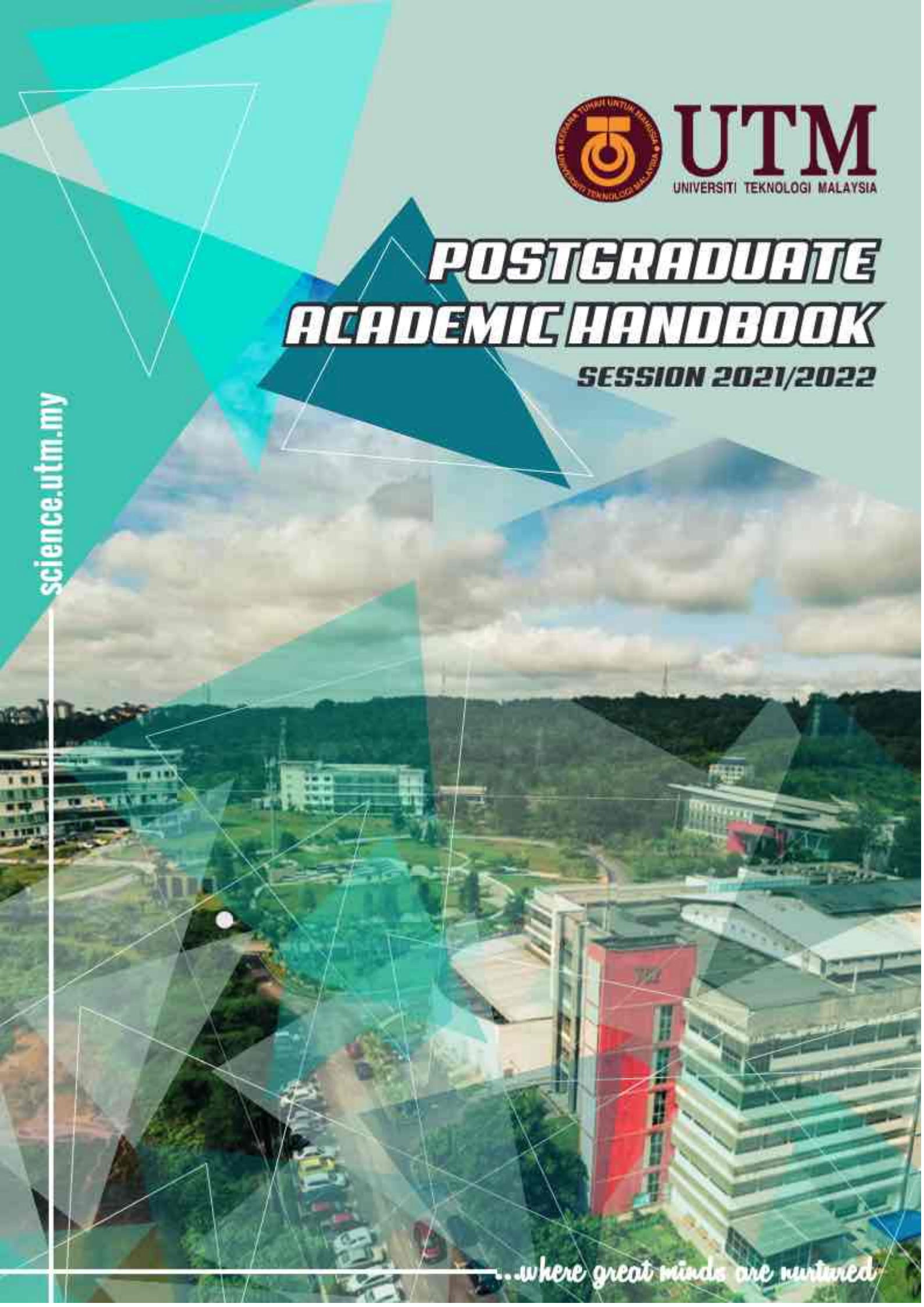
UTM
UNIVERSITI TEKNOLOGI MALAYSIA

POSTGRADUATE ACADEMIC HANDBOOK

SESSION 2021/2022



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...where great minds are nurtured

FACULTY OF SCIENCE
POSTGRADUATE HANDBOOK

2021/2022
ACADEMIC SESSION

Edition: 2021/2022

Attention

All information in this version of the guide is true at time of publishing. The Faculty of Science reserves the right to make amendments to the guide as needed without prior announcement. This Academic Guide is a reference for students from the 2021/2022 Session intake and remains valid until the end of their study. The synopses of courses offered by the Faculty of Science are only available in English, as per the language used in their instruction.

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MESSAGE FROM THE DEAN

السَّلاَمُ عَلَيْكُمْ وَرَحْمَةُ اللهِ وَبَرَكَاتُهُ and Salam Sejahtera,

بِسْـــــــــــــمِ اللهِالرَّحْمَنِ الرَّحِيم

On behalf of the staff of the Faculty of Science, it gives me great pleasure to welcome all new postgraduate candidates to the Faculty of Science, Universiti Teknologi Malaysia for the 2021/2022 academic session. I would like to take this opportunity to congratulate you for being accepted as a postgraduate candidate at the Faculty of Science, Universiti Teknologi Malaysia.

This handbook provides information which serves as your reference with regard to academic matters and provides the necessary information in the implementation of the postgraduate programs at the faculty. You are advised to understand the content of the handbook so as to better assist you as a postgraduate candidate at the faculty.

The Faculty of Science is committed in providing an enriching research environment for postgraduates candidates, fostering intellectual and social interactions between students, supervisors and collaborative partners from higher learning institutions, industries, and community, both locally and globally. The faculty offers both research-based and coursework postgraduate degree. The research-based degree allows you to immerse in your chosen field of interest, while the course-work based degree enables you to master advanced knowledge, beyond your undergraduate study.

The faculty tagline *"..where great minds are nurtured"* signifies our commitment in our endeavour of learning and teaching in bringing out the best in our students. The faculty aims in producing scientist and technologists with the fundamental academic skills in theory and practice, which can contribute to the betterment of society. The COVID-19 pandemic has demonstrated that science is not merely a tool for discovery, but a means to help people, our families and the society. I hope that your postgraduate experience at the Faculty of Science and Universiti Teknologi Malaysia will enable you to play a more important role as scientists in the society.

Once again congratulations and I wish you all the best in your postgraduate journey at the Faculty of Science, Universiti Teknologi Malaysia.

Wassalam

Assoc. Prof. ChM. Dr. Zaiton Abdul Majid
Dean Faculty Science

BACKGROUND OF UNIVERSITI TEKNOLOGI MALAYSIA

Universiti Teknologi Malaysia (UTM) was first established on the 14th of March 1972 under the name of Institut Teknologi Kebangsaan (ITK). On the 1st of April 1975, the name was changed to Universiti Teknologi Malaysia. Although UTM was considered as a new university then, as a technical institution, it had actually existed since 1925 by the name of Kuala Lumpur Technical School. The School initially trained technicians for the Public Works Department and was later opened to other civil servants in 1930.

In 1946, the government upgraded the status of the Technical School to a Technical College. However, the construction of the college only started in 1951 at Jalan Gurney, Kuala Lumpur and completed in 1955.

In 1960, the Technical College began to offer engineering courses on a professional level. Students pursuing these courses were required to sit for professional examinations conducted by the Institution of Civil Engineers, Institution of Mechanical Engineers and the Institution of Electrical Engineers, United Kingdom.

Degree courses were first offered in 1969, when the Planning Committee for Higher Learning recognized the college as a university-level technical institute. On the 14th of March 1972, His Majesty Yang Di Pertuan Agong proclaimed the establishment of Institut Teknologi Kebangsaan, which was later renamed Universiti Teknologi Malaysia. The university was recognized as a technical university focusing on technology, with Bahasa Malaysia as the medium of instruction.

Currently, UTM's main campus is located on a land spanning 1,120 hectares in Skudai, Johor. It is situated about 18 km from Johor Bahru City centre. The branch campus is located at UTM International Campus, Jalan Semarak, Kuala Lumpur. The move from the original campus at Jalan Semarak, Kuala Lumpur, to the main campus in Skudai began in 1985 and proceeded in stages. At present, the Skudai campus houses 5 faculties and 2 faculty-level schools in UTM International Campus, Kuala Lumpur, as follows:

a. Faculty of Science

b. Faculty of Engineering

c. Faculty of Built Environment and Surveying

d. Faculty of Humanities and Social Sciences

e. Azman Hashim International Business School

f. Razak Faculty of Engineering, Technology and Informatics

g. Malaysia-Japan International Institute of Technology (MJIIT)

In June 2010, UTM received recognition and status as a Research University (RU).

PHILOSOPHY, VISION, MISSION AND MOTTO OF UTM

PHILOSOPHY

The divine law of Allah is the foundation for science and technology. UTM strives with total and unified effort to attain excellence in science and technology for universal peace and prosperity in accordance with His will.

Hukum Allah adalah dasar kepada sains dan teknologi. Maka Universiti Teknologi Malaysia berusaha secara menyeluruh dan bersepadu memperkembangkan kecemerlangan sains dan teknologi untuk kesejahteraan dan kemakmuran sejagat sesuai dengan kehendaknya.

VISION

A Premier University Providing World-Class Education and Research

Universiti Terkemuka Menyediakan Perkhidmatan Pendidikan dan Penyelidikan Bertaraf Dunia

MISSION

To Develop Holistic Talents and Prosper Lives Through Knowledge and Innovative Technology

Untuk Membangun Bakat Holistik dan Mensejahtera Kehidupan Menerusi Ilmu dan Inovasi Teknologi

CORE VALUE

Integrity
Integriti

Synergy
Sinergi

Excellence
Kecemerlangan

Sustainability
Kelestarian

MOTTO

"KERANA TUHAN UNTUK MANUSIA"

In the Name of God for Mankind

ABOUT FACULTY OF SCIENCE
THE CHRONOLOGICAL DEVELOPMENT OF FS

YEAR	EVENT
1972	• The Science Service Unit teachings of Physics, Chemistry and Mathematics for the Engineering Faculties of Institut Teknologi Kebangsaan (ITK). • The Centre for Science and Humanities Studies, consisting of four departments (Physics, Chemistry, Mathematics and Humanities) was established. • A Diploma of Science and Education was initiated in cooperation with the Ministry of Education, Malaysia.
1978	• The split of the Centre of Science and Humanities Studies resulted in the formation of the Centre of Science Studies (PPS), which consisted of 3 Departments (Physics, Chemistry and Mathematics).
1978	• The Diploma of Science with Education was renamed as the Integrated Science with Education Course (ISP).
1979	• Enrolment of the first batch of undergraduate students for the Bachelor of Science with Education program (SSP).
1980	• The Department of Computer Science was established and placed under PPS.
1981	• The Centre for Science Studies (PPS) was upgraded and renamed as the Faculty of Science (FS).
1982	• The Education Department and the Department of Technical Science were transferred from the Centre of Humanities Studies into the Faculty of Science.
1983	• The Bachelor of Computer Science Programme was initiated.
1984	• The Department of Computer Science separated from the Faculty of Science to form an independent faculty.
1986	• The Bachelor of Science in Technology with Education (Civil, Electrical, Mechanical) was established.
1987	• The Bachelor of Industrial Science (SSI) course was started. The programmes offered were Industrial Chemistry, Industrial Physics and Industrial Mathematics.
1988	• The Faculty of Science moved to Skudai. • The Bachelor of Computer Science with Education (SPK) was initiated, followed by the Diploma in Education.

1989	• The Faculty officially started its postgraduate program in Chemistry, Physics and Mathematics.
1992	• The Faculty started the Bachelor of Science in Technology with Education (Living Skills) course.
1994	• The Department of Education and the Department of Science and Technical Education were dissolved following the establishment of the Faculty of Education. Three departments remained in the Faculty of Science: The Departments of Chemistry, Physics and Mathematics.
1997	• The Faculty started offering the Bachelor of Industrial Science (Biology) programme.
1998	• The Faculty started offering the Bachelor of Industrial Science (Material Physics) programme.
1999	• The Faculty started offering the Bachelor of Industrial Science (Health Physics) programme.
2000	• The Biology Department was established in the Faculty.
2002	• The Faculty of Science began offering a special programme known as the Excellent Scientists Programme (Pure Physics, Chemistry and Mathematics).
2003	• The enrolment of students for the Undergraduate Programme was limited to only post-matriculation, post-STPM and diploma holders only.
2005	• The Faculty began offering Undergraduate Degree Programmes in Pure Sciences (Biology, Chemistry, Physics and Mathematics).
2010	• Enrolment of students for the Bachelor of Science (Material Physics) and Bachelor of Science (Health Physics) was stopped.
2012	• The Department of Mathematics was renamed the Department of Mathematical Sciences.
2018	• UTM Synergy 4.0 • The Department of Biosciences previously from Faculty of Biosciences and Medical Engineering merged together with the Faculty of Science.

VISION, MISSION, MOTTO, PHILOSOPHY AND OBJECTIVES

VISION

To be a world renowned faculty in the advancement of science and mathematics

MISSION

To lead in the development of holistic talents and knowledge through learning and teaching, research and innovation for universal well-being

MOTTO

"WHERE GREAT MINDS ARE NURTURED"

PHILOSOPHY

Faculty of Science is committed to provide the pillar of strength through fundamental knowledge for the advancement and sustainability of other disciplines for UTM to continue soaring high.

OBJECTIVES

(Educational Goals)

1. To provide quality academic programmes in science and mathematics to meet both local and global education needs.
2. To facilitate the dissemination of knowledge in science and mathematics through innovative and effective teaching and learning.
3. To produce competent and versatile graduates guided by high moral and ethical values.
4. To undertake frontier and transformative research and development in biology, chemistry, physics, and mathematics.
5. To engage in interdisciplinary and collaborative research.
6. To provide an environment conducive to the exchange of knowledge, views, and innovative ideas.
7. To contribute to the advancement of knowledge through scholarly publications.
8. To engage in scientific based smart partnership and global networking.
9. To contribute to the generation of the nation's wealth through research and innovation.
10. To contribute to the improvement of the quality of life, protection of the environment and conservation of natural resources.

BUSINESS, STATEMENT OPPORTUNITY AND COMPETENCY

BUSINESS

To conduct teaching-learning, research and consultancy activities in the field of science and mathematics.

STATEMENT OF OPPORTUNITY

1. Capitalizing on the staff expertise in realizing a culture of intellectual excellence to attract high quality students.
2. Maximizing smart partnership and professional networking with public and private sectors to enhance research, students internship, and graduate employability.
3. Optimizing the usage of state of the art facilities to conduct Faculty's programs, research activities, consultation work, and professional development programs.
4. Implementing market driven academic programs ensures quality graduates and employers satisfaction.
5. Support visionary leadership drives innovative and transformative ideas in achieving management excellence thus increasing Faculty's academic ranking.

FACULTY'S COMPETENCY

1. Conducting quality teaching and learning in science and mathematics through creative and innovative techniques.
2. Designing science and mathematics based programs in line with local and global trends and needs.
3. Undertaking frontier research in science and mathematics.
4. Engaging in interdisciplinary and collaborative research.
5. Producing scholarly publications consistently.
6. Providing scientific consultancy and advisory services.

CLIENTS CHARTER

The Faculty of Science is committed to:

1. Design quality academic programmes which are market-driven, adaptable to the nation's needs and are able to inculcate ethical values to the students.
2. Fulfil academic duties with full responsibility and dedication in accordance with the standards, rules and regulations as stipulated by the University.
3. Execute fair and just assessment in the evaluation of students' academic performance.
4. Provide well-equipped laboratories and regularly maintained facilities conducive to laboratory work and research.
5. Provide professional guidance, supervision and efficient management in laboratory work and research.
6. Provide training and consultation towards the improvement of skills and professionalism.
7. Practise a friendly, open and caring attitude, always ready to provide necessary assistance related to the Faculty's core business.
8. Provide assistance within five (5) minutes of arrival to all clients at the Faculty's service counter.
9. Ensure a safe and healthy working environment in the faculty.

FACULTY OF SCIENCE'S MANAGEMENT TEAM

The Faculty of Science is headed by a Dean, assisted by two Deputy Deans, three Assistant Deans, four Directors, one Information Technology Manager, one Laboratory Manager, one Deputy Registrar and three Assistant Registrars.

	Name : Associate Professor ChM. Dr. Zaiton Abdul Majid Position : Dean Department : Chemistry Email : zaitonmajid@utm.my
	Name : Associate Professor Dr. Shafinaz Shahir Position : Deputy Dean (Academic & Student Affairs) Department : Biosciences Email : shafinazshahir@utm.my
	Name : Professor Dr. Suhairul Hashim Position : Deputy Dean (Development, Research & Innovation) Department : Physics Email : suhairul@utm.my
	Name : Dr. Ezza Syuhada Sazali Position : Assistant Dean (External & Global Engagement) Department : Physics Email : ezzasyuhada@utm.my
	Name : Associate Professor Dr. Normah Maan Position : Assistant Dean (Quality & Strategy) Department : Mathematical Sciences Email : normahmaan@utm.my
	Name : Dr. Mohd Bakri Bakar Position : Assistant Dean (Continuing & TNE) Department : Chemistry Email : bakribakar@utm.my
	Name : ChM. Dr. Norazah Basar Position : Director (Chemistry) Department : Chemistry Email : norazahb@utm.my

	Name : Associate Professor Dr. Abd.Khamim Ismail Position : Director (Physics) Department : Physics Email : khamim@utm.my
	Name : Dr. Zarina Mohd Khalid Position : Director (Mathematical Sciences) Department : Mathematical Sciences Email : zarinamkhalid@utm.my
	Name : Dr. Alina Wagiran Position : Director (Biosciences) Department : Biosciences Email : alina@utm.my
	Name : Dr. Yap Yung Szen Position : Lab Manager Department : Physics Email : yungszen@utm.my
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	Name : Mdm. Syahida Fadilla Moktar Position : Senior Assistant Registrar Department : Academic Office (Postgraduate) Email : syahidafadilla@utm.my
	Name : Mdm. Hamidah Mat Arif Position : Senior Assistant Registrar Department : Administration Office (Research) Email : hamidah-ma@utm.my
	Name : Mr. Mohd Azahari Ayob Position : Senior Assistant Registrar Department : Administration Office (Human Resource Management) Email : hamidah-ma@utm.my

PROGRAMME COORDINATORS

	Name : Assoc. Prof. Dr. Goh Kian Mau Position : Research Programme Coordinator (Bioscience) - PhD Department : Biosciences Email : gohkianmau@utm.my
	Name : Dr. Mohd Helmi Sani Position : Research Programme Coordinator (Bioscience) – Master Department : Biosciences Email : helmisani@utm.my
	Name : Dr. Siti Pauliena Mohd Bohari Position : Mixed Mode Programme Coordinator (Biotechnology) Department : Biosciences Email : pauliena@utm.my
	Name : Dr.Koh Meng Hock Position : Research Programme Coordinator (Physics) Department : Physics Email : kmhock@utm.my
	Name : Dr. Maisarah Duralim Position : Mixed Mode Programme Coordinator (Physics) Department : Physics Email : maisarah@utm.my
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	Name : Dr. Susilawati Toemen Position : Mixed Mode Programme Coordinator (Chemistry) Department : Chemistry Email : susilawatitoemen@utm.my

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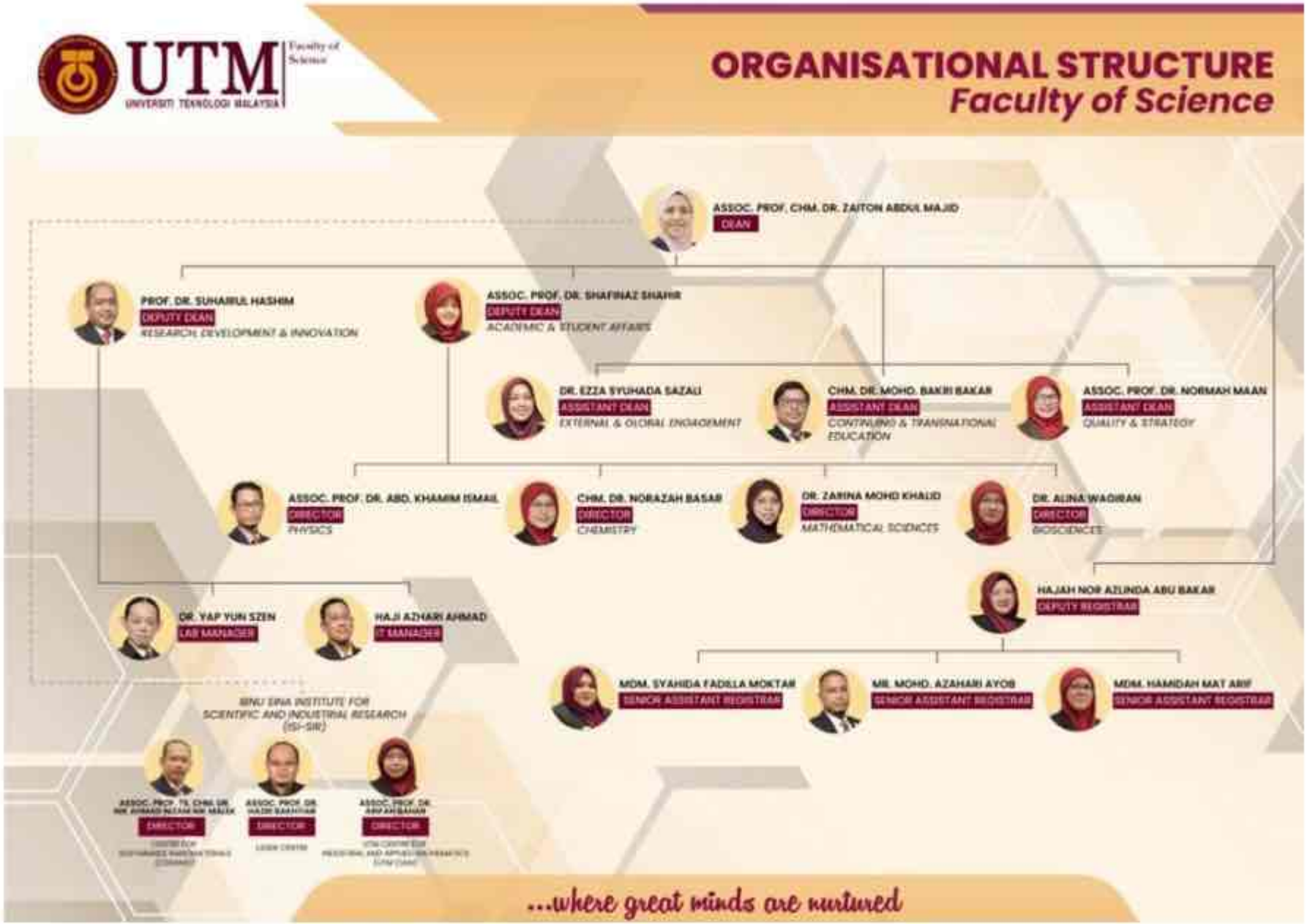
	Name : Dr. Hazzirah Izzati Mat Hassim Position : Mixed Mode Programme Coordinator (Mathematics) Department : Mathematical Sciences Email : hazzirah@utm.my
	Name : Assoc. Prof. Dr. Yeak Su Hoe Position : Mixed Mode Programme Coordinator (Engineering Mathematics) Department : Mathematical Sciences Email : s.h.yeak@utm.my
	Name : Dr. Razif Razali Position : Generic Programme Coordinator Email : razifrazali@utm.my

At present, the Faculty consists of four major divisions:

i. Department of Biosciences
ii. Department of Chemistry
iii. Department of Mathematical Sciences
iv. Department of Physics

Currently, the Faculty has 153 highly qualified and experienced academic staff, assisted by 116 dedicated and hardworking supporting staff.

