UTM
UNIVERSITI TEKNOLOGI MALAYSIA

POSTGRADUATE HANDBOOK
2018/2019

FACULTY OF ENGINEERING
SCHOOL OF BIOMEDICAL ENGINEERING AND HEALTH SCIENCES

www.fbme.utm.my

Programmes Offered

School of Biomedical Engineering and Health Sciences offers 5 (five) **postgraduate programmes** that lead to the award of **postgraduate degrees** (Master or Doctor of Philosophy) in the areas of Biomedical engineering, Rehabilitation Technology & Health Sciences. Students may register for the programme by one of the modes of study offered, namely **course work** and **research**. For **full-time** Master and PhD programme, the normal study durations are 3 - 8 semesters (1.5 - 4 years) and 6 - 12 semesters (3 - 6 years), respectively.

Additional Requirements

Each programme requires the student to take at least one of the **University compulsory courses** from the following options:

- **UHAP 6013** Seminar on Global Development, Economic and Social Issues
- **UICW 6023** Philosophy of Science and Civilization
- **UCSM 1263** IT Project Management

International students are encouraged to take 3 credit hours of university subjects.

- **UHAZ 6123** Malaysian Society and Culture
- **UHAZ 6323** Bahasa Malaysia Penulisan Ilmiah

Apart from the above requirements, research students must take a research methodology class (Compulsory attendance):

- **UMBP0010**- Research Methodology

Research Methodology course is offered as an intensive course during the mid-semester break.

Master Degree programmes

Programmes	Code	MODE*	Research Field*
Master of Science (Biomedical Engineering)	MMBC	1	A
Master of Philosophy (Biomedical Engineering)	MMBE	2	A
Master of Philosophy (Biomedical Engineering-Double Degree)	MMBE	2	A
Master of Philosophy (Rehabilitation Technology)	MMBR	2	B

Doctoral Degree Programmes

Programmes	Code	Research Field*
Doctor of Philosophy (Biomedical Engineering)	PMBE	A
Doctor of Philosophy (Biomedical Engineering – Double Degree)	PMBE	A
Doctor of Philosophy (Health Science)	PMBH	C

***Mode:**

1 = Course work, 2 = Research

*** Research Field:**

A= Biomedical Engineering
B= Rehabilitation and Health Sciences Technology
C= Health Sciences

MASTER OF SCIENCE (BIOMEDIAL ENGINEERING) – BY COURSEWORK

Master of Science (Biomedical Engineering) – By Coursework

Programme Specifications

SBEHS offers the MSc (Biomedical Engineering) programme by course work mode offered in full-time. The MSc (Biomedical Engineering) can be completed within three semesters (1½ years).

General Information

1. Awarding Institution	Universiti Teknologi Malaysia
2. Teaching Institution	Universiti Teknologi Malaysia
3. Programme Name	Master of Science (Biomedical Engineering)
4. Final Award	Master of Science (Biomedical Engineering)
5. Programme Code	MMBC
6. Professional or Statutory Body of Accreditation	MQA
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional (Course work)
9. Mode of operation (Franchise, self-govern, etc)	Self-governing
10. Study Scheme (Full Time/Part Time)	Full Time
11. Study Duration	Minimum : 1.5 yrs Maximum : 3 yrs

Entry Requirement

- Bachelor Degree in Engineering (Biomedical, Electrical, Mechanical, Computer), Science (Physics, Biology, Chemistry, Mathematics, Medical and Health), Medical or other related disciplines from UTM; **OR**
- Other recognized Higher Learning Institution with CGPA ≥ 3.0 or equivalent. For CGPA < 3.0, relevant work experience is needed

Programme Educational Objectives (PEO)

Code	Intended Educational Objectives
PEO1	Establish themselves as practicing professionals with high responsibilities in biomedical engineering discipline.
PEO2	Function effectively and efficiently in managing an organization

	through effective communication skills and high ethics within the biomedical engineering network.
PEO3	Continue education through special training, professional licensure, or additional certifications; or engaged in post-graduate study towards a doctoral degree in biomedical field.

