTTO

In The Name Of God for Mankind. "Kerana Tuhan Untuk Manusia".

UNIVERSITY'S THEME

Inspiring Creative and Innovative Minds

CORE VALUES

Committed
Communicative
Committed
Creative
Consistent
Competent



FACULTY PROFILE

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)



FACULTY IN BRIEF

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Background

There were one undergraduate and several postgraduate programmes offered by Faculty of Health Science and Biomedical Engineering (FKBSK) in the research areas of biomedical engineering, health care, rehabilitation technology, biosignal and medical implant technology. Similarly, Faculty of Biosciences and Bioengineering (FBB) offered undergraduate and postgraduate programmes in the research areas of structural biology, proteomics, functional genomics, nano biotechnology, drug delivery, cancer studies, structural bioinformatics, drug design as well as protein engineering, genetic engineering, tissue engineering, metabolic engineering, biomaterial development, bioprocess engineering, biosensor technology. Both faculties were conducted research in the advancement of life sciences independently. In 2012, FKBSK and FBB were merged to strengthen the interdisciplinary life science research. The new faculty was given the name “Faculty of Biosciences and Medical Engineering (FBME)”.

There are following three departments in FBME:

1. Department Biosciences and Health Sciences
2. Department of Biotechnology and Medical Engineering
3. Department of Clinical Sciences

VISION, MISSION AND MOTTO

VISION

FBME is committed to be a world-class centre of excellence and a leader in teaching, learning and research in the field of biosciences and medical engineering.

MISSION

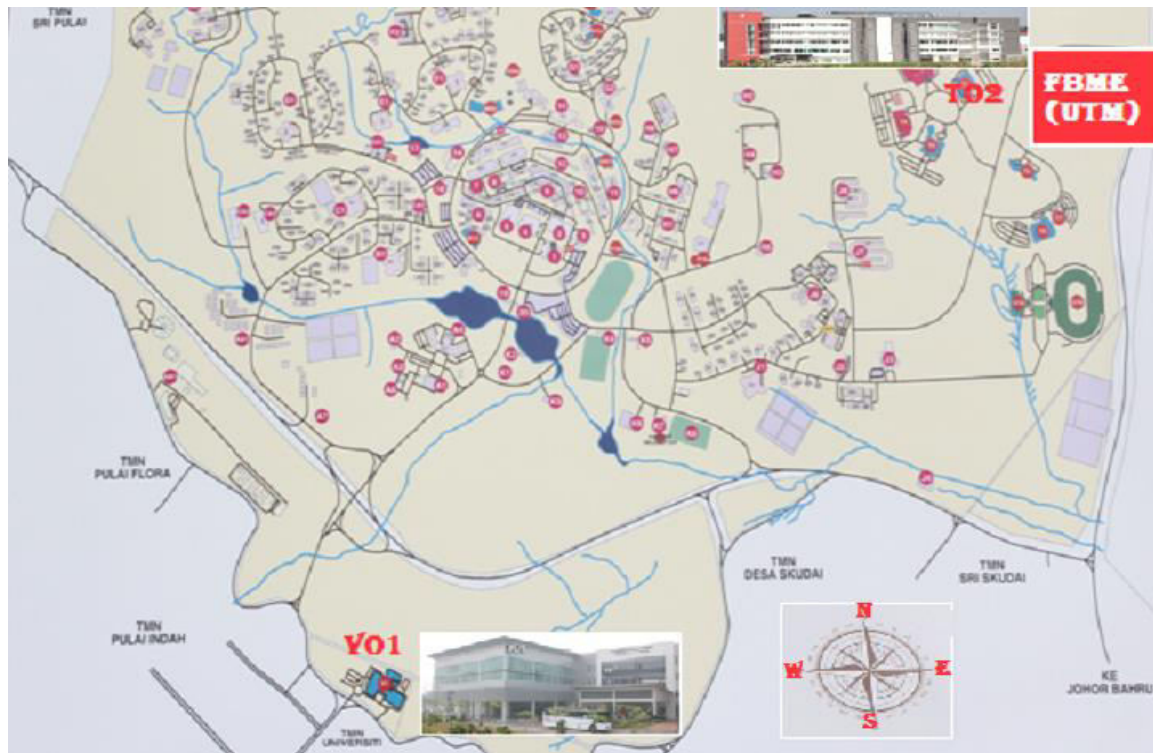
- To produce graduates with high ethical values and good professional conduct who are competent in the fields of biosciences and medical engineering.
- To spearhead advances in the fields of biosciences and medical engineering through multidisciplinary research, integrated learning, and global networking
- To fulfill the needs of all stakeholders in producing graduates that contribute towards nation building, wealth creation and sustainable development

MOTTO

Revealing Science, Engineering the Future

Map to the Faculty

FBME has been allocated two buildings. Satellite building (V01) is situated near Taman Universiti. The administration and academic offices are also located in this building. Second building is located in Research Cluster and therefore called cluster building (T02). Locations of these buildings are shown in the map and visualized by a picture as well.



Faculty Administration



DEAN

Professor Dr. Jasmy Yunus

Email: dean@biomedical.utm.my, jasmy@utm.my,
jasmy@biomedical.utm.my,

Tel Off: 07-5558400

Office: Satellite Building, V01



Deputy Dean (Academic)

Assoc. Prof. Dr. Fahrul Zaman Huyop

Email: fahrul@biomedical.utm.my, fahrul@utm.my

Tel Off: 07-5557566, 07-5558452

Office: Satellite Building, V01/ 03-52-01 Cluster Building, T02



Deputy Dean (Development)

Assoc. Prof. Ir. Dr. Mohammed Rafiq Dato' Abdul Kadir

Email: rafiq@biomedical.utm.my

Tel Off: 07-5558514

Office: Satellite Building, V01



Academic Manager
(Postgraduate Programmes)
Dr. Azli Yahya
Email: azli@biomedical.utm.my
Tel Off: 07-5558439
Office: Satellite Building, V01



Academic Manager
(Undergraduate Programmes)
Dr. Fauzan Khairi Che Harun
Email: fauzan@biomedical.utm.my
Tel Off: 07-5558452
Office: Satellite Building, V01



Academic Manager
(Space UTM)
Dr. Jasmine Hau Yuan Wen
Email: hauyuanwen@biomedical.utm.my
Tel Off: 07-5558498
Office: Satellite Building, V01



Head of the Department
(Biosciences and Health Sciences)
Dr. Shafinaz Shahir
Email: shafinazshahir@utm.my
Tel Off: 07-5557549, 07-5558443
Office: Cluster Building, T02



Head of the Department
(Biotechnology and Medical Engineering)
Dr. Nasrul Humaimi Mahmood
Email: nasrulhumaimi@biomedical.utm.my
Tel Off: 07-5558440
Office: Satellite Building, V01



Head of the Department
(Clinical Sciences)
Associate Prof. Dr. Kahar Osman
Email: kahar@biomedical.utm.my
Tel Off: 07-5558441
Office: Satellite Building, V01



Laboratory Manager
Dr. Alina Wagiran
Email: alina@fbb.utm.my, alina@utm.my
Tel Off: 07-5557531
Office: Cluster Building, T02



IT Manager
Dr. Salehuddin Hamdan
Email: saleh65@utm.my, saleh@biomedical.utm.my
Tel Off: 07-5557547, 07-5558444
Office: Cluster Building, T02



Deputy Registrar (Academic)
Haji Mokhtar Kader
Email: mokhtar@utm.my
Tel Off: 07-5558437
Office: Satellite Building, V01



Senior Assistant Registrar (HR)
Mr. Mohd Farid Rahmat
Email: mfrahmat@biomedical.utm.my
Tel Off: 07-5558436
Office: Satellite Building, V01



Dean's Personal Assistant
Mrs. Saripah Rabi-ah Wan Mashor
Email: saripah@biomedical.utm.my
Tel Off: 07-5558401
Office: Satellite Building, V01

Undergraduate Studies Committee

Chairman

Dean

Professor Dr. Jasmy Yunus

Members:

Deputy Dean (Development)

Assoc. Prof. Dr. Fahrul Zaman Huyop

Deputy Dean (Academics)

Assoc. Prof. Ir. Dr. Mohammed Rafiq Dato' Abdul Kadir

Academic Manager (Undergraduate programmes)

Dr. Fauzan Khairi Che Harun

Head of the Department (Biosciences and Health Sciences)

Dr. Shafinaz binti Shahir

Head of the Department (Biotechnology and Medical Engineering)

Dr. Nasrul Humaimi Mahmood

Head of the Department (Clinical Sciences)

Associate Prof. Dr. Kahar Osman

Laboratory Manager

Dr. Alina Wagiran

IT Manager

Dr. Salehuddin Hamdan

Deputy Registrar (Academic)

Haji Mokhtar Kader

Senior Assistant Registrar (HR)

Mr. Mohd Farid Rahmat



RESEARCH FACILITIES

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

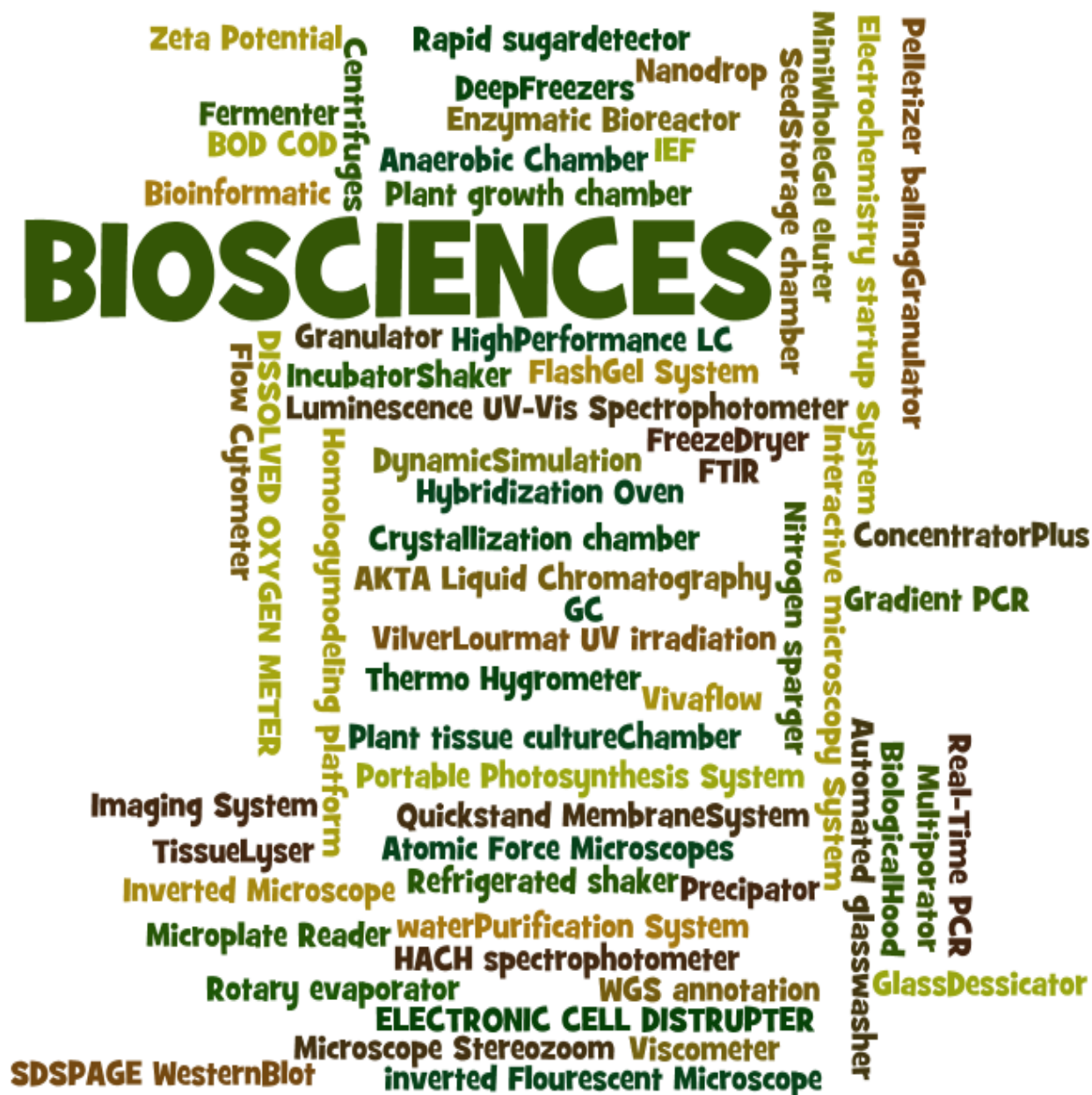


RESEARCH FACILITIES

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Equipment and Techniques

The research facilities available in the faculty are described separately for Biosciences and Medical Engineering as follow:



MEDICAL ENGINEERING

Bioimpedance Analyzer Orthopedic-Related Equipments High End Oscilloscope
 Spirometer Transcutaneous Electrical Nerves Stimulation Trainer Receiver
 Anesthesia Machine OPTO Rehabilitation Equipment Goniometer
 Ultrasound Transducer Thoracolumbar Measurement Posture Evaluation Kits
 Hydraulic Press Dexterity High End Bioamplifier Hemocytometer Chamber
 Spine Analyzer Physiotherapy Equipment Human Torso Trainer
 Patient Simulator Grinder Polisher Equipment Digital Blood Pressure Monitor
 Blood Chamber Hand Wrist And Forearm Table Scoliosimeter
 Logic Analyzer Sensory Assessment Equipment
 Fitness Equipment Magnetotherapy Trainer
 Forearm Workouts Ball Mill Medical Massage Bed
 Phantom Kinethesiometer General
 Wireless Pulse Oximeter With Patient Module
 Mobility Equipment Human Body Models
 Probe Tracking System
 Tabletop SEM Workstation
 Wireless Vital Sign Monitor Electrosurgical Unit
 Assistive Technology Devices CPM Machines
 Ultrasound Probe-Phased Array
 Broadband Power Amplifier Electrospinning
 Neurological Testing Devices Urine Analyzer
 Contact angle measurement Inclinometer
 Spectrum Analyzer
 Electrostimulation Trainer
 3D-Ultrasound Phantom
 Rapid Prototyping Machine
 Ultrasound ECG Stress System
 PowerLab system
 Hemocytometer Chamber
 Ultrasound Power Meter
 Digital Blood Pressure Monitor
 Stethoscope
 Stres Loading Device
 Trainer Machines
 Hemoglobinometer
 Laser-Therapy Trainer
 Audiometer
 Anti-Static Workbench
 Infra Red Lamp
 Ultrasound Phantom
 Binocular Microscope

Computing Facilities

The faculty makes available computing facilities for students' research convenience. Postgraduate Research Laboratories are provided with computers making it easy for teaching, learning and presentation purposes. Another alternative for IT resources is the Bioinformatics Laboratories.

Activities Rooms

Activity room is equipped with tables, chairs, cabinets and sofas for the use of post graduate students. The room also has electrical power outlets and Internet access. Students use this room to conduct general activities such as group discussions or simply to relax.



UNDERGRADUATE PROGRAMMES

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)



UNDERGRADUATE PROGRAMMES

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Programmes Offered

Faculty of Biosciences and Medical Engineering (FBME) offers **3 undergraduate programmes** that lead to the award of the **bachelor degrees** in the areas of Industrial Biology, Biology, Biomedical Engineering and Equine Management.

The normal study duration is 8 semesters (4 years) with minimum accumulated credit of 129 for Biology and Industrial Biology, 137 for Biomedical Engineering and 126 for Equine Management.

Admission Requirement

Student intakes for the Bachelor Degree Programmes are divided into 2 groups that are first year admission and the direct entry admission to second and upper year.

First Year Admission

Minimum Entry Requirements for Ministry of Education Malaysia Matriculation/UM Science Foundation Programme:

University General Requirements:

- Passed Malaysian Certificate Examination (SPM) or equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July paper
- Passed MOEM Matriculation/UM Science Foundation with CGPA of at least 2.00
- Obtained at least a Band 1 in Malaysia University English Test (MUET)

Programme Entrance Requirement:

- Passed with a credit in Mathematics at SPM level or equivalent
- Obtained at least a Grade B- (CGPA 2.67) Biology at Matriculation/Foundation level
- Passed with at least Grade C+ (2.33) in Matriculation/Foundation in any TWO (2) the following subjects: Chemistry, Mathematics and Physics
- Not having any health problems that will prevent student from taking up practical work

Minimum Entry Requirements for STPM Holders:

University Entrance Requirement:

- Passed Malaysian Certificate Examination (SPM) or equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July paper
- Passed Malaysian High School Certificate (STPM) and obtained the following:
 - Grade E in General Studies/General Paper
 - Grade E in TWO (2) other subjects
- Obtained at least a Band 1 in Malaysia University English Test (MUET)

Programme Entrance Requirement:

- Passed with credit in Mathematics at Malaysian Certificate Examination (SPM) level or equivalent
- Obtained with at least Grade B- (CGPA 2.67) in Biology at STPM level

- Obtained with at least at least Grade C+ (CGPA 2.33) in any TWO (2) the following subjects: Chemistry, Mathematics and Physics
- Not having any health problems which that will prevent student from taking up practical work.

Direct Entry to Second or Upper Year Admission

Minimum Entry Requirements for Diploma Holder/Equivalent:

University Entrance Requirement

- Passed Malaysian Certificate Examination (SPM) or equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July paper
- Obtained a Diploma or equivalent qualification recognized by the Malaysian Government and approved by the Senate,
or
- Passed STPM examination in 2009 or before and obtained the following:
 - Grade C (CGPA 2.00) in General Paper; and
 - Grade C (CGPA 2.00) in TWO (2) other subjects
 or
- Passed Matriculation Examination in 2009 or before and obtained at least CGPA 2.00
- Obtained at least a Band 1 in Malaysia University English Test (MUET)

Programme Entrance Requirement

- Obtained a Diploma related to the applied course from UTM or equivalent with at least CGPA 2.50
or
- For those who obtained a CGPA 2.50 but have at least TWO (2) years working experience in related field are eligible to apply; and
- Passed with a credit in Mathematics at SPM level
or
- Obtained at least Grade C in any of Mathematics subjects

Subject's exemption will be given to direct entry students after registration according to the grade of the subjects obtained and provided that the subjects are recognized by the faculty.

The actual year of entry and duration of study are subject to credit exemption approved by university.

International Students

Entry requirements

The general minimum requirement for entry into a Bachelor's Degree Programme is as follows:

- At least the Senior High School Certificate/Senior Secondary School/other equivalent pre-university examination from the government school (with the period of at least 12 years of study from primary to higher secondary) ; or
- General Certificate of Education (GCE) 'A' Level , Diploma in the related field or other equivalent pre-university examinations; or
- Any other certificate that is recognized by the Senate of the University equivalent to the above
- Programme's specific requirements; and
- Language requirements

Regulation and Academic System Guidelines

Academic Calendar

The University Academic Session is divided into two normal semesters namely Semester 1 and Semester 2. Apart from the regular semesters, the University also runs a short semester, which is held during the vacation period at the end of Semester 2. This semester is not taken into account in the maximum study duration stipulated for a particular programme. The academic year is shown in Table 1.

Table 5.1: The Academic Year*

Activities	Duration
Orientation Week for new students [Within the Duration for End of Academic Year Vacation]	1 week
Semester 1	
Lectures	14 weeks
Mid Semester Break	1 week
Revision Week	1 week
Final Examination	3 weeks
End of Semester Examination	3 weeks
Total	19 weeks
Semester 2	
Lectures	14 weeks
Mid Semester Break	1 week
Revision Week	1 week
Final Examination	3 weeks
End of Semester Examination	3 Weeks
Total	19 Weeks
End of Academic Year Vacation	10 Weeks
Total	52 Weeks
OR	
Short Semester	
Lectures & Examination	8 Weeks
End of Semester Vacation	1 Week
Total	52 Weeks

** Subject to changes*

Academic Advisor System

Aim and Objectives

Generally, emphasis is given on advice relating to academic matters as well as others relating to improving student performance:

- Guiding and assisting student to familiarize themselves with learning based on the Semester system.
- Acting as an advisor to students especially in the academic field.
- Guiding students to work as a team.
- Assisting any students facing difficulties, especially in the academic field.
- Acting as a link between students and staff (academic and general) and the faculty.
- To nurture a balanced attitude and assist in personality development of students in line with the need of the nation.

Table 5.2: Roles & functions of academic advisor and roles of students

Academic Advisor	Roles of Students
<ul style="list-style-type: none">▪ Improving student's academic performance and self-confidence▪ Selection of course and field of specialization intellectual development▪ Improving relationship between a student and academic staff▪ Encouraging co-curricular activities▪ Accomplishment of co-curricular activities▪ Student registration▪ Assisting students in overcoming problems in their course▪ Advice on career▪ Identifying students who require counseling▪ Preparing academic report and letter of recommendation to former students under his/her advice	<ul style="list-style-type: none">▪ Meeting the Academic Advisors during the first week to receive general briefing on the Semester System and other matters relating to studies▪ Obtaining endorsement of subject and examination registrations▪ Seeking advice from the Academic Advisor on preparation of study programmed in the aspects of subject selection, total credit hours to register and duration of study▪ Obtaining endorsement for application to withdraw subjects▪ Seeking advice on the effects of registration and withdrawal of subjects▪ Informing and discussing with the Academic Advisor on academic performance and on any problems encountered throughout each semester

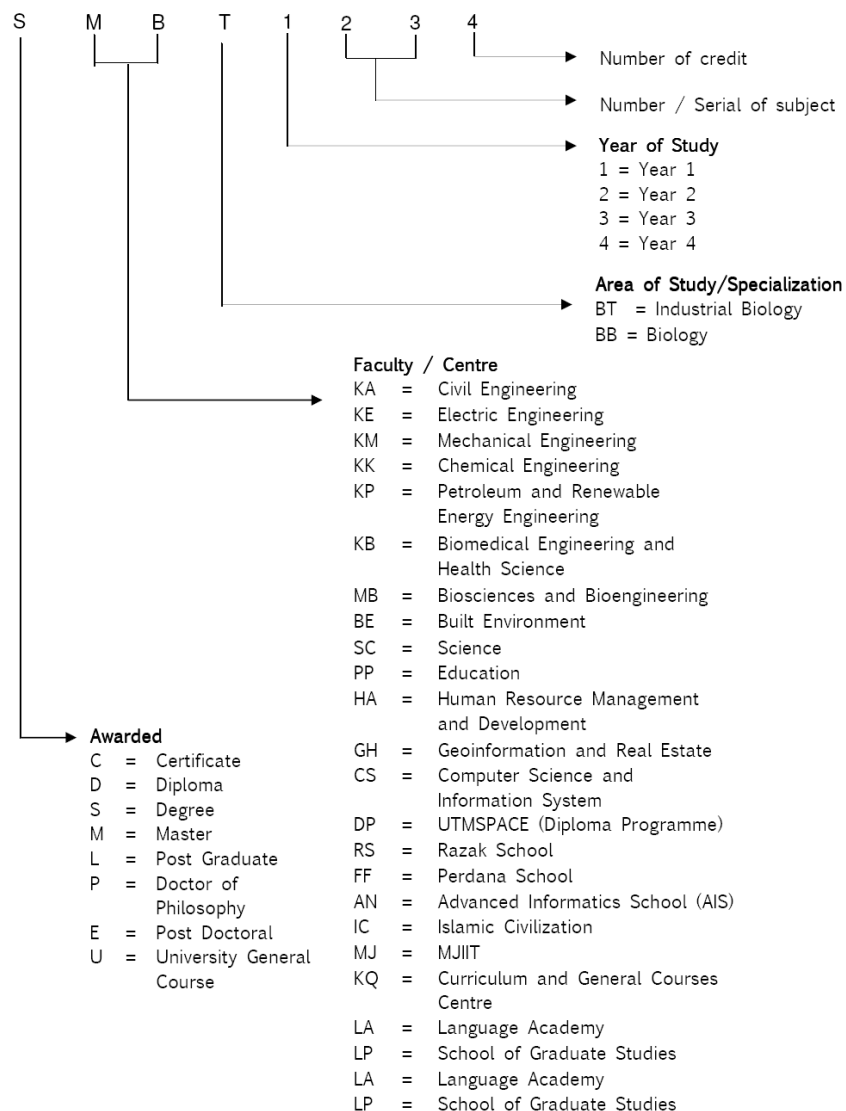
Course Registration

All candidates are required to register their courses on the dates specified by the University. For a student who fails to do this without a valid and acceptable reason, the course offered to him/her is thereby automatically withdrawn.