In terms of facilities and equipments, the Faculty has 2 lecture halls, 25 lecture rooms, 6 computer laboratories under the management of the Department of Mathematical Sciences, 32 laboratories/workshops in the Department of Physics, which are used for teaching and research, 65 laboratories, which are used for teaching and scientific research projects, in the Department of Chemistry, and 44 laboratories, which are used for teaching and scientific research projects, in the Department of Biosciences.


UTM
Faculty of Science
UNIVERSITI TEKNOLOGI MALAYSIA
ORGANISATIONAL STRUCTURE
Faculty of Science
ASSOC. PROF. CHM. DR. ZAITON ABDUL MAJID
DEAN
PROF. DR. SUHAIMI HASHIM
DEPUTY DEAN
RESEARCH, DEVELOPMENT & INNOVATION
ASSOC. PROF. DR. SHAFINAZ SHAHIR
DEPUTY DEAN
ACADEMIC & STUDENT AFFAIRS
DR. EZZA SYUHADA SAZALI
ASSISTANT DEAN
EXTERNAL & GLOBAL ENGAGEMENT
CHM. DR. MOHD. BAKRI BAKAR
ASSISTANT DEAN
CONTINUING & TRANSNATIONAL EDUCATION
ASSOC. PROF. DR. NORMAH MAAN
ASSISTANT DEAN
QUALITY & STRATEGY
ASSOC. PROF. DR. ABD. KHAMIM ISMAIL
DIRECTOR
PHYSICS
CHM. DR. NORAZAH BASAR
DIRECTOR
CHEMISTRY
DR. ZARINA MOHD KHALID
DIRECTOR
MATHEMATICAL SCIENCES
DR. ALINA WAGIRAN
DIRECTOR
BIOSCIENCES
DR. YAP YUN SZEN
LAB MANAGER
HAJI AZHARI AHMAD
IT MANAGER
HAJAH NOR AZLINDA ABU BAKAR
DEPUTY REGISTRAR
MDM. SYAHIDA FADILLA MOKTAR
SENIOR ASSISTANT REGISTRAR
MR. MOHD. AZAHARI AYOB
SENIOR ASSISTANT REGISTRAR
MDM. HAMIDAH MAT ARIF
SENIOR ASSISTANT REGISTRAR
IBNU SINA INSTITUTE FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (ISI-SIR)
DIRECTOR
DIRECTOR
DIRECTOR
...where great minds are nurtured

POSTGRADUATE RESEARCH

Academic staff in the Faculty of Science are very active in research. Some of the research areas are as follows:

CHEMISTRY	MATHEMATICAL SCIENCES
• Biotechnology • Catalysis • Chemometrics • Computational Chemistry • Environmental Chemistry • Forensic Science • Nanostructured Materials • Natural Products • Organic Synthesis • Organometallics • Polymer Electrolytes • Separation Science • Solid State Chemistry • Zeolites	• Algebra and Analysis, • Applied and Computational Mathematics • Numerical Analysis • Statistics and Operational Research
PHYSICS	**BIOSCIENCE**
• Material Physics • Nuclear and Radiation Physics • Optical Physics • Space Physics	• Biological Science • Bioinformatics • Environmental Biotechnology • Genome Biology • Industrial and Food Biotechnology • Medical Biotechnology • Nanobiotechnology • Plant and Agriculture Biotechnology

RESEARCH FACILITIES

The faculty has a range of well equipped research laboratories and computing facilities to support research and teaching. Some of the research facilities are as follows:

- Nuclear Magnetic Resonance Spectrometer (liquid and MAS NMR)
- Gas Chromatography (GC) and Liquid Chromatography (LC) Systems
- Ion Chromatography (IC)
- Capillary Electrophoresis Unit
- Gas Chromatography-Mass Spectrometer (GC- MS)
- Inductively Coupled-Mass Spectrometer (ICP-MS)
- Transmission Electron Microscope (TEM)
- Field Emission Scanning Electron Microscope (FESEM) and X-Ray Diffractometer (XRD)
- Atomic Absorption Spectrometer (AAS)
- Surface Analyzer
- Thermogravimetric Analyzer (TGA)
- Voltammetric Equipment
- Crystal Growth and Ultrasonic Equipment
- Thin Film Coating
- Fiber Bragg Grating Fabricator
- Fiber Coupler Machine
- Laser Welding Machine
- Nd;YAG laser
- Nitro-Dye laser
- CO2 Laser
- Photonic Training Facilities
- Thin Film Fabrication
- PECVD, MOVPE, NDT Ultrasonic Test ing
- Material Analysis Laboratory
- Crystal Growth Laboratory; Crystal Growth & Fabrication
- Nuclear Laboratory
- Zeta Potential, Rapid Sugardetector
- Nanodrop
- Deep Freezers
- Centrifuges
- Incubator Shaker
- Granulator
- High-Performance Liquid Chromatography (HPLC)
- Flow Cytometer
- Dissolved Oxygen Meter
- Luminescence UV-Vis Spectrophotometer
- Seed Storage Chamber
- Pelletizer Bailing Granulator
- Electrochemistry Startup System
- Mini Whole Gel Eluter
- Interactive Microscopy System
- Concentrator Plus
- Gradient PCR
- Real-Time PCR
- Multiporator
- Biological Hood
- Automated Glass Washer
- Glass Desiccator
- Nitrogen Sparger
- Freeze Dryer
- Dynamic Simulation
- Hybridization Oven
- Crystallization Chamber
- AKTA Liquid Chromatography
- Gas Chromatography
- Vilver Lourmat UV Irradiation
- Thermo Hygrometer
- Vivaflow
- Plant Tissue Culture Chamber
- Portable Photosynthesis System
- Quickstand Membrane System
- Refrigerated Shaker
- Precipator
- Water Purification System
- HACH Spectrophotometer
- WGS Annotation
- Electronic Cell Distrupter
- Microscope Stereozoom
- Viscometer, Tissue Lyser
- Inverted Fluorescence Microscope
- Microplate Reader
- Rotary Evaporator
- SDS Page
- Western Blot
- Qubit
- Fermentor
- Isothermal Titration Calorimetry
- bioinformatic facility

The research facilities are supported by a team of qualified and trained technical staff.

STUDENT SUPPORT

There is an excellent student support system in the Faculty of Science, UTM. Students of the Faculty receive close personal guidance from experienced academic supervisors in addition to student-to- student mentoring. Graduate students are also encouraged to participate in activities organized by the Postgraduate Student Society (PGSSFS) or the Chemistry Postgraduate Students Club (Chem Club). Apart from that, students also have access to the department Postgraduate Activity Room which is equipped with computers and internet facilities.

POSTGRADUATE STUDENT SOCIETY FACULTY OF SCIENCE (PGSS FS)

The Postgraduate Student Society Faculty of Science (PGSS FS) is a representative society concerning all interests of postgraduate students in the Faculty of Science, Universiti Teknologi Malaysia (UTM). The committee members of PGSS School/Faculty are selected by a polling process during the Annual General Meeting (AGM) School/Faculty. Meanwhile, the committee members of PGSS UTM (Centre) are selected among the PGSS School/Faculty Presidents by another polling process during the Annual General Meeting of PGSS with the School of Graduate Studies (SPS) UTM. The existence of PGSS FS becomes the main initiator towards interpersonal and soft skills development as well as to voice the needs of all Master and PhD students in the faculty.

PGSS FS

Vision

To be the voice of postgraduate students and acts as a bridge between administration/staff and postgraduate students in the Faculty of Science

Objectives

1. To showcase and promote the interests of its members in all aspects, both within and outside the faculty.
2. To facilitate communication between members and faculty authorities, as well as between members and any other bodies.
3. To aid members while they are enrolled in a course of study.
4. To encourage members' cooperation for educational, social, and cultural activities, as well as for other community-beneficial purposes.

PGSS UTM

Mission

To be an optimal, responsible and holistic postgraduate representation body in UTM

Vision

To be a catalyst in creating a world class leading and exemplary postgraduate society

Motto

From Students to Students

PGSS FS Academic Activities

1. Postgraduate Structured Course (PGSC)
2. Postgraduate Coffee Session (PGCS)
3. Postgraduate Compulsory Course (PGCC)
4. Competition
5. Faculty of Science Postgraduate Seminar Series

POSTGRADUATE PROGRAMMES

ENTRY REQUIREMENTS

MASTER'S DEGREE

- A Bachelor's Degree with good honours from Universiti Teknologi Malaysia or any other institution of higher learning recognised by the Senate; ***OR***

- A qualification equivalent to a Bachelor's Degree and experience in the relevant field recognised by the Senate.

DOCTOR OF PHILOSOPHY

- A Master's Degree from Universiti Teknologi Malaysia or any other Institutions of higher learning recognised by the Senate; ***OR***

- Other qualifications equivalent to a Master's degree and experience in the relevant field recognised by the Senate; ***OR***

- Candidates who are currently registered in a Master's Degree programme at Universiti Teknologi Malaysia, and approved by the Graduate Studies Committee of the respective faculty and the Senate.

For further information, please refer https://admission.utm.my/postgraduate-entry-requirements/.

ENTRY REQUIREMENT TO MASTER BY MIXED-MODE AND RESEARCH PROGRAMME

Obtained Bachelor Degree with the following grade		
• First Class • Second Class Upper • Excellent Pass	**Scale**	**Working Experience**
CPA Scale of 4	2.75 or higher	No Working Experience Needed
CPA Scale of 5	3.38 or higher	
CPA Scale of 20	13.75 and higher	
Percentage	68.75% or higher	
1000 Marks	687.5 or higher	

Obtained Bachelor Degree with the following grade		
• Second Class Lower • Very Good Pass	**Scale**	**Working Experience**
CPA Scale of 4	2.50 ≤ CPA < 2.75	Subject to rigorous internal assessment
CPA Scale of 5	3.13 ≤ CPA < 3.43	
CPA Scale of 20	12.5 ≤ CPA < 13.75	
Percentage	62.5% ≤ CPA < 68.75%	
1000 Marks	625 ≤ CPA < 687.5	

Obtained Bachelor Degree with the following grade		
• Good Pass • Third Class	**Scale**	**Working Experience**
CPA Scale of 4	CPA below 2.50	5 years working experience in the related field
CPA Scale of 5	CPA below 3.13	
CPA Scale of 20	CPA below 12.5	
Percentage	CPA below 62.5%	
1000 Marks	CPA below 625	

APPLICATION CLOSING DATES

POSTGRADUATE ADMISSION

Postgraduate student may apply at any time. Application received after the closing date will be offered for next registration.

Application for **February** intake is open from September to November (for international student) and from September to December (for local student).

Application for **September** intake is open from Mac to Jun (for international student) and from Mac to July (for local student).

MASTER AND PHD BY RESEARCH

Application for Master and PhD by research-mode is open throughout the year and registration will be in February, **May, September and November.** However, candidates can register at any time at the Student Recruitment and Admission Division office at Block F54, UTM Johor Bahru or School of Graduate Studies, Level 8, Menara Razak, UTM Kuala Lumpur.

PROGRAMME FEES

PROGRAMME FEES FOR MALAYSIAN STUDENTS

Fees do not include hostel, convocation (MYR250) & Viva-voce.
* Subject to changes

PROGRAMME	TUITION FEES (MYR For New Students)
Master (Mixed-Mode) 3 Semesters	10,660.00
Master (Research) 2 semesters	9,560.00
Doctor of Philosophy (Research) 6 semesters	18,350.00

Viva-voce fees RM1,500 (Master) and RM2,500 (PhD) to be paid during thesis submission

For further information, please refer https://admission.utm.my/fees-pg-malaysian/.

PROGRAMME FEES FOR INTERNATIONAL STUDENTS

Fees do not include hostel, convocation, VISA & Personal Bond.
* Subject to changes

PROGRAMME	TUITION FEES (MYR For New Students)
Master (Mixed-Mode) 3 Semesters	28,500.00
Master (Research) 2 semesters	28,400.00
Doctor of Philosophy (Research) 6 semesters	48,600.00

Viva-voce fees RM1,500 (Master) and RM2,500 (PhD) to be paid during thesis submission

For further information, please refer https://admission.utm.my/fees-pg-inter/.

MODES OF STUDY

Faculty of Science students may enroll in **any one** of the two modes of study:

- Mixed-Mode (Taught Course and Research)
- Full Research (R)

MIXED-MODE (TAUGHT COURSE AND RESEARCH)

The Mixed-Mode (Taught Course and Research) programme is offered for the master's programme only. In this mode, the candidate must complete a minimum of 40 credits and must obtain a final Cumulative Grade Point Average (CGPA) of at least 3.0 on a scale of 4.0. The minimum 40 credit of several courses including the faculty compulsory, faculty electives, a University elective and a Master's dissertation.

RESEARCH (R)

A Masters or Doctor of Philosophy candidate is supervised by one or more graduate faculty staff who holds a PhD and/or a minimum of an Associate Professor post. The directed work introduces candidates to the processes by which new knowledge is generated and applied accordingly. In the case of panel supervision, co-supervisor(s) from the other universities / industry / research institutions related to the area of study may be appointed.

The academic progress of a candidate is assessed through a bi-annual research progress report. The degree is awarded based on a comprehensive examination (viva voce) of the master's or PhD thesis submitted at the completion of study.

FACULTY OF SCIENCE POSTGRADUATE PROGRAMMES

The Faculty of Science currently offers 16 postgraduate programmes leading to the Master's of Science, Master of Philosophy or Doctor of Philosophy Degrees in areas of science and mathematics.

The normal duration of study are **2–8** semesters (1–4 years) for the Master's programmes and **6–16** semesters (3–8 years) for the Doctor of Philosophy programmes

For the Master's Degree, students may register either for the Masters by Research Programme or Masters by Mixed-Mode.

No.	Programme Name	Modes of Study
1	Master of Science Specialization : Chemistry	Mixed-Mode
2	Master of Science (Forensic Science)	Mixed-Mode
3	Master of Science Specialization : Mathematics	Mixed-Mode
4	Master of Science Specialization : Engineering Mathematics	Mixed-Mode
5	Master of Science Specialization : Physics	Mixed-Mode
6	Master of Science Specialization: Biotechnology	Mixed-Mode
7	Master of Philosophy Field of Research : Chemistry	Research
8	Master of Philosophy Field of Research : Mathematics	Research
9	Master of Philosophy Field of Research : Physics	Research
10	Master of Philosophy Field of Research : Bioscience	Research
11	Master of Philosophy	Research

No.	Programme Name	Modes of Study
12	Doctor of Philosophy Field of Research :Chemistry	Research
13	Doctor of Philosophy Field of Research : Mathematics	Research
14	Doctor of Philosophy Field of Research : Physics	Research
15	Doctor of Philosophy Field of Research : Bioscience	Research
16	Doctor of Philosophy	Research

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

No.	Course code	Faculty	Course name
1	UBSS 6013	AHIBS	Organization Behaviour and Development
2	UBSS 6023	AHIBS	Business Ethics, Responsibility and Sustainability
3	UHMS 6013	FSSK/SHARP	Seminar on Global Development, Economic and Social Issues
4	UHMZ 6023	FSSK/SHARP	Malaysian Society and Culture
5	UHIS 6013	FSSK/ATI	Philosophy of Science and Civilization
6	UHP S6013	FSSK/SP	Dynamics of Leadership
7	UHLM 6013	FSSK/AB	Malay Language for Post Graduates
8	URTS 6013	FTIR	Environmental Ethics
9	UECS 6013	FE/SC	IT Project Management
10	UECS 6023	FE	Introduction to Technopreneurship
11	UMJJ 6013	MJIIT	Basic Japanese Language & Culture

Apart from the above requirements research students must enroll in a research methodology course:

- **USCP 0010** : Research Methodology (HW)

MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY

Programmes by Research (Full-time)

General Information

Faculty of Science offers **Master of Philosophy** and **Doctor of Philosophy** programmes by research in all fields of specialisation (Chemistry, Mathematics, Physics and Bioscience). A student will carry out research in any one of the areas of research. Each research work has to be supervised by a lecturer or a panel of lecturers from the Graduate Faculty. Co-supervisors may also be appointed from a local/international higher institutions or related industry.

In addition to the university compulsory courses, research students may be required to attend lectures related to their research fields. The subjects to be taken shall be determined by the respective supervisors. As part of their training, students are required to participate in seminars and conferences, write technical reports or papers for publications in refereed proceedings or indexed journals.

Assessment for research students is done by means of each semester progress reports, first assessment report and thesis examination (viva-voce). At the end of each semester, all research students will have to submit their progress report to their supervisors by Week 12. All **PhD** and **M.Phil** students must undergo the first assessment of their research proposal. The first assessment is scheduled according to the student's appropriate semester of study as described below:

PROGRAMME	SEMESTER
M.Phil	Semester 2
PhD	Semester 3

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

M.PHIL BY RESEARCH COURSE CODES

SEMESTER / YEAR	CHEMISTRY	MATHEMATICS	PHYSICS	BIOSCIENCE	GENERIC	DESCRIPTION
1/1	MSCK 1100	MSCM 1100	MSCF 1100	MMBB 1100	MSCG 1100	Research
2/1	MSCK 1200	MSCM 1200	MSCF 1200	MMBB 1200	MSCG 1200	Research
3/2	MSCK 2100	MSCM 2100	MSCF 2100	MMBB 2100	MSCG 2100	Research
4/2	MSCK 2200	MSCM 2200	MSCF 2200	MMBB 2200	MSCG 2200	Research
5/3	MSCK 3100	MSCM 3100	MSCF 3100	MMBB 3100	MSCG 3100	Research
6/3	MSCK 3200	MSCM 3200	MSCF 3200	MMBB 3200	MSCG 3200	Research
7/4	MSCK 4100	MSCM 4100	MSCF 4100	MMBB 4100	MSCG 4100	Research
8/4	MSCK 4200	MSCM 4200	MSCF 4200	MMBB 4200	MSCG 4200	Research

For the **M.Phil** programmes in Chemistry, Mathematics, Physics and Bioscience, the subject code for research is given as MSCK wxyz, MSCM wxyz, MSCF wxyz and MMBB wxyz respectively.

w – Year of Study (PhD 1 – 8, MSc 1 – 4)
x – Semester (1 or 2)
y – 0 (Full time)
z – Number of Credits, 0

Ph.D BY RESEARCH COURSE CODES

SEMESTER/ YEAR	CHEMISTRY	MATHEMATICS	PHYSICS	BIOSCIENCE	GENERIC	DESCRIPTION
1/1	PSCK 1100	PSCM 1100	PSCF 1100	PMBB 1100	PSCG 1100	Research
2/1	PSCK 1200	PSCM 1200	PSCF 1200	PMBB 1200	PSCG 1200	Research
3/2	PSCK 2100	PSCM 2100	PSCF 2100	PMBB 2100	PSCG 2100	Research
4/2	PSCK 2200	PSCM 2200	PSCF 2200	PMBB 2200	PSCG 2200	Research
5/3	PSCK 3100	PSCM 3100	PSCF 3100	PMBB 3100	PSCG 3100	Research
6/3	PSCK 3200	PSCM 3200	PSCF 3200	PMBB 3200	PSCG 3200	Research
7/4	PSCK 4100	PSCM 4100	PSCF 4100	PMBB 4100	PSCG 4100	Research
8/4	PSCK 4200	PSCM 4200	PSCF 4200	PMBB 4200	PSCG 4200	Research
9/5	PSCK 5100	PSCM 5100	PSCF 5100	PMBB 5100	PSCG 5100	Research
10/5	PSCK 5200	PSCM 5200	PSCF 5200	PMBB 5200	PSCG 5200	Research
11/6	PSCK 6100	PSCM 6100	PSCF 6100	PMBB 6100	PSCG 6100	Research
12/6	PSCK 6200	PSCM 6200	PSCF 6200	PMBB 6200	PSCG 6200	Research
13/7	PSCK 7100	PSCM 7100	PSCF 7100	PMBB 7100	PSCG 7100	Research
14/7	PSCK 7200	PSCM 7200	PSCF 7200	PMBB 7200	PSCG 7200	Research
15/8	PSCK 8100	PSCM 8100	PSCF 8100	PMBB 8100	PSCG 8100	Research
16/8	PSCK 8200	PSCM 8200	PSCF 8200	PMBB 8200	PSCG 8200	Research

For the **PhD** programmes in Chemistry, Mathematics, Physics and Bioscience, the subject code for research is given as PSCK wxyz, PSCM wxyz, PSCF wxyz, and PMBB wxyz, respectively.

w – Year of Study (PhD 1 – 8, MSc 1 – 4)
x – Semester (1 or 2)
y – 0 (Full time)
z – Number of Credits, 0

MASTER OF SCIENCE (M.Sc)

Programmes By Mixed-Mode (Full-time and Part-time)

General Information

Students have to take at least 42 credits including one compulsory University courses and obtain a CPA of at least 3.0 to graduate. Students have to pass each course with at least a B- grade. The distribution of grade and GPA is given in the following table:

Marks	Grade	Evaluation Point	Level of Achievement
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	
0 – 29	E	0.00	

BIOSCIENCES PROGRAMMES

MASTER OF SCIENCE SPECIALIZATION: BIOTECHNOLOGY

PROGRAMME SPECIFICATION

1. Awarding Institution	UTM
2. Teaching Institution	UTM
3. Programme Name	Master of Science Specialization: Biotechnology
4. Final Award	Master of Science Specialization: Biotechnology
5. Programme Code	MMBT
6. Professional or Statutory Body of Accreditation	Malaysian Ministry of Higher Education Kementerian Pengajian Tinggi Malaysia
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-govern
10. Study Scheme	Full Time
11. Study Duration	Minimum: 1½ years Maximum: 4 years
12. Entry Requirement	**University Entry Requirement** i) A bachelor's degree in the field or related fields with a minimum CGPA of 2.75 or equivalent, as accepted by the HEP Senate; or ii) A bachelor's degree in the field or related fields or equivalent iwth a minimum CGPA of 2.50 and not meeting CGPA of 2.75, can be accepted subject to rigorous internal assessment; or iii)A bachelor's degree in the field or related fields or equivalent with a minimum CGPA of 2.00 and not meeting CGPA 2.50, can be accepted subject to a minimum of 5 years working experience in the relevant field and rigorous internal assessment. **Faculty Entry Requirement** Bachelor of Science (Biology, Biochemistry, Biotechnology, Microbiology, Bioscience, Chemistry, Chemical Engineering, Bioprocess Engineering, Environmental Engineering, Genetics or equivalent) with CPA $\geq$ 3.0 will be considered for this programme.