Programme Learning Outcomes (PLO)

After having completed the programme, graduates should be able to demonstrate the following competencies:

Code	Intended Learning Outcomes
PLO1	Ability to integrate both theory and applications of advanced biomedical engineering principles.
PLO2	Ability to adapt and utilize advanced techniques and scientific thinking skills in solving complex biomedical engineering problems.
PLO3	Ability to carry out forefront research and development biomedical engineering projects through organized and systematic approach
PLO4	Ability to evaluate and make appropriate professional decisions by taking into accounts social and environmental responsibilities, and related ethics.
PLO5	Ability to communicate effectively through rational arguments via oral and written in biomedical engineering field as well as to public
PLO6	Ability to evaluate and make appropriate professional decisions by taking into accounts social and environmental responsibilities, and related ethics

Students are required to successfully complete a minimum of **45 credits** which include at least:

Classification	Credit
University General Elective Courses (UHA* ***3) (to choose from the list given by School of Graduate Studies)	3
General Course (UMBP 0013 Research Methodology)	3
Programme Core Courses	
Biomedical Measurement Technique	3
Diagnostic and Therapeutic Technology	3
Advanced Biomedical Engineering	3
Medical Informatics	3
Biomechanics	3
Research Methodology	3
Programme Elective Courses	

Anatomy and Physiology for Engineers	3
Biomedical Fluid Mechanics	3
Biostatistics	3
Medical Imaging and Image Processing	3
Health Care Technology Management	3
Neuroscience	3
Pathophysiology	3
Advance Biosignal Processing	3
Quantitative System Physiology & Simulation	3
Rehabilitation Engineering	3
Speech Processing	3
Tissue Engineering	3
Ultrasound and Electromagnetic in Medicine	3
Choose 4 courses only	**12**
Master Project	
Master Project 1	4
Master Project 2	8
Total Credit	**45**

Course Classification

No.	Classification		Credit Hours	Percentage
i.	Faculty Core	Courses	15	35.7%
ii.	Faculty Elective Course		12	28.6%
iii.	Master Project		12	28.6%
iv.	University General Elective Course		6	7.1%
Total			**45**	**100**

Regulation of Assessment

Marks	Grade	Evaluation Point	Interpretation
90-100	A+	4.00	Excellent Pass
80-89	A	4.00	
75-79	A-	3.67	
70.74	B+	3.33	Good Pass
65-69	B	3.00	
60-64	B-	2.67	Pass
55-59	C+	2.33	Fail
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	

Award Requirements

For the award of Master of Science (Biomedical Engineering), students should achieve a total minimum of 45 credit hours with minimum CPA of 3.00.

Course Menu

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
MMBC 1003	Biomedical Measurement Technique	3	
MMBC 1013	Diagnostic and Therapeutic Technology	3	
MMBC 1023	Advanced Biomedical Engineering	3	
MMBC 1**3	Elective 1	3	
UHA* ***3	University General Elective Course	3	
UMBP 0013	Research Methodology	3	
Total Credit		**18**	
Cumulative Credits		**18**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
MMBC 1033	Medical Informatics	3	
MMBC	Biomechanics	3	

1043			
MMBC 1184	Master Project 1	4	
MMBC 1**3	Elective 2	3	
MMBC 1**3	Elective 3	3	
Total Credit		**16**	
Cumulative Credits		**34**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
MMBC 1198	Master Project 2	8	
MMBC 1**3	Elective 4	3	
MMBC 1184	Master Project 1	4	
MMBC 1**3	Elective 2	3	
MMBC 1**3	Elective 3	3	
Total Credit		**11**	
Cumulative Credits		**45**	

Elective Course	
Code	**Course**
MMBC 1015	Anatomy and Physiology for Engineers
MMBC 1063	Biomedical Fluid Mechanics
MMBC 1073	Biostatistics
MMBC 1083	Health Care Technology Management
MMBC 1093	Medical Imaging and Image Processing
MMBC 1103	Neuroscience
MMBC 1113	Pathophysiology
MMBC 1123	Advance Biosignal Processing
MMBC 1133	Quantitative System Physiology &Simulation
MMBC 1143	Rehabilitation Engineering
MMBC 1153	Cardiovascular Engineering
University Elective Course	
UH** ***3	University Elective

Graduation Checklist

To graduate, students must pass all the stated courses in this checklist. It is the

responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the course are not allowed to graduate.

No.	Code	Course	Credit Earned (Jkd)	Credit Count-Ed (Jkk)	Tick (√) If Passed
Engineering Courses					
1	MMBC 1003	Biomedical Measurement Technique	3	3	
2	MMBC 1013	Diagnostic and Therapeutic Technology	3	3	
3	MMBC 1023	Advanced Biomedical Engineering	3	3	
4	MMBC 1**3	Elective 1	3	3	
5	MMBC 1033	Medical Informatics	3	3	
6	MMBC 1043	Biomechanics	3	3	
7	MMBC 1184	Master Project 1	4	4	
8	MMBC 1**3	Elective 2	3	3	
9	MMBC 1**3	Elective 3	3	3	
10	MMBC 1198	Master Project 2	8	8	
11	MMBC 1**3	Elective 4	3	3	
12	UMBP 0010	Research Methodology	3	3	
Total Credit			**42**	**42**	
University General Courses					
Kluster 1: Penghayatan Falsafah, Nilai & Sejarah (Faculty of Social Sciences and Humanities)					
1	UHA* ***3	University General Elective Course	3	3	
Total Credit			**45**	**45**	

Course Synopsis

MMBC 1003: Biomedical Measurement Technique
Objectives

1. Identify and explain the basic and advances concept of biomedical instrumentation and measurement

2. Analyze physiological properties and design suitable instrumentation for specific purpose to solve biomedical engineering problems.