Course registration for senior students will automatically be done by the University's administration based on examination results in the previous semester. However, senior students whose study is interrupted due to a study break or being withheld from study are required to re-register their courses.

Course Code and Abbreviations

Each of the course and subject code offered by the faculty is made up of four letters and followed by four digits. For an example: SMBT1234*



**Note: Please always check for updates with your Program Coordinator each registration period.*

Changing a Programme Of Study

Changing a programme of study is not advisable. However, students may apply to change programme within the faculty or between faculties after at least undergoing one semester of study at the University.

Course Registration

Every semester, students are required to register every subject to be taken using the correct codes. Students can only register courses that are offered by the faculty. There are courses that are designated as pre-requisites for some other subjects (refer the chapter on Curriculum). The pre-requisite subjects must be registered and passed before the other course can be registered.

Course registration must be completed before the expiry of the compulsory specified duration for registration that is two (2) days before the start of the semester. However, with acceptable reasons,

students may register within two weeks of the beginning of semester. Any application for late registration of courses without acceptable reasons to the University, but within a specified duration, will warrant a fine. Students who fail to complete course registration before the expiry date for late registration will be terminated from his/her study, unless with reasons acceptable to the University.

The minimum number of credits to be registered by a full time student is 12 (except for final semester student). This does not include course registered with **HS (Attendance Only)** and **HW (Compulsory Attendance)** status. Students who get a **KS (Conditional Pass)** are not allowed to register more than 12 credits in the following semester. Students who wish to register more than 18 credits will have to get the Dean's permission.

Pre-registration of subjects for a particular semester can be carried out during a specified duration. It is the student's responsibility to verify the registration of the subject taken by them and to inform the faculty of any errors or discrepancies in the registration record. Correction of the registration errors should be done within the period given.

With the knowledge of the concerned lecturer and the agreement of the Academic Advisor, a student can apply to withdraw any courses which have been registered for the semester not later than the first Friday on the ninth (9) week of the semester.

Permission to withdraw any courses is subjected to the minimum total credit regulation, unless approval is obtained from Dean. The **Withdrawn (TD)** status will be recorded in the subject registration and transcript records.

Status of Courses

Apart from the regular courses, there are courses that have a particular status as follows:

- **HW – (Compulsory Attendance)**

A student is required to attend lectures, practical training or seminar and will be awarded either a **HL (Passed Attendance)** or a **HG (Failed Attendance)** grade. If the student passes, credits will be taken into account in computing **Credits Obtained**, but will not be considered in computing the **GPA (Grade Point Average)** and **CPA (Cumulative Point Average)**. If the student fails, credits will not be counted into **Credits Obtained** and the subject must be repeated until a pass is obtained.

- **UM – (Repeat Course)**

For a course with an **UM** status, grade **HL** will be awarded if the course is of an **HW** status. Students are required to pass with at least a **D** grade. However, the credits for a failed **UM** (**E** grade) course will not be counted in the **CPA** computation since they have been taken into consideration during the previous semester. This is to avoid duplication.

- A student who obtains **E** grade for any courses that is a pre-requisite for higher courses must repeat the failed course on the next semester it is offered.
- A student who fails an elective course is allowed to take another elective course as a substitute but the credits and grade of the original course will be taken into account in **GPA** and **CPA**.

▪ **UG – (Repeat Grade)**

A student may improve any subjects with a C- grade or lower using the **UG** status. This permission is given once only. The better grade between the previous and current grade will be awarded and used in the computation of GPA and CPA.

▪ **HS – (Attendance Only)**

Students may take a course with an **HS** status for the following reasons:

- To fulfill the requirement as a full time student as stipulated by scholarship sponsors.
- To seek further knowledge on the related subject

Credit System and Student Learning Time (SLT)

- **Credit** is a student workload required to achieve the objectives of a programme of study which consist of the time required to complete all planned learning activities. All courses offered by the faculty have a credit except of those approved by the University Senate.

▪ **What is Student Learning Time (SLT)**

- Effective learning time or student effort in learning or the learning volume (a quantitative measurement of all learning activities), in order to achieve the specified learning outcomes
- Inclusive of all learning time components (learning activities) i.e. formal and non-formal. Total time required by students to learn a particular component of curriculum
- Official Contact Time + Guided Learning Time + Self Study Time (Independent Learning) + Assessment Time
- Synonymous to students' academic load, e.g. credit hours, subjects, modules, etc.

▪ **Undergraduate Project**

The final year Undergraduate Project is split into 2 semesters. In the first semester the project is taken, it is given 2 credits and in the later semester it is given 4 credits. Both of these parts are evaluated individually.

▪ **Industrial Training**

Industrial Training is evaluated with a **Passed Attendance (HL)** or **Fail Attendance (HG)** grade.

Credit Exemption

Credit Exemption (CE) concerns subjects taken by a student before being accepted to the first degree programmes in UTM as approved by the Senate. Courses given credit exemption will not be taken into account in the computation of GPA and CPA.

Conditions for credit exemption are as follows:

- Subjects to be applied for credit exemption must have the same content or at least not less than 80% with the subject offered by the University;
- The grade or grade point obtained in the said subject should not be less than C; and
- The total credit hours to be exempted must not exceed 50% of the total credits for graduation

Application for **credit exemption** must be submitted to the faculty within ten (10) weeks after registration as a student.

Credit Transfer

Credit Transfer (CT) is for courses taken by a student at other Institution of Higher Learning after his admission to the first degree programmes in UTM as approved by the Faculty.

In case of credit transfer, all credits obtained from the Institute of Higher Learning at which the student has undertaken the study, together with their grades and grade points, will be taken into account in the GPA and CPA computation subject to the condition that the student is not allowed to transfer more than 50% of the total number of credits for graduation but not more than one semester of study for any Institution of Higher Learning.

Application for transfer of credits must be made at least one semester before a student undergoes study at another Institution of Higher Learning for the purpose of credit transfer.

Credit Obtained

Credits Obtained is the total number of credits for courses for which a student has passed including subjects with **HW (Compulsory Attendance)** which have a credit value. Credits for courses registered with the **HS (Attendance Only)** will not be taken into account in computing **Credits Obtained**. **Credit Obtained** is computed for each semester and for all semesters. For students with credit transfer, the credits will be added to the passed course credits in order to determine the overall **Credit Obtained**. The total **Credit Obtained** is very closely related the **Credits for Course Graduation**.

Credit Counted

Credits Counted is the total number of credits taken by a student in a semester and in all semesters. The number of credits is used in the computation of GPA and CPA for the student concerned. Credits for course registered with **HS** and **HW** status will not be used in computing **Credits Counted**. Credits for courses registered with a **UM (Repeat Course)** status will not be involved in the CPA.

Classification of Students

Students are classified as a First Year, Second Year, Third Year and Fourth Year according to the number of credit earned. A student is deemed to have progressed a particular year of course if the **Credits Earned** is not less than the following value:

$$\text{Credits Earned} = \text{Total Credits Earned at normal semester} - 5$$

Thus, the classification of students is shown in Table 5.3.

Table 5.3: Classification of students

Classification of Students	Total Credits Must Be Earned For The Second Semester		
	B. Sc. (Industrial Biology)	B. Sc. (Biology)	B. Eng. (Biomedical)
First Year	32	32	32
Second Year	30	30	34
Third Year	33	33	34
Fourth Year	29	29	32

Credit for Graduation

A student must pass all subjects specified for his/her course of study. The total minimum credits that students must earn in order to graduate and the maximum period to complete and pass a course are as shown in Table 5.4.

Table 5.4: Credits for graduation and maximum period of study

Degree	Minimum Number of Credits	Maximum Number of Semesters
Bachelor of Science (Industrial Biology)	129	12
Bachelor of Science (Biology)	129	12
Bachelor of Engineering (Biomedical)	137	12

All deferment of study (except for approved medical reason) is counted towards the period of graduating.

Lecture Attendance

Students must attend not less than 80% of contact hours specified for a particular subject including courses with **HW (Compulsory Attendance)** and **HS (Attendance Only)** status.

Students who do not attend lectures or whose attendance is less than 80% without acceptable reasons will not be allowed to attend future lectures and sit for any evaluation, and zero mark (E Grade) will be given to the course with **HW(Compulsory Attendance)** status or **HG (Failed Attendance)** for courses with **HW (Compulsory Attendance)** status.

Subjects with **HS (Attendance Only)** status will be removed from the transcript if the attendance is less than 80% of the scheduled contact hours.

Grading System

A student's performance in a course is indicated by the grade obtained. The relationship between marks, grades and grade points are as given in Table 5.5. Generally the passing grade for any subject is D+. However, the passing grade for a particular subject is subject to the Faculty's requirement with the approval of the University Senate.

Credits Earned is the total number of credits for subjects for which a student has passed including subjects with **HW (Compulsory Attendance)** which have a credit value. Credits for courses registered with the **HS (Attendance Only)** will not be taken into account in computing **Credits Earned**. **Credit Earned** is computed for each semester and for all semesters.

Table 5.5: Relationship between Marks, Grades and Grade Points

Mark	Grade	Grade point
90 – 100	A+	4.00
80 – 89	A	4.00
75 – 79	A-	3.67
70 – 74	B+	3.33
65 – 69	B	3.00
60 – 64	B-	2.67
55 – 59	C+	2.33
50 – 54	C	2.00
45 – 49	C-	1.67
40 – 44	D+	1.33
35 – 39	D	1.00
30 – 34	D-	0.67
00 – 29	E	0.00

Apart from the above grades, the following subject grades are also used:

TD (Withdraw)

This grade is given to course withdrawn during a specified duration as stipulated by the Senate. Credits will not be counted when computing **Credits Counted, Credits Obtained, GPA** and **CPA**.

TS (Incomplete)

Grade given to students who could not sit for the final examination or to complete the course work for a particular course due to illness as certified by a Medical Officer of the University or of a government hospital or due to other reasons acceptable by the Senate.

HS (Attendance Only)

Grade given to subjects registered with **Attendance Only** status. Credits will not be taken into account when computing **Credits Counted, Credits Earned, GPA** and **CPA**.

HL (Passed on Attendance)

Passed grade given to courses registered with **Compulsory Attendance (HW)** status. If passed (**HL**), credits will be taken into account when computing **Credits Counted** and **Credit Obtained** but not when computing the GPA and CPA.

HG (Failed on Attendance)

Failed grade given to subjects registered with **Compulsory Attendance (HW)** status. If failed (**HG**), Credits will not be taken into account when computing **Credits Counted, GPA** and **CPA**.

Examination

The end of semester examinations are the final examination for courses taught through lectures. The allocation of marks for this should not exceed 50% of the overall evaluation mark for the course.

Grades of each course have to be displayed by the course lecturer and students may submit an appeal for re-evaluation of the examination grade for any subject to the Faculty within a specified duration and following a specified procedure. Appeals will not be entertained after the expiry date. Students will be charged a sum of RM50.00 for each of the courses appealed.

Special Examinations

Special examinations may be held for any students in the following cases:

- Students who are unable to sit for the end of semester examination due to illness as certified by the University Medical Officer or by a government hospital;
- A final semester student who passes with a status of **KB (Good Pass)**, but fails a course from the last two semesters; and
- A final semester student who passes with a status of **KB (Good Pass)**, but fails a **repeat course (UM)** with the condition that the subject was taken each time it was offered.

Marks for **Special Examination** in cases ii) and iii) above will determine the results for the related course but will not be considered in the computation of the final GPA and CPA.

A student who has been ill (case i) and was unable to sit for the end of semester examination must submit the medical certificate to the Faculty not later than 24 hours before the examination of the said course was held in order to qualify him/her to apply for a special examination. The result of the special examination will be taken into account in computing **Credits Obtained** and **Credits Counted** for the determination of **GPA** and **CPA**.

The **TS (Incomplete)** grade will then be deleted and replaced by the grade obtained in the special examination. If a student fails in his/her special examination, he/she is required to repeat the subject in the following semester (subject to the maximum duration of study remaining) and has to register either as a full time student or an external candidate.

Special examination for Semester 1 will be held not later than 2 weeks after the subject registration for Semester 2. For Semester 2, special examination will be held not later than 3 weeks after the Semester 2 examination result slips are issued.

Special examination may not be held in the following cases:

- Courses not having end of semester examination
- Students not having sat the final examination without reasons acceptable by the University.

Academic Performance

The student's performance is evaluated based on GPA and CPA.

GPA: Grade Point Average

GPA is the grade point average obtained by a student in a particular semester. GPA is computed as per the following:

$$\text{GPA} = \frac{(\text{Credit Hour} \times \text{Pointer}) \text{ for that semester}}{\text{Total Credit Counted for that semester}}$$

CPA: Cumulative Grade Point Average

CPA is the cumulative grade point average obtained by a student for all semesters studied. CPA is computed as per the following:

$$\text{GPA} = \frac{\Sigma(\text{Credit Hour} \times \text{Pointer}) \text{ for all semester}}{\Sigma(\text{Credit Counted}) \text{ for all semester}}$$

Table 5.6: Example of GPA and CPA calculation

Semester 1						
Courses	Credit (K)	Grade	Grade Point (M)	Credit Points (KxM)	Credit Counted	Credit Earned
SQBI 1303	3	B+	3.33	9.99	3	3
SQBS 1182	2	D+	1.33	3.99	2	2
SQBS 1603	3	D	1.00	3.00	3	3
SSCH 1023	3	C	2.00	6.00	3	3
SSCH 1103	3	B-	2.67	8.01	3	3
UICI 1012	2	D	1.00	2.00	2	2
TOTAL (Σ)			19.66	32.99	16	16

$$\text{GPA} = \frac{32.99}{16} = 2.06$$

$$\text{CPA} = \frac{32.99}{16} = 2.06 : \text{KB}$$

Semester 2						
Courses	Credit (K)	Grade	Grade Point (M)	Credit Points (KxM)	Credit Counted	Credit Earned
SQBS 1143	3	D+	1.33	3.99	3	3
SQBS 1173	3	D	1.00	3.00	3	3
SQBS 1222	2	C	2.00	6.00	2	2
SSCH 2243	3	D-	0.67	2.01	3	3
SSCH 2861	1	E	0.00	0.00	1	1
ULAB 1112	2	B+	3.33	6.66	2	2
UHS 1152	2	A	4.00	4.00	2	2
TOTAL (Σ)				25.66	16	16

$$\text{GPA} = \frac{25.66}{16} = 1.60 \quad \text{CPA} = \frac{32.99 + 25.66}{16+16} = \frac{58.65}{32} = 1.83 : \text{KS}$$

The academic performance rating of a student is determined at the end of a normal semester using CPA as the following:

Table 5.7: Academic performance rating

Academic Status	CPA
KB – Good Pass	$CPA \geq 2.00$
KS – Conditional Pass	$1.70 \leq CPA < 2.00$
KG – Fail (Dismissed)	$CPA < 1.70$

Students who obtain $GPA < 1.00$ even though the $CPA \geq 2.00$ can be dismissed from study or can be asked to defer their study to the following semester or can be allowed to proceed with their study in the following semester with the faculty's approval.

The academic rating of a student is not determined for semester III (Short Semester) although the GPA and CPA are computed in the usual manner. Grades obtained in that semester will be included in the computation of CPA in the following semester 1.

Students who obtained a **KS** rating (CPA less than 2.00) are allowed to register between nine (9) to twelve (12) credits only in the following semester. Students who obtained a **KS** status three (3) times consecutively will be given the **KG** status and terminated from their studies.

The University Senate may consider to re-admit students who obtained the **KG (Dismissed)** status in their first semester of study to **re-register (DS)** if the students submit an application to the faculty. The students may be rested for one semester before being allowed to resume study. The student is deemed to have used one semester of his/her study duration. **Re-registering** students who fail to obtain **KB** status in the semester which he/she resumed the study will be given **KG** status and will be terminated.

The Dean's List

The Dean's List is an appreciation of academic excellence awarded to students with a GPA of 3.50 and above and has registered for at least 12 credit hours for the particular semester. Students will be given a Dean's List Certificate. The Dean's List will be displayed on the notice board of the faculty. The student's transcript will show the notation.

Procedure for Awarding a Degree

Degrees are awarded during the two regular semesters. However, under special circumstances, the Senate may allow the awarding of degrees during the Short Semester. Students are required to submit an application for graduation (awarding of degree) in a particular semester within the specified duration. The application must be made using the Application for Awarding a Degree Form (UTM.E/7-7) obtainable from the Academic Office. The application must be attached with the list of Degree Audit (a listing of what students have completed and what remains to be eligible to graduate). A penalty will be imposed on late application of degree award. Students who do not submit their application for the award of degree during the specified duration will be given a **Good Pass** or **KB (TK)**.

Students who do not submit their application for the award of degrees within five (5) years of completion of their courses, will not be awarded with a degree. Student who are not eligible to apply but submits an application will be asked to pay a penalty.

A student must fulfill all requirements as follows to be awarded a degree:

- Obtained Good Pass (KB)
- Has passed all subjects specified
- Has applied for graduation and has been certified by the Faculty
- Other conditions as specified

Students who have finished their study duration with a status **Good Pass (Course Completed) KB (TK)** are not eligible to apply for graduation.

Deferment of Study

Students may apply for deferment of his/her study due to health reasons by submitting a certificate report from University medical doctor or a government hospital. In such cases the deferred semester will not be counted in the duration of study. A similar case to deferment may be granted to students for the interest of the University or the country.

Students may apply for deferment of his/her study for other reasons (financial, academic or personal). The student who applies for deferment of his/her study should first contact the Academic Advisor to discuss the plan of study. The application must be made before the mid-semester break by using the **Deferment of Study Form** obtainable from the Faculty's Academic Office. The University can also ask students to defer his/her study on the basis that the student obtain a GPA < 1.00 even with a CPA = 1.70. The semester will be considered as used by the students.

Prizes and Awards

The Royal Education Award

The prize is contributed by the Office of the “Penyimpan Mohor Besar Raja-Raja Malaysia”. It is awarded to a Bumiputera graduate and a Non-Bumiputera graduate with a first class honors degree and are involved in co-curricular activities. The prize is in the form of RM 2,500.00 in cash, certificate and medal.

Chancellor's Award

This award is given to the best graduate for each Convocation Ceremony. The prize consists of a medal worth RM 1,000 and RM 1,500 cash as well as a certificate of acknowledgement.

Vice Chancellor's Award

This award is presented to the best graduate nominated by each faculty. The prize is in the form of a medal, certificate and some cash.

Academic Prize

This prize is given to the best graduate for each programme and specialization of each faculty. Prizes sponsored by statutory and professional bodies or organizations as well as private companies. Prizes are in the form of medals, cheques or cash, books or acknowledgement certificates.

Dean's Medal

This award is presented to graduates who obtain a CGPA of 3.5 and above in the final semester.

Miscellaneous

Lecture Hours

Lecture hours are as specified by the University, being from Monday to Friday, from 8:00 am to 6:00 pm. If necessary, lectures may be held at night from 8:00 to 11:00 pm.

The University allocates Wednesday afternoon, starting 2:00 to 6:00 pm for Co-curricular courses.

Lecture periods are generally limited to 1 hour/lecture. Lectures will commence on the hour as specified in the timetable and will be stopped 10 minutes before the following period.

Permission Not To Attend Classes

Permission not to attend classes can be given to students who make an application to be exempted from lecture/tutorial/laboratory/workshop/seminar for a short duration of time on the following reasons:

- Visiting ill/burial of a family member or;
- Attending a court proceeding or;
- Participating in sporting/cultural practice/competition; and
- Other acceptable reasons

The application must be made using the Exemption From Lecture Application Form obtainable from the Academic Office. Consent of the concerned lecturers must be obtained. The duration for which a student may be granted permission not to attend class is limited to 20% of the number of lecturers/tutorials/practical for each semester.

Application for Academic Transcript

Students who are eligible to apply for an academic transcript may do so at the Registrar Office (Academic Administration Division) by filling in the Transcript Application Form (UTM.E/6-1) obtainable from the said office. Students who are eligible to apply are:

- Students who have terminated their study from the University (Graduates, Completed Course or Dismissed from study).
- Students who obtain Failed (Terminated) (KG). Academic transcript will not be issued to students who hold debt with the University.

Document and Examination Result Certification

Faculty Administrative officials namely the Deputy Registrar and Assistant Registrar have been empowered by the University to certify copies of the said documents. Students who require certification of certificates/examination results or other documents may see one of the above-mentioned officers by bringing along the original copies of the relevant documents.

Confirmation Letter for Student Status

Students who require such certification/confirmation letters may submit an application to the Faculty Academic Office. This letter is only issued to students for the purpose of applying for financial assistance, extension of scholarship/loan, conducting off campus study/practical work, driving license and other purposes deemed as necessary for the benefit of student education at the University.

Change of Permanent Address

It is the responsibility of the student to inform the Faculty administration of his/her latest address should there be any changes in his/her study/permanent address in order to ensure that he/she can easily be contacted by the Faculty. Students are required to use the Change of Address Form available from the Faculty Academic Office. By this means, the University/Faculty administration is able to get in contact with the student concerning any university matters or in case of emergency.

Academic and Personal Records

From time to time, students may check their individual academic record and personal record online *via* the website Academic Information Management Systems (AIMS2000): <http://aimsweb.utm.my/>



B.SC. IN BIOLOGY

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)



BACHELOR OF SCIENCE IN BIOLOGY

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Program Features

The Bachelor of Science (Biology) degree provides an understanding of BIOLOGICAL PROCESSES at the MOLECULAR and CELLULAR levels. It offers broad-based integrating subjects such as genetics, biochemistry, microbiology and cell biology, and does not assume that students on entry have a strong background in chemistry. Both fundamental and applied topics are covered. Graduates of this programme will have sound understanding and knowledge of multiple disciplines and a flexible approach and willingness to embrace new technologies making them well positioned to have exciting and rewarding careers.

The Bachelor of Science (Biology) is a highly structured programme designed to cover both TRADITIONAL and MODERN BIOLOGY which emphasizes coursework and training in many aspects of molecular biology, genetics, phycology, mycology, ecology, enzymology, immunology, virology, DNA analysis techniques, protein isolation techniques, and recombinant DNA techniques. The programme is designed not only to train students in the necessary technical skills but also to provide them with the theoretical basis for continued study.

The first two years of this programme is emphasized on the compulsory fundamentals accounting theoretical and technical skills. Students are then exposed to more advanced knowledge in biology during their third year of study. Teaching is *via* lectures, supervisions, assignments and laboratory classes. A research experience is an important component of the Bachelor of Science (Biology) programme. In the final year, students conduct laboratory-based research projects which are integrated with the expertise of our academic staff. This experience is invaluable in the intellectual development of a student and in their subsequent search for technical positions in industrial, medical or government research laboratories. The programme also provides opportunities for students to engage in diverse and interdisciplinary research areas, ranging from molecular biology, with its potential to revolutionize medicine and agriculture, to ecology, with its applications for sustainable management of the environment. It is aspired that these research fields will satisfy and meet future challenges in improving the quality of human life as well as sustaining the habitats and biodiversity.