	English Language Requirement i) **Student with TOEFL score if 60 and above can enroll at faculty** ii) **Students with TOEFL score of 60 and below required to attend either:** • **Intensive English Programme (IEP) conducted by Language Academy (LA), UTM** *and pass IELTS with a minimum of 6.0 or pass CEFR – aligned test with the required score* Or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108 iii) **Student with IELTS band 6.0 and above can enroll at faculty** iv) **Student with band 5.5 and below are required to attend either:** • **Intensive English Programme (IEP) conducted by Language Academy (LA), UTM** and pass IELTS with a minimum of 6.0 or pass CEFR-aligned test with the required score or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108

13. Programme Educational Objectives (PEO)

Graduates of the programme should be :

1. PEO 1 : able to contribute to the advancement of science and technology
2. PEO 2 : able to think critically, analytically and innovatively in solving problem
3. PEO 3 : practice good management, leadership and governance
4. PEO 4 : able to communicate across a broad spectrum of issues

14. Programme Learning Outcomes (PLO)				
		Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
	PLO1	Demonstrate advanced knowledge and interdisciplinary concepts in global perspectives across related disciplines in biotechnology	Lectures, seminars, directed reading, independent study	Examinations, tests, quizzes, written assignments
	PLO2	Critically analyse, evaluate and synthesize current critical issues and information independently from relevant sources in biotechnology related fields	Lectures, laboratory works, mini project	Examinations, tests, oral presentations, written assignments, Dissertation, quizzes
	PLO3	Demonstrate the ability to conduct specialised research methodologies independently using basic and specific biotechnology equipment in generating reliable and valid data.	Mini project, supervised project.	Dissertation, oral presentations, written assignments
	PLO7	Competently use a quantitative/qualitative tool to analyse and evaluate numerical and graphical data for study or research.	Lecture, independent study.	tests, examinations, assignment, quizzes, Dissertation

INTENDED LEARNING OUTCOMES			TEACHING AND LEARNING METHODS	ASSESSMENT
GENERIC SKILLS	**PLO4**	Ability to demonstrate interpersonal skills in planning, resource management and problem solving with the group in scholastic activities	Group assignments, research project supervision, laboratory works	Oral presentations, written assignments, laboratory reports,
	PLO5	Ability to communicate effectively, both orally and in writing with peers and other relevant communities	Research project supervision, group assignments, laboratory work, lecture	Oral presentations, written assignments, research project presentation, laboratory reports
	PLO6	Competently use a wide range of suitable digital technologies and appropriate software to enhance study and research.	Group assignments, laboratory works	Oral presentations, laboratory reports,
	PLO8	Demonstrate independence, leadership and interpersonal skills in planning, resource management and problem solving within the group in scholastic activities.	Lectures, group assignments, Mini project	written assignments, laboratory reports, peer assessment
	PLO9	Integrate knowledge for lifelong learning with development of new ideas and solutions.	Research project supervision, laboratory works	Dissertation, laboratory reports
	PLO10	Initiate and/or lead entrepreneurial ventures/projects	Research project, Group assignments,	written assignments, Oral presentations
	PLO11	Demonstrate understanding, awareness and adherence to biosafety, ethical, professional and legal norms as well as awareness of commercial and social issues related to biotechnology.	Independent study, supervised project, laboratory works	Dissertation, assignment

15. Classification of Courses

No.	Classification	Credit Hours	Percentage	Standard (QA)
i.	University General Course	3	7	50%
ii.	Core Courses	18	43	
iii.	Elective Courses	-	-	
iv.	Dissertation	21	50	50%
	Total	42	100	100%

16. Total credit hours to graduate : 42 credit hours

17. Programme structures and features, curriculum, and award requirements

The course is offered in full-time mode and based on a 3 Semester Academic Year with several subjects being delivered and assessed in each semester. Assessment: Based on final examination, coursework and dissertation.

Award requirements:
To graduate, students should:

- achieve a total of minimum 42 credit hours with minimum CPA of 3.00
- complete and pass viva M.Sc Dissertation.

Course Category	Code	Course	Credit
University general course (3 Credits)	**UHX XXX3**	(Choose 1 courses from the list given by School of Graduate Studies)	3
Core Courses (18 Credits)	**Semester 1**		
	***USCP 0010**	Research Methodology	HW
	MMBT 1713	Bioinformatics	3
	MMBT 1173	Biochemistry and Microbial Physiology	3
	MMBT 1153	Molecular Mechanisms in Gene Expression and Regulation	3
	MMBT 1683	Protein Engineering	3

	Semester 2		
		Research Methodology	HW
	***USCP 0010**	Industrial Technology and Bioreactor Design	3
	MMBT 1233	Environmental Bioengineering	3
	MMBT 1563	Research Proposal	0
	MMBT 1280		
Research (21 Credits)	**Semester 3**		
	MMBT 2180	Dissertation	21
TOTAL CREDIT			**42**

***USCP 0010**: Research Methodology is being offered every semester

18. Mapping of Programme Learning Outcomes to Course												
	COURSES OFFERED	**Knowledge and Understanding**	**Cognitive Skills**	**Practical Skills**	**Numeracy Skills**	**Interpersonal Skills**	**Communication Skills**	**Digital Skills**	**Leadership, Autonomy and Responsibility**	**Personal Skills**	**Entrepreneurial Skills**	**Ethics**
Code	**Courses**	**PLO1 KW**	**PLO2 CG**	**PLO3 PS**	**PLO7 NS**	**PLO4 IPS**	**PLO5 CS**	**PLO6 DS**	**PLO8 LAR**	**PLO9 PRS**	**PLO10 ENT**	**PLO11 ETS**
University General Courses (Choose 1 from the list*)												
UHXX XXX3	University Elective									✔		✔
Core Courses												
MMBT 1713	Bioinformatics	✔	✔	✔								✔
MMBT 1173	Biochemistry and Microbial Physiology	✔	✔	✔						✔		
MMBT 1153	Molecular Mechanisms in Expression and Regulation	✔	✔						✔			✔
MMBT 1233	Industrial Technology and Bioreactor Design	✔	✔			✔						
MMBT 1673	Protein Engineering	✔	✔			✔	✔					
MMBT 1563	Environmental Bioengineering	✔	✔			✔			✔			

Core Courses												
MMBT 2180	Dissertation		✔	✔	✔	✔	✔	✔		✔	✔	✔

Key:
1. Technical Skills: PLO1, 2, 3 and 7
2. Generic Skills : PLO 4, 5, 6, 8, 9, 10 and 11.

* List of University General Courses
1. UBSS 6013 : Organization Behaviour and Development
2. UBSS 6023: Business Ethics, Responsibility and Sustainability
3. UHMS 6013: Seminar on Global Development, Economic and Social Issues
4. UHMZ 6023: Malaysian Society and Culture
5. UHIS 6013: Philosophy of Science and Civilization
6. UHPS 6013: Dynamics of Leadership
7. UHLM 6013: Malay Language for Post Graduates
8. URTS 6013: Environmental Ethics
9. UECS 6013: IT Project Management
10. UECS 6023: Introduction to Technopreneurship
11. UMJJ 6013: Basic Japanese Language & Culture

19. Support for students and their learning

Students and their learning are supported by:

- Briefing of all new post-graduate students during registration week.
- Postgraduate Handbook for every academic session.
- Information services provided by the Graduate School (SPS) and through the university's web site.
- Student Support provided by counselors and psychologists at 'Unit Perkhidmatan Sokongan Pelajar' (UPSP), UTM Medical Centre, accommodation officers and University Library and others.
- Student Advisors Programme: Selected academic staff provides advice on academic progress and monitoring students' performance and achievements.
- Special programmes on career development conducted by the university to ensure students acquire necessary skills during their academic and future career.
- Staff student ratio for teaching of 1:12.
- Extensive library and other learning resources and facilities

20. Career Prospect

Graduate of the programme can work as:

- Research officer - Research Institute, university and industries
- Science Officer - Research Institute, university and industries
- Academician (teacher, tutor, lecturer)
- Sales executive for biotech product

or

They can further their education by doing a PhD programme in the related field of study.

21. Regulation of Assessment

Assessment rules and degree classification applies for every course with the minimum passing mark of 60%. To qualify for the degree award, students should complete all of the programme's requirements; achieve passing mark for every courses examination. Dissertation will be examined by a panel of internal examiners appointed by the Department's Post-graduate Committee; their roles include evaluating candidates' viva-voce and written project dissertation.

Summary of marks, grades, and their evaluation points

Marks	Grade	Evaluation Point	Level of Achievement
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	

For further information on academic regulations please refer to the graduate school website: http://www.sps.utm.my/

22. Facilities available List of laboratories:

Laboratories

- Animal Tissue Culture Laboratory
- Biodiagnostic Laboratory
- Bionanotechnology Laboratory
- Bioprocess Laboratory
- Biosensor Laboratory

- Biofilm Laboratory
- Computational Pharmacy and Molecular Modeling Laboratory
- Environmental Bioengineering Laboratory
- Enzyme Research Laboratory
- Genomics and Proteomics Laboratory
- Mesoporous and Nanoporous Material Laboratory
- Microbiology Research Laboratory
- Plant Molecular Biology and Tissue Culture Laboratory
- Postgraduate Research Laboratories
- Specific Research Laboratory
- Structural Biology Laboratory
- Tissue Engineering Laboratory
- Virology Laboratory
- Spectrometry and Chromatograpy Room that house analytical equipments such as High Performance Liquid Chromatography (HPLC), luminometer, top range UV-visible spectrophotometers, Gas Chromatography (GC), Total Organic Carbon (TOC) analyzer and Microscopy Room that houses CCTV- phase contrast and stereo microscopes, simple light and stereo microscopes.

23. Methods for Evaluating and Improving the Quality and Standards of Teaching and Learning

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards

1. Students' performance in terms of:
- KB/KS/KG –Pass/conditional pass/fail
- CPA – Cumulative point average
- Graduating students' performance
- GOT – Graduate on time
- Completion Rate
- Analysis of course performance

2. Employability
- Exit survey
- Alumni survey
- Market survey

3. Lecturer's performance
- Teaching evaluation by students (e-PPP)
- Annual staff appraisal (e-LPPT)
- Teaching Evaluation System (TES)
-

4. Curriculum review
- Faculty academic committee
- External examiner reports
- CLO achievement survey by students

5. Delivery system
- Academic Quality Assurance Committee
- Malaysia Quality Assurance (MQA) standards

24. Regulation of Programme Assessment

Role of Board of Study (BOS): Alumni, Industry and University professor:
and
Role of External Examiners (Visiting Examiners):
- review and evaluate program curriculum,
- review and evaluate methods of student's assessment,
- make necessary recommendations to the Academic Committee.

25. Programme Assessment Tools

Measurement Tools	Programme Learning Outcomes (PLO)											Duration	Action by
	1	2	3	4	5	6	7	8	9	10	11		
Course Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Course Assessment Report (CAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Annual Programme Assessment Report (APAR)	x	x	x	x	x	x	x	x	x	x	x	Per year	Faculty
Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Final Semester	Faculty
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x	Once/ 3 year	Director

CURRICULUM STRUCTURE

SEMESTER 1

CODE	COURSE	CREDIT
MMBT 1173	Biochemistry & Microbial Physiology	3
MMBT 1153	Molecular Mechanism in Gene Expression & Regulation	3
MMBT 1683	Protein Engineering	3
USCP 0010	Research Methodology	HW
MMBT 1713	Bioinformatics	3
Total Credit Hours		***12***

SEMESTER 2

CODE	COURSE	CREDIT
MMBT 1233	Industrial technology and Bioreactor design	3
MMBT 1563	Environmental Bioengineering	3
USCP 0010	Research Methodology	HW
MMBT 1280	Research Proposal	0
UHX XXX3	University Compulsory Subject	3
Total Credit Hours		***9***

SEMESTER 3

CODE	COURSE	CREDIT
MMBT 2180	Dissertation	21
Total Credit Hours		**21**
	TOTAL CREDIT	**42**

MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY

Field of Research: Bioscience

- By Research (Full time)

Department of Biosciences offers full time research programmes leading to M.Phil. and Ph.D. degree for students interested in pursuing research careers. To ensure the suitability of the research for the given academic level, students are required to present their research proposal to be evaluated by experts in the related area. This usually takes place in the second semester for M.Phil. student and third semester for Ph.D. student. Students are expected to disseminate the output of their research through writing of research articles and presentations in conferences. On completion of the research project, students are required to submit their dissertation/thesis for evaluation by external and internal examiners appointed by the Faculty of Science. The programmes are MQA accredited.

Programme	NEC Code	MQA Reference Number (Certificate Number)
M.Phil.	421 (Biology and Biochemistry)	MQA/SWA0353 (18889)
Ph.D.	421 (Biology and Biochemistry)	MQA/SWA0455 (20672)

Field of Research

The research project of the student may fall into one or more aspects of the following field:

- Biological Science
- Bioinformatics
- Environmental Biotechnology
- Genome Biology
- Industrial and Food Biotechnology
- Medical Biotechnology
- Nanobiotechnology
- Plant and Agriculture Biotechnology

Courses and duration of study

The normal duration of study is 2–8 semesters (1–4 years) for M.Phil. and 6–16 semesters (3–8 years) for the Ph.D. programme.

Students must register a Research Course with the following code in each semester.

Year/ Semester (Total Semester)	M.Phil.	Ph.D.
1/1 (Sem. 1)	MMBB 1100	PMBB 1100
1/2 (Sem. 2)	MMBB 1200	PMBB 1200
2/1 (Sem. 3)	MMBB 2100	PMBB 2100
2/2 (Sem. 4)	MMBB 2200	PMBB 2200
3/1 (Sem. 5)	MMBB 3100	PMBB 3100
3/2 (Sem. 6)	MMBB 3200	PMBB 3200
4/1 (Sem. 7)	MMBB 4100	PMBB 4100
4/2 (Sem. 8)	MMBB 4200 **(maximum semester)**	PMBB 4200
5/1 Sem. (9)	-	PMBB 5100
5/2 (Sem. 10)	-	PMBB 5200
6/1 (Sem. 11)	-	PMBB 6100
6/2 (Sem. 12)	-	PMBB 6200
7/1 (Sem. 13)	-	PMBB 7100
7/2 (Sem. 14)	-	PMBB 7200
8/1 (Sem. 15)	-	PMBB 8100
8/2 Sem. (16)	-	PMBB 8200 **(maximum semester)**

All research students must enrol in Research Methodology (USCP 0010) and at least one of the University's General Courses (subjected to courses offered in each semester listed in SPS website). Examples of General Courses offered are:

No.	Course code	Faculty	Course name
1	UBSS 6013	AHIBS	Organization Behaviour and Development
2	UBSS 6023	AHIBS	Business Ethics, Responsibility and Sustainability
3	UHMS 6013	FSSH/SHARP	Seminar on Global Development, Economic and Social Issues
4	UHMZ 6023	FSSH/SHARP	Malaysian Society and Culture
5	UHIS 6013	FSSH/ATI	Philosophy of Science and Civilization

6	UHPS 6013	FSSH/SOE	Dynamics of Leadership
7	UHLM 6013	FSSH/LA	Malay Language for Post Graduates
8	URTS 6013	RFTI	Environmental Ethics
9	UECS 6013	FE/SC	IT Project Management
10	UECS 6023	FE	Introduction to Technopreneurship
11	UMJJ 6013	MJIIT	Basic Japanese Language & Culture

Credit transfer of Research Methodology and the University's General Courses

Students can apply for credit transfer if the course(s) taken in another M.Phil. programme(s) prior to the current study with at least 80% identical learning outcomes.

Deferment of study

- Students may apply for deferment of the programme registration for not more than **TWO SUBSEQUENT** semesters subject to University's approval.
- Students who do not register for any courses in a semester must apply for deferment. The deferred semester will be counted as a part of the total study period.
- Students who withdraw (TD) from **ALL** courses in a semester will automatically be given a deferment. The deferred semester will be counted as a part of the total study period.
- Students may apply for deferment of study due to health reasons. The application has to be accompanied with a medical report certified by a Medical Officer recognised by the University. The deferred semester may not be counted as a part of the total study period.

Conversion from M.Phil. to Ph.D. programme

M. Phil. students can apply for conversion to a Ph.D. programme in the second semester upon achieving the requirement listed in the table below.

Bachelor's Degree CGPA	**Requirements**
CGPA $\geq$ 3.33	Presented **TWO** conference articles in proceedings with ISBN. **OR** published **ONE** article in a SCOPUS/WOS/ERA indexed journal.
3.00 $\leq$ CGPA $\leq$ 3.32	Published **ONE** article in a WOS indexed journal.

Students will be requested to defend the research proposal to the evaluation panels. Passing the evaluation is necessary for successful conversion to Ph.D. programme.

Assessments and evaluation

(i) First Assessment
Students are required to present a research proposal (**with preliminary/expected results**) for evaluation purposes within the duration specified by the University, according to the following schedule:

Programme	Semester
M.Phil.	2nd semester
Ph.D.	3rd semester

If the students failed to present without any valid reasons, the student may be given a TM status by the Faculty.

(ii) Progress Report Assessment
All postgraduate research students are required to submit a progress report online (GSMS system) before the due date. The online system will usually be opened in week 10–13 of each semester, unless specified otherwise in the academic calendar.

The supervisor shall evaluate the progress report. A student whose progress is satisfactory (MM status) will be recommended for the continuation of his/her candidature.

A student may be given a TM or GG status if he/she does not submit his/her progress report.

The Faculty shall terminate the candidature of a student whose progress is not satisfactory (TM status) for **TWO** consecutive semesters.

(iii) Qualifying Assessment (Fast Track Ph.D.)
Fast track students in the Ph.D. programme must undergo a qualifying assessment after 6 to 18 months of registration in the Ph.D. programme. The result of the assessment can be one of the following:

a. **Pass** - The student will continue their Ph.D. programme and proceed with the First Assessment in the following semester.

b. **Fail** - The student will be transferred to the M.Phil. programme and a new study period begins.

(iv) Viva Voce (Oral Examination)

A student should submit Notice for Thesis Submission (NHT) approved by the supervisor at least three months prior to submission of the dissertation/thesis for examination, or three months before expiry of the maximum study duration. Dissertation/Thesis report must follow the guidelines prescribed in the UTM Thesis Manual 2018 and the report must be written in English. Students shall apply for a permission if the dissertation/thesis is to be written in other languages, i.e. Bahasa Malaysia. The Turnitin score for each chapter shall not be more than 20%. The publication criteria for the M.Phil. and Ph.D. programme is listed below.