Synopsis

This course provides the students a complete exposure of various recording mechanism and biomedical parameters measured for diagnostic application. Also introduces students to design biomedical measurement systems and biomedical instrumentation. 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.

References

- *Leslie Cromwell (1997). Biomedical Instrumentation and measurement. Prentice Hall, India, New Delhi.*
- *John G. Webster (1998). Medical Instrumentation, Application and Design (3rd Ed). John Wiley.*
- *Khandpur R.S (1997). Handbook of Biomedical Instrumentation Tata McGraw-Hill, New Delhi.*
- *Joseph J.Carr and John M. Brown (1997). Introduction to Biomedical Equipment Technology. John Wiley and sons, NewYork.*
- *Geoddes and L.E. Baker (1975).Principles of Applied Biomedical Instrumentation. John Wiley, L.A.*
- *R.S. Khandpur (2003). Hand-book of Biomedical Instrumentation, TMH, 2nd Ed.*
- *Mackay, Stuart R (1968). Biomedical Telemetry. John Wiley*

MMBC 1013: Diagnostic and Therapeutic

Objectives

1. Explain knowledge in advanced diagnostic and therapeutic technology in the clinical and hospital environment
2. Analyze and categorize scientific and technical knowledge for research in advanced diagnostic and therapeutic technology.

Synopsis

This course is designed to introduce students on how the bio-signal is measured, recorded and monitored and details on the broad collection of diagnostic and therapeutic equipments. At the end of the course, student will be able to learn various techniques that have been used in healthcare environment, clinical or research.

References

- *Alan K. David, Scott A. Fields, D. Melessa Phillips, Joseph EScherger and Robert B. Taylor (2008). Taylor's Diagnostic and Therapeutic Challenges: A Handbook. Springer.*
- *Dyro, J. F. (2004). Clinical Engineering Handbook. Elsevier.*
- *Geddes, L. A., Baker, L. E. (1989). Principles of Applied Biomedical Instrumentation. Wiley Interscience.*
- *Khandpur (2003). Handbook of Biomedical Instrumentation.McGraw Hill.*
- *Stephen McPhee, Maxine Papadakis and Michael W. Rabow (2011). Current*

Medical Diagnosis and Treatment. McGraw Hil
- *Related journal papers*

MMBC 1023: Advanced Biomedical Engineering
Objectives
1. Explain advanced technology and knowledge used in medical devices to diagnose and treat patients by applying the electronics, signal processing, biomechanics medical and therapy knowledges.
2. Design device used in diagnosis and clinical treatment by combining biological and medical science

Synopsis

This course provides the students with the introduction to advanced technologies of biomedical engineering in the field of bioinstrumentation, biophysics, biomaterials and biomechanics. The impact of technologies on clinical research, rehabilitation engineering, and patient care will be dealt along with professional ethics. The course explores techniques for assessing current information practices, determining the information needs of health care providers and patients, developing interventions using biomedical technology, and evaluating the impact of those interventions.

References
- Joesph D. Bronzino (2000). The Biomedical Engineering *Handbook. CRC Press LLC.*
- Dyro, J. F. (2004). Clinical Engineering Handbook.
- *Geddes, L. A. and Baker, L.E. (1989). Principles of AppliedJ. F. (2004). Biomedical Instrumentation. Wiley Interscience.*
- Khandpur (2003). Handbook of Biomedical Instrumentation. McGraw Hill

MMBC 1033: Medical Informatics
Objectives
1. Apply medical informatics knowledge to improve the quality of health care, reduce cost, provide better education for providers and patients.

Synopsis

This course provides students with the organization of medical information, the effective management of information using computer technology, and the impact of such technology on medical research, education, and patient care. The course explores techniques for assessing current information practices, determining the information needs of health care providers and patients, developing interventions using computer technology, and evaluating the impact of those interventions.