Selected students will be offered to join *study abroad programme* at University of Kent, United Kingdom. This programme allows students to be exposed to different ways of teaching and learning process, gain new and more advance knowledge in biotechnology and promoting students enthusiasm to be part of biotechnology player at the international level.

Programme Educational Objectives

The Bachelor of Science (Biology) degree programme consists of a combination of basic core requirements and a wide variety of electives with the goals of preparing:

- Graduates who are technically competent in the field of biological sciences, creative, innovative and able to contribute effectively to public or private sectors at national or international levels.
- Graduates who are motivated and prepared for further study or for employment in the biological-based industries, research development or outside their field.
- Graduates who possess ethical values and are competent in solving problems intellectually based on facts and ideas to enable effective lifelong learning.

- Graduates who are able to adapt to the changing social and research environment in order to stay competitive in further studies and in the job market.

Programme Outcomes

The programme will prepare students with the ability to:

- Acquire fundamental and practical knowledge of biological sciences
- Apply knowledge and relevant technical skills in biological sciences
- Analyze or synthesize or evaluate theoretical or experimental data using fundamental knowledge in biological sciences
- Communicate, with clarity and coherence, concepts and arguments in Biological Sciences
- To solve problems using scientific approach in the context of their chosen specialization.
- Work collaboratively as an individual and as a leader in a team
- Create awareness of business opportunity and entrepreneurship
- Practice ethical values in professional practice and social interactions for sustainable development
- Demonstrate the acquisition of the skills and attributes necessary for lifelong learning, including intellectual independence, effective time management and utilization of a variety of resource materials
- Acquire and understand knowledge in contemporary issues locally and internationally.

Programme Structure

To be awarded with the Bachelor of Science (Biology) degree, students are required to fulfill 129 credit hours consisting of the following:

Table 6.1: Programme structure of B.Sc. (Biology)

Classification of Courses	Credits
Faculty Cores	24
Programmes Core	47
Electives	33
University General	12
English Language	6
Co-curriculum/Service Learning	2
Industrial training	5
Total Credits	129

Industrial Experience/Training

Students are given the opportunity to enhance their technical skills and employment prospects through a 12 week industrial training experience in biological science related industry, or in appropriate laboratories at private or government sectors in the third year of study. This placement allows students to apply their knowledge and skills in the workplace as well as to gain new experiences in working environment.

Duration of Study

4 years (Full-time).

Career Prospects

Graduates from this programme have found employment in various private and government sectors or research institutes as Academicians, Microbiologist, Product Specialist, Research Officer, Clinical Coordinator, Project Manager, Environmental officer, and Postdoctoral. Most of our graduates have opted to pursue their MSc or PhD degrees locally or abroad in more advanced field of bioscience such as cell signalling, cancer and stem cell research, protein chemistry, genomics and proteomics and structural biology.

Curriculum

The curriculum is designed with a specific subjects being delivered and assessed in each semester. Assessment is based on coursework, final examination and final year project thesis. The courses are categorized as university general courses, programme core courses and programme elective courses such as the followings:

Table 6.2: Curriculum of Bachelor of Science (Biology)

YEAR 1 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBT 1303	Microbiology (+Lab)	3	
SMBB 1182	Introduction to Biomolecules	2	
SMBB 1603	Bioorganic Chemistry	3	
SSCM 1023	Mathematical Methods 1	3	
SSCM 1103	Statistics	3	
UICI 1012	Islamic and Asian Civilizations		
	OR		
ULAM 1112	Malay Language for Communication	2	
TOTAL CREDIT HOURS		16	

YEAR 1 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBB 1143	Cellular and Molecular Biology	3	
SMBB 1173	Cellular Biochemistry & Metabolism (+Lab)	3	SMBB 1182
SMBB 1222	Introduction to Bioscience	2	
SSCC 1293	Analytical Chemistry	3	
SSCK 1891	Analytical Chemistry Practical	1	
ULAB 1122	Academic English Skills	2	
UHAS 1172	Dynamica Malaysia		
	OR		
UHAS 1162	Arts, Customs and Beliefs of Malaysians (International Student)	2	
TOTAL CREDIT HOURS		16	

YEAR 2 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBB 2153	Genetic Engineering (+Lab)	3	SMBB 1143
SMBB 2323	Mycology	3	SMBT 1303
SMBB 2753	Basic Genetics	3	
UKQ* 1**1	Co-Curriculum I/Service Learning	1	
UHAS 3**2	General University	2	
<i>Elective (choose 2 credits)</i>			
UICI 2042	Islamic Institutions	2	
UICI 2032	Islam & Current Issues	2	
TOTAL CREDIT HOURS		14	

YEAR 2 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBB 2603	Enzymology (+Lab)	3	SMBB 1173
SMBB 2263	Plant Physiology (+Lab)	3	
SMBB 2503	Immunology	3	
SMBU 2613	Research Methodology	3	
ULAB 2112	Advanced English for Academic Communication	2	
UHAS 2122	Creative and Critical Thinking	2	
TOTAL CREDIT HOURS		16	

YEAR 3 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBB 3273	Animals Physiology (+Lab)	3	
SMBB 3113	Phycology	3	SMBB 1303
ULAB 3**2	English Elective	2	
UKQ* ****	Co-Curriculum II/ Service Learning	1	
<i>Elective (Choose 9 credits)</i>			
SMBB 3183	Bioenergetics (*)	3	SMBB 1173
SMBB 3323	Physiology and Screening of Industrial Microorganisms (*)	3	SMBT 1303
SMBB 3203	Nutritional Biochemistry	3	
SMBT 3333	Food Microbiology	3	
SMBB 3573	Biological Control and Environmental Conservation	3	
TOTAL CREDIT HOURS		18	

YEAR 3 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBB 3433	Virology	3	SMBB 2503
SMBU 3193	Bioethics in Research and Development	3	
<i>Elective (choose 9 credits)</i>			
SMBB 3683	Structure and Function of Proteins (*)	3	
SMBU 3723	Biocomputation and Bioinformatics (*)	3	
SMBB 3413	Extremophiles	3	
SMBT 3213	Molecular Biotechnology	3	
SMBB 3173	Gene Expression	3	
TOTAL CREDIT HOURS		15	

SHORT SEMESTER			
Code	Courses	Credit	Pre-req
SMBU 3915	Industrial Training (HW)	5	
TOTAL CREDIT HOURS		5	

YEAR 4 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBB 4583	Ecology	3	
SMBU 4922	Undergraduate Project 1	2	
<i>Elective Courses (Choose 9 Credits)</i>			
SMBB 4713	Genomics and Proteomics (*)	3	SMBB 2603
SMBT 4663	Protein Separation Techniques in Biotechnology	3	SMBB 2603
SMBT 4183	Applied Microbial Biochemistry and Biotransformation	3	SMBB 1173
SMBB 4723	Systems Biology	3	
SMBB 4493	Toxicology	3	
TOTAL CREDIT HOURS		14	

YEAR 4 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBB 4193	Cell Signaling	3	SMBB 1173
SMBU 4924	Undergraduate Project II	4	SMBU 4922
UHAS 3012	Entrepreneurship and Enterprise Development	2	
<i>Elective Courses(Choose 9 credits)</i>			
SMBB 4733	Structural Biology	3	
SMBB 4153	Synthetic Biology	3	SMBB 2153
SMBB 4143	Gene Therapy	3	
SMBT 4693	Biosensor Technology (+Lab)	3	SMBB 2603
TOTAL CREDIT HOURS		15	

Note: Courses stated as () are compulsory electives that should be taken in order to fulfill the graduation requirement.*

Total Credit Earned: 129

Total Credit Counts: 124



B.SC. IN INDUSTRIAL BIOLOGY

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)



BACHELOR OF SCIENCE IN INDUSTRIAL BIOLOGY

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Program Features

The Bachelor of Science (Industrial Biology) is a BIOTECHNOLOGY-based programme designed to grant a strong academic foundation in biological sciences and chemistry, training in the various biotechnologies and a solid understanding of their application in industry and biomedicine. The programme is designed not only to train students in the necessary technical skills but also to provide them with the theoretical basis for continued study in biotechnology, molecular biology, biochemistry, and other related areas or to obtain employment in academic, industrial, or government research laboratories.

With the aim of using living organisms, cells and their components for products and services, our curriculum is designed to contribute to the modern biotechnology education that provides multidisciplinary knowledge. It also reflects the broad spectrum of bioengineering concept as well as skills to accomplish the needs of biotechnology-based industries and also research institutes. As biotechnology is the key of this programme, we offer courses that integrate knowledge with the elements of blue biotechnology (*environmental biotech*), white biotechnology (*industrial biotech*), green biotechnology (*agri-biotech*) and red biotechnology (*biopharma*). These include gene and protein engineering technology, fermentation technology, bioprocess engineering, enzyme technology, plant and animal cell/tissue culture technology and biosensor technology. These technologies are applied in agriculture, health care, forensics, industrial processing and environmental protection / management in many useful ways.

The first two years of this programme is emphasized on the compulsory fundamentals accounting theoretical and technical skills. Students are then exposed to a more advance knowledge in biotechnology during their third and fourth year of study. A research experience is an important component of the interdisciplinary biotechnology degree programme. Students have numerous opportunities to pursue research projects and gain experience working with state-of-the-art instrumentation under the guidance of members of the faculty. This experience is invaluable in the intellectual development of a student and in their subsequent search for technical positions in industrial, medical or government research laboratories.

Selected students will be offered to join ***study abroad programme*** at the University of Kent, United Kingdom. This programme allows students to be exposed to different ways of teaching and learning processes, gain new and more advance knowledge in biotechnology and promoting student enthusiasm to be part of biotechnology player at the international level.

Programme Educational Objectives

The Bachelor of Science (Industrial Biology) degree programme consists of a combination of basic core requirements and a wide variety of electives with the goals of preparing graduates who:

- Technically competent, creative and resourceful in the field of biotechnology
- Motivated and prepared for further education or for employment in biotechnology-based industries as scientists or technologists in production and research development or explore independent employment and business opportunities
- Able to propose new thoughts or idea from data or information with a critical logical mind-set and high ethical standard

- Able to adapt to the changing social and research environment in order to stay competitive in further education as well as the job market

Programme Outcomes

The programme outcomes are:

- Ability to acquire knowledge as well as understand the fundamental and applied concepts in industrial biology.
- Ability to apply the knowledge and practical skills in industrial biology.
- Ability to analyze, synthesize and evaluate experimental data.
- Ability to present ideas clearly, effectively and confidently through written and oral modes.
- Ability to think creatively and critically in solving problems.
- Ability to lead and work cooperatively in a team to achieve common goals.
- Ability to acquire basic entrepreneurship skills.
- Ability to perform tasks given ethically, honestly and with dedication.
- Ability to acquire new knowledge and skills independently from a variety of sources.
- Ability to acquire and understand knowledge in contemporary issues locally and internationally.

Programme Structure

To be awarded with the Bachelor of Science (Industrial Biology) degree, students are required to fulfill 129 credit hours consisting of the following:

Table 7.1: Programme structure of B.Sc. (Industrial Biology)

Classification of Courses	Credits
Faculty Core	24
Programmes Core	47
Electives	33
University General	12
English Language	6
Co-curriculum/Service Learning	2
Industrial Training	5
Total Credits	129

Industrial Experience/Training

Students may also gain firsthand experience of working in biotechnology through an industrial training experience in private or government sectors during the short semester in their third year of study. Students from this programme are required to obtain one period of at least 12 weeks approved industrial experience in biological sciences-related industry, or in appropriate laboratories or institutions. This placement allows students to apply their knowledge and skills in the workplace as well as to gain new experiences in working environment.

Duration of Study

4 years (Full-time).

Career Prospects

Most of our graduates move directly into full-time employment, including Malaysian biological and non-biological based industries, government or private sectors and any other public services. These include hospitals, universities or research institutes such as IMR, MARDI, FRIM, SIRIM and MPOB. Graduates from this programme are employed as Microbiologist, Biotechnology Engineer, Research Officer, Clinical Coordinator, Project Manager, Environmental Officer, Product Specialist Postdoctoral position etc. Some of the graduates pursue their study locally or abroad in more advanced field of biotechnology such as cancer and stem cell research, proteomics and metabolic engineering. A number of them became an academia in universities or private learning institutes.

Curriculum

The curriculum is designed with a specific subjects being delivered and assessed in each semester. Assessment is based on coursework, final examination and final year project thesis. The courses are categorized as university general courses, programme core courses and programme elective courses such as the followings:

Table 7.2: Curriculum of Bachelor of Science (Industrial Biology)

YEAR 1 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBT 1303	Microbiology (+ Lab)	3	
SMBB 1182	Introduction to Biomolecules	2	
SMBB 1603	Bioorganic Chemistry	3	
SSCM 1023	Mathematical Method 1	3	
SSCM 1103	Statistics	3	
UICI 1012	Islamic and Asian Civilizations		
	OR	2	
ULAM 1112	Malay Language for Communication		
TOTAL CREDIT HOURS		16	
YEAR 1 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBB 1143	Cellular & Molecular Biology	3	
SMBB 1173	Cellular Biochemistry & Metabolism (+Lab)	3	SMBB 1182
SMBT 1212	Introduction to Biotechnology	2	
SSCC 2243	Principles of Analytical Chemistry	3	
SSCC 2861	Analytical Chemistry Practical 1	1	
ULAB 1122	Academic English Skills	2	
UHAS 1172	Ethnic Relations (Local Student)		
	Arts, Customs and Beliefs of	2	
UHAS 1162	Malaysians (International Student)		
TOTAL CREDIT HOURS		16	

YEAR 2 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBB 2153	Genetic Engineering (+ Lab)	3	SMBB 1143
SMBT 2513	Introduction to Bioprocess Engineering (+ Lab)	3	SMBT 1303
SHAD 1513	Principles of Management	3	
UKQ* ****	Co-Curriculum I/ Service Learning	1	
UHAS 2**2	General University	2	
<i>Electives Courses (choose 2 credits)</i>			
UICI 2042	Islamic Institution	2	
UICI 2032	Islam & Current Issues	2	
TOTAL CREDIT HOURS		14	

YEAR 2 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBT 2233	Fermentation Technology (+Lab)	3	SMBT 2513
SMBT 2693	Enzyme Technology and Biocatalysis (+Lab)	3	SMBB 1173
SMBU 2613	Research Methodology	3	
SHAF 1013	Principles of Marketing	3	
ULAB 2112	Advanced English for Academic Communication	2	
UHAS 2**2	Nationhood Elective	2	
TOTAL CREDIT HOURS		16	

YEAR 3 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBT 3523	Bioprocess Engineering	3	SMBT 2513
SMBT 3243	Tissue Culture Technology (+Lab)	3	
ULAB 3--2	Compulsory English Elective	2	
UKQ ****	Co-Curriculum II/ Service Learning	1	
<i>Elective Courses (Choose 9 Credits)</i>			
SMBT 3163	Techniques in Molecular Biology (*)	3	SMBB 2153
SMBB 3323	Physiology and Screening of Industrial Microorganisms (*)	3	SMBT 1303
SMBT 3333	Food Microbiology	3	
SMBT 3353	Industrial Microbiology	3	
SMBB 3573	Biological Control and Environmental Conservation		
TOTAL CREDIT HOURS		18	

YEAR 3 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBU 3193	Bioethics in Research & Development	3	SMBU 2613
SMBU 3723	Biocomputation and Bioinformatics	3	
SHAD 1043	Organizational Behavior	3	
<i>Elective Courses (6 credits)</i>			
SMBB 3173	Gene Expression	3	
SMBT 3213	Molecular Biotechnology	3	
SMBB 3433	Virology	3	
SMBB 3503	Immunology	3	
TOTAL CREDIT HOURS		15	

SHORT SEMESTER			
Code	Courses	Credit	Pre-req
SMBU 3915	Industrial Training (HW)	5	
TOTAL CREDIT HOURS		5	

YEAR 4 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBU 4922	Undergraduate Project 1	2	
SMBT 4663	Protein Separation Techniques in Biotechnology	3	SMBT 2693
<i>Elective Courses (Choose 9 Credits)</i>			
SMBT 4253	Applications of Tissue Culture (*)	3	SMBT 3243
SMBT 4183	Applied Microbial Biochemistry and Biotransformation (*)	3	SMBB 1173
SMBT 4273	Biorefinery Technology	3	
SMBT 4283	Industrial Waste Management	3	
SMBT 4263	Pharmaceutical Biotechnology	3	
TOTAL CREDIT HOURS		14	

YEAR 4 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBU 4924	Undergraduate Project II	4	SMBU 4922
UHAS 3012	Entrepreneurship and Enterprise Development	2	
<i>Elective Courses(Choose 9 credits)</i>			
SMBT 4693	Biosensor Technology (*)	3	SMBT 2693
SMBT 4293	Environmental Biotechnology	3	
SMBT 4323	Bioremediation and Biodegradation	3	
SMBB 4143	Gene Therapy	3	
TOTAL CREDIT HOURS		15	

Note: Courses stated as () are compulsory electives that should be taken in order to fulfill the graduation requirement.*

Total Credit Earned: 129

Total Credit Counts: 124



B.ENG. IN BIOMEDICAL

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)



BACHELOR OF ENGINEERING IN BIOMEDICAL

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Program Features

Application of engineering techniques in biomedical science is gradually expanding. Today, with the increasing complexity of medical technology, there is a growing demand for technical professionals who can effectively integrate the fields of biomedical science and engineering. Professionals who are capable of understanding medical problems within the context of engineering sciences will be able to solve problems that are of interest to both engineers and medical practitioners.

This new field of biomedical engineering has made significant contributions to technological advancement in various fields of medicine and healthcare. These include the creation and production of artificial human parts, communication aids and assistive tools for people with disabilities, new diagnostic and therapeutic tools that lead to new medical procedures, etc. The use of equipment and devices in modern medicine is so prevalent that we cannot imagine a situation without it. Technology in medicine has advanced so much that, today, there are countless medical devices specifically designed for home use.

Moreover, the Government of Malaysia will be introducing the Medical Devices Act in the near future. This act will put in place a more comprehensive and stringent set of regulations to ensure the safety of patients and personnel when using medical devices. Suppliers of medical equipments and health centers/hospitals will be made to be more responsible when dealing with medical devices.

Programme Educational Objectives

The Programme Educational Objectives (PEOs) have been developed to meet the needs of the stakeholders of the faculty and the University. Besides that, the PEOs are formulated to be consistent with the vision and mission of both faculty and university. The PEOs are expected to be accomplished within several years after the graduation. The educational objectives of the biomedical engineering programme are to:

- Achieve competitive positions or entry into programme of advanced study in areas of their interest.
- Are competent and productive in Biomedical Engineering and related practice.
- Able to continue to develop professionally through both practical experience and life-long learning.
- Able to communicate and lead effectively.
- Practice high standards of ethical conduct and societal responsibilities.

Programme Outcomes

The programme outcomes are:

- Apply knowledge of science and engineering fundamentals to the solution of complex biomedical engineering problems.
- Identify, formulate and solve complex biomedical engineering problems through structured research literature and scientific approach using first principles of mathematics, natural sciences and engineering sciences.

- Design solutions for complex biomedical engineering problems with consideration for public health and safety, cultural, societal, and environmental needs.
- Conduct investigation into complex Biomedical Engineering problems using research-based knowledge and methodology to provide scientific conclusions.
- Select and apply appropriate techniques, resources, and modern medical engineering and IT tools, to complex biomedical engineering activities, with an understanding of the limitations.
- Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues to professional biomedical engineering practice.
- Understand the role of biomedical engineers in society regarding social, cultural, environmental and global responsibilities for sustainable development.
- Ability to evaluate and make appropriate professional decision by taking into account ethical principles, social and environmental responsibilities.
- Communicate effectively on complex engineering activities through written, oral, visual and graphical forms to colleagues and society at large.
- Work in a team not only as a committed individual but also as a leader in achieving common goals in multi-disciplinary settings.
- Ability to adapt with the latest development within the biomedical engineering field for lifelong learning and continuous knowledge improvement.
- Demonstrate knowledge and understanding of management principles in biomedical engineering and be aware of the importance of entrepreneurship.

Programme Structure

The numbers of credits required for graduates to be awarded with the bachelor degree are 137 credits. Allocations of total credits according to category of subjects are as follow:

Table 8.1: Programme structure of B.Eng. (Biomedical)

Classification of Courses	Credits
Core Courses	77
Elective Courses	38
University Compulsory	22
Total Credits	137

The programme is a mixed curriculum of engineering and biomedical sciences. The course content for 1st year and 2nd year is more towards engineering subjects from biomedical engineering, such as Introduction to Biomedical Engineering, Basic Anatomy and Physiology etc.

The 3rd year will see more subjects from biomedical engineering such as Biomedical Instrumentation & Measurement, Clinical Engineering, and Biomedical Materials.

In the final year, students will be further reinforced in biomedical engineering through subjects like Biomedical Systems Design, Biochemistry for Biomedical Engineers and Biomedical Signal Processing. Students will also be required to choose elective subjects in biomedical engineering which include subjects like Rehabilitation Engineering, Biosystems Modelling and Medical Informatics. In addition, students in the final year are required to complete a Final Year Project (FYP), Professional Practice in Biomedical Engineering and Entrepreneurship.

Industrial Experience/Training

Students will also undergo a compulsory industrial attachment programme of at least 12 weeks, either in the private sector or government agencies, during the short semester in the 3rd year. This will give students an exposure of the working environment in the industry as well as to prepare them with practical knowledge of biomedical engineering for FYP

Duration of Study

4 years (Full-time).

Registration as A Graduate Engineer with the Board of Engineers Malaysia (BEM)

BEM plays a pivotal role in uplifting the image of the engineering profession. BEM is committed in its role in bringing the engineering profession to greater heights and to project the image of engineers in the right perspective. BEM also endeavors to exert its influence in any high profile committee that would decide on any matter that concerns the practice of Professional Engineers serving in the private and public sectors. Representatives of BEM also sit in various committees, including that of the Board of Architects Malaysia and the Board of Quantity Surveyors Malaysia, thus ensuring that the voice of the engineers is heard, and their recommendations taken into consideration.

Graduates from the biomedical engineering programme who hold a Bachelor of Engineering (Bio-Medical) may apply to register with the Board of Engineers, Malaysia as graduate engineers in the biomedical engineering field.

Career Prospects

Graduates of this course can find work opportunities in hospitals, companies involved in biomedical products/services, Ministry of Health Malaysia and any other parties involved in healthcare. Among the job opportunities available to the biomedical engineering graduates are:

- Government regulators to oversee the implementation of the Medical Devices Act when it is enacted.
- Engineers in hospital or medical centers responsible for the procurement, maintenance and usage of medical devices.
- Sales engineer in biomedical devices supply companies.
- R&D engineers in biomedical engineering research facilities.
- Engineers involved in maintaining, testing and commissioning biomedical devices.
- Engineers involved in the manufacturing of medical devices.
- Engineers in the Ministry of Health, Malaysia, responsible for the planning, management and operation of the engineering services of the public healthcare sector.