Programme	Publication criteria
M. Phil.	Students may submit their dissertation after 12 months with at least one publication that has been accepted or published in either journal, conference, or book chapters for the purpose of the viva voce.
Ph.D.	**Submission of thesis for normal duration of study (within 6 - 16 semesters)** Students can submit their thesis for viva voce after having: • at least **ONE** accepted or published article in a WOS indexed journal, or • **TWO** accepted or published articles in Scopus/ERA/Malaysia Journal Management System indexed journals. **Early thesis submission (in the Semester 5)** Students can submit their thesis for viva voce after having: • accepted or published **TWO** articles in WOS/Scopus/ERA indexed journals. **Submission of thesis using publication format** Students can submit their thesis for viva voce using publication format if the following condition is fulfilled: • At 24 months after the student enrols; a minimum of **THREE** journal articles indexed in Scopus/WOS with at least **TWO** articles accepted or published in Q1/Q2 WOS indexed journals. • At least 30 months after the student enrols: a minimum **THREE** journal articles indexed in Scopus/WOS with at least **ONE** journal article accepted or published in Q1/Q2 WOS indexed journal.

Dissertation/Thesis examination for M.Phil. and Ph.D. programmes should be made according to the criteria set for the programme as approved by the Senate. For instance, oral defence cannot be held more than twice. The thesis examiner should consist of at least one internal and one external examiner, unless specified in *Peraturan Akademik Pengajian Siswazah* 2020. Please refer to the Faculty on the fee imposed for viva voce.

Change of supervisor

During the study period, students may apply for a change of supervisor if necessary. The application is made by filling in the specific form available at the Faculty's Postgraduate Office. The application needs to be supported and approved by the Faculty's Academic Committee. However, students have to take note that the application for a change in supervisor can only be made with the following restrictions (except for special cases):

- Change of supervisor can only be made **ONCE** throughout the study period.
- Application can only be made **BEFORE** the First Assessment.

Abbreviations

ATI : Academy of Islamic Civilisation
AHIBS : Azman Hashim International Business School
ERA : Excellence in Research Australia
FE : Faculty of Engineering
FSSH : Faculty of Social Sciences and Humanities

GG	: *Gagal* (Fail)
GSMS	: Graduate Studies Management System
LA	: Language Academy
MJIIT	: Malaysia-Japan International Institute of Technology
MM	: *Memuaskan* (Satisfactory)
M.Phil.	: Master of Philosophy
MQA	: Malaysian Qualifications Agency
NEC	: National Education Code
NHT	: Notis Hantar Thesis (Notice for Thesis Submission)
Ph.D.	: Doctor of Philosophy
RFTI	: Razak Faculty of Technology and Informatics
SC	: School of Computing
SHARP	: School of Human Resource Development & Psychology
SOE	: School of Education
TD	: *Tarik Diri* (Withdraw)
TM	: *Tidak Memuaskan* (Unsatisfactory)
WOS	: Web of Science

CHEMISTRY PROGRAMMES

MASTER OF SCIENCE SPECIALIZATION: CHEMISTRY

PROGRAMME SPECIFICATION

1. Awarding Institution	UTM
2. Teaching Institution	UTM
3. Programme Name	Master of Science Specialization : Chemistry
4. Final Award	Master of Science Specialization : Chemistry
5. Programme Code	MSCK2
6. Professional or Statutory Body of Accreditation	Malaysian Ministry of Higher Education Kementerian Pengajian Tinggi Malaysia
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-govern
10. Study Scheme	Full Time
11. Study Duration	Minimum: 1½ years Maximum: 4 years
12. Entry Requirement	**General University Requirements:** Basic conditions of entry is referring to the Assessment Guidelines in 1998 Entry, Pind. 1/2013. **Faculty Requirements:** Bachelor of Science with a CGPA of ≥ 3.0 from Universiti Teknologi Malaysia in chemistry or any institutions of higher learning recognized by the Senate in the same field. OR equivalent to a Bachelor of Science degree with experience in the same field and recognized by the UTM Senate. **English Language Requirement** i) **Student with TOEFL score of 60 and above can enroll at faculty** ii) **Students with TOEFL score of 60 and below required to attend either:** • **Intensive English Programme (IEP) conducted by Language Academy (LA), UTM** *and pass IELTS with a minimum of 6.0 or pass CEFR – aligned test with the required score* Or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108

	iii) **Student with IELTS band 6.0 and above can enroll at faculty** iv) **Student with IELTS band 5.5 and below are required to attend either:** • **Intensive English Programme (IEP) conducted by Language Academy (LA), UTM** and pass IELTS with a minimum of 6.0 or pass CEFR-aligned test with the required score or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108

13. Programme Educational Objectives (PEO)

Graduates of the programme should be :

1. PEO 1 : Apply an in-depth knowledge in advanced areas of chemistry to fulfil the needs of stakeholders
2. PEO 2 : Able to solve problems in the field of chemistry and sciences through intellectual skills and competence
3. PEO 3 : Responsive and adaptive to changing situations with a drive to continuously acquire new knowledge and skills
4. PEO 4 : Able to articulate ideas and findings through oral presentation and scientific writing
5. PEO 5 : Able to independently design, perform and manage scientific research using acceptable methodology

14. Programme Learning Outcomes (PLO)				
	Intended Learning Outcomes		**Teaching and Learning Methods**	**Assessment**
	PLO1	Synthesize comprehensive knowledge in theory, methodology and practice independently in advanced Chemistry.	Active lecture, assigned reading, group discussion, assignment and research work.	Examinations, tests, quizzes, project reports and assignments
	PLO2	Construct critical solutions to related complex issues in the field of frontier Chemistry.	Active lectures, research works, assigned reading, group discussion and problem-based assignments, hands-on instrumentations, chemistry related software.	Examination, test, assignment report, dissertation, oral presentation, group project, and computer simulation.
	PLO3	Conduct practical skills and analytical work efficiently based on advanced Chemistry knowledge.	Active lectures, research works, assigned reading, group discussion and problem-based assignments, hands-on instrumentations, chemistry related software skills, experimental work, research presentation and report.	Research proposal, project presentation, dissertation and viva-voce.
	PLO7	Evaluate the numerical and graphical data for studies and research purposes using qualitative, quantitative, mathematical and statistical methods.	Laboratory works, individual / group assignments	Progress report, logbooks and group assignment report.

Intended Learning Outcomes			Teaching and Learning Methods	Assessment
GENERIC SKILLS	**PLO4**	Collaborate effectively with different people in learning and employment communities.	Group projects, laboratory work, independent research.	Written assignment, and research proposal, dissertation, research project report.
	PLO5	Communicate effectively through variety of media and technology to a diverse audience.	Assignment, research proposal, dissertation.	Project report and group presentation, dissertation, viva-voce
	PLO6	Competent in utilizing a wide range of appropriate digital technologies and appropriate software to enhance studies and research.	Assignment, individual research project, hands-on instrumentations, chemistry related software skills, experimental work, research presentation and report	Report and seminar presentation, proposal and dissertation.
	PLO8	Demonstrate significant autonomy, independence, leadership, and substantial responsibility in studies and research	Group assignment, laboratory work.	Group assignment report and dissertation thesis.
	PLO9	Build self-advancement through continuous development of new ideas, solutions and systems.	Active lecture, individual assignment, laboratory work, dissertation.	Laboratory report, individual assignment report, seminar presentation and dissertation thesis.
	PLO10	Propose entrepreneurial opportunities in the field of Chemistry	Active lecture, laboratory works and research work.	Written assignment, dissertation thesis and progress report.
	PLO11	Comply to ethical and professional codes of practice on complex issues in the area of Chemistry.	Active lecture, laboratory works, research proposal, and research work.	Individual and group assignment reports and dissertation thesis.

15. Classification of Courses

No.	Classification	Credit Hours	Percentage	Standard (QA)
i.	University General Course	3	7	50%
ii.	Core Courses	12	29	
iii.	Elective Courses	6	14	
iv.	Dissertation	21	50	50%
	Total	42	100	100%

16. Total credit hours to graduate: 42 credit hours

17. Programme structures and features, curriculum, and award requirements

The course is offered in full-time mode and based on a 3 Semester Academic Year with several subjects being delivered and assessed in each semester. Assessment: Based on final examination, coursework and dissertation.

Award requirements:

To graduate, students should:

achieve a total of minimum 42 credit hours with minimum CPA of 3.00

complete and pass viva M.Sc Dissertation.

Course Category	Code	Course	Credit
University general course (3 Credits)	**UXXX 6XX3**	(Choose 1 courses from the list given by School of Graduate Studies)	3
Core Courses (12 Credits)	**Semester 1** **MSCK 1713**	Advanced Inorganic Chemistry	3

	MSCK 1413	Advanced Physical Chemistry	3
	MSCK 1303	Research Methodology	3
	Semester 2		
	MSCK 1613	Advanced Organic Chemistry	3
Elective Courses (6 Credits)	**Choose 2 only**		3+3
	MSCK 1213	Advanced Analytical Chemistry	
	MSCK 1223	Advanced Electroanalytical Chemistry	
	MSCK 1243	Advanced Separation Methods	
	MSCK 1323	Advanced Biochemistry	
	MSCK 1333	Advanced Biotechnology	
	MSCK 1423	Quantum Chemistry and Spectroscopy	
	MSCK 1473	Advanced Surface and Colloid Chemistry	
	MSCK 1463	Advanced Solid State Chemistry	
	MSCK 1653	Advanced Organic Spectroscopy	
	MSCK 1743	Bioinorganic Chemistry	
	MSCK 1753	Inorganic Reaction Mechanism	
Research (21 Credits)	**MSCK XX80**	Dissertation	21
		TOTAL CREDIT	**42**

18. Mapping of Programme Learning Outcomes to Course												
	COURSES OFFERED	**Knowledge and understanding**	**Cognitive Skills**	**Practical Skills**	**Numeracy Skills**	**Interpersonal Skills**	**Communication Skills**	**Digital Skills**	**Leadership, Autonomy and Responsibility**	**Personal Skills**	**Entrepreneurial Skills**	**Ethics and Professionalism Skills**
Code	**Courses**	**PLO1 KW**	**PLO2 CG**	**PLO3 PS**	**PLO7 NS**	**PLO4 IPS**	**PLO5 CS**	**PLO6 DS**	**PLO8 LAR**	**PLO9 PRS**	**PLO10 ENT**	**PLO11 ETS**
University General Courses (Choose 1 from the list*)												
UXXX 6XX3	University Course						✔					
Core Courses												
MSCK 1713	Advanced Inorganic Chemistry	✔	✔	✔					✔			✔
MSCK 1613	Advanced Organic Chemistry	✔	✔	✔						✔		
MSCK 1413	Advanced Physical Chemistry	✔	✔	✔			✔					
MSCK 1303	Research Methodology	✔	✔	✔		✔	✔	✔				
Elective Courses (Choose 2)												
MSCK 1213	Advanced Analytical Chemistry	✔	✔	✔	✔				✔			
MSCK 1223	Advanced Electroanalytical Chemistry	✔	✔	✔								✔
MSCK 1243	Advanced Separation Methods	✔	✔	✔				✔				

MSCK 1323	Advanced Biochemistry	✔	✔	✔			✔					
MSCK 1333	Advanced Biotechnology	✔	✔	✔							✔	
MSCK 1423	Quantum Chemistry and Spectroscopy	✔	✔	✔	✔					✔		
MSCK 1473	Advanced Surface and Colloid Chemistry	✔	✔	✔				✔				
MSCK 1463	Advanced Solid State Chemistry	✔	✔	✔						✔		
MSCK 1653	Advanced Organic Spectroscopy	✔	✔	✔					✔			
MSCK 1743	Bioinorganic Chemistry	✔	✔	✔								✔
MSCK 1753	Inorganic Reaction Mechanism	✔	✔	✔								✔
Research												
MSCK 2180	Dissertation	✔	✔	✔			✔			✔		✔

Key:

1. Technical Skills: PLO1, 2, 3 and 7
2. Generic Skills : PLO 4, 5, 6, 8, 9, 10 and 11.

*** List of University General Courses**

1. UBSS 6013 : Organization Behaviour and Development
2. UBSS 6023: Business Ethics, Responsibility and Sustainability
3. UHMS 6013: Seminar on Global Development, Economic and Social Issues
4. UHMZ 6023: Malaysian Society and Culture
5. UHIS 6013: Philosophy of Science and Civilization

6. UHPS 6013: Dynamics of Leadership
7. UHLM 6013: Malay Language for Post Graduates
8. URTS 6013: Environmental Ethics
9. UECS 6013: IT Project Management
10. UECS 6023: Introduction to Technopreneurship
11. UMJJ 6013: Basic Japanese Language & Culture

19. Support for students and their learning Students and their learning are supported by:

- Briefing of all new post-graduate students during registration week.
- Postgraduate Handbook for every academic session.
- Information services provided by the Graduate School (SPS) and through the university's web site.
- Student Support provided by counselors and psychologists at 'Unit Perkhidmatan Sokongan Pelajar' (UPSP), UTM Medical Centre, accommodation officers and University Library and others.
- Special programmes on career development conducted by the university to ensure students acquire necessary skills during their academic and future career.
- Staff student ratio for teaching of 1:12.
- Extensive library and other learning resources and facilities
- Each student is assigned an academic advisor (programme tutor) whose role is to assist and advice on programme of study.

20. Career Prospects

Graduate of the programme can work as:

a) chemists or scientists in private and government research institutions such as MARDI, PORIM, RRI, PRSS, AMREC, SIRIM and MINT
b) lecturers or researchers in higher learning institutions, following further their degree qualifications at Masters of PhD levels;
c) officers in agencies or industries in which sound knowledge of chemistry and high levels of generic skills are required.

OR

They can further their education by doing a PhD programme in the related field of study.

21. Regulation of Assessment

Assessment rules and degree classification applies for every course with the minimum passing mark of 60%. To qualify for the degree award, students should complete all of the programme's requirements; achieve passing mark for every courses examination. Dissertation will be examined by a panel of internal examiners appointed by the Department's Post-graduate Committee; their roles include evaluating candidates' viva-voce and written project dissertation.

Summary of marks, grades and their evaluation points

Marks	Grade	Evaluation Point	Level of Achievement
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	

For further information on academic regulations please refer to the graduate school website: http://www.sps.utm.my/

22. Facilities available List of laboratories:

Laboratories

- Inorganic Chemistry Laboratory 1 & 2
- Physical Chemistry Laboratory 1 & 2
- Organic Chemistry Laboratory 1 & 2
- Analytical Laboratory 1, 2, & 3
- Project Laboratories
- Macromolecule Laboratory
- Biotechnology Laboratory
- Students Computer Room
- Resource Centre

Major Equipments

- Nuclear Magnetic Resonance Spectrometer
- Gas Chromatography-Mass Spectrometer System
- Fourier Transform Infrared Spectrometers
- Gel Permeation Chromatograph
- UV-Visible Spectrometers
- High Performance Liquid Chromatograph
- Gas Chromatograph
- Liquid Chromatograph
- Atomic Absorption Spectrometer
- Ion Chromatograph
- Capillary Electrophoresis Unit
- BET Surface Analyser
- Diffrential Scanning Calorimeter
- Voltammetric Systems
- Fluorescence Spectrometer
- Surface Adsorption/Desorption System
- Total Organic Carbon Analyser
- Flame Photometer
- Electron Spin Resonance Spectrometer
- X-Ray Diffraction Spectrometer
- Inductively Coupled Plasma

23. Methods for Evaluating and Improving the Quality and Standards of Teaching and Learning

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards

1. Students' performance in terms of:

- KB/KS/KG –Pass/conditional pass/fail
- CPA – Cumulative point average
- Graduating students' performance
- GOT – Graduate on time
- Completion Rate
- Analysis of course performance

2. Employability

- Exit survey
- Alumni survey
- Market survey

3. Lecturer's performance

- Teaching evaluation by students (e-PPP)
- Annual staff appraisal (e-LPPT)
- Teaching Evaluation System (TES)

4. Curriculum review

- Faculty academic committee
- External examiner reports
- CO achievement survey by students

5. Delivery system

- Academic Quality Assurance Committee
- Malaysia Quality Assurance (MQA) standards

24. Regulation of Programme Assessment

Board of Study (external examiner, IAP and Alumni) are appointed by the Faculty Academic Committee to:

- review and evaluate program curriculum,
- review and evaluate methods of students assessment,
- make necessary recommendations to the Academic Committee.

25. Programme Assessment Tools

Measurement Tools	Programme Learning Outcomes (PLO)											Duration	Action by
	1	2	3	4	5	6	7	8	9	10	11		
Course Exit Survey (SCO)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Course assessment report (CAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Annual Programme Assessment report (APAR)	x	x	x	x	x	x	x	x	x	x	x	Per Year	Faculty
Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Final Semester	Faculty
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x	Once/ 3 year	Director

CURRICULUM STRUCTURE

INTAKE SEMESTER I 2021/2022

Semester I 2021/2022

Course Code	Course Name	Credit
MSCK 1713	Advanced Inorganic Chemistry	3
MSCK 1413	Advanced Physical Chemistry	3
UHMx 6XX3	University Compulsory Course	3
*MSCK 1303	Research Methodology	3
*MSCK 1xx3	Elective Course	3
	Total	**12**

**Choose one*

Semester II 2021/2022

Course Code	Course Name	Credit
MSCK 1613	Advanced Organic Chemistry	3
MSCK 1303	*Research Methodology	3
MSCK 1xx3	*Elective Course	3
MSCK 1xx3	*Elective Course	3
	Total	**9**

**Choose two*

Sem I 2022/2023

Course Code	Course Name	Credit
MSCK 2180	Dissertation	21
	Total	**21**

INTAKE SEMESTER II 2021/2022

Semester II 2021/2022

Course Code	Course Name	Credit
MSCK 1613	Advanced Organic Chemistry	3
UHMx 6XX3	University Compulsory Course	3
MSCK 1303	*Research Methodology	3
MSCK 1xx3	*Elective Course	3
MSCK 1xx3	*Elective Course	3
	Total	**12**

**Choose two*

Semester I 2022/2023

Course Code	Course Name	Credit
MSCK 1713	Advanced Inorganic Chemistry	3
MSCK 1413	Advanced Physical Chemistry	3
*MSCK 1303	Research Methodology	3
*MSCK 1xx3	Elective Course	3
	Total	**9**

**Choose one*

Semester II 2022/2023

Course Code	Course Name	Credit
MSCK 2180	Dissertation	21
	Total	**21**

LIST OF ELECTIVE COURSES

Course availability is subject to change

Course Code	Course Name	Credit
MSCK 1213	Advanced Analytical Chemistry	3
MSCK 1223	Advanced Electroanalytical Chemistry	3
MSCK 1243	Advanced Separation Methods	3
MSCK 1323	Advanced Biochemistry	3
MSCK 1333	Advanced Biotechnology	3
MSCK 1423	Quantum Chemistry and Spectroscopy	3
MSCK 1463	Advanced Solid-State Chemistry	3
MSCK 1473	Advanced Surface and Colloid Chemistry	3
MSCK 1653	Advanced Organic Spectroscopy	3
MSCK 1743	Bioinorganic Chemistry	3
MSCK 1753	Inorganic Reaction Mechanism	3

MASTER OF SCIENCE (FORENSIC SCIENCE)

PROGRAMME SPECIFICATION

1. Awarding Institution	UTM
2. Teaching Institution	UTM
3. Programme Name	Master of Science (Forensic Science)
4. Final Award	Master of Science (Forensic Science)
5. Programme Code	MSCS2
6. Professional or Statutory Body of Accreditation	Ministry of Higher Education Malaysia (Kementerian Pengajian Tinggi Malaysia)
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-govern
10. Study Scheme	Full Time
11. Study Duration	Minimum: 1½ years Maximum: 4 years
12. Entry Requirement	**General University Requirements:** Basic conditions of entry is referring to the Assessment Guidelines in 1998 Entry Pind. 1/2013. **Faculty Requirement:** Bachelor of Science (Pure Science, Applied Science, Forensic Science, Health Sciences or related courses) with a CGPA of at least 3.00 from any institution recognized by the Senate OR Bachelor of Science (Pure Science, Applied Science, Forensic Science, Science Health or related courses) or equivalent and recognized with CGPA 2.70 - 2.99 and working experience of at least ONE (1) year in a related field OR Bachelor of Science (Pure Science, Applied Science, Forensic Science, Science Health or related courses) or equivalent and recognized with CGPA 2.50 - 2.69 and working experience of at least TWO (2) years in relevant field **English Language Requirement** i) **Student with TOEFL score of 60 and above can enroll at faculty** ii) **Students with TOEFL score of 60 and below required to attend either:** • **Intensive English Programme (IEP) conducted by**

	Language Academy (LA), UTM *and pass IELTS with a minimum of 6.0 or pass CEFR – aligned test with the required score* Or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108 iii) **Student with IELTS band 6.0 and above can enroll at faculty** iv) **Student with IELTS band 5.5 and below are required to attend either:** • **Intensive English Programme (IEP) conducted by Language Academy (LA), UTM** and pass IELTS with a minimum of 6.0 or pass CEFR-aligned test with the required score Or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108

13. Programme Educational Objectives (PEO)

Graduates of the programme should be:

1. PEO 1 : Knowledgeable, competent, innovative and enterpreneurial in various fields of forensic science.
2. PEO 2 : Scholarly through research and solve problems critically, analytically, and creatively based on scientific facts and sound ideas.
3. PEO 3 : Professional, ethical, responsible and responsive to the values of humanity and sustainability in forensic practice.
4. PEO 4 : Effective in communication, contributive to working teams and competitive to local and global markets.