References
- *Nordin, M. & Frankel, V. (2001). Basic Biomechanics of the Musculoskeletal System. Lippincott Williams & Wilkins.*
- *Humphrey, J.D. & Delange, S.L. (2003). An Introduction to Biomechanics. Solids and Fluids, Analysis & Design. Springer.*

- Hall, S. J. (2003). Basic Biomechanics. McGraw-Hill Publishers Hall.
- Abd Rahman Musa (2007). Statics Made Simple. Pearson Prentice Hall.
- Donald R. Peterson and Joseph D. Bronzino (2008).Biomechanics: Principles and Applications. CRC Press.
- T. Clive Lee & Peter Niederer (Editors) (2010). Basic Engineering for Medics and Biologists. IOS Press BV, Netherlands

MMBC 1043: Biomechanics

Objectives

1. Analyze biomechanics knowledge on specific movement patterns from both anatomical and mechanical

Synopsis

This course provides the students with application of the principles of mechanics and the techniques of engineering to the human body. The series of lectures explore the musculoskeletal system and highlights selected applications in the area of orthopedics (gait analysis, joint replacement) and analyzing the various forms of human movement.

References

- *Nordin, M. & Frankel, V. (2001). Basic Biomechanics of the Musculoskeletal System. Lippincott Williams & Wilkins.*
- *Humphrey, J.D. & Delange, S.L. (2003). An Introduction to Biomechanics. Solids and Fluids, Analysis & Design. Springer.*
- Hall, S. J. (2003). Basic Biomechanics. McGraw-Hill Publishers Hall.
- Abd Rahman Musa (2007). Statics Made Simple. Pearson Prentice Hall.
- Donald R. Peterson and Joseph D. Bronzino (2008).Biomechanics: Principles and Applications. CRC Press.

MMBC 1053 : Anatomy and Physiology for Engineers

Objectives

1. Identify and relate the structure and function of the tissue, organ, and systems in humans.

Synopsis

This course provides fundamental concepts of the basic structure and function of the human body as an integrated set of systems from an engineering perspective. This course will expand student's knowledge in the engineering approach toward understanding functions and by giving some engineering solutions and increasing the ability of the students to integrate between the engineering technology and multiple related medical disciplines. Engineering principles will be used to analyse anatomical structures and physiological functions at the tissue, organ, and systems levels.

References

- *Principles of Anatomy and Physiology, 12th Edition, Gerard J. Tortora, Bryan*

H. Derrickson, 2009

- *Hole's human anatomy and physiology, David Shier, Jackie Butler and Ricki Lewis, McGraw-Hill, 2004*
- *Essentials of anatomy and physiology, Frederic H. Martini and Edwin F. Bartholomew, Prentice Hall, 2000*
- *Atlas Netter Interactive Atlas of Human Anatomy v3.0, F. Netter.Medical. CD-ROM*

MMBC 1063: Biomedical Fluid Mechanics

Objectives

1. Explain and categorize biomedical fluids mechanic knowledge of mass conservation, energy conservation, and momentum balance to flowing fluids to solve biomedical engineering problem and relate the structure and function of the tissue, organ, and systems in humans.
2. Analyze biomedical problems related to biofluid using current techniques

Synopsis

This course provides the students with application of the principles of mechanics and the engineering techniques which is the fluid mechanics to the biological fluid flow, in particular cardiovascular system. Other system related to biological flow will be explored such as respiratory flow, flow around body, and bird flight mechanism. By the end of the course, student should be able to understand fluid mechanics and its pertinent application to flow in the biological system – cardiovascular system, respiratory system and the likes. Other outcome of this course would be for the student to apply fluid mechanics analysis of human circulation, as well as artificial organs implanted within human body for disease treatment.

References

- *Jagan N. Mazumdar, Biofluid Mechanics, World Scientific Publishing, 2004*
- *Krishnan B. Chandran, Stanley E. Rittgers, and Ajit P. Yoganathan, Biofluid Mechanics: The Human Circulation, 2nd Edition, CRC Press, 2012*
- *Megh R. Goyal, Biofluid Dynamics of Human Body Systems, Apple Academic Press, 2014*
- *Biofluid Methods in Vascular and Pulmonary Systems, Biomechanical Systems Technicques and Application Volume IV, Editor : Cornelius Leondes, CRC Press LLC, 2001*

MMBC 1073: Biostatistics

Objectives

1. Explain and apply biostatistics knowledge in biomedical engineering

Synopsis

This course provides statistical concepts and methods with emphasis on applications in clinical medicine, epidemiology and public health. This course also explores advanced biostatistical methods that have been used in designing and analyzing biomedical and public health investigations.