Curriculum

The curriculum is designed with a specific subjects being delivered and assessed in each semester. Assessment is based on coursework, final examination and final year project thesis. The courses are categorized as university general courses, programme core courses and programme elective courses such as the followings:

Table 8.2: Curriculum of Bachelor of Engineering (Bio-medical)

YEAR 1 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBE 1513	Basic Anatomy and Physiology	3	
SMBE 1012	Introduction to Biomedical Engineering	2	
SKEU 1023	Circuit Theory	3	
SSCE 1693	Engineering Mathematics 1	3	
ULAB 1122	Academic English Skills	2	
UHAS 1172	Malaysian Dynamics	2	
*UHAS 1112	<i>Malay Language Communication</i>	2	
TOTAL CREDIT HOURS		15	

YEAR 1 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBE 1523	Advanced Anatomy and Physiology	3	SMBE 1513
SMBE 1313	Statics and Dynamics	3	
SKEU 1223	Digital Electronics	3	
SSCE 1793	Differential Equations	3	
U*** 2**2	Individual Development, Community Development & Globalization	2	
U*** 1**1	Co-Curriculum 1	1	
UICI 1012	Islamic and Asian Civilization	2	
*UHAS 1162	<i>Art, Custom and Belief of Malaysian</i>	2	
TOTAL CREDIT HOURS		17	

YEAR 2 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SKEU 2073	Signals and Systems	3	
SKEU 1063	Electronic Devices	3	
UHAS 2122	Creative and Critical Thinking	2	
SMBE 2712	Laboratory 1	2	
SSCE 1993	Engineering Mathematics 2	3	
ULAB 2112	Advanced English for Academic Communications	2	
SMBE 2032	Computer Programmemeing for Biomedical Engineer	2	
TOTAL CREDIT HOURS		17	

YEAR 2 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBE 2413	Biophysics	3	
UICI 2022	Science, Technology and Human	2	
SKEU 2043	Electromagnetic Field Theory	3	SSCE 1993
SSCE 2193	Engineering Statistics	3	
SKEU 3133	System Modeling and Analysis	3	
SMBE 2513	Basics Rehabilitation	3	
TOTAL CREDIT HOURS		17	

YEAR 3 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SKEU 3063	Electronic Circuits and Systems	3	SKEU 1063
SKEU 3533	Communication Principles	3	SKEU 2073
SMBE 3712	Laboratory 2	2	
SMBE 3313	Biomedical Materials	3	
SSCE 2393	Numerical Methods	3	
U*** 1**1	Co-curriculum 2	1	
ULAB 3**2	English Elective	2	
TOTAL CREDIT HOURS		17	

YEAR 3 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBE 3323	Solid Mechanics	3	
SMBE 3023	Biomedical Imaging	3	
SMBE 3423	Clinical Engineering	3	
SMBE 3722	Laboratory 3	2	
SMBE 3033	Microprocessor Systems	3	
SMBE 3043	Instrumentation and Measurement in Biomedical	3	
TOTAL CREDIT HOURS		17	

SHORT SEMESTER			
Code	Courses	Credit	Pre-req
SMBE 4915	Industrial Training (HW)	5	
TOTAL CREDIT HOURS		5	

YEAR 4 (SEMESTER 1)			
Code	Courses	Credit	Pre-req
SMBE 4313	Biomedical Systems Design	3	
SMBE 4413	Biochemistry For Biomedical Engineers	3	
SMBE 4712	Laboratory 4	2	
SMBE 4812	Project Part I	2	
SMBE 4023	Biomedical Signal Processing	3	SKEU 2073
SMBE 4**3	Elective 1	3	
TOTAL CREDIT HOURS		16	

YEAR 4 (SEMESTER 2)			
Code	Courses	Credit	Pre-req
SMBE 4824	Project Part II	4	SMBE 4812
SMBE 4**3	Elective 2	3	
SMBE 4**3	Elective 3	3	
UHAS 3012	Entrepreneurship	2	
SHAS 4542	Engineering Management	2	
SMBE 4032	Professional Biomedical Engineering Practice	2	
TOTAL CREDIT HOURS		16	

ELECTIVE COURSES

CODE	COURSES	CREDIT	PRE-REQ
SMBE 4043	Biomedical Image Processing	3	
SMBE 4053	Biosystem Modeling	3	
SMBE 4063	Advanced Biomedical Signal Processing	3	
SMBE 4073	Biosensor And Transducers	3	
SMBE 4083	Artificial Intelligence	3	
SMBE 4423	Biomedical Informatics	3	
SMBE 4433	Biomedical Instrumentation Management	3	
SMBE 4513	Rehabilitation Engineering	3	
SMBE 4523	Sports Technology in Exercise Rehabilitation	3	
SMBE 4323	Biomedical Devices	3	
SMBE 4333	Biologically-inspired Devices	3	
SMBE 4343	Cell and Tissue Engineering	3	

Note: Courses stated as () are compulsory electives that should be taken in order to fulfill the graduation requirement.*

****Choose three (3) courses from this group.**

Total Credit Earned: 137

Total Credit Counts: 132



B.SC. IN EQUINE MANAGEMENT

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)



BACHELOR OF SCIENCE (EQUINE MANAGEMENT)

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Program Features

The rapid development of equine industry in Malaysia has demanded more experts in the field of equine science and equine management. Universiti Teknologi Malaysia (UTM) aspires to be the pioneer among higher learning institutions in Malaysia and in the region to promote equine sports and equestrian activities among students as well as the public to develop interest and passion for the sports.

The curriculum structure for Bachelor of Science (Equine Management) has taken into consideration requirements and recommendations of various equine associations, equine establishments and especially the Malaysian Equine Council (MEC). The curriculum will mainly cover the basic theory of equine science and equine management whilst developing the students with practical skills, good communication, leadership quality as well as entrepreneurship.

Methods of teaching and learning is through lectures, tutorials, practical work, group discussions, individual presentations, group presentations and industrial training. The percentage of the study methods being delivered are 72% teaching courses, 18% practical, 6% industrial training, 4% of individual and group projects.

Programme Objectives

The objectives of this programme are to produce professionals who are:

- Skilled and competent in equine science and equine management globally and are able to contribute to the development of the country's equine industry.
- Highly capable in project management specifically related to the equine industry and practice.
- Prominent leaders or members of equine teams while being creative, innovative, and are able to adapt to the equine industry.
- Socially responsible while being involved with the equine community and contribute to the growth of the industry with high ethical value.

Programme Learning Outcomes

The expected programme learning outcomes are:

- Ability to understand and apply knowledge of equine science and equine management.
- Ability to analyse and manage resources related to the field of equine.
- Ability to solve problems creatively using knowledge and technical skills in equine science and equine management.
- Ability to communicate effectively in both written and verbal communication.
- Ability to think creatively and critically in solving problems related to equine field.
- Demonstrate confidence to act effectively in a team.
- Demonstrate ability to practice lifelong learning.
- Demonstrate entrepreneurship skills.
- Demonstrate leadership skills.
- Demonstrate professionalism and good ethics.

Programme Structure

For the award of Bachelor of Science (Equine Management), students should achieve a total minimum of 126 credit hours with minimum CPA of 2.00. Allocations of total credits according to category subjects are as follow:

Table 9.1: Programme structure of Bachelor of Science (Equine Management)

Classification of Courses	Credits
General University Course	20
Programme Core Course	70
Programme Elective Course	36
Total Credits	126

Industrial Experience/Training

Students are given the opportunities to experience practical training in any institutions, government agencies, industry players or any equine establishments which is related to the field of equine. This placement allow the students to apply their knowledge and skills in the workplace as well as to gain new experiences in working environment.

Duration of Study

4 years (Full-time)

Career Prospects and Career Paths

In general, the total number of horses in Malaysia is approximately 10,000 according to the 17th Malaysia Equine Council Annual General Meeting in 2009. There are approximately 150 registered clubs, associations, and organisations involved in the equine industry and this involves an estimated number of 5,000 personnel. From this total, 20% (1,000 personnel) are estimated to be needed in management and administration for the equine industry. This is the main area for the placement of equine management graduates.

Graduates may get employment in various fields of equine which include entrepreneur and business entities, services and support (suppliers), recreation and clubs, as well as coaching and training for high performance.

Graduates may also get the chance to be employed as Youth and Sports Officer (S41) under Jabatan Perkhidmatan Awam scheme.

Curriculum

The curriculum is designed with a specific subjects being delivered and assessed in each semester. Assessment is based on coursework, skill assessment, final examination and final year project thesis. The courses are categorized as university general courses, programme core courses and programme elective courses such as the followings:

Table 9.2: Curriculum of Bachelor of Science (Equine Management)

YEAR 1 (SEMESTER 1)			
Code	Courses	Credit	Pre-Req
SMBQ 1013	Introduction to Equine Science and Industry	3	
SMBQ 1023	Introduction to Management	3	
SMBQ 1093	Basic Horse Handling	3	
SMBQ 1282	Practical Experience in Equine Farm Management I	2	
UHAS 1172	Malaysian Dynamics (Malaysian Students)	2	
UHAS 1162	Arts, Customs and Beliefs of Malaysian (International Students)	2	
ULAB 1122	English for Academic Communication	2	
UICI 1012	Islamic and Asian Civilization	2	
TOTAL CREDIT HOURS		17	

YEAR 1 (SEMESTER 2)			
Code	Courses	Credit	Pre-Req
SMBQ 1102	Sports Psychology	2	
SMBQ 1112	Foundation of Equine Performance	2	
SMBQ 1203	Equine Anatomy and Physiology	3	
SMBQ 1033	Farm and Stable Management	3	
SMBQ 1292	Practical Experience in Equine Farm Management II	2	
UKQ* 1**1	Co-Curriculum 1	1	
U*** 2**2	Individual, Community Development & Globalisation Cluster (Malaysian Students)	2	
ULAM 1112	Bahasa Melayu Untuk Komunikasi (International Students)		
TOTAL CREDIT HOURS		15	

YEAR 2 (SEMESTER 1)			
Code	Courses	Credit	Pre-Req
SMBQ 2122	Horse Riding I: Endurance	2	
SMBQ 2213	Basic Equine Healthcare and Diseases	3	
SMBQ 2043	Commercial Equine Facilities Design and Management	3	
SMBQ 2302	Practical Experience in Equine Farm Management III	2	
UICI 2022	Science, Technology, and Mankind	2	
ULAB 2112	Advanced English for Academic Communication	2	
TOTAL CREDIT HOURS		14	

YEAR 2 (SEMESTER 2)			
Code	Courses	Credit	Pre-Req
SMBQ 2053	Equine Business Management	2	
SMBQ 2063	Principles of Risk Management	3	
SMBQ 2133	Horse Behaviour and Training	2	
SMBQ 2142	Horse Riding II: Dressage	3	
SMBQ 2223	Equine Disease Management	3	
SMBQ 2312	Practical Experience in Equine Farm Management IV	2	
TOTAL CREDIT HOURS		15	

YEAR 3 (SEMESTER 1)			
Code	Courses	Credit	Pre-Req
SMBQ 3243	Equine Nutrition	3	
SMBQ 3233	Equine Lameness and Conditioning	3	
SMBQ 3152	Horse Riding III: Jumping	2	
SMBQ 3322	Practical Experience in Equine Farm Management V	2	
ULAB 3**2	English Elective	2	
UHAS 2122	Innovation & Creativity Cluster	2	
TOTAL CREDIT HOURS		14	

YEAR 3 (SEMESTER 2)			
Code	Courses	Credit	Pre-Req
SMBQ 3302	Research Methodology	2	
SMBQ 3073	Event and Competition Management	3	
SMBQ 3183	Equestrian Motion Analysis	3	
SMBQ 3263	Equine Quarantine	3	
SMBQ 3332	Practical Experience in Equine Farm Management VI	2	
UKQ* 1**1	Co-Curriculum II	1	
UHAS 3012	Entrepreneurship and Enterprise Development	2	
TOTAL CREDIT HOURS		16	

SHORT SEMESTER			
Code	Courses	Credit	Pre-Req
SMBQ 4368	Industrial Training	8	
TOTAL CREDIT HOURS		8	

YEAR 4 (SEMESTER 1)			
Code	Courses	Credit	Pre-Req
SMBQ 4163	Rider Instructor Training	3	
SMBQ 4173	Equine Evaluation and Selection	3	
SMBQ 4192	Equine for Disabled	2	
SMBQ 4253	Equine Therapy and Rehabilitation	3	
SMBQ 4342	Practical Experience in Equine Farm Management VII	2	
SMBQ 4102	Undergraduate Project I	2	
TOTAL CREDIT HOURS		15	

YEAR 4 (SEMESTER 2)			
Code	Courses	Credit	Pre-Req
SMBQ 4083	Equine Seminar	3	
SMBQ 4273	Equine Reproduction and Breeding Technologies	3	
SMBQ 4352	Practical Experience in Equine Farm Management VIII	2	
SMBQ 4114	Undergraduate Project II	4	
TOTAL CREDIT HOURS		12	

Total Credit Earned: 126

TUITION FEES (ACADEMIC YEAR 2013/2014)

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

The tuition fees for Bachelor programmes for the academic year 2013/2014 are given bellow.

Table 10.1: Tuition fees for academic year 2013/2014

Type of Payment	Fees (RM)
Study fees	
Registration	20.00
Minggu haluan siswa	180.00
Alumni	100.00
Co-curriculum	300.00
Payment for each semester	
Activity & student's khairat	21.00
Student service	45.00
UTM service	110.00
Computer service	20.00
Education: BEng Biomedical or BSc Biology/Industrial Biology	700.00 660.00
Residential college fees (/day)	
Single (Johor Bahru campus)	4.00 – 7.00
Single (Kuala Lumpur campus)	4.00
Double (Johor Bahru campus)	3.50 – 5.00
Double (Kuala Lumpur campus)	3.00
Family residents (/month)	450.00 – 1,100.00

** The rates are subject to change.*



APPENDICES

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)



APPENDIX A: SYNOPSIS OF COURSES FOR BIOLOGY AND INDUSTRIAL BIOLOGY

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Core courses for Biology (SMBB)

SMBB 1182 INTRODUCTION TO BIOMOLECULES

This course focuses on the description to the structure and function of biomolecules that are important in understanding the biochemistry of living organisms. These include the discussion on the structural and functional properties of proteins, nucleic acids, carbohydrates and lipids. Proteins are at the center of the action in biological processes thus it will be given a major attention during this course. The properties of amino acids, reaction kinetics and catalytic mechanisms of enzymes will be explained in detail.

SMBB 1603 BIO-ORGANIC CHEMISTRY

This course focuses on basic and fundamental theory in bio-organic chemistry. Bio-organic chemistry is the knowledge of organic chemistry for the biological materials. The fundamental of organic chemistry is essential prior to understanding the biochemistry and biomolecules since each of biological compounds comprises of organic molecules. An introduction of this subject includes the fundamental of organic compounds frameworks and their functional groups. The topic on the basic structure of biological compounds such as proteins, carbohydrates, nucleic acid etc. is enclosed. The analysis and characterization of organic compounds by various instrumental techniques namely UV-Visible spectroscopy, Infrared (IR) spectroscopy, nuclear magnetic resonance (NMR) and mass spectrometry (MS) are also covered in detail.

SMBB 1143 CELLULAR AND MOLECULAR BIOLOGY

This subject will facilitate students to understand and visualize processes in cell biology and those responsible for DNA transmission and expression hence mechanisms by which bacteria inherit genetic information as the blue print of life. The lectures will explain relationship between structure and function in molecular biology and how this relationship operates to control biochemical processes. Topics include macromolecules like DNA, RNA and proteins and how processes like replication, transcription and translation operate, eukaryotic genetics. Students will cover related aspects such as mutation and mutagenesis, effects of mutation and how cells overcome mutation. Students will also learn about basic techniques in molecular biology as the basis for genetic engineering. PowerPoint presentation by each group will be done at the end of the semester on designated topics.

SMBB 1173 CELLULAR BIOCHEMISTRY AND METABOLISM (+LAB)

This course focuses on theory and practical in basic biochemistry. Practical are arranged in separate sessions to give students enough time to develop their skills in biochemical analysis. Discussion on properties of water as medium for most of the biochemical reactions is also conducted. This also includes the introduction to metabolism, glucose catabolism, glycogen catabolism and synthesis and gluconeogenesis, citric acid cycle, oxidative phosphorylation and electron transport chain. Important aspects of lipid breakdown and synthesis, protein metabolism, amino acid and nucleotide synthesis are also covered in detail.

SMBB 1222 INTRODUCTION TO BIOSCIENCES

This course explores how biology is used in both academic and commercial settings within the fields of biotechnology, pharmaceutical and clinical sciences. Topics will include: applications of biotechnology in microbes, plants, and animals, the human genome project and its relation to medical biotechnology, DNA forensics, and pharmaceutical drug discovery, delivery, and FDA approval. The debate surrounding subjects such as cloning, stem cells, and genetically modified foods will also be discussed.

SMBB 2153 GENETIC ENGINEERING (+LAB)

Pre-requisite: SMBB 1143 Cellular and Molecular Biology

This course encompasses the basic principles and techniques involved in molecular biology which will enable students to apply these techniques in the genetic engineering laboratory. The introductory lecture will expose students to genetic engineering and its application in various sectors of the industry such as agriculture, medical, pharmaceutical, environmental, etc. The following lectures will revolve around techniques in genetic engineering, cloning of heterologous genes in the *Escherichia coli* host which will include common procedures in molecular biology, enzymes important in molecular biology, plasmids and bacteriophage as cloning vectors, gene libraries preparation and screening for gene of interest. Before semester ends, students are to produce a group poster relevant to genetic engineering as a form of team-working experience. Peer group evaluation is mandatory. Some of the concepts taught will be applied in this laboratory practical. Students will have the opportunity to hands on the isolation of genomic DNA, agarose gel electrophoresis, PCR amplification, DNA ligation, preparation of competent cells, transformation, and lastly verify the clones of interest by plasmid DNA extraction and DNA restriction digestion.

SMBB 2323 MYCOLOGY

Pre-requisite: SMBT 1303 Microbiology (+Lab)

Introduces the structure of fungi, development of reproduction system, mechanisms of spore release and classification of fungi based on life cycle. Interaction of species in community of fungi will be discussed. The influence of fungi towards stability of plant community, nutrient cycle and environment will be taught. The benefits and disadvantages of fungi in economic, agriculture, medical and industrial will be explained in details. Biosafety regulation when working with fungi will be explained.

SMBB 2753 BASIC GENETICS

Genetics is the science of heredity. Various concepts and branches will be introduced. Topics to be discussed included Mendel's Laws, the cytological basis of heredity and cytogenetics, biochemical Genetics molecular and microbial Genetics, genetic variation at the protein and DNA levels, genetic basis of evolution and recombinant DNA technology/genetic engineering.

SMBB 2603 ENZYMOLOGY (+LAB)

Pre-requisite: SMBB 1173 Cellular Biochemistry and Metabolism (+Lab)

The course of enzymology deals with the general theoretical basis, with some industrial applications. The mechanisms of enzyme action are studied, with rates of enzymatic reactions: kinetics (Michaelian and non Michaelian kinetics, inhibition, effects of pH) and enzymes catalysis: acid-base catalysis and covalent catalysis. Special interest is devoted to structure-function relationship of enzymes with examples of enzymes with known structures. This course will move on to cover allosteric interactions of enzymes, enzyme regulation and finally the applications of enzymes in biotechnology and industry in particular the use of immobilized enzymes for industrial processes.

SMBB 2263 PLANT PHYSIOLOGY (+LAB)

Plant Physiology is an integrative discipline that answers questions about plant form and function. In this course, several aspects of plant physiology which include plant water relations, transpiration, phloem transport, photosynthesis, respiration, growth and development will be focused. This course will also emphasize on the roles of hormones in plant development and secondary metabolite in plant defenses.

SMBB 2503 IMMUNOLOGY

Introduces the basic concept of immunology and mechanism of immune response for better understanding on the development of immune system. Mechanism of natural and acquired immune, structure and function of antibody will also be discussed further. Upon completion, students should be able to define and describe the role of immune system against infection and disease and their example.

SMBB 3113 PHYCOLOGY

Pre-requisite: SMBT 1303 Microbiology (+Lab)

This course provides an introduction into algae and its application in industry. Topics include the definition of algae, techniques in applied phycology, characteristics, seaweed properties on morphology, life history, physiology, genetics and ecology are provided for the further understanding of healthy and continuous utilization of coastal environments and seaweed resources.

SMBB 3173 GENE EXPRESSION

This course is designed to expose the students in understanding the molecular mechanisms in the expression and regulation of gene in both prokaryotes and eukaryotes. A brief introduction will be included and the overview of the molecular genetics will be discussed. Regulation and the control of gene expression will be discussed by using several selected operons as model.

SMBB 3183 BIOENERGETICS

Pre-requisite: SMBB 1173 Cellular Biochemistry and Metabolism (+Lab)

Transformations of energy in biological systems will be discussed in this course. Essential features of cell metabolism and thermodynamic principles underlying biological processes will be described to relate processes by which energy is made available. Since most of the energy generated by heterotrophs is derived from the oxidation of substrates and plants from photosynthesis, processes related to oxidative phosphorylation and photophosphorylation will be emphasized. Generation and consumption of energy in central metabolic pathways of carbohydrates and lipid metabolism will be illustrated and compared.

SMBB 3203 NUTRITIONAL BIOCHEMISTRY

This course is designed to expose the student to the knowledge and understanding of the food and nutrition. Food is defined as a substance that can be metabolized and used by an organism while nutrition is the usage of food and other nourishing material by our body. The metabolism of macro, micronutrient and functional food as well as the role of nutrition in influencing cell growth and gene function will be explained to the students.

SMBB 3273 ANIMAL PHYSIOLOGY (+LAB)

This course is designed to expose the student to the knowledge and understanding in cell organization that developed the animal involving the structure and function of its body system. They will be introduced to basic structures and functions of the mammalian system. This includes the human body, biochemistry,

cell biology, and histology, principles of support and movement, and nervous system. Lectures will focus on events occurring at the molecular, cellular, organic and systemic levels and will address how structure and function are interrelated at these different levels. This course will be applied to several other courses including mammalian cell and tissue culture, microbiology, immunology, biochemistry and bioenergetic. The study of concepts and terminology in this course will develop the students' understanding of health science and allow for effective and succinct communication.

SMBB 3323 PHYSIOLOGY AND SCREENING OF INDUSTRIAL MICROORGANISMS

Pre-requisite: SMBT 1303 Microbiology

This course introduces the students to the role of microbes and how some of them may be isolated from the environment. The course aims to address the following topics such as identification of potential industrial microbes, microbial growth requirements, enumeration techniques and preparation of stock culture, isolation of strict anaerobes, hyperthermophiles, fungi, alkalophiles, acidophiles and actinomycetes from the environment. Important biotechnological application and benefits of each microbe will also be discussed.

SMBB 3413 EXTREMOPHILES

This course will give a broad overview of how life can not only survive, but thrive and flourish under conditions considered to be 'extreme' in the human sense. More specifically this course will describe the environments where these organisms reside and shed light, at the molecular level, on the mechanisms that enable these unique organisms to survive. Covering all known types of extremophiles (including thermophiles, psychrophiles, halophiles, acidophiles, piezophiles, and alkaliphiles).

SMBB 3433 VIROLOGY

The course is designed for student in order to be able to distinguish between viruses and other organisms based on its identification, disease caused and life cycle. Replication of different type of viruses will be discussed. Students will also be taught on the impact of viral infections towards society. Current issue on viral research and its applications for curing diseases will also be studied.

SMBB 3503 IMMUNOLOGY

Introduces the basic concept of immunology and mechanism of immune response for better understanding on the development of immune system. Mechanism of natural and acquired immunity, structure and function of antibody will also be discussed further. Upon completion, students should be able to define and describe the role of immune system against infection and disease and their example.

SMBB 3573 BIOLOGICAL CONTROL AND ENVIRONMENTAL CONSERVATION

This course discussed about principle and philosophy of biological control agents and methods in implementing this technique, in order to develop alternatives for conventional pesticides that may be more acute in some commodities than in others. Various specific aspects in this course are; i) the conceptual of agents (types and mechanisms) and targets on quantitative techniques, ecology and behavior of selected natural enemies, ii) measures focus on beneficial arthropods, entomopathogenic nematodes, viruses and microorganisms, iii) as well as on the interaction between crop, pest and beneficial organisms, iv) the future and factors that limit the biological control. The study case and current issues also will be discussed to guarantee the student alert with the effectiveness and benefit of this application. It is useful in encouraging student ability in debating biological control function of cultural and natural ecosystem management.