14. Programme Learning Outcomes (PLO)

At the end of this programme, students will be able to:

		Intended Learning Outcomes	Teaching and Learning Methods	Assessment
	PLO1	Ability to acquire, understand and apply advanced knowledge as well as understanding of forensic science principles and related research advances critically and integrative. (Knowledge and Understanding -KW)	Lectures, group discussion and problem-based learning.	Examinations, tests, and assignments
	PLO2	Ability to conduct standard and specialized forensic methods/ approaches and/or apply practical skills, tools or investigative techniques which are informed by forensic science knowledge at its forefront and the latest development in the discipline. (Cognitive Skills - CG)	Lectures, simulated crime case investigation, group discussion and problem-based learning.	Examinations, tests, and assignments, oral presentations and group crime scene investigation simulation.
	PLO3	Ability to design and implement or adapt highly advanced, specialized research methodologies which is at the forefront of one or more area of forensic science specialization. (Practical Skills - PS)	Lectures, simulated crime case investigation, group discussion, problem based learning and forensic skills	Examinations, tests, assignments, oral presentations, group assignments, computer simulation, group crime scene investigation simulation.
	PLO7	Ability to apply mathematical and statistical methods to analyze and evaluate numerical and graphical data for forensic study and/or casework. (Numeracy Skills -NS)	Demonstration, group discussion, problem-based learning.	Test, assignment.

	Intended Learning Outcomes		Teaching and Learning Methods	Assessment
GENERIC SKILLS	**PLO4**	Ability to convey information, insights, ideas and problems, as well as present solutions cogently/coherently to peers, scholarly community and society at large in the field of expertise, ethically and professionally. (Interpersonal Skills - IPS)	Lectures, group discussion and problem-based learning, assignment discussion.	Individual assignment, assignment report, and oral presentations.
	PLO5	Ability to communicate technical, scientific and forensic information as well as expert testimony effectively via oral and written presentations (Communication Skills-CS)	Lectures, group discussion and problem-based learning.	Oral presentations, written assignments.
	PLO6	Ability to competently use a wide range of suitable digital technologies and appropriate software to enhance study, research and/or work/practice. (Digital Skills-DS)	Demonstration, group discussion, problem-based learning.	Test, assignment.
	PLO8	Ability to demonstrate leadership, professionalism and management skills, and take full responsibility for own work, and significantly for others in the forensic research team/organization/projects/work. (Leadership, Autonomy and Responsibility - LAR)	Lectures, simulated crime case investigation, group discussion and problem-based learning.	Oral presentations, group assignments, group crime scene investigation simulation.
	PLO9	Ability to exemplify self-advancement through continuous academic and/or professional development those are relevant in forensic science. (Personal Skills -PRS)	Lectures, simulated crime case investigation, group discussion and problem-based learning.	Oral presentations, group assignments, group crime scene investigation simulation.
	PLO10	Ability to recommend on the commercialisation value of the forensic research (Entrepreneurial Skills-ENT)	Lecture, Group discussion	Assignment
	PLO11	Adhere to professional ethics in dealing with complex issues. (Ethics and Professional Skills - ETS)	Lecture, Group discussion	Assignment

15. Classification of Courses

No.	Classification	Credit Hours	Percentage	Standard (QA)
i.	University General Course	3	6.12	50%
ii.	Core Courses	15	30.61	
iii.	Elective Courses	4	8.16	
iv.	Research methodology course	3	6.12	
v.	Dissertation	24	48.97	50%
	Total	49	100	100%

16. Total credit hours to graduate: 49 credit hours

17. Programme structures and features, curriculum, and award requirements

The course is offered in full-time mode and based on a 3 Semester Academic Year with several subjects being delivered and assessed in each semester. Assessment: Based on final examination, coursework and dissertation.

Award requirements:

To graduate, students should:

- achieve a total of minimum 49 credit hours with minimum CPA of 3.00
- complete and pass viva M.Sc Dissertation.

Course Category	Code	Course	Credit
University general course (3 Credits)	UXXX 6XX3	(Choose 1 courses from the list given by School of Graduate Studies)	3
Core Courses (18 Credits)	MSCN 1803	Forensic Evidence and the Aspects of Law	3
	MSCN 1813	Forensic Analytical Instrumentation	3
	MSCN 1823	Forensic Chemistry	3
	MSCN 1923	Biological Aspects of Forensic Sciences	3

	MSCN 1853	Forensic Practical	3
Elective Courses (9 Credits)	(Choose 1 from the list)		
	MSCN 1913	Crime Scene Investigation	3
	MSCN 1963	Computer Forensics	3
	MSCN 1933	Examination of Questioned Documents	3
	MSCN 1973	Fire and explosion Investigation	3
	MSCN 1943	Quality Assurance in Forensic Science	3
	MSCN 1953	Forensic Engineering	3
	MSCN 1983	Firearms and Forensic Ballistics	3
	MSCN 1993	Forensic Toxicology and Drugs of Abuse	3
Research Methodology Courses (3 Credits- Compulsory)	MSCN 1033	Research Methodology	3
Elective Courses (1 Credit- Compulsory)	MSCN 1831	Expert Testimony and Moot Court	1
Research (24 Credits)	MSCN XX80 MSCN XX80	Forensic Research Proposal Dissertation	24
		TOTAL CREDIT	**49**

18. Mapping of Programme Learning Outcomes to Course												
	COURSES OFFERED	**Knowledge and Understanding**	**Cognitive Skills**	**Practical Skills**	**Numeracy Skills**	**Interpersonal Skills**	**Communication Skills**	**Digital Skills**	**Leadership, Autonomy and Responsibility**	**Personal Skills**	**Entrepreneurial Skills**	**Ethics and Professionalism Skills**
Code	**Courses**	**PLO1 KW**	**PLO2 CG**	**PLO3 PS**	**PLO7 NS**	**PLO4 IPS**	**PLO5 CS**	**PLO6 DS**	**PLO8 LAR**	**PLO9 PRS**	**PLO10 ENT**	**PLO11 ETS**
University General Courses (Choose 1 from the list*)												
UXXX 6XX3	University General Course	✔					✔		✔			
Core Courses												
MSCN 1803	Forensic Evidence and the Aspects of Law	✔	✔	✔			✔					✔
MSCN 1813	Forensic Analytical Instrumentation	✔	✔	✔	✔						✔	
MSCN 1823	Forensic Chemistry	✔	✔	✔				✔				
MSCN 1923	Biological Aspects of Forensic Sciences	✔	✔	✔		✔						
MSCN 1853	Forensic Practical	✔	✔	✔				✔	✔	✔		
Elective Courses (Choose 1)												
MSCN 1913	Crime Scene Investigation	✔	✔	✔								

MSCN 1963	Computer Forensics	✔	✔	✔				✔				
MSCN 1933	Examination of Questioned Documents	✔	✔	✔								
MSCN 1973	Fire and explosion Investigation	✔	✔	✔								
MSCN 1943	Quality Assurance in Forensic Science	✔	✔	✔								
MSCN 1953	Forensic Engineering	✔	✔	✔								
MSCN 1983	Firearms and Forensic Ballistics	✔	✔	✔								
MSCN 1993	Forensic Toxicology and Drugs of Abuse	✔	✔	✔								
Elective Courses (Compulsory)												
MSCN 1831	Expert Testimony and Moot Court	✔	✔	✔			✔					✔
Research Methodology Course (Compulsory)												
MSCM 1303	Research Methodology	✔	✔				✔	✔				
Research												
MSCN XX80	Forensic Research Proposal	✔	✔	✔			✔					✔
MSCN XX80	Dissertation	✔	✔	✔			✔					✔

Key:

1. Technical Skills: PLO1, 2, 3 and 7
2. Generic Skills : PLO 4, 5, 6, 8, 9, 10 and 11.

*** List of University General Courses**

1. UBSS 6013 : Organization Behaviour and Development
2. UBSS 6023: Business Ethics, Responsibility and Sustainability
3. UHMS 6013: Seminar on Global Development, Economic and Social Issues
4. UHMZ 6023: Malaysian Society and Culture
5. UHIS 6013: Philosophy of Science and Civilization
6. UHPS 6013: Dynamics of Leadership
7. UHLM 6013: Malay Language for Post Graduates
8. URTS 6013: Environmental Ethics
9. UECS 6013: IT Project Management
10. UECS 6023: Introduction to Technopreneurship
11. UMJJ 6013: Basic Japanese Language & Culture

19. Support for students and their learning Students and their learning are supported by:

- Briefing of all new post-graduate students during registration week.
- Postgraduate Handbook for every academic session.
- Information services provided by the Graduate School (SPS) and through the university's web site.
- Student Support provided by counselors and psychologists at 'Unit Perkhidmatan Sokongan Pelajar' (UPSP), UTM Medical Centre, accommodation officers and University Library and others.
- Student Advisors Programme: Selected academic staff provides advice on academic progress and monitoring students' performance and achievements.
- Special programmes on career development conducted by the university to ensure students acquire necessary skills during their academic and future career.
- Staff student ratio for teaching of 1:12.
- Extensive library and other learning resources and facilities

20. Career Prospects

Graduate of the programme can work as:

- Research officer – Research Institute, university and industries
- Science Officer -- Research Institute, university and industries
- Academician
- Mathematics practitioner
- Data analyst

OR

They can further their education by doing a PhD programme in the related field of study.

21. Regulation of Assessment

Assessment rules and degree classification applies for every course with the minimum passing mark of 60%. To qualify for the degree award, students should complete all of the programme's requirements; achieve passing mark for every courses examination. Dissertation will be examined by a panel of internal examiners appointed by the Department's Post-graduate Committee; their roles include evaluating candidates' viva-voce and written project dissertation.

Summary of marks, grades and their evaluation points

Marks	Grade	Evaluation 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

For further information on academic regulations please refer to the graduate school website: http://www.sps.utm.my/

22. Facilities available

List of laboratories:

1. Forensic Analytical Laboratory
2. Inorganic Chemistry Laboratory 1 & 2
3. Physical Chemistry Laboratory 1 & 2
4. Organic Chemistry Laboratory 1 & 2
5. Analytical Chemistry Laboratory 1, & 2
6. Project Laboratories
7. Macromolecule Laboratory
8. Biotechnology Laboratory
9. Students Computer Room
10. Resource Centre

List of Forensic & Capital Instruments

1. Stereomicroscopes
2. Comparison microscope
3. Crime lite
4. Nuclear Magnetic Resonance Spectrometer
5. Gas Chromatography-Mass Spectrometer System
6. Fourier Transform Infrared Spectrometers
7. Gel Permeation Chromatograph
8. UV-Visible Spectrophotometers
9. High Performance Liquid Chromatographs
10. Gas Chromatographs
11. Atomic Absorption Spectrometer
12. Ion Chromatograph
13. Capillary Electrophoresis Unit
14. BET Surface Analyser
15. Differential Scanning Calorimeter
16. Voltammetric Systems
17. Fluorescence Spectrophotometer
18. Surface Adsorption/Desorption System
19. Total Organic Carbon Analyzer
20. Flame Photometer
21. Electron Spin Resonance Spectrometer
22. X-Ray Diffraction Spectrometer
23. Inductively Coupled Plasma-Mass Spectrometer

List of computer laboratories:

1. Computer Lab
2. Smart Classroom
3. Resource Centre

23. Methods for Evaluating and Improving the Quality and Standards of Teaching and Learning

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards

1. Students' performance in terms of:

- KB/KS/KG –Pass/conditional pass/fail
- CPA – Cumulative point average
- Graduating students' performance
- GOT – Graduate on time
- Completion Rate
- Analysis of course performance

2. Employability

- Exit survey
- Alumni survey
- Market survey

3. Lecturer's performance

- Teaching evaluation by students (e-PPP)
- Competency check-list for staff (CS).
- Annual staff appraisal (e-LPPT)
- ++ TES

4. Curriculum review

- Faculty academic committee
- External examiner reports
- CLO achievement survey by students

5. Delivery system

- Academic Quality Assurance Committee
- Customer Satisfaction Index (CSI)
- Employer Satisfaction Index (ESI)
- Malaysia Quality Assurance (MQA) standards

24. Regulation of Programme Assessment
++BoS

Role of External Examiners (Visiting Examiners): Visiting Examiners are appointed by the Faculty Academic Committee to:

- review and evaluate program curriculum,
- review and evaluate methods of students assessment,
- make necessary recommendations to the Academic Committee.

25. Programme Assessment Tools

Measurement Tools	Programme Learning Outcomes (PLO)											Duration	Action by
	1	2	3	4	5	6	7	8	9	10	11		
Course Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Course Assessment Report (CAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Annual Programme Assessment	x	x	x	x	x	x	x	x	x	x	x	Per year	Faculty

Report (APAR)													
Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Final Semester	Faculty
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x	Once/ 3 year	Director

CURRICULUM STRUCTURE

INTAKE SEMESTER I 2021/2022

Semester I 2021/2022

Course Code	Course Name	Credit
MSCN 1823	Forensic Chemistry	3
MSCN 1803	Forensic Evidence and the Aspects of Law	3
MSCN 1813	Forensic Analytical Instrumentation	3
MSCN 1033	Research Methodology	3
	TOTAL	**12**

Semester II 2021/2022

Course Code	Course Name	Credit
MSCN 1853	Forensic Practical	3
MSCN 1923	Biological Aspects of Forensic Sciences	3
MSCN 19X3	Forensic Elective	3
UHAX 6XX3	University compulsory course	3
MSCN 1180	Forensic Research Proposal	6
	TOTAL	**18**

Semester I 2022/2023

Course Code	Course Name	Credit
MSCN 2180	Dissertation	18
MSCN 1831	Expert Testimony and Moot Court	1
	TOTAL	**19**

INTAKE SEMESTER II 2021/2022

Semester II 2021/2022

Course Code	Course Name	Credit
MSCN 1853	Forensic Practical	3
MSCN 1923	Biological Aspects of Forensic Sciences	3
MSCN 19X3	Forensic Elective	3
UHAX 6XX3	University compulsory course	3
MSCN 1033	Research Methodology	3
	TOTAL	**15**

Semester I 2022/2023

Course Code	Course Name	Credit
MSCN 1823	Forensic Chemistry	3
MSCN 1803	Forensic Evidence and the Aspects of Law	3
MSCN 1813	Forensic Analytical Instrumentation	3
MSCN 1180	Forensic Research Proposal	6
MSCN 1831	Expert Testimony and Moot Court	1
	TOTAL	**16**

Semester II 2022/2023

Course Code	Course Name	Credit
MSCN 2180	Dissertation	18
	TOTAL	**18**

LIST OF ELECTIVE COURSES

Course availability is subject to change

Course Code	Course Name	Credit
MSCN 1913	Crime Scene Investigation	3
MSCN 1963	Computer Forensics	3
MSCN 1933	Examination of Questioned Documents	3
MSCN 1973	Fire and explosion Investigation	3
MSCN 1943	Quality Assurance in Forensic Science	3
MSCN 1953	Forensic Engineering	3
MSCN 1983	Firearms and Forensic Ballistics	3
MSCN 1993	Forensic Toxicology and Drugs of Abuse	3

MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY
Field of Research: Chemistry
- By Research (Full time)

Department of Chemistry offers full time research programmes leading to M.Phil. and Ph.D. degree for students interested in pursuing research careers. To ensure the suitability of the research for the given academic level, students are required to present their research proposal to be evaluated by experts in the related area. This usually takes place in the second semester for M.Phil. student and third semester for Ph.D. student. Students are expected to disseminate the output of their research through writing of research articles and presentations in conferences. On completion of the research project, students are required to submit their dissertation/thesis for evaluation by external and internal examiners appointed by the Faculty of Science. The programmes are MQA accredited.

Programme	NEC Code	MQA Reference Number (Certificate Number)
M.Phil.	442 (Chemistry)	MQA/SWA0311 (20677)
Ph.D.	442 (Chemistry)	MQA/SWA0313 (12980)

Field of Research

The research project of the student may fall into one or more aspects of the following field:

- biotechnology
- catalysis
- chemometrics
- computational chemistry
- environmental chemistry
- forensic science
- nanostructured materials
- natural products
- organic synthesis
- organometallics
- polymer electrolytes
- separation science
- solid state chemistry
- zeolites

Courses and duration of study

The normal duration of study is 2–8 semesters (1–4 years) for M.Phil. and 6–16 semesters (3–8 years) for the Ph.D. programme.

Students must register a Research Course with the following code in each semester.

Year/ Semester (Total Semester)	M.Phil.	Ph.D.
1/1 (Sem. 1)	MSCK 1100	PSCK 1100
1/2 (Sem. 2)	MSCK 1200	PSCK 1200
2/1 (Sem. 3)	MSCK 2100	PSCK 2100
2/2 (Sem. 4)	MSCK 2200	PSCK 2200
3/1 (Sem. 5)	MSCK 3100	PSCK 3100
3/2 (Sem. 6)	MSCK 3200	PSCK 3200
4/1 (Sem. 7)	MSCK 4100	PSCK 4100
4/2 (Sem. 8)	MSCK 4200 **(maximum semester)**	PSCK 4200
5/1 Sem. (9)	-	PSCK 5100
5/2 (Sem. 10)	-	PSCK 5200
6/1 (Sem. 11)	-	PSCK 6100
6/2 (Sem. 12)	-	PSCK 6200
7/1 (Sem. 13)	-	PSCK 7100
7/2 (Sem. 14)	-	PSCK 7200
8/1 (Sem. 15)	-	PSCK 8100
8/2 Sem. (16)	-	PSCK 8200 **(maximum semester)**

All research students must enrol in Research Methodology (USCP 0010) and at least one of the University's General Courses (subjected to courses offered in each semester listed in SPS website). Examples of General Courses offered are:

No.	Course code	Faculty	Course name
1	UBSS 6013	AHIBS	Organization Behaviour and Development
2	UBSS 6023	AHIBS	Business Ethics, Responsibility and Sustainability
3	UHMS 6013	FSSH/SHARP	Seminar on Global Development, Economic and Social Issues
4	UHMZ 6023	FSSH/SHARP	Malaysian Society and Culture

5	UHIS 6013	FSSH/ATI	Philosophy of Science and Civilization
6	UHPS 6013	FSSH/SOE	Dynamics of Leadership
7	UHLM 6013	FSSH/LA	Malay Language for Post Graduates
8	URTS 6013	RFTI	Environmental Ethics
9	UECS 6013	FE/SC	IT Project Management
10	UECS 6023	FE	Introduction to Technopreneurship
11	UMJJ 6013	MJIIT	Basic Japanese Language & Culture

Credit transfer of Research Methodology and the University's General Courses

Students can apply for credit transfer if the course(s) taken in another M.Phil. programme(s) prior to the current study with at least 80% identical learning outcomes.

Deferment of study

- Students may apply for deferment of the programme registration for not more than **TWO SUBSEQUENT** semesters subject to University's approval.
- Students who do not register for any courses in a semester must apply for deferment. The deferred semester will be counted as a part of the total study period.
- Students who withdraw (TD) from **ALL** courses in a semester will automatically be given a deferment. The deferred semester will be counted as a part of the total study period.
- Students may apply for deferment of study due to health reasons. The application has to be accompanied with a medical report certified by a Medical Officer recognised by the University. The deferred semester may not be counted as a part of the total study period.

Conversion from M.Phil. to Ph.D. programme

M. Phil. students can apply for conversion to a Ph.D. programme in the second semester upon achieving the requirement listed in the table below.

Bachelor's Degree CGPA	**Requirements**
CGPA $\geq$ 3.33	Presented **TWO** conference articles in proceedings with ISBN. **OR** published **ONE** article in a SCOPUS/WOS/ERA indexed journal.
3.00 $\leq$ CGPA $\leq$ 3.32	Published **ONE** article in a WOS indexed journal.

Students will be requested to defend the research proposal to the evaluation panels. Passing the evaluation is necessary for successful conversion to Ph.D. programme.

Assessments and evaluation

(i) First Assessment

Students are required to present a research proposal (**with preliminary/expected results**) for evaluation purposes within the duration specified by the University, according to the following schedule:

Programme	Semester
M.Phil.	2nd semester
Ph.D.	3rd semester

If the students failed to present without any valid reasons, the student may be given a TM status by the Faculty.

(ii) Progress Report Assessment

All postgraduate research students are required to submit a progress report online (GSMS system) before the due date. The online system will usually be opened in week 10–13 of each semester, unless specified otherwise in the academic calendar.

The supervisor shall evaluate the progress report. A student whose progress is satisfactory (MM status) will be recommended for the continuation of his/her candidature.

A student may be given a TM or GG status if he/she does not submit his/her progress report.

The Faculty shall terminate the candidature of a student whose progress is not satisfactory (TM status) for **TWO** consecutive semesters.

(iii) Qualifying Assessment (Fast Track Ph.D.)

Fast track students in the Ph.D. programme must undergo a qualifying assessment after 6 to 18 months of registration in the Ph.D. programme. The result of the assessment can be one of the following:

a. **Pass** - The student will continue their Ph.D. programme and proceed with the First Assessment in the following semester.

b. **Fail** - The student will be transferred to the M.Phil. programme and a new study period begins.

(iv) Viva Voce (Oral Examination)

A student should submit Notice for Thesis Submission (NHT) approved by the supervisor at least three months prior to submission of the dissertation/thesis for examination, or three months before expiry of the maximum study duration. Dissertation/Thesis report must follow the guidelines prescribed in the UTM Thesis Manual 2018 and the report must be written in English. Students shall apply for a permission if the dissertation/thesis is to be written in other languages, i.e. Bahasa Malaysia. The Turnitin score for each chapter shall not be more than 20%. The publication criteria for the M.Phil. and Ph.D. programme is listed below.