References

- *Bernard Rosner (2005). Fundamental of Biostatistics. Duxbury Press.*
- *Jerrold Zar (2009). Biostatistical Analysis. Pearson.*
- *Leon Gordis (2004). Epidemiology. WB Saunders.*
- *Douglas G. Altman (1990). Practical Statistics for Medical Research. Chapman & Hall, CRC.*

MMBC 1083: Health Care Technology Management

Objectives

1. To Identify and explain the systems or procedures relating to plan and procurement, utilization and maintenance of healthcare technologies
2. Analyze and adapt the existing health care technology policies in health care management

Synopsis

This course provides the students the ability to develop a systematic process for planning and managing health technology assets to achieve the highest quality care at the best cost. It explains the concepts of health care management and describes the various types of health plan in operation today. This course also covers the strategic planning as well as technology assessment, facilities planning, procurement, and service or maintenance management.

References

- *Dyro, J. F. (2004). Clinical Engineering Handbook. Elsevier.*
- *Joseph D Bronzino and Robert J Austin-LaFrance (1992). Management of medical technology: a primer for clinical engineers, Boston: Butterworth-Heinemann.*
- *David Y, Judd T (1993). Medical technology management, Redmond, WA, SpaceLabs Medical, INC.*

MMBC 1093: Medical Imaging and Image Processing

Objectives

1. To apply the techniques in image major by using image analysis knowledge.

Synopsis

This course provides students with an overview of the key concepts behind the main imaging modalities used in diagnostic imaging. The course also introduces students in the basic concepts and methods for image analysis and processing in biomedical engineering and medical physics as well as the use of basic software for image analysis and processing in biomedical engineering and medical physics.

References

- *Gonzalez, Rafael C., and Richard E. Woods. "Digital image processing prentice hall." Upper Saddle River, NJ (2002).*
- *Gonzalez, Woods, and Richard E. Woods. "Eddins, Digital Image Processing Using MATLAB." Third New Jersey: Prentice Hall (2004).*
- *Suri, Jasjit S., David Wilson, and Swamy Laxminarayan, eds. Handbook of*

biomedical image analysis. (Vol 1) Springer Science & Business Media, 2005.
- *Suri, Jasjit S., David Wilson, and Swamy Laxminarayan, eds. Handbook of biomedical image analysis. (Vol 2) Springer Science & Business Media, 2005.*
- *Suri, Jasjit S., David Wilson, and Swamy Laxminarayan, eds. Handbook of biomedical image analysis. (Vol 3) Springer Science & Business Media, 2005.*
- *Isaac. N. Bankman, "Handbook of Medical Imaging, Processing and Analysis", Academic Press, 2000.*

MMBC 1103: Neuroscience

Objectives

1. To analyze on various techniques, skills and modern equipment used in neuroscience.

Synopsis

This Neuroscience course is a comprehensive introduction to the mammalian nervous system, focusing on the structure and function of the human brain. Anatomical, cellular, chemical, physiological, and molecular aspects of neuroscience will be discussed. Topics that will be covered include: neurons and glia, neuroanatomy, action potentials, synaptic transmission, neurotransmitters, sensory systems (vision, hearing, and touch), motor systems, behavioral responses, development, learning and memory, aging, mental illness, neurodegenerative diseases, and genomics. An inquiry-based approach will be taken to facilitate student learning of the material.

References

- *Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. Neuroscience: Exploring the Brain. 3rd ed. Baltimore, Md.: Lippincott Williams & Wilkins, 2001. ISBN: 0-7817-6003-8.*
- *Kandel, Eric R., James H. Schwartz, and Thomas M. Jessell. Principles of Neural Science. 4th ed. New York: McGraw-Hill, 2000. ISBN: 0-8385-7701-6. This textbook is recommended.*
- *Dale Purves, George J. Augustine, David Fitzpatrick , William C. Hall, Anthony-Samuel Lamantia , James O. McNamara , Leonard E. White (2007). Neuroscience. Sinauer Associates Inc., U.S.*
- *Larry R. Squire, James L. Roberts, Nicholas C. Spitzer, Michael J. Zigmond, Susan K. McConnell, Floyd E. Bloom (2002). Fundamental Neuroscience. Academic Press.*

MMBC 1184: Master Project 1

Objectives

1. To apply engineering knowledge in professional practices in overcome biomedical engineering issues.
2. Solve research problems and present research results logically, creatively, innovatively and analytically based on scientific facts and research experience.

3. Communicate effectively across a range of context and audiences.

Synopsis

The research project proposal emphasizes integration and application of knowledge to solve a biomedical engineering problem. The student must identify a thesis advisor, conduct preliminary research, write research proposal and make a presentation which will be evaluated. For seminar, student will attend paper presentation to expose themselves into research and to gain new knowledge.