SMBB 4143 GENE THERAPY

The course will introduce the students to the background and basic principles of gene therapy. Current gene therapy approaches and strategies which include the use of a variety of vectors useful for gene delivery and non-viral vectors. Among the diseases of interest used as models are cystic fibrosis, cancer, ADA, AIDS and SCID. The advantages, limitation, ethical issues, clinical trial and future of gene therapy will also be discussed.

SMBB 4153 SYNTHETIC BIOLOGY

Pre-requisite: SMBB 2153 Genetic Engineering

This course offers an introduction to synthetic biology. It is designed for final year students who have an interest in bioengineering at the cellular network level. Students will be introduced to the field of synthetic biology and its application in systems biology and applied engineering. Students will be taught in quantitative terms the basic principles of operation of regulation at the cellular level, including metabolic, signaling and gene networks; discover how cellular networks can be reengineered, applications in metabolic engineering; building computer models of cellular networks systems and how these can be modeled and studied experimentally. By the end of the course, students will be able to make explain the network's possible dynamic behavior using simple visual inspection of a network structure.

SMBB 4193 CELL SIGNALLING

Pre-requisite: SMBB 1173 Cellular Biochemistry and Metabolism

This course provides an overview of current understanding of the biological roles of extracellular molecular chaperones. First the structure and function of molecular chaperones, their role in the cellular response to stress and their disposition within the cell will be discussed. It also questions the basic paradigm of molecular chaperone biology - that these proteins are first-and-foremost protein-folding molecules. The current paradigms of protein secretion are reviewed and the evolving concept of proteins (such as molecular chaperones) as multi-functional molecules for which the term 'moonlighting proteins' has been introduced is discussed. The role of exogenous molecular chaperones as cell regulators is examined and the physiological and pathophysiological role that molecular chaperones play is described. In the final section, the potential therapeutic use of molecular chaperones is described and the final chapter asks the question - what does the future hold for the extracellular biology of molecular chaperones?

SMBB 4493 TOXICOLOGY

An introductory toxicology course emphasizing on principles and applications of toxicology. Techniques of measuring toxicity, differentiating ecotoxicity tests and bioassays. Characterization of natural and chemical toxins. Natural toxins are those produced by microorganisms and plants; toxins produced by a variety of microorganisms such as bacterial toxins, marine toxins, aflatoxin and phytotoxins will also be discussed. While, chemical toxins/pollutants will include polar and non-polar organic compounds such as insecticides, pesticides and oxidants. Toxicity due to heavy metals and radionuclides will also be included apart from physical, chemical and biological factors that can influence the dose-response relationships. Chemical and biological transformation of toxins; and the ecological, toxicological, and molecular biological responses associated with exposure. Case studies focusing on toxicity effects of natural and chemical toxins on human health, animals and other biological systems will be discussed.

SMBB 4583 ECOLOGY

This course will introduce students to the major concepts, principles and elements of ecology i.e. higher levels of the organisation of life on earth and the interactions between organisms and their environment in a hierarchy of levels of organization: individuals, populations, communities, and ecosystems. Students

will then examine ways in which ecology can be applied to solving crucial environmental problems like global climate change, sustainability, agroforestry, biodiversity and conservation, invasive species, ecotoxicology, biomonitoring and bioremediation, and restoration ecology. Case studies are examined in detail. While some sociological and economic issues are discussed, the emphasis is on the biological aspects of these crucial problems.

SMBB 4683 STRUCTURE AND FUNCTION OF PROTEINS*

Pre-requisite: SMBB 1182 Introduction to Biomolecules

This course is a comprehensive introduction to the study of proteins and their importance to modern biochemistry. This course will start with a brief historical overview of the subject then move on to discuss the building blocks of proteins and their respective chemical and physical properties. This course will also explore experimental and computational methods of comparing proteins, methods of purification and protein folding and stability.

SMBB 4713 GENOMICS AND PROTEOMICS

Students will learn the fundamental concepts of genomics and proteomics. Lectures will cover the structure, function and evolution of the human genome, strategies for large-scale sequencing projects, Human disease genes and expression. Bioinformatics for the analysis of sequence data; approaches for determining gene expression patterns and functions Will be explained in addition to protein/peptide separation techniques, protein mass spectrometry, bioinformatics tools, and biological applications which include quantitative proteomics, protein modification proteomics, interaction proteomics, structural genomics and structural proteomics.

SMBB 4723 SYSTEMS BIOLOGY

This course offers an introduction to systems biology. This course is designed for students who have an interest in bioengineering at the cellular network level. Students will be introduced to the field of systems biology and its application in applied engineering. Students will understand in quantitative terms the basic principles of operation of regulation at the cellular level, including metabolic, signaling and gene networks; discover how cellular networks can be reengineered and its applications such as metabolic engineering; learn how to build computer models of cellular networks and how these can be modeled and studied experimentally. By the end of the course students will be able to make statements on the network's possible dynamic behavior.

SMBB 4733 STRUCTURAL BIOLOGY

This course will provide an understanding of basic and applied aspects of macromolecular structure including structure-function relationships and structure determination techniques. This course will provide knowledge that would enable students to interpret typical structural data in terms of biological function, and to use structural data bases. Finally, this course will provide the students with knowledge of the applications of structural biology in the areas of biotechnology and in particular in the field of drug design and discovery.

Core courses for Industrial Biology (SMBT)

SMBT1212 INTRODUCTION TO BIOTECHNOLOGY

This course describes basic scientific knowledge that applies to biotechnology including molecular biology, bioinformatics, genomics and proteomics. Basic molecular biology & practical applications, some historical examples, contemporary applications of biotechnology will be discussed to provide tools and basic knowledge in order to understand biotechnology. The emerging areas of biotechnology, for example Agricultural Biotechnology, Forensic Biotechnology, Bioremediation, Aquatic Biotechnology, Regulatory agencies and issues that impact Biotechnology industry will be discussed as well. In addition to that, a provocative and issues in Biotechnology, genetically modified food, genetic testing, embryos for research/human cloning, ethical/legal/social questions & dilemmas will be incorporated during lecture to allow healthy discussion at the end of the semester.

SMBT 1303 MICROBIOLOGY

This course focuses on theory and practical in basic microbiology. Practical are arranged in separate sessions to give students enough time to develop their skills related to microbiological techniques, particularly in aseptic techniques and microscopy. Discussions are mainly on different classes of microorganism especially bacteria: bacterial physiology and anatomy, nutrient requirement and physical factors influencing growth, metabolism and microbial genetics. Metabolic diversity in microorganisms, classes of fungi, algae, protozoa and their benefit and applications are also looked into. Discussion on physical and chemical control of microbial growth is part of the role of microorganisms in controlling diseases caused by microorganisms. Application of microbes in industries such as food, beverages and in environment will also be included.

SMBT 2233 FERMENTATION TECHNOLOGY (+LAB)

Pre-requisite: SMBT 2513 Introduction to Bioprocess Engineering

The course will emphasize on fermentation technology and bioreactor design for microbial, plant and animal cell cultures. The student will be exposed to the economics of fermentation technology, strain development and improvement, development of cost-effective medium for large scale fermentation. The physiology of microbial growth and product formation in batch, continuous and fed-batch cultures will be explained. The students will have knowledge on the differences between batch and continuous sterilization process. The kinetic of air sterilization and theory of fibrous filter will be explained. The fluid rheology and the bioreactor design for free and immobilised cell culture will be included in this course. The relationship between $K_L a$ and scaling up process will be explained.

SMBT2513 INTRODUCTION TO BIOPROCESS ENGINEERING (+LAB)

Pre-requisite: SMBT 1303 Microbiology

This course presents the principles and methodology frequently applies in bioprocess engineering. It emphasizes the application of biological knowledge in the industry. This course introduces the principles and chemical engineering calculations for unit operations commonly found in industries. Laboratory sessions are also incorporated to allow students to develop their hands-on skills and their ability to interpret laboratory data.

SMBT 2693 ENZYME TECHNOLOGY AND BIOCATALYSIS (+LAB)

Pre-requisite: SMBB 1173 Cellular Biochemistry and Metabolism

This course provides a body of knowledge relevant to the principles of enzymology and techniques employed in the utilization of enzymes. This course presents a basic introduction to the principles by

which enzymes catalyze reactions and provide knowledge of the theory as well as applications of modern approaches to enzyme technology. Students will also be introduced to the economic and commercial considerations concerning the viability of enzyme technologies. Generally, this course serves to provide an awareness of the current and possible future applications of enzyme technologies. Students are given practical experiences on basic techniques in enzyme technology such as protein extraction and purification. Variety of protein purification techniques will be introduced besides the technique of enzyme immobilization for industrial applications. Student will also be required to carry out characterization of the purified enzyme based on the enzymes' pH and temperature optima, substrate specificity, and V_K.

SMBT 3523 BIOPROCESS ENGINEERING

Pre-requisite: SMBT 2513 Introduction to Bioprocess Engineering

This course is the continual lectures for the course encoded SQBI 2513. The concepts and applications of energy balance, thermodynamic and fluid mechanics are introduced in this course. All these theories will be applied later by looking at a few bioprocess case studies. The usual practices in industry such as the plant design, instrumentation control, costing and scaling up, as well as the knowledge in CGMP, GLP, ISO are also introduced in this course.

SMBT 3243 TISSUE CULTURE TECHNOLOGY

This course covers historical aspect of plant and animal tissue culture, biology of cultured cells, design and layout of the cell culture laboratory, equipments and handling of the tissue culture. Aseptic technique, general safety, culture vessels and media preparation & sterilization will be discussed. Other topics will include cultivation of plant & animal cells and tissues and some important applications. Laboratory sessions will be included to provide students experiences in handling and cultivation of plant and animal tissues.

SMBT3163 TECHNIQUES IN MOLECULAR BIOLOGY

Pre-requisite: SMBB 2153 Genetic Engineering

Introduces students to techniques in gene manipulation, protein expression, genomic cloning, cDNA, site directed mutagenesis, PCR and microarray. It will emphasize on the basic concepts in genomic and proteomic studies, DNA sequences as well as application of genetic therapies. Upon completion, students should be able to define concepts and theories on molecular biology techniques and some application of techniques used in molecular biology. Laboratory hands-on will be carried out on selective topics.

SMBT 3333 FOOD MICROBIOLOGY

This course will emphasize on the study of both beneficial and detrimental effects of micro-organisms in food. Initially this course will introduce the types of micro-organisms found in food, factors that affect their survival and growth in foods, and effects of microbial growth in foods. Discussion focuses on micro-organisms related to food spoilage and food preservation. Disease-causing micro-organisms are studied in the context of food safety. General principles of food preservation, contamination and food deterioration will be discussed in greater details. Pathogenic microorganisms and useful microbes in food will be differentiated for the industrial application. The purpose and importance of Hazard Analysis Critical Control Point (HACCP) in promoting food safety is addressed. Relationship of Good Manufacturing Practices (GMP) to HACCP is discussed. Halal issues are also addressed in relation to food safety.

SMBT 3353 INDUSTRIAL MICROBIOLOGY

This course emphasizes on the application of microorganism, plant and animal cell culture at various type of industry. The mechanism and processes of microbes at industrial level will be explained, which include production of primary and secondary metabolites by microbes, plant and animal cell culture using fermentation technology in commercial scale. These also include antibiotic production, brewing process in beverages industry, food production, microbial spoilage of food and factors influencing. Insight to the bioremediation / biodegradation in wastes treatment processes, and bio-recovery process will be explained. Microbes and biogeochemical cycle such as nitrogen cycle, sulfur and phosphate, immobilization technology and its uses in industry are also discussed. Current issue related with industrial microbiology will be highlighted

SMBT 3213 MOLECULAR BIOTECHNOLOGY

This course covers the principle and application of biotechnology in industry as well as current issues involved in molecular biotechnology. The course will introduce genetic engineering basically from the perspective of advantages, strategies and the products. Some of the biotechnology products can be commercialized will be discussed as well. Production of transgenic plants and transgenic animals will be discussed in greater details especially on molecular techniques involved. Subsequently the course deals with an introduction to eugenics, human genetic engineering and human cloning, techniques in gene therapy with its application. This course will also include an introduction to intellectual property, permission for usage, protection as well as benefits and relationship between biotechnology and intellectual property and current issues involved in biotechnology from various field.

SMBT 4663 PROTEIN SEPARATION TECHNIQUES IN BIOTECHNOLOGY

Pre-requisite: SMBT 2693 Enzyme Technology and Biocatalysis

In this course, fundamental knowledge of protein structure: primary, secondary, tertiary and quaternary structures as well as chemical characteristics of proteins will be discussed. Different techniques of extraction and purification using will be described. The efficiency of the protein purification technique is then evaluated in order to maximize protein recovery and purity.

SMBT 4253 APPLICATIONS OF TISSUE CULTURE

Pre-requisite: SMBT 3243 Tissue Culture Technology

This course elaborates the principles and application of plant and animal cell and tissue culture. The potential and the usage of tissue culture in biotechnology, research and industry involve transformation techniques, in vitro breeding, genetic engineering and germplasm conservation. The course will also provide knowledge in protoplast fusion, embryo rescue, haploid, and somaclonal variation. Upon completion, students should be able to explain some useful techniques in improving the quality of animal and plant including their health and development.

SMBT 4183 APPLIED MICROBIAL BIOCHEMISTRY AND BIOTRANSFORMATION

Pre-requisite: SMBB 1173 Cellular Biochemistry and Metabolism

Discussion on the physiology of microorganisms, primary metabolic pathways, microbial metabolic diversity and secondary metabolism in microorganisms. The secondary metabolites with important application to health, industries and the environment will be described. In addition, microbial transformation of synthetic and naturally occurring recalcitrant molecules will be explained and outlined. Heavy metals biotransformation will also be included.

SMBT 4273 BIOREFINERY TECHNOLOGY

The biorefinery technology course will emphasize on the global issue of value added product from biomass. The benefit of chemical, enzymatic and microbial pretreatment will be identified. The criteria of biofuel and biomaterials from several substrates through several processes will be explained. The selection and criteria of microorganisms which involved in biorefinery will be identified. Student will have an exposure on the utilization of green technology and global model of biorefinery.

SMBT 4283 INDUSTRIAL WASTE MANAGEMENT

This course provides students with principle knowledge on waste management of different types of industrial wastes. Highlight will be given on the types of waste and their characteristics, pollution prevention technology and pollution reduction in various types of industry and industrial estate, including resource management in both regional and local areas. Due to unplanned developmental activities as well as ever-increasing population, which have caused enormous strain on the environmental resources, societies across the world face several problems of environmental degradation. However, it is imperative to maintain a balance between the capacity of the environment and the quantum of sustainable utilization. This is only possible by understanding the environment in its totality and the principles of its scientific management.

SMBT 4263 PHARMACEUTICAL BIOTECHNOLOGY

This course will be initiated by highlighting some of the key differences between the discovery and development of small molecules and biopharmaceuticals. Discussion includes the advancement of recombinant DNA technology in the exploitation of drug targets for the production of pharmaceuticals that provide health benefits. The second part of this course provides a brief overview of each class of macromolecules with respect to physiological role and clinical application. The final part focuses on the future and advances that will enhance the ability to develop new and already identified macromolecules into safe and effective biopharmaceuticals. This part also describes gene and cell therapies, strategies that are needed when traditional drug therapy is not suitable or effective.

SMBT 4693 BIOSENSOR TECHNOLOGY

Pre-requisite: SMBT 2693 Enzyme Technology and Biocatalysis

This course will present an overview of the fundamental principles and applications of biosensors. More specifically it will cover the following subjects: What is a sensor? How does a sensor become biological in nature? The history of biosensors. What are the components of a biosensor? What are the types of transducers used in biosensors? What are bioreceptor molecules? How are bioreceptor molecules attached to the transducers, i.e. immobilised? What are the most important factors that govern the performance of a biosensor? In what areas have biosensors been applied?

SMBT 4293 ENVIRONMENTAL BIOTECHNOLOGY

This course covers definition and duties of environmental biotechnology, scope of use and the integrated approach of biological system in environmental biotechnology aspect. Fundamental aspect of microbes and metabolism will be part of the discussion prior to a more detailed explanation on the biological involvement in the control of pollution and bioremediation of pollutant in various types of environments. Therefore, students will be introduced to the nature of biowastes, biological waste treatment and its important parameter affecting the process. The use of plant in environmental application will also be included.

SMBT 4323 BIOREMEDIATION AND BIODEGRADATION

This subject provides a basic knowledge of bioremediation and biodegradation. The process by which microorganism are stimulated to rapidly degrade hazardous organic contaminants to environmentally safe levels in soils, subsurface materials, water, sludges and residues is discussed.

Core courses for both SMBB and SMBT

SMBU 2613 RESEARCH METHODOLOGY

This course will introduce students to research methodology so as to develop understanding of the research process as applied to biological sciences. Qualitative and quantitative research methods and approaches to solve problems are examined. An appropriate research methodology and analysis of a particular research problem is proposed and justified. The written proposal is evaluated based on the logical consistency of the written material and evaluate the outcome of a research project in terms of useable knowledge; and to design, defend and evaluate research proposals.

SMBU 3193 BIOETHICS IN RESEARCH AND DEVELOPMENT

Pre-requisite: SMBU 2613 Research Methodology

This course provides an introduction to bioethical principles used to make decisions when confronted with ethical issues involving the application and usage of biotechnology. The goal is to develop a framework for the appreciation and understanding of ethical dilemmas within the biotechnological, pharmaceutical and medical fields. This course begins with a brief overview of ethics, and then moves to develop and consider the moral values and principles relevant to biotechnology and bioethics. The course hopes to develop moral wisdom (knowledge about ethics and the ability to think ethically) and moral virtue (a stronger commitment to act morally). Students will also be introduced to fundamental bioethical review systems, including the theory of peer review and moral and ethical responsibilities of scientists.

SMBU 3723 BIOCOMPUTATION AND BIOINFORMATICS

This course covers the principles and methodology for Bioinformatics. It focuses on the application of computational methods and tools to study biological problems. This course will introduce the principles, scope, application and limitations of computational tools in bioinformatics.

SMBU 3915 INDUSTRIAL TRAINING

Students are required to undergo Industrial Training (IT) in selected local industries or government bodies for 10 weeks. At the end of their training, students are required to submit a written report on their work. The evaluation of the subject is based on the Industrial Supervisor's report, the Faculty Supervisor's report, the student's Log Book write-up and written report. To be eligible for Industrial Training, a student must have obtained the following:

- (i) A total credit count of at least 40 credits hours, and
- (ii) Is of Good Standing (KB) in Semester 1 of Year 2, or was on Probationary Standing (KS) only once prior to Industrial Training.

Students will not be permitted to undergo Industrial Training, if

- (i) their total credit count is less than 40, or
- (ii) they were on Probationary Standing (KS) twice consecutively.

SMBU 4922 UNDERGRADUATE PROJECT I

This course is the first part of the Final Year Project. Each student will be assigned a topic and a supervisor at the beginning of Semester 1 of year 3. The student will be introduced to laboratory work/written research assignments related to the project proposed by the supervisor. The students will also be trained to make a literature survey. At the end of the semester, each student is required to write a satisfactory progress report to be allowed to take SQBU 4924 in the following semester. The evaluation of this course will be based on the progress report, evaluation by supervisor, and a possible oral presentation as required. Only students of Good Standing (KB) in the previous semester are allowed to register for SQBU 4924.

SMBU 4924 UNDERGRADUATE PROJECT II

Pre-requisite: SMBU 4922 Undergraduate Project I

This course is the second part of the Final Year Project and is a continuation of SQBU 4922. It is an extension of the laboratory work/written research assignments from SQBU 4922. At the end of the semester, each student is required to present their findings and submit a report to the faculty on a certified date. Evaluation of the course is based on oral presentation and submitted report.

SSCH 1023 MATHEMATICAL METHODS 1

The course revises and extends Matriculation and STPM topics such as differentiation and integration and includes topics such as complex numbers and differential equations, which may be new to many students. Topics covered include parametric equations, functions, polar coordinates, vectors, and complex numbers. Students will learn how to define functions, and plot the graphs, using the Cartesian as well as polar coordinates; solve problems involving complex numbers and vectors. Additional topics include limits and continuity, differentiation techniques and its applications, integration techniques including improper integrals. Upon completion, the students would have acquired some quite powerful tools of analysis. This is also an introductory course on differential equations. Topic includes first order ordinary differential equations (ODEs). Students will learn how to classify and solve first order ODEs.

SSCH 1103 STATISTICS

The course is an introduction to statistics, reviewing some descriptive statistics which includes probability and random variables. Then, the topic of sampling distributions and inferential statistics which include estimation procedures and hypothesis testing is covered. The latter using the method of analysis of variance when more than two means are involved. Also, simple linear regression and contingency table are introduced. Students will be trained in the use of computer software such as Microsoft Excel and SPSS.

SSCK 1203 ANALYTICAL CHEMISTRY FOR ENGINEERING

This course provides a basic introduction to quantitative chemical analysis, with emphasis on wet chemical methods. Topics include introduction to analytical chemistry, sampling, sample preparation, data analysis & method validation, gravimetric analysis and volumetric analysis.

SSCK 1891 ANALYTICAL CHEMISTRY PRACTICAL

The subject introduces students to Good Laboratory Practices in classical (wet chemistry) methods. Experiments are designed to complement the topics covered in Fundamentals of Analytical Chemistry (SSCH 2243), which include gravimetric and volumetric techniques. Part of the course consists of a short laboratory project.

APPENDIX B: SYNOPSIS OF COURSES FOR BIOMEDICAL FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Syllabus Summary: Electrical Courses

SKEU 1023 CIRCUIT THEORY

This course introduces students to the basic laws, theorems and methods of DC and AC circuit analysis such as Ohms law, Kirchhoff Current and Voltage Laws, Thevenin and Norton theorems, concept of series and parallel circuits etc. Based on these, the students are expected to be able to solve variables in any given DC and AC electric circuits. With the knowledge learned, the student would be able to apply the basic laws, theorem and methods of analysis for solving various problems in circuit analysis with confidence.

SKEU 1223 DIGITAL ELECTRONICS

This course emphasizes on the design, analysis, planning and implementation of complex digital systems using programmable logic, with specific focus on programmable logic devices. In order to facilitate the learning process, computer-aided design (CAD) software is used throughout the course. Some practical or almost actual environment problems and solutions are provided. With the knowledge learned, the student would be able to analyze the counter and register circuits completely with confidence and design synchronous counters.

SKEU 2073 SIGNALS AND SYSTEMS

This course introduces the students to the different types of signals and systems. Emphasis mainly will be on continuous signal. Signal representation in both the time (Fourier series) and frequency domain (Fourier and Laplace transform) will be discussed. The concept of transfer function is introduced and the applications of the Laplace transform (such as for the solution of differential equations, and circuit analysis) is presented. Finally, the use of Bode plot in filter design will be covered.

SKEU 1063 ELECTRONICS DEVICES

This is the first course in the field of electronics. It consists of basic electronic devices such as the diode, the bipolar junction transistor, and the field effect transistor. Course content will include the devices' basic structure, biasing and basic applications. With the knowledge learned, the student would be able to apply the basic laws, theorem and methods of analysis for solving various basic biasing circuits using data sheet with confidence.

SMBE 2032 COMPUTER PROGRAMMING TECHNIQUES FOR BIOMEDICAL ENGINEER

As a fundamental subject, this course equips the students with theory and practice on problem solving techniques by using the structured approach. From this course, the student will be equipped with skills of programming to solve simple to moderate problems. The course covers the following: preprocessor directives, constants and variables, data types, input and output statements, text files, control structures: sequential, selection and loop, built-in and user-defined functions, one dimensional and two dimensional arrays.

SKEU 2523 ELECTROMAGNETIC FIELD

This course introduces students to some major views and theories in the area of electrostatic, magnetostatic and electromagnetic fields. This elementary electromagnetic field theory is summarized in Maxwell's equations for static and time varying fields in integral and differential forms, and also a time domain analysis of wave propagation.