Programme	Publication criteria
M. Phil.	Students may submit their dissertation after 12 months with at least one publication that has been accepted or published in either journal, conference, or book chapters for the purpose of the viva voce.
Ph.D.	**Submission of thesis for normal duration of study (within 6 - 16 semesters)** Students can submit their thesis for viva voce after having: • at least **ONE** accepted or published article in a WOS indexed journal, or • **TWO** accepted or published articles in Scopus/ERA/Malaysia Journal Management System indexed journals. **Early thesis submission (in the Semester 5)** Students can submit their thesis for viva voce after having: • accepted or published **TWO** articles in WOS/Scopus/ERA indexed journals. **Submission of thesis using publication format** Students can submit their thesis for viva voce using publication format if the following condition is fulfilled: • At 24 months after the student enrols; a minimum of **THREE** journal articles indexed in Scopus/WOS with at least **TWO** articles accepted or published in Q1/Q2 WOS indexed journals. • At least 30 months after the student enrols: a minimum **THREE** journal articles indexed in Scopus/WOS with at least **ONE** journal article accepted or published in Q1/Q2 WOS indexed journal.

Dissertation/Thesis examination for M.Phil. and Ph.D. programmes should be made according to the criteria set for the programme as approved by the Senate. For instance, oral defence cannot be held more than twice. The thesis examiner should consist of at least one internal and one external examiner, unless specified in *Peraturan Akademik Pengajian Siswazah* 2020. Please refer to the Faculty on the fee imposed for viva voce.

Change of supervisor

During the study period, students may apply for a change of supervisor if necessary. The application is made by filling in the specific form available at the Faculty's Postgraduate Office. The application needs to be supported and approved by the Faculty's Academic Committee. However, students have to take note that the application for a change in supervisor can only be made with the following restrictions (except for special cases):

- Change of supervisor can only be made **ONCE** throughout the study period.
- Application can only be made **BEFORE** the First Assessment.

Abbreviations

ATI	: Academy of Islamic Civilisation
AHIBS	: Azman Hashim International Business School
ERA	: Excellence in Research Australia
FE	: Faculty of Engineering
FSSH	: Faculty of Social Sciences and Humanities
GG	: *Gagal* (Fail)
GSMS	: Graduate Studies Management System
LA	: Language Academy
MJIIT	: Malaysia-Japan International Institute of Technology
MM	: *Memuaskan* (Satisfactory)
M.Phil.	: Master of Philosophy
MQA	: Malaysian Qualifications Agency
NEC	: National Education Code
NHT	: Notis Hantar Thesis (Notice for Thesis Submission)
Ph.D.	: Doctor of Philosophy
RFTI	: Razak Faculty of Technology and Informatics
SC	: School of Computing
SHARP	: School of Human Resource Development & Psychology
SOE	: School of Education
TD	: *Tarik Diri* (Withdraw)
TM	: *Tidak Memuaskan* (Unsatisfactory)
WOS	: Web of Science

MASTER OF FORENSIC SCIENCE

PROGRAMME SPECIFICATION

1. Awarding Institution	UTM
2. Teaching Institution	UTM
3. Programme Name	Master of Forensic Science
4. Final Award	Master of Forensic Science
5. Programme Code	MSCQ2
6. Professional or Statutory Body of Accreditation	Ministry of Higher Education Malaysia (Kementerian Pengajian Tinggi Malaysia)
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-govern
10. Study Scheme	Full Time
11. Study Duration	Minimum: 1½ years Maximum: 4 years
12. Entry Requirement	**General University Requirements:** Basic conditions of entry is referring to the Assessment Guidelines in 1998 Entry Pind. 1/2013. **Faculty Requirement:** Bachelor of Science (Chemistry, Industrial Chemistry, Forensic Science, Applied Science, Health Science or related courses) with CPA ≥ 3.0 from any institution of higher learning recognized by the Senate OR Bachelor of Science (Chemistry, Industrial Chemistry, Forensic Science, Applied Science, Health Science or related courses) or equivalent and recognized with CPA ≥ 2.7 and work experience for at least ONE year in related field OR Bachelor of Science (Chemistry, Industrial Chemistry, Forensic Science, Applied Science, Health Science or related courses) or equivalent and recognized with CPA ≥ 2.5 and work experience for at least TWO years in related field. **English Language Requirement** i) **Student with TOEFL score of 60 and above can enroll at faculty** ii) **Students with TOEFL score of 60 and below required to attend either:** • **Intensive English Programme (IEP) conducted by Language**

	Academy (LA), UTM *and pass IELTS with a minimum of 6.0 or pass CEFR – aligned test with the required score* Or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108 iii) **Student with IELTS band 6.0 and above can enroll at faculty** iv) **Student with IELTS band 5.5 and below are required to attend either:** • **Intensive English Programme (IEP) conducted by Language Academy (LA), UTM** and pass IELTS with a minimum of 6.0 or pass CEFR-aligned test with the required score or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108

13. Programme Educational Objectives (PEO)

Graduates of the programme should be :

1. PEO 1 : Skilled, competent, ethical, creative and innovative for meeting the requirement of national development and advancement.
2. PEO 2 : Capable to continuously enhance forensic science knowledge and research skills for providing better services and products.
3. PEO 3 : Capable of developing new forensic technologies as well as facilitating technology transfer.
4. PEO 4 : Capable to collaborate with relevant governmental agencies and private entities for enhancing forensic practice and/or reseach activities.

14. Programme Learning Outcomes (PLO)

At the end of this programme, students will be able to:

Intended Learning Outcomes			Teaching and Learning Methods	Assessment
	PLO1	Ability to acquire and apply advanced knowledge as well as understanding of forensic principles and related research advances. (Advanced Knowledge)	Lectures, group laboratory works, group discussion and problem-based learning.	Examinations, tests, project reports and assignments
	PLO2	Ability to demonstrate thorough knowledge, understanding and research skills in applying scientific methodology for undertaking and reporting laboratory analyses and field investigation. (Research Skills)	Lectures, group laboratory practical, simulated crime case investigation, group discussion and problem based learning. Hands-on instrumentations, forensic skills and research project.	Examinations, tests, assignments, and project reports, Oral presentations and group crime scene investigation simulation.
	PLO3	Ability to think critically in formulating and solving problems related to crime scene and forensic science, as well as competent in initiating, developing, and pursuing a scientific research. (Critical Thinking and Problem Solving)	Lectures, simulated crime case investigation, group discussion, problem based learning and expert witness testimony Hands-on instrumentations, forensic skills and research project. Research proposal, experimental works, project presentation and report.	Examinations, tests, assignments, project reports, Moot court. Oral presentations, group projects, computer simulation. Proposal, presentation and project report

	Intended Learning Outcomes		Teaching and Learning Methods	Assessment
GENERIC SKILLS	**PLO4**	Ability to act ethically and professionally with sensible humane values while undertaking their profession and societal obligations. (Ethics, Values and Professionalisms)	Research project, expert witness testimony.	Individual assignment, research project report, oral presentation and moot court.
	PLO5	Ability to communicate technical, scientific and forensic information as well as expert testimony effectively via oral and written presentations (Communication Skills-CS)	Group laboratory works, individual research, expert testimony in moot court session, simulated crime scene investigation.	Oral presentations (seminar and moot court), written assignments, and research project report.
	PLO6	Ability to independently and continuously seek relevant forensic knowledge and skills from various appropriate sources (Life-long Learning)	Research projects and problem-based learning.	Assignment and research project report.
	PLO8	Ability to demonstrate good interpersonal skills with ability to work collaboratively within a team in achieving a common goal. (Team Working)	Group laboratory works, simulated crime scene investigation, expert testimony.	Group reports (laboratory works, crime scene investigation and moot court) and presentations.

15. Classification of Courses

No.	Classification	Credit Hours	Percentage	Standard QA
i.	University General Course	3	6.7 %	
ii.	Research methodology course	3	6.7 %	
iii.	Core Courses	18	40 %	
iv.	Elective Courses	9	20 %	
v.	Research Project	12	26.7 %	
	Total	45	100 %	

16. Total credit hours to graduate: 45 credit hours

17. Programme structures and features, curriculum, and award requirements

The course is offered in full-time mode and based on a 3 Semester Academic Year with several subjects being delivered and assessed in each semester. Assessment: Based on final examination, coursework and dissertation.

Award requirements:

To graduate, students should:

- achieve a total of minimum 45 credit hours with minimum CPA of 3.00
- complete and pass presentation M.Sc Research Project.

Course Category	Code	Course	Credit
University general course (3 Credits)	UXXX 6XX3	(Choose 1 courses from the list given by School of Graduate Studies)	3
Core Courses (18 Credits)	MSCQ 1803	Forensic Evidence and the Aspects of Law	3
	MSCQ 1823	Forensic Chemistry	3
	MSCQ 1923	Biological Aspects of Forensic Sciences	3
	MSCQ 1853	Forensic Practical	3
	MSCQ 1913	Crime Scene Investigation	3
	MSCQ 1833	Expert Testimony and Moot Court	3
Elective Courses (9 Credits)	(Choose 1 from the list)		
	MSCQ 1813	Forensic Analytical Instrumentation	3
	MSCQ 1963	Computer Forensics	3
	MSCQ 1933	Examination of Questioned Documents	3
	MSCQ 1973	Fire and explosion Investigation	3
	MSCQ 1943	Quality Assurance in Forensic Science	3
	MSCQ 1953	Forensic Engineering	3
	MSCQ 1983	Firearms and Forensic Ballistics	3
	MSCQ 1993	Forensic Toxicology and Drugs of Abuse	3
Research Methodology Courses (3 Credits- Compulsory)	MSCQ 1033	Research Methodology	3
Research Project (24 Credits)	MSCQ 1180	Research Project 1	12
	MSCQ 2180	Research Project 2	
		TOTAL CREDIT	**45**

18. Mapping of Programme Learning Outcomes to Course

Code	COURSES OFFERED	Advanced Knowledge	Research Skills	Critical Thinking & Problem Solving	Ethics, Values, Professionalism	Communication Skills	Lifelong Learning	Social Skills	Team Working	Leadership	Information Management	Managerial & Entrepreneurial
Code	**Courses**	**PLO1 AKW**	**PLO2 RS**	**PLO3 CTPS**	**PLO4 EM**	**PLO5 CS**	**PLO6 LL**	**PLO7 SS**	**PLO8 TS**	**PLO9 LS**	**PLO10 IM**	**PLO 11 ME**
University General Courses (Choose 1 from the list*)												
UXXX 6XX3	University General Course											
Core Courses												
MSCQ 1803	Forensic Evidence and the Aspects of Law	✔		✔		✔	✔					
MSCQ 1913	Crime Scene Investigation											
MSCQ 1833	Expert Testimony and Moot Court	✔		✔	✔	✔			✔			
MSCQ 1823	Forensic Chemistry	✔	✔	✔		✔	✔					
MSCQ 1923	Biological Aspects of Forensic Sciences	✔	✔	✔		✔	✔					
MSCQ 1853	Forensic Practical	✔	✔	✔		✔			✔			
Elective Courses (Choose 1)												
MSCQ 1813	Forensic Analytical Instrumentation	✔	✔	✔		✔	✔					
MSCQ 1963	Computer Forensics	✔	✔	✔		✔	✔					
MSCQ 1933	Examination of Questioned Documents	✔	✔	✔		✔	✔					
MSCQ 1973	Fire and explosion Investigation	✔	✔	✔		✔	✔					
MSCQ 1943	Quality Assurance in Forensic	✔	✔	✔		✔	✔					

	Science											
MSCQ 1953	Forensic Engineering	✔	✔	✔		✔	✔					
MSCQ 1983	Firearms and Forensic Ballistics	✔	✔	✔		✔	✔					
MSCQ 1993	Forensic Toxicology and Drugs of Abuse	✔	✔	✔		✔	✔					
Research Methodology Course												
MSCM 1303	Research Methodology	✔	✔	✔	✔		✔					
Research												
MSCQ 1180	Forensic Research Project 1	✔		✔	✔	✔	✔					
MSCQ 2180	Forensic Research Project 2	✔		✔	✔	✔	✔					

Key:

1. Technical Skills: PLO 1, 2, 3
2. Generic Skills : PLO 4, 5, 6, 7, 8, 9, 10 and 11.

*** List of University General Courses**

1. UBSS 6013 : Organization Behaviour and Development
2. UBSS 6023: Business Ethics, Responsibility and Sustainability
3. UHMS 6013: Seminar on Global Development, Economic and Social Issues
4. UHMZ 6023: Malaysian Society and Culture
5. UHIS 6013: Philosophy of Science and Civilization
6. UHPS 6013: Dynamics of Leadership
7. UHLM 6013: Malay Language for Post Graduates
8. URTS 6013: Environmental Ethics
9. UECS 6013: IT Project Management
10. UECS 6023: Introduction to Technopreneurship
11. UMJJ 6013: Basic Japanese Language & Culture

19. Support for students and their learning

Students and their learning are supported by:

- Briefing of all new post-graduate students during registration week.
- Postgraduate Handbook for every academic session.
- Information services provided by the Graduate School (SPS) and through the university's web site.
- Student Support provided by counselors and psychologists at 'Unit Perkhidmatan Sokongan Pelajar' (UPSP), UTM Medical Centre, accommodation officers and University Library and others.
- Student Advisors Programme: Selected academic staff provides advice on academic progress and monitoring students' performance and achievements.
- Special programmes on career development conducted by the university to ensure students acquire necessary skills during their academic and future career.
- Staff student ratio for teaching of 1:12.
- Extensive library and other learning resources and facilities

20. Career Prospects

Graduate of the programme can work as:

- Research officer – Research Institute, university and industries
- Science Officer -- Research Institute, university and industries
- Academician
- Mathematics practitioner
- Data analyst

OR

They can further their education by doing a PhD programme in the related field of study.

21. Regulation of Assessment

Assessment rules and degree classification applies for every course with the minimum passing mark of 60%. To qualify for the degree award, students should complete all of the programme's requirements; achieve passing mark for every courses examination. Dissertation will be examined by a panel of internal examiners appointed by the Department's Post-graduate Committee; their roles include evaluating candidates' viva-voce and written project dissertation.

Summary of marks, grades and their evaluation points

Marks	Grade	Evaluation 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

For further information on academic regulations please refer to the graduate school website: http://www.sps.utm.my/

22. Facilities available

List of laboratories:

1. Forensic Analytical Laboratory
2. Inorganic Chemistry Laboratory 1 & 2
3. Physical Chemistry Laboratory 1 & 2
4. Organic Chemistry Laboratory 1 & 2
5. Analytical Chemistry Laboratory 1, & 2
6. Project Laboratories
7. Macromolecule Laboratory
8. Biotechnology Laboratory
9. Students Computer Room
10. Resource Centre

List of Forensic & Capital Instruments

1. Stereomicroscopes
2. Comparison microscope
3. Crime lite
4. Nuclear Magnetic Resonance Spectrometer
5. Gas Chromatography-Mass Spectrometer System
6. Fourier Transform Infrared Spectrometers
7. Gel Permeation Chromatograph
8. UV-Visible Spectrophotometers
9. High Performance Liquid Chromatographs

10. Gas Chromatographs
11. Atomic Absorption Spectrometer
12. Ion Chromatograph
13. Capillary Electrophoresis Unit
14. BET Surface Analyser
15. Differential Scanning Calorimeter
16. Voltammetric Systems
17. Fluorescence Spectrophotometer
18. Surface Adsorption/Desorption System
19. Total Organic Carbon Analyzer
20. Flame Photometer
21. Electron Spin Resonance Spectrometer
22. X-Ray Diffraction Spectrometer
23. Inductively Coupled Plasma-Mass Spectrometer

List of computer laboratories:

1. Computer Lab
2. Smart Classroom
3. Resource Centre

23. Methods for Evaluating and Improving the Quality and Standards of Teaching and Learning

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards

1. Students' performance in terms of:

- KB/KS/KG –Pass/conditional pass/fail
- CPA – Cumulative point average
- Graduating students' performance
- GOT – Graduate on time
- Completion Rate
- Analysis of course performance

2. Employability

- Exit survey
- Alumni survey
- Market survey

3. Lecturer's performance

- Teaching evaluation by students (e-PPP)
- Competency check-list for staff (CS).
- Annual staff appraisal (e-LPPT)
- ++ TES

4. Curriculum review

- Faculty academic committee
- External examiner reports
- CLO achievement survey by students

5. Delivery system

- Academic Quality Assurance Committee
- Customer Satisfaction Index (CSI)
- Employer Satisfaction Index (ESI)
- Malaysia Quality Assurance (MQA) standards

24. Regulation of Programme Assessment

++BoS

Role of External Examiners (Visiting Examiners): Visiting Examiners are appointed by the Faculty Academic Committee to:

- review and evaluate program curriculum,
- review and evaluate methods of students assessment,
- make necessary recommendations to the Academic Committee.

25. Programme Assessment Tools

Measurement Tools	**Programme Learning Outcomes (PLO)**											**Duration**	**Action by**
	1	2	3	4	5	6	7	8	9	10	11		
Course Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Course Assessment Report (CAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Annual Programme Assessment Report (APAR)	x	x	x	x	x	x	x	x	x	x	x	Per year	Faculty
Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Final Semester	Faculty
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x	Once/ 3 year	Director

CURRICULUM STRUCTURE

SEMESTER 1

COURSE CODE	COURSE	CREDIT
MSCQ 1823	Forensic Chemistry *Kimia Forensik*	3
MSCQ 1803	Forensic Evidence and the Aspects of Law *Bukti Forensik dan Aspek Perundangan*	3
MSCQ 1XX3	Elective 1 *Elective 1*	3
MSCQ 1033	Research Methodology *Kaedah Penyelidikan*	3
UHAX 6XX3	University Compulsory Course *Kursus Wajib Universiti*	3
	Total	**15**

XX – year and semester of study

SEMESTER 2

COURSE CODE	COURSE	CREDIT
MSCQ 1853	Forensic Practical *Amali Forensik*	3
MSCQ 1923	Biological Aspects of Forensic Sciences *Aspek Biologi Sains Forensik*	3
MSCQ 1913	Siasatan Tempat Jenayah *Crime Scene Investigation*	3
MSCQ 1180	Forensic Research Project 1 *Projek Penyelidikan Forensik 1*	6
	Total	**15**

SEMESTER 3

COURSE CODE	COURSE	CREDIT
MSCQ 2180	Forensic Research Project 2 *Project Penyelidikan Forensik 2*	6
MSCQ 1833	Expert Testimony and Moot Court *Keterangan Pakar dalam Mahkamah*	3
MSCQ 1XX3	Elective 2 *Elective 2*	3
MSCQ 1XX3	Elective 3 *Elective 3*	3
	Total	**15**

XX – year and semester of study

TOTAL CREDITS	**45**

LIST OF ELECTIVE COURSES

COURSE CODE	COURSE	CREDITS
MSCN 1813	Forensic Analytical Instrumentation *Analitikal Forensik Berinstrumen*	3
MSCQ 1933	Examination of Questioned Documents *Pemeriksaan Dokumen yang dipertikaikan*	3
MSCQ 1943	Quality Assurance in Forensic Science *Jaminan Kualiti dalam Sains Forensik*	3
MSCQ 1953	Forensic Engineering *Kejuruteraan Forensik*	3
MSCQ 1963	Computer Forensics *Komputer Forensik*	3
MSCQ 1973	Fire and Explosion Investigation *Siasatan Kebakaran dan Letupan*	3
MSCQ 1983	Firearms and Forensic Ballistics *Senjata dan Balistik Forensik*	3
MSCQ 1993	Forensic Toxicology and Drugs of Abuse Toksikologi Forensik dan Dadah yang Disalahgunakan	3

Elective course availability is subject to change

MATHEMATICAL SCIENCES PROGRAMMES

MASTER OF SCIENCE SPECIALIZATION: MATHEMATICS

PROGRAMME SPECIFICATION

1. Awarding Institution	UTM
2. Teaching Institution	UTM
3. Programme Name	Master of Science Specialization : Mathematics
4. Final Award	Master of Science Specialization : Mathematics
5. Programme Code	MSCM2
6. Professional or Statutory Body of Accreditation	Ministry of Higher Education Malaysia (Kementerian Pengajian Tinggi Malaysia)
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-govern
10. Study Scheme	Full Time
11. Study Duration	Minimum: 1½ years Maximum: 4 years
12. Entry Requirement	1. A Bachelor's Degree with good honours from Universiti Teknologi Malaysia or any other institution of higher learning recognised by the Senate; or 2. A qualification equivalent to a Bachelor's Degree and experience in the relevant field recognised by the Senate.

13. Programme Educational Objectives (PEO)

Graduates of the programme should be :

1. PEO 1 : capable of disseminating advanced mathematical knowledge
2. PEO 2 : capable and passionate in pursuing further knowledge in mathematical sciences or related areas
3. PEO 3 : capable of using information technology with confidence
4. PEO 4 : competent player in achieving the nation's aspirations in mathematical sciences

14. Programme Learning Outcomes (PLO)

At the end of this programme, students will be able to:

	Intended Learning Outcomes		Teaching and Learning Methods	Assessment
	PLO1	synthesize complex information, concepts, theories and methods in the field of mathematical sciences. (Knowledge and Understanding -KW)	Guided lectures, computer laboratory works, directed reading, group discussion, problem solving and intellectual discourse.	Examinations, tests, quizzes, project reports and assignments.
	PLO2	construct solutions for various problems related to the discipline of mathematical sciences. (Cognitive Skills - CG)	Lectures, mini research, computer laboratory works, article critique and group discussions. Hands-on mathematical software and simulation	Oral examination(viva), Test, assignments, project reports and dissertation.
	PLO3	conduct research methodologies using advanced mathematical tools. (Practical Skills - PS)	Guided lectures, case studies, paper critique, group discussions and problem solving. Hands- on mathematical software and simulation.	Tests, assignments, research proposal, academic writing, project reports and oral presentations.
	PLO7	evaluate numerical and graphical data using advanced mathematical softwares. (Numeracy Skills -NS)	Case studies, computer-based learning and directed reading	Assignments, programming and simulation reports

Intended Learning Outcomes			Teaching and Learning Methods	Assessment
GENERIC SKILLS	**PLO4**	cooperate effectively in managing relationships within organization. (Interpersonal Skills - IPS)	Case studies, projects and group discussions	Project reports, group presentation, reflection journal and peer assessment
	PLO5	communicate cogently to convey information and ideas to various range of community. (Communication Skills-CS)	Group discussion and active learning,	Project reports, assignments and group presentation
	PLO6	competently utilize a wide range of digital technologies to enhance study and work. (Digital Skills-DS)	Case studies, computer-based learning and directed reading	Assignments, programming and simulation reports
	PLO8	manage project with full responsibility based on maturity and leadership skills. (Leadership, Autonomy and Responsibility -LAR)	Lecture, Active Learning, Group projects and presentations	Project reports, assignments, and group presentation
	PLO9	integrate new information with relevant resources through lifelong learning for professional development. (Personal Skills -PRS)	Lectures, group works, case studies	Project reports, group presentations
	PLO10	propose commercialization of mathematical based projects through entrepreneurial perspective. (Entrepreneurial Skills-ENT)	Lecture, Group discussion	Project reports, assignments and group presentation
	PLO11	adhere to professional ethics in dealing with complex issues. (Ethics and Professional Skills - ETS)	Brainstorming, discussion and case studies.	Assignments and research project reports.