References

- *School of Graduate Study. UTM Thesis Manual.http://www.sps.utm.*

MMBC 1198: Master Project 2

Objectives

- To apply engineering knowledge in professional practices in overcome biomedical engineering issues.
- Solve research problems and present research results logically, creatively, innovatively and analytically based on scientific facts and research experience
- Communicate effectively across a range of context and audiences.
- Work responsibly with specialized laboratory equipment with appropriate technical, transferable and interpersonal skills

Synopsis

The research project thesis emphasizes integration and application of knowledge to solve a biomedical engineering problem. The student must conduct research, document the findings and make a presentation which will be evaluated.

References

- *School of Graduate Study. UTM Thesis Manual.http://www.sps.utm.*

UMBP0010: Research Methodology

Objectives

1. To discuss the principles, various techniques, skills and process in conducting academic research.

Synopsis

This course covers the general principles of Research Methodology that are applicable to any discipline. It discusses the fundamental process in conducting an academic research. The theoretical and practical aspects of preparing a research proposal presented. Amongst topics that will be covered are introduction to research and its philosophy, problem formulation and research objective, literature review, research methodology and design, data collection procedures, data analysis, research proposal and thesis preparation and research management.

References

- FSKSM ((2010). *Handbook of Research Methods in Computing*, UTM.

MASTER OF PHILOSOPHY – BY RESEARCH

Master of Philosophy – By Research

Programme Specifications

School of Biomedical Engineering and Health Sciences (SBEHS) offers the following three master programmes by research mode:

1. Master of Philosophy (Biosciences)
2. Master of Philosophy (Rehabilitation Technology)
3. Master of Philosophy (Biomedical Engineering)
4. Master of Philosophy (Biomedical Engineering-Double Degree) Universiti Teknologi Malaysia (UTM) and Technical University Ilmenau (TUIL) Germany have started an International Double Degree programme in Biomedical Engineering. The student will be awarded with 2 certificates, which are Master in Engineering (Biomedical) from UTM and/or Master in Biomedical Engineering (MSc) from TUIL. The students are required to spend at least 7 months at the partner university. Limited scholarships from German's government are available for selected students.

Programme Features

The above three Masters by research programmes are offered as full-time. A student will carry out research in any one of the areas of research chosen. Each research project is supervised by a lecturer of the Graduate Faculty. A Graduate Faculty member is an academic staff who has a doctoral degree qualification or an academic staff who holds an academic post of at least associate professor and is involved directly or indirectly in the post-graduate programmes. Co-supervisors may also come from a related industry.

General Information

1. Awarding Institution	Universiti Teknologi Malaysia
2. Teaching Institution	Universiti Teknologi Malaysia
3. Programme Name	Master of Philosophy (Biomedical Engineering) Master of Philosophy (Biomedical Engineering-Double Degree) Master of Philosophy (Rehabilitation Technology)

4. Final Award	Master of Philosophy (Biomedical Engineering) Master of Philosophy (Biomedical Engineering, UTM + Msc Computer Engineering, Ilmenau, Germany) Master of Philosophy (Rehabilitation Technology)
5. Programme Code	MMBE MMBE MMBR
6. Professional or Statutory Body of Accreditation	Malaysia Qualification Agency
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-governing
10. Study Scheme (Full Time/Part Time)	Full Time
11. Study Duration	Minimum : 1.5 yrs (3 semester) Maximum : 4 yrs (8 semester)

Entry Requirement

Master of Philosophy (Biomedical Engineering)

- Bachelor of Engineering (Biomedical, Mechanical, Electrical, Chemical, Computer), Bachelor of Science (Biology, Physics, Chemistry), Bachelor of Medicine with CPA ≥3.0 will be considered for this programme; OR
- Bachelor of Engineering with CPA < 3.0 and one year working experience in areas related to Medical Engineering

Master of Philosophy (Rehabilitation Technology)

- Bachelor Degree in any field of Allied Health Sciences, related to Therapy and Rehabilitation, Sports Science, engineering field such as Electrical Engineering, Biomedical Engineering, Mechanical Engineering or related disciplines with good honour from Universiti Teknologi Malaysia or other institutions of higher education approved by the Senate; or
- A student candidate with lower qualifications will be considered if the

candidate is proven to have adequate academic background and appropriate working experience

Award Requirements

Assessment is done by examining first assessment reports (research proposal), second assessment report (*mini-viva*), each semester's progress reports, and thesis examination (*viva-voce*).

All students registered for MPhil programmes must undergo the first assessment by presenting their research proposal (after completed General Elective University Course and Research Methodology Course), and the second assessment (*mini-viva*) by presenting their on-going research's progress in regards to their research proposal. Students who opted for the double degree programme must undergo the first assessment at their home university and only the second assessment at their partner university. To be inaugurated by any degree, all students must undergo thesis examination which can be done at least two-months after the second assessment. The first assessment and the second assessment are scheduled according to the student's appropriate semester of study as described below:

Task	Full Time
First Year Assessment	Semester 1 or 2
Mini Viva	Semester 2 or 3
Progress Report	Week 12 (Every semester)

Students who are submitting the final draft of their thesis should send in the Notice of Thesis Submission to the Faculty at least 3 months prior to the date of submitting their thesis.