SKEU 3133 SYSTEM MODELING AND ANALYSIS

This course introduces the students to the fundamental ideas and definitions of control systems such as block diagrams, plants or processes, open loop and close loop control systems, transfer functions and transient and steady state responses. Students will be taught how to obtain mathematical models of actual physical systems such as electrical, mechanical, electromechanical and simple fluid flow systems in transfer function and state-space equation. Methods of system representation such as block diagram representation and signal flow graphs will be examined. The students will also be exposed to techniques of analysing control systems such as time domain analysis and stability. Finally, an introduction to the design and analysis of control systems using MATLAB will also be given.

SKEU 3063 ELECTRONIC CIRCUITS AND SYSTEM

This course introduces students to some major views and theories in amplifiers and its application. It will examine some key issues in basic definition, construction of analogue amplifiers, operational amplifiers and analogue system with special focus on analysis of transistor amplifiers through small signal equivalent circuits. This course also covers some topics in functional electronic circuits. The circuits are derived from a diverse electronic circuitry existed in many electronic instrumentation. The course will also provide practice in carrying out a computer simulation and modeling of the amplifier's circuits using PSPICE or MultiSim software. The function, the behaviour and the characteristics of the functional circuits are analysed.

SKEU 3533 COMMUNICATION PRINCIPLES

This course introduces the students the basic principles of communication systems. The fundamental concepts of analogue modulation in particular amplitude and frequency modulations will be strongly emphasized. Topics include types of modulated waveforms, transmitter and receiver structures. The two most significant limitations on the performance of a communications system; bandwidth and noise will be discussed. The concept of sampling, quantization and line coding techniques in rendering an information signal to be compatible with a digital system are explained prior to the study of coded pulse modulation and pulse code modulation (PCM). The waveforms and spectral analysis of bandpass digital modulations are introduced. The system performance in terms of bit error rate (BER) will also be covered. Finally, multiplexing, a method to utilize the communication resource efficiently is studied where two techniques will be explored; time-division and frequency-division multiplexing.

SMBE 3033 MICROPROCESSOR SYSTEM

This course introduces the principles and applications of microprocessors. Topics emphasized are processor architecture in detail incorporation with HLL language and fundamentals of designing and implementing the embedded system. This course emphasizes on understanding the fundamentals of microprocessor operation, writing coherent and error-free HLL programmes, and designing basic microprocessor-based circuits. With the knowledge learned, the student would be able to design microprocessor-based systems using HLL programmes completely.

Syllabus Summary: Laboratory Courses

SMBE 2712 LABORATORY 1

The course includes the experiments on basic electrical, electronic, digital signal processing; technical drawing and programming that are related to biomedical engineering. It exposes the students to some common electrical and electronic components and circuits such as diode, transistor, RLC circuits and MSI circuits. On the other hand, this teaching laboratory also provides the skill of programming for embedded system, digital signal processing in matlab and technical drawing using software.

SMBE 3712 LABORATORY 2

The purpose of this course is to provide students with practical experience in the use of equipment, experimental data analysis, and to develop basic skill in laboratory report writing. At least 10 experiments from participating third year laboratories such as Control, Basic Communications, Instrumentation, Microprocessor, and Industrial Electronics. The students will also be exposed to the common electrical engineering equipment and measurement techniques. At the end of the course students should be able to develop skills in report writing, improve their communication skills and know how to work in a team.

SMBE 3722 LABORATORY 3

3rd Year Laboratory is a required course for third year students in Bachelor of Engineering (Biomedical) degree programme. This course involves the conduct of experiments in 2 different laboratories covering the areas of Bioinstrumentation, Biomechanics and Biomaterial, Medical Imaging, Biomedical Signal Processing and Clinical engineering. The approach of this laboratory however is different in sense that the students are not given procedural type laboratory experimental sheets. Instead they will be given problems to solve that require them to conduct certain experiments. The students are required to solve a given problem as a team, design suitable experimental procedures and conduct the experiment, present the problem solutions and submit the report.

SMBE 4712 LABORATORY 4

This course involves experiments in many different areas of biomedical engineering such as Bioinstrumentation, Biomechanics & Biomaterial, Medical Imaging, Biomedical Signal Processing and Clinical Engineering. This laboratory session is conducted as a Problem-Based Learning (PBL) approach. The students are grouped into 4-5 students per a group, and they will be given problems to solve that require them to do pre-labs and conduct experiments within 4 weeks. The students are required to solve the given problems as a team, design suitable experimental procedures, conduct the experiments, present the problem solutions and submit a full formatted report.

Syllabus Summary: Mathematical Courses

SSCE 1693 ENGINEERING MATHEMATICS 1

This course is about multivariable calculus of real and vector-valued functions. The basic theory of partial derivatives and multiple integrals of real functions with their applications are discussed. This theory is extended to vector valued functions to describe motion in space, directional derivatives, gradient, divergence and curl, line integrals, surface integrals and volume integral. Related theorems, namely Green's Theorem, Stokes' Theorem and Gauss Divergence Theorem and their applications are discussed in detail.

SSCE 1793 DIFFERENTIAL EQUATIONS

This is an introductory course on differential equations. Topics include first order ordinary differential equations (ODEs), linear second order ODEs with constant coefficients, the Laplace transform and its inverse, Fourier series, and partial differential equations (PDEs). Students will learn how to classify and solve first order ODEs, use the techniques of undetermined coefficients, variation of parameters and the Laplace transform to solve ODEs with specified initial and boundary conditions, and use the technique of separation of variables to solve linear second order PDEs.

SSCE 1993 ENGINEERING MATHEMATICS 2

This course is about multivariable calculus of real and vector-valued functions. The basic theory of partial derivatives and multiple integrals of real functions with their applications are discussed. This theory is extended to vector valued functions to describe motion in space, directional derivatives, gradient, divergence and curl, line integrals, surface integrals and volume integral. Related theorems, namely Green's Theorem, Stokes' Theorem and Gauss Divergence Theorem and their applications are discussed in detail.

SSCE 2193 ENGINEERING STATISTICS

This course begins with basic statistics, elementary probability theory and properties of probability distributions. Introduction to sampling distribution, point and interval estimation of parameters and hypothesis testing are also covered. Simple linear regression and one-way analysis of variance are also taught in this course. Students are also introduced to some nonparametric methods in analyzing data.

SSCE 2393 NUMERICAL METHODS

This course discuss problem solving using numerical methods that involve non-linear equations, systems of linear equation, interpolation and curve fitting, numerical differentiation and numerical integration, Eigen value problems, ordinary differential equations and partial differential equations.

Syllabus Summary: Biomedical Courses

SMBE 1513 BASIC ANATOMY AND PHYSIOLOGY

This course is a study of anatomical terminologies, body structures, orientation and physiological or function of human body systems through lectures, models and diagrams. The course programme is equivalent to other paramedical courses. Knowledge in anatomy is fundamental in biomedical engineering programmes because it provides the pathway to integrate between the engineering technology and multiple related medical disciplines. Even after graduation, knowledge in anatomy is still applicable in many medical disciplines such as research and technology developments, medical technology consultancy, hospital management and health care industries.

SMBE 1012 INTRODUCTION TO BIOMEDICAL ENGINEERING

This is a course specially designed to introduce biomedical and health science engineering and motivate students towards understanding the programme of biomedical engineering at UTM. This course introduces the programme offered and gives an opportunity to student know what they are entitled to for the next 4 years. It also gives an overview on how to cope with the university environment. Lastly, this course will facilitate the students to plan their career path towards a being a biomedical engineer.

SMBE 1523 ADVANCED ANATOMY AND PHYSIOLOGY

This course is an advanced study of anatomical terminologies, body structures, orientation and physiological events of human body systems through lectures, models and diagrams. Knowledge in anatomy & physiology are fundamental in biomedical engineering programmes because it provides the pathway to integrate between the engineering technology and medical disciplines. Even after graduation, knowledge in anatomy & physiology can be applicable in many medical disciplines such as research and technology developments, medical technology consultancy, hospital management and health care industries.

SMBE 1313 STATICS AND DYNAMICS

Mechanics & biology have always fascinated humankind. In Biomedical Engineering programmes, statics and dynamics are two basic important subjects that equip undergraduates with the necessary tools to solve bio-mechanic related problems. This subject covers the concepts and principles of statics and dynamics that is applied in the biomedical field. Covered in the course will be explanations of physical behavior of materials under static loads and during motion. Emphasis is placed on the importance of satisfying equilibrium, analysing structure, biomechanics of human joints, kinematics and kinetics of rigid bodies.

SMBE 2413 BIOPHYSICS

This course is designed to enable students to comprehend the many types of physical processes occurring at the cellular level of the human body. It will emphasize on the transport mechanism in an infinite medium which will include the flow, flux, diffusion Brownian motion and fluid drag. Transport through membrane structure will be dealt especially with regards to the volume transport, solute transport and ionic motion in and outside cell membrane. Properties of the signal transport by nerve cell will be studied and modeling of nerve impulse will be based on Hodgkin-Huxley experiment. Finally during the course, the student will be exposed to the study of electrical properties of heart cells based on non-conducting model. Some typical examples of ECG graphs with regards to different heart disorders will also be highlighted.

SMBE 2513 BASIC REHABILITATION

This subject aims to introduce students to the basics of rehabilitation so that they can understand important rehabilitation concepts and issues in disability management, within the context of rehabilitation engineering. It will equip students with basic knowledge and skills for the application of science, technology and engineering to the design and development of assistive (adaptive) technology and rehabilitation techniques. It will provide students with an understanding of the nature of problems confronting people with disabilities and an ability to provide technical solutions for these problems.

SMBE 3313 BIOMEDICAL MATERIALS

This subject provides an introduction to the fundamentals of and recent advances in biomedical materials. It covers a broad spectrum of biomedical materials which include metals, ceramics, polymers and composites. It takes an interdisciplinary approach to describing the chemistry and physics of materials, their biocompatibility, and the consequences of implantation of devices made of these materials into the human body. The subject is also designed to familiarise students with failure of materials through fracture, fatigue, wear and corrosion.

SMBE 3323 SOLID MECHANICS

The course provides students with the knowledge to determine the strength and stiffness of structures being used. The structures that will be studied in this course are bars, pins, bolts, shafts and beams and the types of applied loading are axial forces, deformations due to the change in temperature, torsional loads, transverse loads and combination of these loads. At the end of the course, students should be able to determine the mechanical properties of the materials with respect to their strength and stiffness. Students should be able to calculate stresses, strains and deformations in structures due to various types of loading conditions. The students should also be able to use the acquired knowledge to solve real problems either coming from research problems, or from real-world biomedical problems.

SMBE 3023 BIOMEDICAL IMAGING

A course is for introducing and exposing students to the world of medical tomography. It focuses on physical, operation and signal formation of medical tomography techniques from various imaging modalities such as MRI, ultrasound, CT-scan, nuclear medicine and X-ray.

SMBE 3423 CLINICAL ENGINEERING

This course introduces students to major principles of clinical engineering. The scope of clinical engineering covers pre-market, market and post-market life-cycle of medical devices as well as risk and personnel management. These include procurement planning, incident investigation, equipment management, productivity, cost effectiveness, information systems integration, and patient safety activities. Students will also be exposed to the related law, standard and regulation for medical devices.

SMBE 3043 INSTRUMENTATION AND MEASUREMENT IN BIOMEDICAL

This course introduces students to biomedical measurement systems and biomedical instrumentation design. The architecture of electronic instruments used to measure physiological parameters is addressed, as well as the analysis of major process functions integrated in these instruments.

SMBE 4313 BIOMEDICAL SYSTEM DESIGN

This course is designed for students to gain detailed topical exposure to design methodologies and principles specific to the practice of biomedical design. Emphasis is on developing efficient and effective design techniques as well as project-oriented skills from both technical and non-technical consideration. At the end of this course, students should be able to identify and apply appropriate methodology in performing design tasks, recognize the fundamental principles of biomedical design and practices, and formulate and apply general problem solving strategy in the analysis of situation, problem and potential problem. At the end of this course, students should be able to identify and apply industry standards in design communication.

SMBE 4413 BIOCHEMISTRY FOR BIOMEDICAL ENGINEERS

The course provides fundamental concepts of biochemistry (macromolecules function and properties of living systems) and focuses in the biochemical analysis and techniques of these macromolecules. The mechanism of the major macromolecules metabolism, enzymes reactions, regulations and inhibitions are also addressed as well as laboratory safety and statistical analysis applied to biochemistry.

SMBE 4023 BIOMEDICAL SIGNAL PROCESSING

Manual analyses of biomedical signals has many limitations and very subjective. Therefore, computer analysis of these signals is essential since it can provide accurate diagnosis as well as quantitative measurement. Hence, this course presents methods of processing the biomedical signals. The course will discuss the fundamental approach of biomedical signal processing. Among biomedical signal processing topics covered in this course are: discrete time and system analysis, data acquisition, digital filter design and discrete time Fourier transform. This course also provides introduction to some biomedical signal and its related basic processing techniques.

SMBE 4032 PROFESSIONAL BIOMEDICAL ENGINEERING PRACTICE

The purpose of this course is to introduce and expose students to the concepts, theories and the practice of Professional Engineer. With the knowledge learned, the student would be able to apply the principles to real world situations.

Syllabus Summary: Compulsory Courses

SMBE 4915 INDUSTRIAL TRAINING (HW)

Industrial Training Programme is a compulsory component of the undergraduate curriculum at the Faculty of Biomedical & Health Science Engineering. Placements at the participating industries are structured for undergraduates in the third semester of their third year study. The industries where the students will be attached to during their training is listed in the supporting document (LI-CL). These industries cover all areas in Biomedical Engineering such as biomedical instrumentation and signal processing, clinical science and engineering, therapy and rehabilitation and biomechanics and biomaterial. The nature of jobs involved in the training includes designing, manufacturing, testing, maintaining, fabricating and etc.

SMBE 4812 PROJECT PART I

The aim of the Final Year Project (FYP) is to give students opportunity to apply the knowledge that they have gained while studying in FKBSK to solve practical engineering problems. By doing so, it is hoped that the students will gain knowledge and experience in solving problems systematically thus when they graduate, they will be ready to work as reliable and productive engineers.

SMBE 4824 PROJECT PART II

This course is a continuation from SMBE 4812. Students must submit a project thesis and present it at the end of the semester. Grades will be given for both.

Syllabus Summary: Fourth Year Elective Courses

SMBE 4043 BIOMEDICAL IMAGE PROCESSING

This course introduces students to introductory and intermediate levels of image processing techniques. The area of coverage would be the digitization process as a mean to acquire the digital image. Next would be the enhancement and restoration processes which are to improve the quality of the image for next stage processing. Both the spatial domain and frequency domain approaches will be covered. The next stage would be the segmentation process. This is an important step towards advanced level processing. Finally the topic of compression and coding will be covered. MATLAB will be used extensively for better understanding. By adapting this knowledge, students will be able to develop essential technical skills in solving biomedical image problems with some degree of accuracy. It focuses on medical image

processing of image obtained from the various imaging modalities such as MRI, ultrasound, CT-scan, nuclear medicine and X-ray.

SMBE 4053 BIOSYSTEM MODELING

The objective of this course is to introduce students to the mathematical model, methods and their biological application, and model of subsystem in human body. This course introduces students to some major views and theories in modeling the subsystem in human body. It is almost impossible to cover all subsystems in human body. As guidance, topics may include: the maintenance of cell homeostasis, excitation and conduction in nerve fibers, synaptic transmission and the neuromuscular junction, properties of muscles, the lung - physical and mechanical aspects of respiration, volume and composition of body fluids - the kidney, the cardiovascular systems, the heart as a pump, neural control of the heart and circulation, and the autonomic nervous system. The course will also provide practice in carrying out a computer simulation and modeling of bio system using Matlab/Simulink/LabView software.

SMBE 4063 ADVANCED BIOMEDICAL SIGNAL PROCESSING

This course presents two fundamental concepts of signal processing: linear systems and stochastic processes. Various estimation, detection and filtering methods are taught and demonstrated on biomedical signals. All methods will be developed to answer concrete question on specific biomedical signal such as ECG, EEG and etCO₂. The focus of the course is a series of labs that provide practical experience in processing biomedical data, with examples from cardiology, neurology, respiratory and speech processing.

SMBE 4073 BIOSENSORS AND TRANSDUCERS

This course is intended to introduce the function of biosensor and a transducer in the medical electronics industry. An overview of biosensors and an in-depth and quantitative view of device design including fabrication technique. Discussion of the current state of the art biosensor to enable continuation into advanced biosensor design and fabrication. Topics emphasize biomedical, bio-processing, military, environmental, food safety, and bio-security applications.

SMBE 4083 ARTIFICIAL INTELLIGENCE

This course introduces students to the fundamentals of two techniques of artificial intelligence (AI), namely, fuzzy logic and neural networks. Both techniques have been successfully applied by many industries in consumer products and industrial systems. Fuzzy logic offers flexibility in developing rule-based systems using natural language type of rules. Neural networks on the other hand, have strong generalization and discriminant properties and offer a simple way of developing system models and function approximation. They are highly applicable for many pattern recognition applications. This course give the students appropriate knowledge and skills to develop, design and analyze effectively these two AI techniques for practical problems with some degree of accuracy. The students will also be given a hands-on programming experience in developing fuzzy logic and neural networks system to effectively solve real world problems.

SMBE 4323 BIOMEDICAL DEVICES

A biomedical device is a product which is used for medical purposes in patients, in diagnosis, therapy or surgery. It includes a wide range of products varying in complexity and application and sometimes categorized into either passive or active devices. Examples include tongue depressors, medical thermometers, blood sugar meters, total artificial hearts, joint replacement devices,

fibrin scaffolds, stents and X-ray machines. The global market of biomedical devices reached roughly 209 billion US Dollar in 2006 and is expected to grow with an average annual rate of 6 - 9% through 2010. Due to its importance, this course will introduce to students some of the many types of devices that are currently being used in the medical field.

SMBE 4333 BIOLOGICAL INSPIRED DEVICES

The course provides students with an overview of non-conventional engineering approaches is biology, and to show how these approaches can be used to design and develop better (simpler, more robust, energy-efficient) solutions, especially in the development of novel biomedical devices. The focus of the course will be mainly on the physical part (i.e. the structure and function) of organisms or parts of the organism, rather than the signal processing part. The students will practice on implementing bio-inspired mechanism in solving engineering problems.

SMBE 4343 CELL AND TISSUE ENGINEERING

Tissue engineering integrates principles of engineering and life sciences towards the fundamental understanding of structure-function relationships in normal and pathological tissues. The course will cover the introduction and fundamentals of tissue engineering, extracellular matrix, cells, biomaterials in tissue engineering, scaffold in tissue engineering, in vitro and in vivo strategies, clinical applications of tissue engineering and ethical and regulatory issues in tissue engineering.

SMBE 4423 BIOMEDICAL INFORMATICS

The course provides the student with the basic theoretical knowledge and practical experience from the area of medical informatics and radiobiology. The medical informatics knowledge covers area of processing of medical data, fundamentals of medical information system design, computer-aided medical diagnostics, and telemedicine. The radiobiology covers the physics of radiation, application of radiation in diagnostic and therapeutic, and radiation safety.

SMBE 4513 REHABILITATION ENGINEERING

This course will focus on the principles and application of rehabilitation sciences & assistive technology from the rehabilitation engineering perspective. It aims to provide the students with in-depth understanding pertaining important issues in rehabilitation engineering and equip students with knowledge and skills for the application of science, technology and engineering to the design and development of assistive (adaptive) technology and rehabilitation systems. It will also provide students with an understanding of the nature of problems confronting people with disabilities and an ability to provide technical solutions for these problems. Interdisciplinary interaction and teamworking for optimal disability management will be stressed, with emphasis being given to the role of the rehabilitation engineering professional in the team.

SMBE 4523 SPORTS TECHNOLOGY IN EXERCISE REHABILITATION

The course provides fundamental concept of sports science, technology and exercise rehabilitation. It focuses on total fitness, the biomechanics of sports, common injuries that occur in sport and how to prevent it. The application of technology in the process in exercise rehabilitation, assessment of injury, sports massage and psychological aspect of injuries are also addressed.

SMBE 4433 BIOMEDICAL INSTRUMENTATION MANAGEMENT

Healthcare technology management provide an overview of systematic process in which qualified health care professionals, typically clinical engineers, in partnership with other healthcare leaders, plan for and manage health technology assets to achieve the highest quality care at the best cost. It explains the basic concepts of managed care and describes the various types of health plan in operation today. This subject will cover the strategic planning as well as technology assessment and facilities planning proceed with technology procurement and conclude with service or maintenance management.

APPENDIX C: SYNOPSIS OF COURSES FOR EQUINE MANAGEMENT

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Core courses for Equine Management (SMBQ)

SMBQ 1013 INTRODUCTION TO EQUINE SCIENCE AND INDUSTRY

This course in general acts as an introduction to the student to get an overview of the equine sports and industry. Students will learn the economic aspect of equine as well as the different entities that define the equine industries as a whole. Students will be able to evaluate and analyze domestic equine industry in terms of its impact and economic performance

SMBQ 1093 BASIC HORSE HANDLING

This course is an introduction to the basic skills necessary for daily care and maintenance of the horse. Topics include safety, stall care, feeding and basic nutrition, handling and restraint, vices, common cause and treatment of lameness, equine emergencies and first aid, bandaging, basic medications, and trailer safety. Preventative health care, deworming and vaccination programs, and dental and farrier care are introduced.

SMBQ 1102 SPORTS PSYCHOLOGY

This course aim to prepare students the knowledge in risk management for equine industry. This course expose the students with the principles of risk management, risk management strategies, identifying the risks, assessing the risks, and managing the risk that will occur in various parties such as riders, staffs, horse, equipments, facilities and managing the incidents. Student also able to discuss about the issues related to managing the risk in equine industry.

SMBQ 1112 FOUNDATION OF EQUINE PERFORMANCE

The aim of this course is to further previous knowledge gained in other courses and recognise the qualities needed in a competition horse. This course also aim to develop an understanding on the foundation of equine performance in order to produce and sustaining performance horse at a competitive level.

SMBQ 1203 EQUINE ANATOMY & PHYSIOLOGY

This module aims to build the knowledge and understanding of the mechanisms of energy metabolism and means of monitoring performance. This module also aims to understand and clearly define the anatomical features of the horse and develop the ability to identify the anatomy of the musculoskeletal system. The student will develop the ability to identify anatomical features and relate its structure to function. An in-depth understanding of equine physiology is vital when training horses to a high level whilst minimising the risk of injury.

SMBQ 2122 HORSE RIDING I ENDURANCE

This course focuses on the knowledge and development of basic skills pertaining to Endurance riding. Students will acquire knowledge and understanding which covers the aspect of the horse as well as the rider on the subject of Endurance riding. Students will develop the skills required to be able to conduct Endurance with a sound base of knowledge to reflect equine performance.

SMBQ 2133 HORSE BEHAVIOUR AND TRAINING

This course focuses on understanding and determining the horse behaviour. Students will acquire the knowledge and skills to identify and observe the horse behaviour to ensure well being and soundness of the horse. Modern day management of horses often results in equine behavioural problems and the range of behavioural problems has a wide impact on equine welfare. Developing understanding of innate equine behaviour and methods of behavioural training could vastly improve equine welfare for the horses concerned. This module aims to develop application of training techniques as a solution to given behavioural problems. This will be achieved through developing an understanding of a range of training methods and behavioural modification techniques.

SMBQ 2142 HORSE RIDING II DRESSAGE

This course focuses on the knowledge and development of basic skills pertaining to Dressage. Students will acquire knowledge and understanding which covers the aspect of the horse as well as the rider on the subject of Dressage. Students will develop the skills required to be able to conduct Dressage with a sound base of knowledge to reflect equine performance.