15. Classification of Courses

No.	Classification	Credit Hours	Percentage	Standard (QA)
i.	University General Course	3	7	50%
ii.	Core Courses	9	21.5	
iii.	Elective Courses	9	21.5	
iv.	Dissertation	21	50	50%
	Total	42	100	100%

16. Total credit hours to graduate: 42 credit hours

17. Programme structures and features, curriculum, and award requirements

The course is offered in full-time mode and based on a 3 Semester Academic Year with several subjects being delivered and assessed in each semester. Assessment: Based on final examination, coursework and dissertation.

Award requirements:

To graduate, students should:

- achieve a total of minimum 42 credit hours with minimum CPA of 3.00
- complete and pass viva M.Sc Dissertation.

Course Category	Code	Course	Credit
University general course (3 Credits)	UXXX 6XX3	(Choose 1 courses from the list given by School of Graduate Studies)	3
Core Courses (9 Credits)	MSCM 1033	Research Methodology	3
	MSCM 1043	Mathematical Methods 1	3
	MSCM 1053	Computational Mathematics	3
Elective Courses (9 Credits)	(Choose 3 from the list)		
	MSCM 1113	Advanced Engineering Mathematics	3
	MSCM 1123	Theoretical Mechanics	3
	MSCM 1133	Soliton & Nonlinear Waves	3
	MSCM 1143	Fluid Mechanics and Heat Transfer	3
	MSCM 1153	Applied and Computational Complex Analysis	3
	MSCM 1163	Mathematical Methods 2	3
	MSCM 1173	Partial Differential Equations	3
	MSCM 1213	Group Theory I	3
	MSCM 1223	Galois Theory	3
	MSCM 1233	Mathematical Analysis	3
	MSCM 1253	Theory of Matrices	3
	MSCM 1263	Point Set Topology	3
	MSCM 1273	Group Theory II	3
	MSCM 1313	Numerical Ordinary Differential Equations	3
	MSCM 1323	Finite Difference Methods for Partial Differential Equations	3
	MSCM 1333	Finite Element Methods	3
	MSCM 1353	Parallel Computing	3
	MSCM 1363	Numerical Integral Equation	3
	MSCM 1393	Numerical Linear Algebra	3
	MSCM 1413	Mathematical Statistics	3
	MSCM 1423	Probability Theory	3
	MSCM 1433	Stochastic Processes	3
	MSCM 1453	Generalized Linear Models	3
	MSCM 1463	Time Series	3
	MSCM 1473	Multivariate Analysis	3

	MSCM 1613 MSCM 1623 MSCM 1633 MSCM 1643 MSCM 1663	Advanced Optimization Techniques Mathematics of Operations Research Game Theory Heuristic Optimization Methods Supply Chain Modelling	3 3 3 3 3
Research (21 Credits)	MSCM XX80	Dissertation	21
		TOTAL CREDIT	**42**

18. Mapping of Programme Learning Outcomes to Course

Code	Courses	Knowledge and Understanding	Cognitive Skills	Practical Skills	Numeracy Skills	Interpersonal Skills	Communication Skills	Digital Skills	Leadership, Autonomy and Responsibility	Personal Skills	Entrepreneurial Skills	Ethics and Professionalism Skills
		PLO1 KW	PLO2 CG	PLO3 PS	PLO7 NS	PLO4 IPS	PLO5 CS	PLO6 DS	PLO8 LAR	PLO9 PRS	PLO10 ENT	PLO11 ETS
University General Courses (Choose 1 from the list*)												
UXXX 6XX3	University General Course						✔					
Core Courses												
MSCM 1033	Research Methodology	✔	✔			✔			✔		✔	✔
MSCM 1043	Mathematical Methods 1	✔	✔							✔		
MSCM 1053	Computational Mathematics	✔	✔	✔			✔					
MSCM 2180	Dissertation		✔	✔								
Elective Courses (Choose 2)												
MSCM 1113	Advanced Engineering	✔	✔							✔		✔

	Mathematics											
MSCM 1123	Theoretical Mechanics	✔	✔				✔					
MSCM 1133	Soliton & Nonlinear Waves	✔	✔							✔		
MSCM 1143	Fluid Mechanics and Heat Transfer	✔	✔							✔		
MSCM 1153	Applied and Computational Complex Analysis	✔	✔				✔					
MSCM 1163	Mathematical Methods 2	✔	✔							✔		
MSCM 1173	Partial Differential Equations	✔	✔							✔		
MSCM 1213	Group Theory I	✔	✔				✔					
MSCM 1223	Galois Theory	✔	✔							✔		
MSCM 1233	Mathematical Analysis	✔	✔				✔					
MSCM 1253	Theory of Matrices	✔	✔				✔					
MSCM 1263	Point Set Topology	✔	✔							✔		
MSCM 1273	Group Theory II	✔	✔							✔		
MSCM 1313	Numerical Ordinary Differential Equations	✔	✔							✔		
MSCM 1323	Finite Difference Methods for Partial Differential Equations	✔	✔							✔		
MSCM 1333	Finite Element Methods	✔	✔					✔		✔		
MSCM 1353	Parallel Computing	✔	✔				✔	✔				
MSCM 1363	Numerical Integral Equation	✔	✔							✔		
MSCM 1393	Numerical Linear Algebra	✔	✔							✔		
MSCM 1413	Mathematical Statistics	✔	✔		✔		✔					

MSCM 1423	Probability Theory	✔	✔							✔		
MSCM 1433	Stochastic Processes	✔	✔							✔		
MSCM 1453	Generalized Linear Models	✔	✔		✔		✔					
MSCM 1463	Time Series	✔	✔							✔		
MSCM 1473	Multivariate Analysis	✔	✔				✔					
MSCM 1613	Advanced Optimization Techniques	✔	✔			✔						
MSCM 1623	Mathematics of Operations Research	✔	✔						✔	✔		
MSCM 1633	Game Theory	✔	✔				✔					
MSCM 1643	Heuristic Optimization Methods	✔	✔							✔		✔
MSCM 1663	Supply Chain Modelling	✔	✔							✔		
Research												
MSCM XX80	Dissertation		✔	✔			✔			✔		✔

Key:

1. Technical Skills: PLO1, 2, 3 and 7
2. Generic Skills : PLO 4, 5, 6, 8, 9, 10 and 11.

*** List of University General Courses**

1. UBSS 6013 : Organization Behaviour and Development
2. UBSS 6023: Business Ethics, Responsibility and Sustainability
3. UHMS 6013: Seminar on Global Development, Economic and Social Issues
4. UHMZ 6023: Malaysian Society and Culture
5. UHIS 6013: Philosophy of Science and Civilization
6. UHPS 6013: Dynamics of Leadership
7. UHLM 6013: Malay Language for Post Graduates
8. URTS 6013: Environmental Ethics

9. UECS 6013: IT Project Management
10. UECS 6023: Introduction to Technopreneurship
11. UMJJ 6013: Basic Japanese Language & Culture

19. Support for students and their learning Students and their learning are supported by:

- Briefing of all new post-graduate students during registration week.
- Postgraduate Handbook for every academic session.
- Information services provided by the Graduate School (SPS) and through the university's web site.
- Student Support provided by counselors and psychologists at 'Unit Perkhidmatan Sokongan Pelajar' (UPSP), UTM Medical Centre, accommodation officers and University Library and others.
- Student Advisors Programme: Selected academic staff provides advice on academic progress and monitoring students' performance and achievements.
- Special programmes on career development conducted by the university to ensure students acquire necessary skills during their academic and future career.
- Staff student ratio for teaching of 1:12.
- Extensive library and other learning resources and facilities

20. Career Prospects

Graduate of the programme can work as:

- Research officer - Research Institute, university and industries
- Science Officer - Research Institute, university and industries
- Academician
- Mathematics practitioner
- Data analyst

OR

They can further their education by doing a PhD programme in the related field of study.

21. Regulation of Assessment

Assessment rules and degree classification applies for every course with the minimum passing mark of 60%. To qualify for the degree award, students should complete all of the programme's requirements; achieve passing mark for every courses examination. Dissertation will be examined by a panel of internal examiners appointed by the Department's Post-graduate Committee; their roles include evaluating candidates' viva-voce and written project dissertation.

Summary of marks, grades and their evaluation points

Marks	Grade	Evaluation 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

For further information on academic regulations please refer to the graduate school website: http://www.sps.utm.my/

22. Facilities available

List of computer laboratories:

1. Computer Lab
2. Smart Classroom
3. Resource Centre

23. Methods for Evaluating and Improving the Quality and Standards of Teaching and Learning

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards

1. Students' performance in terms of: • KB/KS/KG –Pass/conditional pass/fail	**4.** Curriculum review • Faculty academic committee

- CPA – Cumulative point average
- Graduating students' performance
- GOT – Graduate on time
- Completion Rate
- Analysis of course performance

2.Employability
- Exit survey
- Alumni survey
- Market survey

3. Lecturer's performance
- Teaching evaluation by students (e-PPP)
- Annual staff appraisal (e-LPPT)
- Teaching Evaluation System (TES)
- External examiner reports
- CLO achievement survey by students

5. Delivery system
- Academic Quality Assurance Committee
- Customer Satisfaction Index (CSI)
- Employer Satisfaction Index (ESI)
- Malaysia Quality Assurance (MQA) standards

24. Regulation of Programme Assessment

Board of Study (BoS) Faculty of Science:
- External Examiners
- IAP
- Alumni

BoS panels are appointed by the Faculty Academic Committee to:
- review and evaluate program curriculum,
- review and evaluate methods of students assessment,
- make necessary recommendations to the Academic Committee.

25. Programme Assessment Tools

Measurement Tools	**Programme Learning Outcomes (PLO)**											**Duration**	**Action by**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**		
Course Exit Survey (SCO)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Course assessment report (CAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Annual Programme Assessment report (APAR)	x	x	x	x	x	x	x	x	x	x	x	Per Year	Faculty
Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Final Semester	Faculty
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x	Once/ 3 year	Director

CURRICULUM STRUCTURE

INTAKE SEM 1 2021/2022 (OCTOBER 2021)

Semester 1

Course Code	Course Name	Credit
MSCM1043	Mathematical Methods 1	3
U*** 6***	University Compulsory Subject	3
Electives (Choose 6 credits)		
MSCM 1143	Fluid Mechanics and Heat Transfer	3
MSCM 1263	Point Set Topology	3
MSCM 1323	Finite Difference Methods	3
MSCM 1463	Time Series	3
MSCM 1623	Mathematics of Operational Research	3
	TOTAL	**12**

Semester 2

Course Code	Course Name	Credit
MSCM 1053	Computational Mathematics	3
MSCM 1033	Research Methodology	3
Elective (Choose 3 credits)		
MSCM 1133	Soliton & Non Linear Waves	3
MSCM 1253	Theory of Matrices	3
MSCM 1353	Parallel Computing	3
MSCM 1453	Generalized Linear Model	3
MSCM 1663	Supply Chain Modelling	3
	TOTAL	**9**

Semester 3

Course Code	Course Name	Credit
MSCM2180	Dissertation	21
	TOTAL	**21**

INTAKE SEM 2 2021/2022 (FEBRUARY 2022)

Semester 1

Course Code	Course Name	Credit
MSCM 1053	Computational Mathematics	3
U*** 6***	University Compulsory Subject	3
Electives (Choose 6 credits)		
MSCM 1133	Soliton & Non Linear Waves	3
MSCM 1253	Theory of Matrices	3
MSCM 1353	Parallel Computing	3
MSCM 1453	Generalized Linear Model	3
MSCM 1663	Supply Chain Modelling	3
	TOTAL	**12**

Semester 2

Course Code	Course Name	Credit
MSCM1043	Mathematical Methods 1	3
MSCM 1033	Research Methodology	3
Elective (Choose 3 credits)		
MSCM 1143	Fluid Mechanics and Heat Transfer	3
MSCM 1213	Group Theory I	3
MSCM 1393	Numerical Linear Algebra	3
MSCM 1463	Time Series	3
MSCM 1633	Game Theory	3
	TOTAL	**9**

Semester 3

Course Code	Course Name	Credit
MSCM2180	Dissertation	21
	TOTAL	**21**

MASTER OF SCIENCE SPECIALIZATION: ENGINEERING MATHEMATICS

PROGRAMME SPECIFICATION

1. Awarding Institution	UTM
2. Teaching Institution	UTM
3. Programme Name	Master of Science Specialization : Engineering Mathematics
4. Final Award	Master of Science Specialization : Engineering Mathematics
5. Programme Code	MSCJ2
6. Professional or Statutory Body of Accreditation	Malaysian Ministry of Higher Education Kementerian Pengajian Tinggi Malaysia
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-govern
10. Study Scheme	Full Time
11. Study Duration	Minimum: 1½ years Maximum: 4 years
12. Entry Requirement	1. A Bachelor's Degree with good honours from Universiti Teknologi Malaysia or any other institution of higher learning recognised by the Senate; or 2. A qualification equivalent to a Bachelor's Degree and experience in the relevant field recognised by the Senate.

13. Programme Educational Objectives (PEO)

Graduates of the programme should be :

1. PEO 1 : knowledgeable, creative and innovative in both areas of mathematics and engineering and able to teach, pursuing further knowledge in engineering mathematics at advanced level
2. PEO 2 : competent and dedicated to support the development and growth of science and engineering in line with the country's development plan
3. PEO 3 : able to carry out research activities in engineering mathematics and lead effectively in multidisciplinary projects team

14. Programme Learning Outcomes (PLO)

At the end of this programme, students will be able to:

Intended Learning Outcomes			Teaching and Learning Methods	Assessment
	PLO1	acquire and apply advanced knowledge in engineering mathematics. (Knowledge and Understanding -KW)	Guided lectures, computer laboratory works, directed reading, group discussion, problem solving and intellectual discourse	Examinations, tests, quizzes, project reports and assignments
	PLO2	critically analyze, evaluate and synthesize new, complex and abstract ideas and current critical issues in discipline of engineering mathematics. (Cognitive Skills - CG)	Lectures, mini research, computer laboratory works, article critique and group discussions Hands-on mathematical software and simulation	Oral examination(viva), assignments, project reports and dissertation
	PLO3	demonstrate work skills and operational skills in common employment environment such as organisational skills; selection of mathematical method and tools, and technology methods (Practical Skills - PS)	Guided lectures, case studies, paper critique, group discussions and problem solving Hands- on mathematical software and simulation	Examinations, tests, assignments, research proposal, academic writing, project reports and oral presentations
	PLO7	apply mathematics' quantitative, qualitative and tools to analyze and evaluate numerical and graphical data for study and work (Numeracy Skills -NS)	Case studies, computer-based learning and directed reading	Assignments, programming and simulation reports

Intended Learning Outcomes			Teaching and Learning Methods	Assessment
GENERIC SKILLS	**PLO4**	demonstrate the skills of interactive communications and collaborative skills in managing relationships in teams and within the organization. (Interpersonal Skills - IPS)	Group discussion, active learning	Project reports, assignments and group presentation
	PLO5	communicate and convey information or ideas cogently and professionally in appropriate language in various medium, to a range of audience and different situations (Communication Skills-CS)	Case studies, projects and group discussions	Project reports, group presentation
	PLO6	competently use a wide range of digital technologies, appropriate mathematical software and programming language to support study and work (Digital Skills-DS)	Brainstorming, discussion and case studies	Assignments and research project reports.
	PLO8	demonstrate leadership, professionalism and management skills, and take full responsibility for own work, and significantly for others in the research team and projects (Leadership, Autonomy and Responsibility -LAR)	Lecture, Active Learning and Group discussion	Project reports, assignments and group presentation
	PLO9	integrate knowledge for lifelong learning with demonstrating confidence, self-control; social skills and proper etiquette; and commitment to professionalism in the work place (Personal Skills -PRS)	Lecture, Active Learning, Group projects and presentations	Project reports, assignments and group presentation
	PLO10	recommend on the commercialization value of the mathematical methods and algorithms used in project (Entrepreneurial Skills-ENT)	Lecture, Active Learning and Group discussion	Project reports, assignments and group presentation
	PLO11	demonstrate awareness and respect of etiquette in the exercise of professional skills and responsibilities (Ethics and Professional Skills - ETS)	Lecture, Active Learning, Group discussion and case study	Project reports, assignments and group presentation

15. Classification of Courses

No.	Classification	Credit Hours	Percentage	Standard (QA)
i.	University General Course	3	7.10	50%
ii.	Core Courses	9	21.45	
iii.	Elective Courses	9	21.45	
iv.	Dissertation	21	50	50%
	Total	42	100	100%

16. Total credit hours to graduate : 42 credit hours

17. Programme structures and features, curriculum, and award requirements

The course is offered in full-time mode and based on a 3 Semester Academic Year with several subjects being delivered and assessed in each semester. Assessment: Based on final examination, coursework and dissertation.

Award requirements:

To graduate, students should:

- achieve a total of minimum 42 credit hours with minimum CPA of 3.00
- complete and pass viva M.Sc Dissertation.

Course Category	Code	Course	Credit
University general course (3 Credits)	ULAJ 6013	Japanese Language	3
Core Courses (9 Credits)	MSCJ 1033	Research Methodology	3
	MSCJ 1523	Methods of Engineering Mathematics	3
	MSCJ 1533	Numerical Methods in Engineering	3
Elective Courses (9 Credits)	Semester 1 (Choose 1 Eng., 1 Maths)		
	Mxxx xxx3	*Mechanical/Civil/Electrical Engineering course*	6
	MSCJ 1513	Partial Differential Equations	
	MSCJ 1753	Fluids Mechanics and Heat Transfer	
	MSCJ 1733	Soliton and Nonlinear Waves	
	Semester 2 (Choose 1 Eng.)		
	Mxxx xxx3	Mechanical/Civil/Electrical Engineering course	
	MSCJ 1513	Partial Differential Equations	
	MSCJ 1753	Fluids Mechanics and Heat Transfer	3
	MSCJ 1733	Soliton and Nonlinear Waves	
Research (21 Credits)	Semester 3 MSCJ xx80	Dissertation	21
TOTAL CREDIT			**42**

18. Mapping of Programme Learning Outcomes to Course

	COURSES OFFERED	Knowledge and Understanding	Cognitive Skills	Practical Skills	Numeracy Skills	Interpersonal Skills	Communication Skills	Digital Skills	Leadership, Autonomy and Responsibility	Personal Skills	Entrepreneurial Skills	Ethics and Professionalism Skills
Code	**Courses**	**PLO1 KW**	**PLO2 CG**	**PLO3 PS**	**PLO7 NS**	**PLO4 IPS**	**PLO5 CS**	**PLO6 DS**	**PLO8 LAR**	**PLO9 PRS**	**PLO10 ENT**	**PLO11 ETS**
University General Courses												
ULAJ 6013	Japanese Language						✔					
Core Courses												
MSCJ 1523	Methods of Engineering Mathematics	✔				✔				✔		
MSCJ 1533	Numerical Methods in Engineering	✔	✔					✔	✔			
MSCJ 1033	Research Methodology	✔	✔	✔					✔		✔	✔
MSCJ 2180	Dissertation		✔		✔	✔	✔					
Elective Courses (Choose 1)												
MSCJ 1513	Partial Differential Equations	✔	✔							✔		
MSCJ 1753	Fluids Mechanics and Heat Transfer	✔	✔			✔				✔		
MSCJ 1733	Soliton and Nonlinear Waves	✔	✔			✔				✔		
Elective Courses (Choose 2 from Mechanical, Civil or Electrical Engineering courses)												
Mxxx xxx3												
Research												
MSCJ xx80	Dissertation		✔		✔	✔	✔					

Key:

1. Technical Skills: PLO1, 2, 3 and 7
2. Generic Skills : PLO 4, 5, 6, 8, 9, 10 and 11.

19. Support for students and their learning

Students and their learning are supported by:

- Briefing of all new post-graduate students during registration week.
- Postgraduate Handbook for every academic session.
- Information services provided by the Graduate School (SPS) and through the university's web site.
- Student Support provided by counselors and psychologists at 'Unit Perkhidmatan Sokongan Pelajar' (UPSP), UTM Medical Centre, accommodation officers and University Library and others.
- Student Advisors Programme: Selected academic staff provides advice on academic progress and monitoring students' performance and achievements.
- Special programmes on career development conducted by the university to ensure students acquire necessary skills during their academic and future career.
- Staff student ratio for teaching of 1:12.
- Extensive library and other learning resources and facilities

20. Career Prospects

Graduate of the programme can work as:

- Research officer – Research Institute, university and industries
- Science Officer -- Research Institute, university and industries
- Academician
- Mathematics practitioner
- Engineers in various institutions/industries

OR

They can further their education by doing a PhD programme in the related field of study.