Additional requirements

In addition to the university compulsory course, research students may be required to attend lectures related to their research fields. The courses to be taken shall be determined by the respective department graduate committee from time to time. As part of their training, students are required to present in seminars and conferences, as well as producing technical reports or papers for publications in proceedings or journals.

Course Menu

Master of Philosophy (Biomedical Engineering)

Semester	Full-Time	Description	Credit
1	MMBE1100	Research	0
	MMBE1200	Research	0
2	MMBE2100	Research	0

	MMBE2200	Research	0
3	MMBE3100	Research	0
	MMBE3200	Research	0

Master of Philosophy (Rehabilitation Technology)

Semester	Full-Time	Description	Credit
1	MMBR1100	Research	0
	MMBR1200	Research	0
2	MMBR2100	Research	0
	MMBR2200	Research	0
3	MMBR3100	Research	0
	MMBR3200	Research	0

General Elective University Course (Compulsory)			
Code	**New Code**	**Course**	**Credit**
UMBP0010	UMBP0010	Research Methodology	HW
UH** ***3	UH** ***3	General Elective University Course	3

DOCTOR OF PHILOSOPHY

Doctor of Philosophy

Programme Specifications

School of Biomedical Engineering and Health Sciences (SBEHS) offers four Doctor of Philosophy programmes:

1. Doctor of Philosophy (Health Science)
2. Doctor of Philosophy (Biomedical Engineering)
3. Doctor of Philosophy (Biomedical Engineering) – Double Degree Universiti Teknologi Malaysia (UTM) and Technical University Ilmenau (TUIL) Germany have started an International Double Degree programme in Biomedical Engineering. The doctorate double degree programme enables student to be awarded with 2 certificates, which are Doctor of Philosophy (PhD) degree in Biomedical Engineering from UTM and Doctor in Computer Science and Automation (Dr.-Ing) from Technical University Ilmenau, Germany (TUIL). The students are required to spend at least 9 months at the partner university.

Programme Features

SBEHS offers Doctor of Philosophy program by research. This program is offered as a full-time. A student will carry out research in any one of the areas of research chosen. Each research project is supervised by a lecturer of the Graduate Faculty. A Graduate Faculty member is an academic staff who has a doctoral degree qualification or an academic staff who holds an academic post at least senior lecturer and is involved directly or indirectly in the postgraduate programs. Co-supervisor may also come from a related industry.

General Information

1. Awarding Institution	Universiti Teknologi Malaysia
2. Teaching Institution	Universiti Teknologi Malaysia
3. Programme Name	Doctor of Philosophy (Biomedical Engineering) Doctor of Philosophy (Health Sciences)
4. Final Award	Doctor of Philosophy (Biomedical Engineering) Doctor of Philosophy (Health Sciences)
5. Programme Code	PMBE PMBH

6. Professional or Statutory Body of Accreditation	Malaysia Qualification Agency
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-governing
10. Study Scheme (Full Time/Part Time)	Full Time
11. Study Duration	Minimum : 3 years (6 semester) Maximum : 6 years (12 semester)

Entry Requirement

Doctor of Philosophy (Biomedical Engineering)

- Master of Engineering (Biomedical Engineering, Mechanical Engineering, Electrical Engineering, Chemical Engineering, Computer Engineering), Master of Science (Biology, Physics, Chemistry), Master of Medicine with CPA ≥3.0 will be considered for this program; **OR**
- Other qualifications equivalent to a Master's degree and experience in the relevant field recognized by the Senate; **OR**
- Candidates who are currently registered in a Master's Degree programme at Univeristi Teknologi Malaysia, and approved by the Graduate Studies Committee of the respective faculty and the Senate.

Doctor of Philosophy (Health Science)

- Master Degree in Rehabilitation Technology, Electrical Engineering, Biomedical Engineering, Mechanical Engineering, Medical Physics, Health Sciences, Sport Sciences with CPA ≥3.0 will be considered for this program; **OR**
- Related fields with good honour from Universiti Teknologi Malaysia or any other institution of higher learning recognised by the Senate

Award Requirements

Assessment is done by examining first assessment report and presentation (research proposal), each semester's progress reports, second assessment report and presentation (mini viva) and thesis examination (viva voce).