SMBQ 2213 BASIC EQUINE HEALTHCARE AND DISEASE

This course aims to equip the students with the knowledge of basic equine healthcare that covers the fundamental aspects to be considered in equine healthcare such as physical condition of the horse, routine care, feeding and exercise. Students will learn management practices and routine preventive care of horses which will contribute to equine healthcare and welfare.

SMBQ 3152 HORSE RIDING III SHOW JUMPING

This course focuses on the knowledge and development of basic skills pertaining to Show Jumping. Students will acquire knowledge and understanding which covers the aspect of the horse as well as the rider on the subject of Show Jumping. Students will develop the skills required to be able to conduct show jumping with a sound base of knowledge to reflect equine performance.

SMBQ 3183 EQUESTRIAN MOTION ANALYSIS

This course is to develop students understanding of biomechanical factors influencing the athletic horse. The specific aims are to understand the relationship between equine anatomy, movement and performance; and to develop understanding and practical skills in the methodologies for measuring biomechanical parameters. Students also will be able to do an analysis to evaluate equine performance within biomechanical parameters.

SMBQ 3243 EQUINE NUTRITION

The module aims are to build on knowledge gained within the horse management module, to develop knowledge of nutritional requirements in a wide variety of horses, recognise the significance of poor ration formulation within the industry and the environmental management of arable crops.

SMBQ 3302 RESEARCH METHODOLOGY

This course introduces undergraduate students in education as an informal training in handling research. Basically, this research describes on the nature of educational research and also introduces the steps in the research process. Relevant topic in this course includes identification of research problems, ethical issues in conducting a research, the definition of research and importance of research in the field of education. This course also covers an important characteristics of research mainly the research problems, questions and objectives, hypothesis testing and implementing a research, literature review, research design, sampling methods, research instruments (qualitative and quantitative), collecting and data administration, data analysis (qualitative and quantitative) including descriptive and inferential statistics. This course also provides students with information and suggestions on how to put a report together in a correct and efficient manner.

SMBQ 3233 EQUINE LAMENESS & CONDITIONING

This course aims to expose the students with the principles of the clinical evaluation and interpretation of lameness disorders of the fore-and hind limbs of horses. Methods used in large-animal radiography and the latest techniques for managing and treating equine lameness. Anatomy and pathology of some areas of the musculoskeletal system.

SMBQ 3263 EQUINE QUARANTINE

This course aims to equip the student with the knowledge of equine quarantine which covers the aspect of legal requirements and the whole procedure and process of quarantine in Malaysia. This course touches on the management of horses which contribute to equine healthcare and welfare.

SMBQ 4163 RIDING INSTRUCTOR TRAINING

This module is designed to aid the students who wishes to take an instructional role in the industry. Student will gain knowledge on the coaching perspective, how to organise, conduct, demonstrate and evaluate performance of the rider and the horse. Students will be able to do an assessment and provide solutions during their class lessons.

SEQA 4082 EQUINE SEMINAR

This course will equip students with the knowledge and skills to write papers and articles related to organizing seminars on current issues in the field of sports science. Course content covering aspects of producing writing seminar papers or academic articles, poster presentation, present papers and discuss current issues in the field of equine in Malaysia and internationally.

SMBQ 4173 EQUINE EVALUATION & SELECTION

This course aims to provide students with a knowledge from function aspect of performance and anatomy, breed standards in the equine industry, components of judging various breeds and judging various disciplines. This course also provides an ability for students to assessing equines market value, understanding the market value, factors drives a horse's price and various horse price-ranges for better purchase decision. This course also provides the students with behavioural observation techniques, effective measuring techniques, interpretation of behavioural monitoring, developing potentials, training programmes and specialist training equipment. Students will also acquire knowledge for veterinary and farriery procedures, examination for purchase, identify the causes and treatment of lameness, hoof structure and function.

SMBQ 4193 EQUINE FOR DISABLED

This course aim to provide a student to the knowledge, concepts, principles and theories involved in equine for disabled. There are severaly common disabilities that can get benefit from the equine treatment such as Cerebral Palsy, Down Syndrome, Brain Injury, Seizure Disorders, Autism, Autistic Spectrum Disorders, learning disabilities.

SMBQ 4253 EQUINE THERAPY AND REHABILITATION

The modern horse is subject to a wide range of uses. These all have the potential to cause physiological stress and strain on the horse, particularly the musculoskeletal system. This course aims to build on existing knowledge and give the student an understanding of the types of susceptibilities that the horse may be subjected to and of the therapeutic and rehabilitation techniques currently practised.

SMBQ 4273 EQUINE REPRODUCTION AND BREEDING TECHNOLOGIES

This course is to provide an introduction to the anatomy and physiology of reproduction in the mare and the stallion. The course also aims to develop the ability to care for a range of breeding and young stock and to allow the student to develop an understanding of the principles of breeding management.

SMBQ 4368 INDUSTRIAL TRAINING

This course is open to opportunities for students to experience practical training in any institution or industry related to the field of equine. Students have the opportunity to practice the knowledge they have learned in real-life situations and at the same time learn more about the knowledge, skills, management and technology of the industry. In addition to providing a record of daily work in the industry, at the end of the course, students should prepare a written report and reflect on the training industries that have been implemented.

SMBQ 1023 INTRODUCTION TO MANAGEMENT

The aim of this course is to provide a general introduction in management to students whose field of study is not management, but whose careers are likely to have a significant managerial component. Students will be able to understand the concepts and language of management and to be aware of the relationships among all management disciplines. This course aims to provide you with an overview of the role of management thereby giving you an appreciation of the key issues associated with achieving purposeful activity within organisations.

SMBQ 2033 FARM AND STABLE MANAGEMENT

Management of horse stable requires particular skills and understanding. The horse is a complex animal whose psychology is vital to its effective husbandry. The routine of this husbandry is vital, as is the understanding of different methods. The basic principles of horse care are fundamental and underpin the requirements of whichever area of the horse industry the student finds employment.

SMBQ 2043 COMMERCIAL EQUINE FACILITIES DESIGN AND MANAGEMENT

This course focuses on the design and construction of various types of private and commercial equine facilities. Topics include property layout, construction options, equipment, hay production and pasture management, water and waste management, zoning requirements, environmental impact of stables, legal obligations, contracts and liability, and economics and business management of facilities.

SMBQ 2053 EQUINE BUSINESS MANAGEMENT

This course aim to address the types of organisation that require commercial managers within the Equine sector and the responsibilities that are fundamental to the role of a commercial manager. The course address the complexity of the equine market and the influence this will have on the strategic aims of a business or the entry to market of new business. The course also address the relevance of sustainability within a commercial context.

SMBQ 2062 PRINCIPLES OF RISK MANAGEMENT

This course aim to prepare students the knowledge in risk management for equine industry. This course expose the students with the principles of risk management, risk management strategies, identifying the risks, assessing the risks, and managing the risk that will occur in various parties such as riders, staffs, horse, equipments, facilities and managing the incidents. Student also able to discuss about the issues related to managing the risk in equine industry.

SMBQ 2223 EQUINE DISEASE MANAGEMENT

This course aims to equip the student with the knowledge of equine diseases and health management of horses. Students will be more knowledgeable and proficient at recognizing and managing some of the major health problems associated with equine. The emphasis of this course will be on preventive maintenance and necessary managerial practices needed to keep the equine health and welfare.

SMBQ 3073 EVENT AND COMPETITION MANAGEMENT

The main aim of this course is to enable the learner to identify and evaluate the factors that affect the demand for recreational facilities and special events, considering social and environmental concerns with a long term strategic view. In addition, the on-going processes involved in facility management are emphasised whilst considering organisational constraints. Also the aim is to provide learners with the skills necessary to plan, manage, deliver and evaluate an event.

APPENDIX D: SYNOPSIS OF UNIVERSITY REQUIRED COURSES AND ENGLISH ELECTIVES

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

University Required Courses

The University Required Courses was offered by Centre of General Courses and Co-curriculum (CGCC) who responsible in assisting the university in developing students' personalities and producing human resources who are of high quality, knowledgeable, skillful, creative, innovative, competitive and noble. The University Required Courses and Co-curricular courses are classified into 8 clusters and they are pre-requisite for graduation in UTM. All students are required to take 20 credits of University Required Courses from different cluster. The list of courses offered by Centre of General Courses and Co-Curriculum (CGCC) under certain cluster is tabulated in Table 10.1.

The Centre for General Courses and Co-Curriculum are also offering eight pillars of co curricular courses to the students. This is in accordance with the objectives of the Ministry of Higher Education in enhancing human capital towards the holistic development of students. The eight pillars of co-curricular courses are:

- i) Sports
- ii) Culture
- iii) Leadership
- iv) Volunteerism
- v) Community Service
- vi) Public Speaking
- vii) Entrepreneurship
- viii) Initiative and Innovation

Table 11.1: Cluster of University Required Courses

No	Cluster	Credit
1	Communication	6
2	Compulsory MOHE	2
3	Compulsory MOHE Malaysia Education	2
4	Enlightened Mind and Development of Civilization	2
5	Entrepreneurship	2
6	Innovation Creativity	2
7	Individual and Community Development / Globalization	2
8	Co-curriculum / Service Learning	2
Total Credit		20

Table 10 .2: University Required Courses in Different Cluster

Cluster	Courses	Credit
Communication	1. ULAB 1112 English For Academic Communication	2 (C)
	2. ULAB 2112 Advanced English For Academic Communication	2 (C)
	3. ULAB 3112 English For Career Search	2 (E)
	4. ULAB3122 English For Work place Communication	
	5. ULAB 3132 Reading For Specific Purposes	1&2 Compulsory (C), 3-7 Elective (E)
	6. ULAB 3142 Writing For Specific Purposes	
	7. ULAB3152 Effective Oral Communication	
Compulsory MOHE	UICI 1012 "Islamic Civilization and Asia (TITAS)"	2
Compulsory MOHE Malaysia Education	UHS 1172 "Dinamika Malaysia" replaced UHS1152 - Ethnic Relations	2
Enlightened Mind and Development of Civilization	ULT XXXX Science, Technology and Human	2
Entrepreneurship	UHAS 3012 Entrepreneurship and Enterprise Development	2
Innovation Creativity	UXXXXXX Research Methodology	2
	UHS 2122 Critical and Creative Thinking	
Individual and Community Development / Globalization	1. ULTXXXX Al-Quran and Human Civilization	2
	2. ULTXXXX The Science and Philosophy of Solat	
	3. ULTXXXX Introduction to Science of Muamalat	
	4. ULTXXXX Asset Planning and Management	
	5. ULTXXXX Family Planning	
	6. ULTXXXX Introduction to Comparative Religion	
	7. ULTXXXX Biopsychosocial-Spiritual	
	8. ULTXXXX Islamic Art Philosophy	
	9. UPS1102 Healthy Living	
	10. UHS2162 Cross-Culture Management	
	11. UHS2152 Cross-Culture in Organizations	
	12. USA2014 Civil Engineering in Community	
	13. UHS2132 Communication in Management	
	14. UHS2142 Leadership in Organizations	
	15. UHS2032 Technocrats and Development	
	16. UHS2042 Introduction to Industrial Sociology	
	17. UHS2052 Effective Communication	
	18. UHS2062 Introduction to Industrial Psychology	
	19. UHS2092 Professional Ethics	
	20. UHS2112 Introduction to International Relation	
	21. UICI 3042-Islamic Institutions	
	22. UICI 3032-Islam & Current Issues	
	23. *ULAM1112 Malay Language For Communication *Compulsory to International Student	
Co-curriculum / Service Learning	UKQAXXXX (Refer to CGCC website)	2
Total Credit		20

U* 2**2—Individual Development, Community & Globalization**

Please refer to Faculty of Management & Human Resource Development

UICI 1012—Islamic and Asian Civilization

The course familiarizes students with the Islamic and Asian Civilization. It discusses on the science of civilization that embraces an introductory to the science of civilization, the interactions of various civilizations (Malay, China and India) Islam in Malay Civilization and its role in establishing the Malaysian civilization, Contemporary issues on the Islamic and Asian Civilization, Islam Hadhari and nation-building. At the end of the course, student will be exposed extensively to the history, principles, value and fundamental aspects of the civilizational studies in Malaysia and ways to strengthen the integrity of the Malaysian as a citizen of a multi-racial country which has a high tolerance towards others. Throughout the learning process, some aspects of generic skills such as team working, communication skills and ethics will be emphasized.

UICI 2022—Science, Technology & Human

Please refer to Faculty of Islamic Civilization.

UICI 3032 ISLAM AND CURRENT ISSUES

The course acquaints students with various topics on current issues and Islamic approaches to overcome problems and to encounter challenges. The topics comprise discussion on globalization, clash of Eastern and Western civilizations, moral decadence, ethical issues in science and technology, economic issues, development and environmental issues, post-modernism, governance and administration, issues that challenge the credibility of Islam as well as fundamentalism and extremism. Issues pertaining to the ethics relations and ethnic chauvinism, and the current challenges of Muslim people will also be discussed. At the end of the course students will be able to explain the Islamic views pertaining to current issues and to current issues and to provide answers and alternatives to problems by referring to Islamic principles. They are also able to work in teams and be equipped with communication and problem solving skills.

UICI 3042 ISLAMIC INSTITUTIONS

The course exposes students to the comprehensiveness of Islam via its distinctive institutions. It discusses various institutions including family, social, education, economy, legislative and jurisdiction, enforcement and politics. The discussion will be focused on the concepts of family, its internalizing and implementation, the concepts of society and social responsibilities, Islamic philosophy and educational system, concepts of Islamic economics, insurance and banking, the concept and characteristics of law and legislation, the position of Islamic law in the Malaysia constitution, wilayah al-Qhada'. Wilayah al-Hisbah and al-Masalim, includes the concepts of Islamic politics and its dominion. At the end of the course, students are able to understand the concepts and roles of various Islamic institutions which can be an alternative solution to overcome the problem of Ummah. Students are also able to work in teams and be equipped with communication and problem solving skills.

UKQR 11 - Co-curriculum**

The subject is handled by Centre for General Studies and Co-Curriculum. For registration, students must select from a list of courses offered every semester. The objectives of the course are to create a balanced and all-rounded education in order for students to be more mature: Training in leadership with greater emphasis on organizational discipline and team working among students: Strengthen and develop talents and skills for own benefit and society: Promote social integration within the society and community.

UHAS 3012—Entrepreneurship

Please refer to Faculty of Management & Human Resource Development

UHAS 4542—Engineering Management

This course introduces the engineer to management principles and their application in the different kinds of work they are likely to encounter. Today, these principles are needed by the engineering manager and those they manage. The basic outline of the course will include the four main management functions followed by the functions of technology management, especially on project management. Finally, the course further discusses resource management processes in achieving organization goals and objectives efficiently and effectively.

Nationhood Electives

UHS 1152 ETHNIC RELATIONSHIP

This course discusses the basic sociological concepts on culture and ethnic relations. It focuses on the development of ethnic relations in Malaysia from the sociology, history and constitution perspectives. It also aims to develop skills in understanding and making sense of the Malaysian society thus enabling the students to contribute to the country's development. Among the topics covered in the course are issues on globalisation, government policies and strategies in the context of national solidarity and development, multi-ethnic relations for the Islamic perspectives and cultures.

UHS 1172 DYNAMIC MALAYSIA

This course covers various disciplines of social sciences, which includes knowledge sociology, political science, history and international relations. This course is will add value to the UTM students to develop self-esteem, foster unity among students, and produce students a dynamic and global thinking.

UHS 2032 TECHNOCRAT AND DEVELOPMENT

This course focuses on the technocrat's roles and responsibilities toward the nation development profess. This course includes topics on sociology, economics, politics, technology, professional ethics and globalization issues from various perspectives.

UHS 2042 INTRODUCTION TO INDUSTRIAL SOCIOLOGY

The aim of this course is to discuss industrial aspects according to sociological perspectives. It focused on the role of industrial sociology, industrial development and implication towards society and family. It also discusses employees' right under the respective laws and the function of unions in industrial relations.

UHAS 2122 CREATIVE AND CRITICAL THINKING

This subject is to review the concepts, theories and practices of the critical and creative thinking. Techniques on critical and creative thinking could help students to be more realistic, innovative and far-sighted in their actions. This is a kind of constructive approach to develop student's thinking to be more mature and intellect as a graduate-to-be.

UHS 2052 EFFECTIVE COMMUNICATION

This course focus on effective communication techniques. These include verbal and non-verbal communication, interpersonal communication, public speaking, conflict management and problem solving.

UHS 2062 INTRODUCTION TO INDUSTRIAL PSYCHOLOGY

Industrial Psychology is part of the psychology discipline, which is related to behavioural science at the workplace. It also applies psychology principles in understanding various behaviours, which involve employees and work. Industrial psychology also considers personnel issues, workplace problems and behavioural management at the workplace.

UHS 2072 RACIAL RELATION

The course aims to introduce and expose students to the aspects related to social relation sociology. This includes basic concepts of racial relations such as race, racism, ethnicity, ethnocentrism, prejudice, stereotype, and form of races/ethnic identity in Malaysia, the Balkans, South Africa, the United States and South East Asia countries. The focus is more on causes, effects as well as the process and methods of solving racial relation problems.

UHS 2082 MALAYSIAN SOCIO-ECONOMIC DEVELOPMENT

The course focuses on the meaning and measurement of development, development theories, and development plan in Malaysia before and after Independence, poverty eradication, society restructuring and development strategy or various sectors in Malaysia. The development strategy is viewed especially in urbanisation, industrial sector, privatisation, foreign investment, technology transfer and national industrial policies.

UHS 2092 PROFESSIONAL ETHICS

This course consists of basic debates on ethics (morale), ethics theories, ethics awareness, ethics principles and functions, ethics relation with professionalism, ethics problem in profession, value and structure of professional ethics, service obligation, obligation towards the profession, current issues in management, medicine engineering and business.

Compulsory and Electives English Courses

ULAB 1112 ENGLISH FOR ACADEMIC COMMUNICATIONS

This course prepares students for the skills needed to perform academic tasks such as extracting information from texts taken from different sources, producing academic assignments, presenting ideas orally and exchanging views during group discussions. It emphasises on various skills such as reading academic texts, identifying main ideas, making and expanding notes into coherent writing. At the end of the course, students should be able to apply the skills in an academic setting when communicating in both oral and written discourse.

ULAB 2112 ENGLISH FOR ADVANCED ACADEMIC COMMUNICATIONS

This subject prepares students for advanced academic communication in English with emphasis on oral communication skills. Students will be assigned projects that require them to look for and extract relevant information from various sources. In the process of completing the projects assigned, students will put into practice various skills developed in the earlier subject as well as skills in collecting data through interviews and questionnaire survey, integrating and presenting information (in oral and written form), time management and group interaction. The various oral activities such as presenting a proposal of the project, giving a briefing on the progress of the report and presenting the completed report are designed to build students' oral communication skills and confidence in expressing themselves, i.e. skills that are much needed in their studies and career.

ULAB 3112 ENGLISH FOR CAREER SEARCH

This course exposes students to effective strategies to secure a job upon graduation. Students will be taught job-hunting skills, which include conducting a job search to gather information related to their field of work, producing a portfolio, designing and writing their curriculum vitae and job application letters as well as preparing for and attending job interviews. The activities will be geared towards reflecting upon themselves, namely on their strengths, competencies, skills and qualifications for job-hunting purposes.

ULAB 3122 ENGLISH FOR WORKPLACE COMMUNICATION

This course aims to introduce and expose students to the basic principles of communication at the work place. Students will be given the opportunities to practice effective meeting and discussion skills in formal and informal communicative events and read and write appropriate workplace related documents. Students will also be exposed to situations where they learn to function as individuals and team members and interact verbally and nonverbally with appropriate language, style and gestures.

ULAB 3132 READING FOR SPECIFIC PURPOSE

The aim of this course is to introduce students to texts of different genres and rhetorical structures, namely, literature and science-based texts. Students are taught to deal with two main areas of reading: reading for academic purposes and reading for appreciating literary texts. In reading for academic purposes, students are exposed to authentic texts drawn from journals, research articles and magazines. They are taught how to select, assess, discuss and respond critically to issues related to the texts. They are required to extract the holistic ideas of the theme and react to them in terms of expressing agreement or disagreement, stating advantages or disadvantages of the ideas stated and making inferential opinion and justification. In appreciating literary texts, students are taught to evaluate and analyse some literary texts. In both reading for academic purposes and literary appreciation, the texts serve as stimulus and context for language learning.

ULAB 3142 WRITING FOR SPECIFIC PURPOSE

The course focuses on writing for specific purposes, in particular, technical writing that students are expected to produce. Students will be introduced to elements of effective writing and techniques of gathering technical information about products, services or work related information using letters, memorandums, and e-mails for writing reports to a target audience for a specific purpose. In addition, students will be exposed to proper language usage and acceptable writing standards.

ULAB 3152 EFFECTIVE ORAL COMMUNICATION SKILLS

The course focuses on the techniques of producing good spoken discourse which include public communication such as impromptu and public speeches, group discussion and negotiation. Aspects of sound and speech production will be introduced to improve intelligibility and communicability. Basic principles of oral communication and the importance of non-verbal communication will be introduced for effective communication. Students will have substantial practice in oral communication through in-class tasks and activities. These tasks and activities will enhance students' confidence in using English for academic and professional purposes.