All PhD students must undergo first assessment report and presentation by presenting their research proposal after completed General Elective University Course and Research Methodology Course. They also must undergo second assessment report and presentation (mini viva) at the middle of their study to present their progress. The first and second assessments are scheduled according

to the student's appropriate semester of study as follows:

Task	Full Time
First Assessment	Semester 3
Second Assessment (mini Viva)	Semester 3 or 4
Progress Report	Week 12 (Every semester)

Submission of progress report

Students who are submitting the final draft of their thesis should send in the **Notice of Thesis Submission** to the Faculty at least 3 months prior to the date of submitting their thesis.

Course Menu

Doctor of Philosophy (Biomedical Engineering)

Full Time	Description	Credit
PMBE1100	Research	0
PMBE1200	Research	0
PMBE2100	Research	0
PMBE2200	Research	0
PMBE3100	Research	0
PMBE3200	Research	0
PMBE4100	Research	0
PMBE4200	Research	0
PMBE5100	Research	0
PMBE5200	Research	0
PMBE6100	Research	0
PMBE6200	Research	0
PMBE7100	Research	0
PMBE7200	Research	0

General Elective University Course (Compulsory)			
Code	**New Code**	**Course**	**Credit**
UMBP 0010	UMBP 0010	Research Methodology	HW
UH** ***3	UH** ***3	General Elective University Course	3

Doctor of Philosophy (Health Science)

Full Time	Description	Credit
PMBH1100	Research	0
PMBH1200	Research	0

PMBH2100	Research	0
PMBH2200	Research	0
PMBH3100	Research	0
PMBH3200	Research	0
PMBH4100	Research	0
PMBH4200	Research	0
PMBH5100	Research	0
PMBH5200	Research	0
PMBH6100	Research	0
PMBH6200	Research	0
PMBH7100	Research	0
PMBH7200	Research	0

General Elective University Course (Compulsory)			
Code	**New Code**	**Course**	**Credit**
UMBP 0010	UMBP 0010	Research Methodology	HW
UH** ***3	UH** ***3	General Elective University Course	3

English Language Requirements for Postgraduate Programme (for international students)

Entry Requirement

An International student candidate is required to have a minimum qualification of the Test of English as a Foreign Language (TOEFL) of 525 or TOEFL-IBT of 69 or International English Language Test System (IELTS) of band 5.5. Exemption may be given to those who originate from countries whose native language is English or who graduated from English-speaking countries. Those who do not meet the minimum requirement must attend and pass the Intensive English Programme before they are allowed to proceed with their respective programs of study.

Applicants who do not meet the English proficiency requirements of their chosen programme at Universiti Teknologi Malaysia (UTM) can improve their English at Intensive English Programme (IEP) at Language Academy, UTM or CIEP at ELS Language Centers in Malaysia. **UTM accepts IELTS Level 5.5 and above upon completion of IEP conducted by Language Academy, UTM or ELS English Certificate (level 107) as an ENGLISH LANGUAGE ENTRY REQUIREMENTS FOR INTERNATIONAL STUDENTS**. Students who choose to attend IEP (Language Academy, UTM) must attain IELTS 5.5 or attend ELS and must pass the required English Course(s) before starting their programmes in UTM.

Candidate that did their Bachelor or Master or PhD from the following countries are exempted from the UTM English language requirements. The countries are as follows:

Anguilla	Antigua and Barbuda	Australia	Bangladesh	Bermuda
British Virgin Island	Bahamas	Barbados	Canada	Cayman Island
Christmas Island	Cook Island	Falkland Islands	Fiji	Guernsey
Guam	Gibraltar	Grenada	Guyana	Ghana
Hong Kong	India	Isle of Man	Ireland	Liberia
Jersey	Jamaica	Kiribati	Kenya	Montserrat
Malawi	Malta	Marshall Islands	Mauritius	Niue
Micronesia	Namibia	Nauru	New Zealand	Philippines
Nigeria	Norfolk Island	Papua New Guinea	Pakistan	Saint Kitts and Nevis
Puerto Rico	Palau	Rwanda	Singapore	Seychelles
Saint Lucia	Saint Vincent and the Grenadines	St Helena	Samoa	Swaziland
Sierra Leone	Solomon Island	South Africa	Sudan	Uganda
Tanzania	Tonga	Trinidad & Tobago	Turks and Caicos Island	United Kingdom
US Virgin Islands	United States of America	Zambia	Zimbabwe	

Exemption for candidates from Indonesia, Brunei and other nations that use Malay as medium of communication are exempted from UTM English language requirements based on the following conditions:

- The candidate intends to register for a MSc. And PhD programme by research.
- The candidate declares that the thesis/dissertation will be written in Malay and approved by the supervisor.

FACULTY OF ENGINEERING

SCHOOL OF BIOMEDICAL ENGINEERING AND HEALTH SCIENCES

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