APPENDIX E: ACADEMIC STAFF INFORMATION

FACULTY OF BIOSCIENCES AND MEDICAL ENGINEERING (FBME)

Department of Biosciences and Health Sciences

Abdul Hafidz Omar
Professor

B.Sc (UPM), M.Sc (Aust), Ph.D (Aust)
FoE: Sports rehabilitation & training, rehabilitation engineering, sports injury & sports psychology
Email: aho@biomedical.utm.my
Tel Off: 07-5558447
Office: Satellite Building, V01

Noor Aini binti Abdul Rashid
Professor

BSc (USA) , MSc (USA) , PhD (UK)
FoE: Genetic engineering, molecular biology
Email: nooraini_nar@utm.my
Tel Off: 07-5557517
Office: 04-44-01, Cluster Building, T02

Mohd Shahir Shamsir bin Omar
Associate Professor

BSc (UK) , PhD (UK)
FoE: Computational Biology and Bioinformatics
Email: shahir@fbb.utm.my, shahir@utm.my
Tel Off: 07-5537835
Office: Research Management Centre, UTM and 04-56-01, Cluster Building, T02

Shafinaz binti Shahir
Senior Lecturer

BSc (AUST) , MSc (UTM) , PhD (UK)
FoE: Environmental biotechnology & biosensors
Email: shafinazshahir@utm.my
Tel Off: 07-5557549, 07-5558443
Office: 03-70-01, Cluster Building, T02, and Satellite Building, V01

Fauzan Khairi Che Harun
Senior Lecturer

B.Eng (UTM), M.Sc (UK), Ph.D (UK)
FoE: Biomedical instrumentation, biomimetic design
Email: fauzan@biomedical.utm.my
Tel Off: 07-5558442
Office: Satellite Building, V01

Razauden Mohamed Zulkifli
Senior Lecturer

BSc (UKM) , MSc (UK) , PhD (UK)
FoE: Nutritional Biochemistry And Gene Regulation
Email: razauden@utm.my, razauden@fbb.utm.my
Tel Off: 07-5557532
Office: 04-63-01, Cluster Building, T02

Jasmy Yunus
Professor

B.Sc (CNAAB), M.Sc (Kent), PhD (Kent)
FoE: Rehabilitation engineering, speech therapy, medical electronics
Email: dean@biomedical.utm.my, jasmy@utm.my, jasmy@biomedical.utm.my,
Tel Off: 07-5558400
Office: Satellite Building, V01

Zaharah binti Ibrahim
Associate Professor

BSc (USA) , MSc (USA) , PhD (UTM)
FoE: Biochemistry/ environmental microbiology / microbial bioremediation
Email: zaharah@utm.my
Tel Off: 07-5557545
Office: Cluster Building, T02

Akram Gasmeelseed
Senior Lecturer

PhD (UTM)
FoE: Biosignal analysis, bioelectromagnetics, biophotonics, renewable energy
Email: akram@biomedical.utm.my
Tel Off: N/A
Office: Satellite Building, V01

Fazilah binti Abd. Manan
Senior Lecturer

BSc (UTM) , MSc (UTM) , PhD (AUSTRALIA)
FoE: Environmental Biotechnology
Email: fazilah@utm.my, fazilah@fbb.utm.my
Tel Off: 07-5557542
Office: 03-59-01, Cluster Building, T02

Salehuddin Hamdan
Senior Lecturer

BSc (UKM) , MSc (UTM) , PhD (UK)
FoE: Genetic engineering, molecular biology
Email: saleh65@utm.my, saleh@biomedical.utm.my
Tel Off: 07-5557547, 07-5558444
Office: 03-68-01, Cluster Building, T02

Norahim Ibrahim**Senior Lecturer**

BSc (JAPAN) , MPhil (UK) , PhD (UK)

FoE: Biosensor Technology

Email: norahim@utm.my

Tel Off: 07-5557544

Office: 03-61-01, Cluster Building, T02

Mohd Firdaus Abd Wahab**Senior Lecturer**

BSc (UTM) , MSc (UTM) , PhD (UK)

FoE: Protein Chemistry And Environmental Biochemistry

Email: firdaus@utm.my

Tel Off: 07-5557551

Office: 03-81-01, Cluster Building, T02

Nor Azimah binti Mohd Zain**Senior Lecturer**

BSc (UPM) , PhD (UTM)

FoE: Biological control and environmental conservation, bioprocess engineering

Email: azimah@utm.my

Tel Off: 07-5531278

Office: 04-68-01, Cluster Building, T02

Haryati binti Jamaluddin**Senior Lecturer**

BSc (UTM) , MRes (Bath, UK) , PhD (Bath, UK)

FoE: Protein crystallography, Protein biochemistry

Email: haryati@fbb.utm.my

Tel Off: 07-5557537

Office: 04-67-01, Cluster Building, T02

Khairunnadwa binti Jemon**Lecturer**

BSc (UTM) , MSc (UKM)

FoE: Immunology

Email: khairun_nadwa@biomedical.utm.my

Tel Off: 07-5557563

Office: 04-51-01, Cluster Building, T02

Saleha binti Shahar**Lecturer**

BSc (UKM) , MSc (UKM)

FoE: Virology

Email: saleha@utm.my

Tel Off: 07-5557543

Office: 03-60-01, Cluster Building, T02

Hadafi Fitri Mohd Latip**Tutor**

B.sc and Education (UTM)

FoE: Equestrian

Email: hadafifitri@biomedical.utm.my

Tel Off: 07-5558456

Office: Satellite Building, V01

Kamaruzaman Soeed**Tutor**

B.sc and Education (UTM)

FoE: Exercise Prescription

Email: skamaruzaman@biomedical.utm.my

Tel Off: 07-5558477

Office: Satellite Building, V01

Norhayati binti Abdullah**Senior Lecturer**

BSc (UTM) , MSc (UK) , PhD (UTM)

FoE: Environmental Biotechnology

Email: norhayatiabdullah@fbb.utm.my

Tel Off: 07-5557534

Office: 03-65-01, Cluster Building, T02

Goh Kian Mau**Senior Lecturer**

BSc (UTM) , PhD (UTM)

FoE: Bioprocess And Protein Engineering

Email: gohkianmau@utm.my

Tel Off: 07-5557556

Office: 03-85-01, Cluster Building, T02

Mohd Abu Naser**Senior Lecturer**

BSc (BANGLADESH) , MSc (UK) , PhD (UK)

FoE: Modeling and simulation of protein surface interaction, reactivity of biomolecules

Email: abunaser@biomedical.utm.my

Tel Off: 07-5557557

Office: 03-53-01, Cluster Building, T02

Huszalina binti Hussin**Lecturer**

BSc (UM) , MSc (UK)

FoE: Biochemistry And Biotechnology

Email: huszalina@biomedical.utm.my

Tel Off: 07-5557562

Office: 04-71-01, Cluster Building, T02

Nurliyana binti Ahmad Zawawi**Lecturer**

BSc (UTM) , MSc (UKM)

FoE: Nanotechnology

Email: nurliyana@biomedical.utm.my

Tel Off: 07-5557563

Office: 04-52-01, Cluster Building, T02

Fazrena Nadia binti Md Akhir**Tutor**

BSc (UTM) , MSc (UTM)

FoE: Animal Biotechnology (Vaccine Development)

Email: fazrenanadia@biomedical.utm.my

Tel Off: Study leave

Office: Study leave

Izwyn Zulkapri**Tutor**

B.sc and Education (UTM)

FoE: Sports science, fitness testing

Email: izwyn@biomedical.utm.my

Tel Off: 07-5558466

Office: Satellite Building, V01

Nurizzati binti Mohd Noh**Tutor**

BSc (UTM)

FoE: Cell Signaling

Email: izzati@biomedical.utm.my

Tel Off: Study leave

Office: Study leave

Nurwina Akmal Anuar**Tutor**

B.Sc and Education (UTM), M.Eng (UTM)
FoE: Instrumentation in Therapy and Rehabilitation
Email: nurwina@biomedical.utm.my

Tel Off: N/A

Office: Satellite Building, V01

Praseetha a/p Prabhakan**Tutor**

BSc (UTM) , MSc (UTM)
FoE: Animal Biotechnology (Canser Biology)
Email: praseetha@biomedical.utm.my

Tel Off: Study leave

Office: Study leave

Nurzila binti Abd. Latif**Tutor**

BSc (UM) , MSc (UPM)
FoE: Animal Cell Culture
Email: nurzila@utm.my

Tel Off: Study leave

Office: Study leave

Siti Halimah binti Hasmoni**Tutor**

BSc (UKM) , MSc (UTM)
FoE: Biosensor Technology
Email: halimah@utm.my

Tel Off: 07-5557559

Office: 04-85-01, Cluster Building, T02

Department of Biotechnology and Medical Engineering

Sheikh Hussain bin Shaikh Salleh**Professor**

B.Sc (Bridgeport), M.Eng (UTM), PhD (Edinburgh)
FoE: Heart sound, infant hearing screening, speech processing

Email: shussain@biomedical.utm.my

Tel Off: 07-5535208

Office: Block P11, UTM

Fahrul Zaman bin Huyop**Associate Professor**

BSc (UK) , MSc (UK) , PhD (UK)
FoE: Microbiology & biochemistry, molecular biology of pollutant degradation

Email: fahrul@biomedical.utm.my, fahrul@utm.my

Tel Off: 07-5557566, 07-5558452

Office: 03-52-01, Cluster Building, T02

Adibah binti Yahya**Senior Lecturer**

BSc (UPM) , PhD (UK)
FoE: Biochemistry and microbial physiology
Email: adibah@utm.my

Tel Off: 07-5557540

Office: 03-66-01, Cluster Building, T02

Azli bin Yahya**Senior Lecturer**

B.Eng, M.Sc (Glamorgan), PhD (Loughborough)
FoE: Analog/digital circuit design, current generator for bio-medical application

Email: azli@biomedical.utm.my

Tel Off: 07-5558439

Office: Satellite Building, V01

Chong Chun Shiong**Senior Lecturer**

BSc (UTM) , MSc (UTM) , PhD (UK)
FoE: Enzyme Technology
Email: cschong@utm.my

Tel Off: 07-5557554

Office: 03-83-01, Cluster Building, T02

Madiah binti Md. Salleh**Associate Professor**

BSc (UPM) , MSc (UPM) , PhD (UPM)
FoE: Enzyme and fermentation technology, industrial and environmental biotechnology

Email: madiah@utm.my

Tel Off: 07-5557546

Office: 03-65-01, Cluster Building, T02

Alina binti Wagiran**Senior Lecturer**

BSc (UM) , MSc (UK) , PhD (UK)
FoE: Plant tissue culture and transformation
Email: alina@fbb.utm.my, alina@utm.my

Tel Off: 07-5557531

Office: 04-61-01, Cluster Building, T02

Azman bin Abd Samad**Senior Lecturer**

BSc (UPM) , MSc (UPM) , PhD (UK)
FoE: Plant micropropagation; plant molecular biology
Email: azmansamad@utm.my, azman@fbb.utm.my

Tel Off: 07-5557527

Office: 04-57-01, Cluster Building, T02

Faezah binti Md. Salleh**Senior Lecturer**

BSc (UPM) , PhD (UK)
FoE: Plant Biotechnology
Email: faezah@utm.my

Tel Off: 07-5557555

Office: 03-84-01, Cluster Building, T02

Basem Abu Izneid**Senior Lecturer**

B.Eng KHAI Ukraine, M.Sc KHAI Ukraine, PhD USM
FoE: Biotech Instrumentation, Signal Processing,
Biomedical Electronics systems, Biomedical Telemetry,
Measuring techniques for food quality assessment
Email: basem.zneid@biomedical.utm.my
Tel Off: 07-5558488
Office: Satellite Building, V01

Jeong Jinsoo**Senior Lecturer**

B.Eng (Busan), M.Eng (NY Uni.), PhD (Massey University)
FoE: Noise cancellation & speech enhancement
Email: jeong@biomedical.utm.my
Tel Off: 07-5558492
Office: Satellite Building, V01

Muhammad Arshad Javed**Senior Lecturer**

MSc (UAF), MS, PhD (Kobe University, Kobe, Japan)
FoE: Agriculture Biotechnology, Molecular Breeding,
Molecular analyses of quantitative traits
Email: majaved@utm.my, majaved@fbb.utm.my
Tel Off: 07-5557561
Office: 05-42-01, Cluster Building, T02

Nik Ahmad Nizam bin Nik Malek**Senior Lecturer**

BSc, MSc, PhD (UTM)
FoE: Biochemistry, bio-inorganic chemistry, antimicrobial agents, environmental chemistry, agricultural chemistry
Email: niknizam@utm.my
Tel Off: Industrial Training
Office: Industrial Training

Siti Pauliena binti Mohd. Bohari**Senior Lecturer**

BSc (UPM) , MSc (UPM) , PhD (UK)
FoE: Tissue Engineering, Animal Cell Biotechnology
Email: pauliena@utm.my, pauliena@fbb.utm.my
Tel Off: 07-5557548
Office: 03-80-01, Cluster Building, T02

Arief Ruhullah bin A. Harris**Lecturer**

B.Eng (UTM), M.Eng (UTM)
FoE: Neural engineering, medical electronics, biomedical signal processing
Email: arief@biomedical.utm.my
Tel Off: 07-5558513
Office: Satellite Building, V01

Zaidah binti Rahmat**Lecturer**

BSc (UPM) , MSc (UPM) , PhD (UK)
FoE: Plant Molecular Biology and Proteomics
Email: zaidah@utm.my
Tel Off: 07-5557553
Office: 03-82-01, Cluster Building, T02

Hau Yuan Wen**Senior Lecturer**

B.Eng, M.Eng, PhD (UTM)
FoE: Biomedical embedded system, Biomedical System-on-Chip (SoC), Network-on-Chip (NoC), ESL modelling, FPGA prototyping, computer architecture
Email: hauyuanwen@biomedical.utm.my
Tel Off: 07-5558498
Office: Satellite Building, V01

Malarvili Balakrishnan**Senior Lecturer**

B.Eng , M.Eng (UTM), PhD (Uni of Queensland)
FoE: Biomedical signal processing, medical diagnosis system
Email: malarvili@biomedical.utm.my
Tel Off: N/A
Office: Satellite Building, V01

Nasrul Humaimi Mahmood**Senior Lecturer**

PhD (Warwick, UK), M.Eng, B.Eng (UKM)
FoE: Image Processing, Electronics, Medical Engineering and Rehabilitation Engineering
Email: nasrulumaimi@biomedical.utm.my
Tel Off: 07-5558440
Office: Satellite Building, V01

Shaza Eva binti Mohamad**Senior Lecturer**

BSc (UM) , M.Biotech (UM) , PhD (UK)
FoE: Bioremediation and biodegradation, Molecular mechanisms in gene expression and regulations
Email: shaza@fbb.utm.my, shaza@utm.my
Tel Off: Post Doc
Office: Post Doc

Tan Tian Swee**Senior Lecturer**

B.Eng, M.Eng, PhD (UTM)
FoE: Biomedical signal processing, speech therapy, speech processing, medical electronics
Email: tantswee@biomedical.utm.my
Tel Off: 07-5558501
Office: Satellite Building, V01

Wan Rosmiza Zana binti Wan Dagang**Lecturer**

BSc (UTM) , MSc (UTM) , PhD (UK)
FoE: Biochemical Engineering
Email: rosmiza@utm.my
Tel Off: 07-5557558
Office: 04-69-01, Cluster Building, T02

Zarita binti Zakaria**Lecturer**

BSc (UKM) , MSc (UK)
FoE: Tissue Culture And Plant Molecular Biology
Email: zarita@utm.my
Tel Off: 07-5557518
Office: 04-45-01, Cluster Building, T02

Aizreena binti Azaman**Tutor**

M.Eng (UM), B.Eng (UTM)

FoE: Neural-rehabilitation Engineering, Functional Control System, Biomechanics

Email: aizreena@biomedical.utm.my

Tel Off: Study leave

Mohd Farizal bin Ahmad Kamaroddin**Tutor**

BSc (UTM) , MSc (UTM)

FoE: Plant Bioreactor Design

Email: mohdfarizal@utm.my

Tel Off: Study leave

Mohd Najeb bin Jamaludin**Tutor**

B.Eng (UTM), M.Eng (UTM)

FoE: Data Acquisition System, Mixed Signal Electronics Design, Embedded Microcontrollers, PC Interfacing, Electrocardiogram, Phonocardiogram

Email: najeb@biomedical.utm.my

Tel Off: N/A

Office: Satellite Building, V01

Muhammad Asraf bin Mansor**Tutor**

M.Eng (UTM,Malaysia), B.Eng (UTM,Malaysia)

FoE: Medical electronics, biomedical image processing

Email: asraf@biomedical.utm.my

Tel Off: N/A

Office: Satellite Building, V01

Nadiah binti Sulaiman**Tutor**

BSc (UTM) , MSc (UKM)

FoE: Tissue Engineering

Email: nadiah@utm.my

Tel Off: 07-5557552

Office: 03-75-01, Cluster Building, T02

Noradilin binti Abdullah**Tutor**

BSc (USA)

FoE: Biotechnology

Email: noradilin@fbp.utm.my, noradilin@utm.my

Tel Off: 07-5557560

Office: 05-38-01, Cluster Building, T02

Nurriza binti Ab. Latif**Tutor**

BSc (UM) , MSc (UM)

FoE: Protein Folding

Email: nurriza@utm.my

Tel Off: Study leave

Office: Study leave

Mohd. Helmi bin Sani**Tutor**

BSc (UIA) , MSc (UM)

FoE: Fermentation Technology

Email: helmisani@utm.my

Tel Off: Study leave

Muhammad Amir bin As'ari**Tutor**

B.Eng, M.Eng (UTM),

FoE: Medical Image Processing, Digital Image Processing, Ubiquitous Computing, Machine Learning

Email: amir-asari@biomedical.utm.my

Tel Off: 07-5558511

Office: Satellite Building, V01

Munirah binti Ramli**Tutor**

BSc (UIA)

FoE: Nanobiotechnology

Email: munirah@utm.my

Tel Off: 07-5557539

Office: 05-43-01, Cluster Building, T02

Noor Aimie binti Salleh**Tutor**

B. BEng (UM)

FoE: Biosignal Processing

Email: aimie@biomedical.utm.my

Tel Off: N/A

Office: Satellite Building, V01

Nurashikin binti Ihsan**Tutor**

BSc (UTM) , MSc (UTM)

FoE: Metatranscriptomes of microbial enzymes

Email: nurashikin@utm.my

Tel Off: Study leave

Office: Study leave

Department of Clinical Sciences

Andreas Oechsner **Professor**

D.Sc. (Newcastle, Australia), Dr.-Ing. (Erlangen-Nuremberg, Germany), Dipl.-Ing. (Stuttgart, Germany)
FoE: Biomechanics, biomedical materials, composites, finite element method
Email: oechsner@biomedical.utm.my
Tel Off: 07-5558494
Office: Satellite Building, V01

Kahar Osman **Associate Professor**

BEng (Hartford, USA), MSc (Leeds, UK), PhD (New Hampshire, USA)
FoE: Computational Fluid Dynamics (CFD) and heat transfer, physics of fluid, fluid-structure interaction
Email: kahar@biomedical.utm.my
Tel Off: 07-5558441
Office: Satellite Building, V01

Hendra Hermawan **Senior Lecturer**

Ph.D (Laval, Canada), M.Eng, B.Eng (ITB), C.Eng.
FoE: Metals for biomedical applications, coronary stents
Email: hendra.hermawan@gmail.com
Tel Off: N/A
Office: Satellite Building, V01

Yin Mon Myint **Senior Lecturer**

B.E, M.E, Ph.D (YTU, Myanmar)
FoE: Clinical robot, intelligent control system, signal processing
Email: yinmontt@biomedical.utm.my
Tel Off: 07-5558461
Office: Satellite Building, V01

Ahmad Zahran Md Khudzari **Senior Lecturer**

BSc (Hokkaido, Japan), MSc. (UTM), PhD. (Aston, UK)
FoE: Mechanical Heart Assist Device, Biofluid Mechanics, Experimental design
Email: zahran@biomedical.utm.my
Tel Off: 07-5558462
Office: Satellite Building, V01

Maheza Irna Mohamad Salim **Senior Lecturer**

BEng (Biomedical) (UM), Ph.D Biomedical Engineering (UTM)
FoE: Medical Imaging and Artificial Intelligence
Email: maheza@biomedical.utm.my
Tel Off: 07-5558455
Office: Satellite Building, V01

Eko Supriyanto **Professor**

Dr.-Ing (Hamburg, Germany), M.Eng, B.Eng (ITB)
FoE: Ultrasound diagnostic and therapeutic, prenatal diagnosis, medical electronics, health care management and information system, dialysis & medical imaging
Email: eko@biomedical.utm.my
Tel Off: 07-5558516
Office: Satellite Building, V01

Mohammed Rafiq Dato' Abdul Kadir **Associate Professor**

PhD, MEng (Imperial College London), CPGS (Cambridge)
FoE: Biomechanics, biomanufacturing, medical implants, prosthetic and orthotics
Email: rafiq@biomedical.utm.my
Tel Off: 07-5558514
Office: Satellite Building, V01

Dedy Wicaksono **Senior Lecturer**

Ph.D (TU Delft, Netherlands), M.Eng (Titech, Japan), B.Eng (ITB)
FoE: Medical sensor, biomimetics
Email: dedy.wicaksono@biomedical.utm.my
Tel Off: 07-5558480
Office: Satellite Building, V01

Rania Hussein Al-Ashwal **Senior Lecturer**

MBBS (Yemen), M.Sc (UTM)
FoE: Medicine and Biomedical sciences, oncology, women health, preventive cardiology
Email: drania@biomedical.utm.my
Tel Off: 07-5558467
Office: Satellite Building, V01

Irza Sukmana **Senior Lecturer**

Ph.D (Sherbrooke, Canada), M.Eng and B.Eng (ITB)
FoE: Tissue engineering, biomaterials and biomechanics design and testing, angiogenesis and cellular guidance
Email: irza.sukmana@gmail.com
Tel Off: 07-5558502
Office: Satellite Building, V01

Naznin Sultana **Senior Lecturer**

PhD (HKU, Hk), MSc Eng. (KULeuven, Belgium)
FoE: Biomaterials, composite scaffolds, tissue engineering
Email: naznin@biomedical.utm.my
Tel Off: 07-5558491
Office: Satellite Building, V01

Nugraha Priya Utama**Senior Lecturer**

M.Eng, Ph.D (TITech, Japan) B.Eng (ITB, Indonesia)
FoE: Neuroscience, Assistive Technology, Medical Imaging.

Email: utama@biomedical.utm.my

Tel Off: 0-75558506

Office: Satellite Building, V01

Aqilah Leela T.Narayanan**Senior Lecturer**

B.Sc. (Uni. Teesside, UK), MSc (RCS Ireland)

FoE: Cardiovascular and pulmonary physiotherapy and rehabilitation

Email: aqilah@biomedical.utm.my

Tel Off: 07-5558472

Office: Satellite Building, V01

Lukman Hakim Ismail**Lecturer**

B.Sc (UKM) (Biomedical), M.Mngt (UTM)

FoE: Clinical engineering, healthcare management

Email: lukman@biomedical.utm.my

Tel Off: Study leave

Office: Satellite Building, V01

Mariaulpa Sahalan**Tutor**

B.Sc (USM), M.Sc (USM)

FoE: Medical Physics

Email: mariaulpa@biomedical.utm.my

Tel Off: Study leave

Office: Satellite Building, V01

Nor Raihanah binti Abdull Rahim**Tutor**

B.Eng (UTM)

FoE: Spine Biomechanics, Finite Element

Email: nraihanah@biomedical.utm.my

Tel Off: 07-5558478

Office: Satellite Building, V01

Siti Aisyah Mualif**Tutor**

B.Sc (USM), M.Sc (UiTM)

FoE: Medical Imaging and Radiation

Email: aisyahmualif@biomedical.utm.my

Tel Off: Study leave

Office: Satellite Building, V01

Isniza Ismail**Tutor**

B. PT (Hons) (UKM)

FoE: Physiotherapy

Email: isniza@biomedical.utm.my

Tel Off: N/A

Office: Satellite Building, V01

Aisyah binti Ahmad Shafi**Tutor**

B. Eng (UTM), M.Eng (UTM)

FoE: Dental & Craniofacial Biomechanics

Email: aisyahshafi@biomedical.utm.my

Tel Off: 07-5558484

Office: Satellite Building, V01

Ong Sang Bing**Senior Lecturer**

BSc) (UPM), MSc (UK), PhD (UK)

FoE: Cardiovascular medicine, cardiac mitochondrial biology

Email: ongsangbing@utm.my

Tel Off: 07-5558468

Office: Satellite Building, V01

Syed Mohd Nooh Syed Omar**Lecturer**

B.Eng, M.Eng (Tokyo Denki, Japan)

FoE: Virtual instrumentation, healthcare technology management, medical device safety

Email: syed@biomedical.utm.my

Tel Off: 07-5558512

Office: Satellite Building, V01

Jameel Abdulla Ahmed Muked**Lecturer**

M.Phil (UTM)

FoE: Discrete Device

Email: jameel@biomedical.utm.my

Tel Off: N/A

Office: Satellite Building, V01

Mohd Nazri bin Bajuri**Tutor**

M.Eng (UTM), B.Eng (UTM)

FoE: Computational Biomechanics and Mechanobiology

Email: nazribajuri@biomedical.utm.my

Tel Off: Study leave

Office: Satellite Building, V01

Norhana Jusoh**Tutor**

B.Eng (UTM), M.Eng (UTM)

FoE: Glucose Biosensor

Email: norhana@biomedical.utm.my

Tel Off: CB

Office: Satellite Building, V01

Siti Norbaieah binti Mohamad Hashim**Tutor**

B.Sc (USM), M.Sc (USM)

FoE: Medical Imaging and Radiation

Email: sitinorbaieah@biomedical.utm.my

Tel Off: Study leave

Office: Satellite Building, V01

Siti Ruzita Mahmud**Tutor**

B.PT (Hons) (UKM)

FoE: Physiotherapy

Email: sruzita@biomedical.utm.my

Tel Off: N/A

Office: Satellite Building, V01

Appendix F: Programme Specifications