21. Regulation of Assessment

Assessment rules and degree classification applies for every course with the minimum passing mark of 60%. To qualify for the degree award, students should complete all of the programme's requirements; achieve passing mark for every courses examination. Dissertation will be examined by a panel of internal examiners appointed by the Department's Post-graduate Committee; their roles include evaluating candidates' viva-voce and written project dissertation.

Summary of marks, grades and their evaluation points

Marks	Grade	Evaluation 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

For further information on academic regulations please refer to the graduate school website: http://www.sps.utm.my/

22. Facilities available List of laboratories:

List of computer laboratories:

- Computer Lab
- Smart Classroom
- Resource Centre

23. Methods for Evaluating and Improving the Quality and Standards of Teaching and Learning

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards

1. Students' performance in terms of:

- KB/KS/KG –Pass/conditional pass/fail
- CPA – Cumulative point average
- Graduating students' performance
- GOT – Graduate on time
- Completion Rate
- Analysis of course performance

2. Employability

- Exit survey
- Alumni survey
- Market survey

3. Lecturer's performance

- Teaching evaluation by students (e-PPP)
- Competency check-list for staff (CS).
- Annual staff appraisal (e-LPPT)

4. Curriculum review

- Faculty academic committee
- External examiner reports
- CO achievement survey by students

5. Delivery system

- Academic Quality Assurance Committee
- Customer Satisfaction Index (CSI)
- Employer Satisfaction Index (ESI)
- Malaysia Quality Assurance (MQA) standards

24. Regulation of Programme Assessment

Role of External Examiners (Visiting Examiners): Visiting Examiners are appointed by the Faculty Academic Committee to:

- review and evaluate program curriculum,
- review and evaluate methods of students assessment,
- make necessary recommendations to the Academic Committee.

25. Programme Assessment Tools

Measurement Tools	Programme Learning Outcomes (PLO)											Duration	Action by
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcome Survey (SCO) (course – dependent)												Per semester	Lecturer
Course Assessment Report (CAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Programme Assessment Report (PAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Faculty
Annual Programme Assessment Report (APAR)	x	x	x	x	x	x	x	x	x	x	x	Per year	Faculty
Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Final Semester	Faculty
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x	Once/ 3 year	Director

CURRICULUM STRUCTURE

INTAKE SEM 1 2021/2022 (OCTOBER 2021)

Semester 1

Course Code	Course Name	Credit
MSCJ1523	Methods of Engineering Mathematics	3
ULAJ6013	Japanese Language	3
Elective (Choose 3 credits Maths course, 3 credit Engineering School course) **(Prefer 1 Engineering course only)**		6
MSCJ 1753	Fluids Mechanics and Heat Transfer **(prefer)**	
Total Credit Hours		12

Semester 2

Course Code	Course Name	Credit
MSCJ 1533	Numerical Methods in Engineering	3
MSCJ 1033	Research Methodology	3
Elective (3 credit Engineering School course) **(prefer)**		3
MSCJ 1753	Soliton & Non Linear Waves **(not prefer)**	
Total Credit Hours		9

Note: Student is allowed to choice Mathematics course in second semester, Sem II 2021/22.

Semester 3

Course Code	Course Name	Credit
MSCM2180	Dissertation	21
Total Credit Hours		21

MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY
Field of Research: Mathematics
- By Research (Full time)

Department of Mathematical Sciences offers full time research programmes leading to M.Phil. and Ph.D. degree for students interested in pursuing research careers. To ensure the suitability of the research for the given academic level, students are required to present their research proposal to be evaluated by experts in the related area. This usually takes place in the second semester for M.Phil. student and third semester for Ph.D. student. Students are expected to disseminate the output of their research through writing of research articles and presentations in conferences. On completion of the research project, students are required to submit their dissertation/thesis for evaluation by external and internal examiners appointed by the Faculty of Science. The programmes are MQA accredited.

Programme	NEC Code	MQA Reference Number (Certificate Number)
M.Phil.	461 (Mathematics)	MQA/SWA0311 (20678)
Ph.D.	461 (Mathematics)	MQA/SWA0303 (20720)

Field of Research

The research project of the student may fall into one or more aspects of the following field:

- Study of Algebra
- Functional Analysis
- Group Theory and Its Application
- Graph Theory and Its Application
- Formal Language Theory and Splicing Systems
- Mathematical Modelling of Fluids Flow
- Non-linear Waves and Soliton
- Conceptual and Mathematical Model of Behavioural Changes
- Mathematical and Fuzzy Modelling
- Numerical Analysis
- Numerical Computational Methods (Algorithms)
- Numerical Simulation and Visualization
- Development, Analysis and Implementation of Operational Research
- Optimization Models and Algorithms, Decision Making Gools
- Statistical Modelling and Analysis (Theory and Practise)
- Time Series and Forecasting
- Geo-statistical Modelling
- Functional Data Analysis
- Financial Mathematics
- Survival and Failure Time Modelling
- Robust Statistics

Courses and duration of study

The normal duration of study is 2–8 semesters (1–4 years) for M.Phil. and 6–16 semesters (3–8 years) for the Ph.D. programme.

Students must register a Research Course with the following code in each semester.

Year/ Semester (Total Semester)	M.Phil.	Ph.D.
1/1 (Sem. 1)	MSCM 1100	PSCM 1100
1/2 (Sem. 2)	MSCM 1200	PSCM 1200
2/1 (Sem. 3)	MSCM 2100	PSCM 2100
2/2 (Sem. 4)	MSCM 2200	PSCM 2200
3/1 (Sem. 5)	MSCM 3100	PSCM 3100
3/2 (Sem. 6)	MSCM 3200	PSCM 3200
4/1 (Sem. 7)	MSCM 4100	PSCM 4100
4/2 (Sem. 8)	MSCM 4200 (**maximum semester**)	PSCM 4200
5/1 Sem. (9)	-	PSCM 5100
5/2 (Sem. 10)	-	PSCM 5200
6/1 (Sem. 11)	-	PSCM 6100
6/2 (Sem. 12)	-	PSCM 6200
7/1 (Sem. 13)	-	PSCM 7100
7/2 (Sem. 14)	-	PSCM 7200
8/1 (Sem. 15)	-	PSCM 8100
8/2 Sem. (16)	-	PSCM 8200 (**maximum semester**)

All research students must enrol in Research Methodology (USCP 0010) and at least one of the University's General Courses (subjected to courses offered in each semester listed in SPS website). Examples of General Courses offered are:

No.	Course code	Faculty	Course name
1	UBSS 6013	AHIBS	Organization Behaviour and Development
2	UBSS 6023	AHIBS	Business Ethics, Responsibility and Sustainability
3	UHMS 6013	FSSH/SHARP	Seminar on Global Development, Economic and Social Issues
4	UHMZ 6023	FSSH/SHARP	Malaysian Society and Culture

5	UHIS 6013	FSSH/ATI	Philosophy of Science and Civilization
6	UHPS 6013	FSSH/SOE	Dynamics of Leadership
7	UHLM 6013	FSSH/LA	Malay Language for Post Graduates
8	URTS 6013	RFTI	Environmental Ethics
9	UECS 6013	FE/SC	IT Project Management
10	UECS 6023	FE	Introduction to Technopreneurship
11	UMJJ 6013	MJIIT	Basic Japanese Language & Culture

Credit transfer of Research Methodology and the University's General Courses

Students can apply for credit transfer if the course(s) taken in another M.Phil. programme(s) prior to the current study with at least 80% identical learning outcomes.

Deferment of study

- Students may apply for deferment of the programme registration for not more than **TWO SUBSEQUENT** semesters subject to University's approval.
- Students who do not register for any courses in a semester must apply for deferment. The deferred semester will be counted as a part of the total study period.
- Students who withdraw (TD) from **ALL** courses in a semester will automatically be given a deferment. The deferred semester will be counted as a part of the total study period.
- Students may apply for deferment of study due to health reasons. The application has to be accompanied with a medical report certified by a Medical Officer recognised by the University. The deferred semester may not be counted as a part of the total study period.

Conversion from M.Phil. to Ph.D. programme

M. Phil. students can apply for conversion to a Ph.D. programme in the second semester upon achieving the requirement listed in the table below.

Bachelor's Degree CGPA	Requirements
CGPA $\geq$ 3.33	Presented **TWO** conference articles in proceedings with ISBN. **OR** published **ONE** article in a SCOPUS/WOS/ERA indexed journal.
3.00 $\leq$ CGPA $\leq$ 3.32	Published **ONE** article in a WOS indexed journal.

Students will be requested to defend the research proposal to the evaluation panels. Passing the evaluation is necessary for successful conversion to Ph.D. programme.

Assessments and evaluation

(i) First Assessment

Students are required to present a research proposal (**with preliminary/expected results**) for evaluation purposes within the duration specified by the University, according to the following schedule:

Programme	Semester
M.Phil.	2nd semester
Ph.D.	3rd semester

If the students failed to present without any valid reasons, the student may be given a TM status by the Faculty.

(ii) Progress Report Assessment

All postgraduate research students are required to submit a progress report online (GSMS system) before the due date. The online system will usually be opened in week 10–13 of each semester, unless specified otherwise in the academic calendar.

The supervisor shall evaluate the progress report. A student whose progress is satisfactory (MM status) will be recommended for the continuation of his/her candidature.

A student may be given a TM or GG status if he/she does not submit his/her progress report.

The Faculty shall terminate the candidature of a student whose progress is not satisfactory (TM status) for **TWO** consecutive semesters.

(iii) Qualifying Assessment (Fast Track Ph.D.)

Fast track students in the Ph.D. programme must undergo a qualifying assessment after 6 to 18 months of registration in the Ph.D. programme. The result of the assessment can be one of the following:

a. **Pass** - The student will continue their Ph.D. programme and proceed with the First Assessment in the following semester.

b. **Fail** - The student will be transferred to the M.Phil. programme and a new study period begins.

(iv) Viva Voce (Oral Examination)

A student should submit Notice for Thesis Submission (NHT) approved by the supervisor at least three months prior to submission of the dissertation/thesis for examination, or three months before expiry of the maximum study duration. Dissertation/Thesis report must follow the guidelines prescribed in the UTM Thesis Manual 2018 and the report must be written in English. Students shall apply for a permission if the dissertation/thesis is to be written in other languages, i.e. Bahasa Malaysia. The Turnitin score for each chapter shall not be more than 20%. The publication criteria for the M.Phil. and Ph.D. programme is listed below.

Programme	Publication criteria
M. Phil.	Students may submit their dissertation after 12 months with at least one publication that has been accepted or published in either journal, conference, or book chapters for the purpose of the viva voce.
Ph.D.	**Submission of thesis for normal duration of study (within 6 - 16 semesters)** Students can submit their thesis for viva voce after having: • at least **ONE** accepted or published article in a WOS indexed journal, or • **TWO** accepted or published articles in Scopus/ERA/Malaysia Journal Management System indexed journals. **Early thesis submission (in the Semester 5)** Students can submit their thesis for viva voce after having: • accepted or published **TWO** articles in WOS/Scopus/ERA indexed journals. **Submission of thesis using publication format** Students can submit their thesis for viva voce using publication format if the following condition is fulfilled: • At 24 months after the student enrols; a minimum of **THREE** journal articles indexed in Scopus/WOS with at least **TWO** articles accepted or published in Q1/Q2 WOS indexed journals. • At least 30 months after the student enrols: a minimum **THREE** journal articles indexed in Scopus/WOS with at least **ONE** journal article accepted or published in Q1/Q2 WOS indexed journal.

Dissertation/Thesis examination for M.Phil. and Ph.D. programmes should be made according to the criteria set for the programme as approved by the Senate. For instance, oral defence cannot be held more than twice. The thesis examiner should consist of at least one internal and one external examiner, unless specified in *Peraturan Akademik Pengajian Siswazah* 2020. Please refer to the Faculty on the fee imposed for viva voce.

Change of supervisor

During the study period, students may apply for a change of supervisor if necessary. The application is made by filling in the specific form available at the Faculty's Postgraduate Office. The application needs to be supported and approved by the Faculty's Academic Committee. However, students have to take note that the application for a change in supervisor can only be made with the following restrictions (except for special cases):

- Change of supervisor can only be made **ONCE** throughout the study period.
- Application can only be made **BEFORE** the First Assessment.

Abbreviations

ATI	: Academy of Islamic Civilisation
AHIBS	: Azman Hashim International Business School
ERA	: Excellence in Research Australia
FE	: Faculty of Engineering
FSSH	: Faculty of Social Sciences and Humanities
GG	: *Gagal* (Fail)
GSMS	: Graduate Studies Management System
LA	: Language Academy
MJIIT	: Malaysia-Japan International Institute of Technology
MM	: *Memuaskan* (Satisfactory)
M.Phil.	: Master of Philosophy
MQA	: Malaysian Qualifications Agency
NEC	: National Education Code
NHT	: Notis Hantar Thesis (Notice for Thesis Submission)
Ph.D.	: Doctor of Philosophy
RFTI	: Razak Faculty of Technology and Informatics
SC	: School of Computing
SHARP	: School of Human Resource Development & Psychology
SOE	: School of Education
TD	: *Tarik Diri* (Withdraw)
TM	: *Tidak Memuaskan* (Unsatisfactory)
WOS	: Web of Science

PHYSICS PROGRAMMES

MASTER OF SCIENCE SPECIALIZATION: PHYSICS

PROGRAMME SPECIFICATION

1. Awarding Institution	UTM
2. Teaching Institution	UTM
3. Programme Name	Master of Science Specialization : Physics
4. Final Award	Master of Science Specialization : Physics
5. Programme Code	MSCF2
6. Professional or Statutory Body of Accreditation	Malaysian Ministry of Higher Education Kementerian Pengajian Tinggi Malaysia
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-govern
10. Study Scheme	Full Time
11. Study Duration	Minimum: 1½ years Maximum: 4 years
12. Entry Requirement	**General University Requirements:** Basic conditions of entry is referring to the Assessment Guidelines in 1998 Entry, Pind. 1/2013. **Faculty Requirements:** Bachelor of Science with a CGPA of ≥ 3.0 from Universiti Teknologi Malaysia in chemistry or any institutions of higher learning recognized by the Senate in the same field. OR equivalent to a Bachelor of Science degree with experience in the same field and recognized by the UTM Senate. **English Language Requirement** **i) Student with TOEFL score of 60 and above can enroll at faculty** **ii) Students with TOEFL score of 60 and below required to attend either:** • **Intensive English Programme (IEP) conducted by Language**

	Academy (LA), UTM *and pass IELTS with a minimum of 6.0 or pass CEFR – aligned test with the required score* Or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108 **iii) Student with IELTS band 6.0 and above can enroll at faculty** **iv) Student with IELTS band 5.5 and below are required to attend either:** • **Intensive English Programme (IEP) conducted by Language Academy (LA), UTM** and pass IELTS with a minimum of 6.0 or pass CEFR-aligned test with the required score or • **Certified Intensive English Programme (CIEP)** conducted by ELS Language Center and pass level 108

13. Programme Educational Objectives (PEO)

Graduates of the programme should be :

1. PEO1 : able to apply advanced knowledge and skills in planning, analysis, design and supervision of work related to physics

2. PEO2 : capable and passionate in pursuing further knowledge in physics.

3. PEO 3: able to appreciate entrepreneurship and generate opportunities towards job-creation for the nation.

14. Programme Learning Outcomes (PLO)				
	Intended Learning Outcomes		**Teaching and Learning Methods**	**Assessment**
	PLO1	Construct advanced and comprehensive theoretical and technical knowledge in the field of physics.	Lectures, directed reading, group discussions and problem solving assignments	Tests, Final Exam, Assignments.
	PLO2	Formulate solutions in resolving complex problems based on physics knowledge.	Lectures, laboratory works, assigned reading, group discussions and relevant research document searching. Hands-on instrumentations and software; and writing research project	Tests, Final Exam, Assignments.
	PLO3	Demonstrate physics knowledge and practical skills in conducting scientific research or activities using advanced/contemporary tools in physics field.	Lectures, assigned reading, group discussions and formulating problem and solving them Hands-on instrumentations and software; and writing research project Developing research proposal by identifying the research gap and defending it; presenting research findings in various settings.	Group Projects, Problem-based Projects, Assignments.
	PLO7	Evaluate available tools/ approaches to analyze and solve Physics issues.	Collaborative research project design, implementation and evaluation.	Research presentations (writing and oral), article writing, viva-voce, group projects and assignments.

	Intended Learning Outcomes		Teaching and Learning Methods	Assessment
GENERIC SKILLS	**PLO4**	Work together and collaboratively with different people in learning, communities and other groups and networks, ethically and professionally.	Persuasions of group projects, individual term-paper and assignments following the academic ethics, integrity and honesty.	Research presentations (writing and oral), article writing, viva-voce, group projects and assignments.
	PLO5	Communicate clearly the knowledge, skills, ideas using appropriate methods to peers, experts, and non-experts through various medium.	Power-point presentations on developed scientific documents by the individual.	Research presentations (writing and oral), article writing, viva-voce, group projects and assignments.
	PLO6	Use a broad range of information, media, digital technologies and software to support research works or studies..	Undergoing through diverse databases on scientific research and innovations and practicing them in terms of writing and knowledge sharing.	Research presentations (writing and oral), article writing, viva-voce, group projects and assignments.
	PLO8	Demonstrate leadership, autonomy and responsibility in conducting and managing own research and resources.	Collaborative research project design, implementation and evaluation.	Research presentations (writing and oral), article writing, viva-voce, group projects and assignments.
	PLO9	Exemplify self-advancement through continuous academic development.	Collaborative research project design, implementation and evaluation.	Research presentations (writing and oral), article writing, viva-voce, group projects and assignments.
	PLO10	Demonstrate entrepreneurial characteristics.	Collaborative research project design, implementation and evaluation.	Article writing, group projects and assignments.
	PLO11	Demonstrate adherence to legal, ethical and professional codes of practice as a postgraduate student.	Collaborative research project design, implementation and evaluation.	Research presentations (writing and oral), article writing, viva-voce, group projects and assignments.

15. Classification of Courses

No.	Classification	Credit Hours	Percentage	Standard (QA)
i.	University General Course	6	14	50%
ii.	Core Courses	9	22	
iii.	Elective Courses	6	14	
iv.	Research	21	50	50%
	Total	42	100	100%

16. Total credit hours to graduate : 42 credit hours

17. Programme structures and features, curriculum, and award requirements

The course is offered in full-time mode and based on a 3 Semester Academic Year with several subjects being delivered and assessed in each semester. Assessment: Based on final examination, coursework and dissertation.

Award requirements:

To graduate, students should:

- achieve a total of minimum 42 credit hours with minimum CPA of 3.00
- complete and pass viva M.Sc Dissertation.

Course Category	Code	Course	Credit
University general course (3 Credits)	UHX XXX3	(Choose 1 courses from the list given by School of Graduate Studies)	3
Core Courses (12 Credits)	Semester 1 MSCF 1813 MSCF 1113 MSCF 1423 MSCF 1010 Semester 2 MSCF 1143 MSCF 1020	 Research Methodology Quantum Mechanics Semiconducting Bulk Materials Seminar Electrodynamics Seminar	 3 3 3 0 3 0
Elective Courses (6 Credits)	Semester 1 (Choose 1) MSCF 1313 MSCF 1413 MSCF 1433 MSCF 1123 Semester 2 (Choose 1) MSCF 1443 MSCF 1453 MSCF 1463 MSCF 1513	 Acoustic & Ultrasonics Analytical Techniques Semiconductor Devices Elementary Particles Thin Film Physics Non-Crystalline Solid Phase Transformation Optoelectronics	 3 3
Research (21 Credits)	Semester 3 MSCF XY80	Dissertation	21
TOTAL CREDIT			**42**

18. Mapping of Programme Learning Outcomes to Course

	COURSES OFFERED	Knowledge and Understanding	Cognitive Skills	Practical Skills	Numeracy Skills	Interpersonal Skills	Communication Skills	Digital Skills	Leadership, Autonomy and Responsibility	Personal Skills	Entrepreneurial Skills	Ethics and Professionalism Skills
Code	**Courses**	**PLO1 KW**	**PLO2 CG**	**PLO3 PS**	**PLO7 NS**	**PLO4 IPS**	**PLO5 CS**	**PLO6 DS**	**PLO8 LAR**	**PLO9 PRS**	**PLO10 ENT**	**PLO11 ETS**
University General Courses (Choose 1 from the list*)												
UHXX XXX3							✔					
Core Courses												
MSCF 1813	Research Methodology	✔	✔				✔	✔			✔	
MSCF 1113	Quantum Mechanics	✔	✔									✔
MSCF 1143	Electrodynamics	✔	✔						✔	✔		
MSCF 1423	Semiconducting bulk materials	✔	✔			✔						
Elective Courses (Choose 2)												
MSCF 1123	Elementary Particles	✔	✔							✔		
MSCF 1313	Acoustics and Ultrasonics	✔		✔			✔		✔			
MSCF 1413	Analytical Techniques	✔	✔	✔		✔						
MSCF 1433	Semiconductor Devices	✔	✔							✔		
MSCF 1443	Thin Film Physics	✔	✔			✔						
MSCF 1453	Non-Crystalline Solid	✔	✔	✔						✔		
MSCF 1463	Phase Transformation	✔	✔							✔		
MSCF 1513	Optoelectronics	✔	✔				✔					

Research												
MSCF XY80	Dissertation	✔	✔	✔	✔	✔	✔	✔				

Key:

1. Technical Skills: PLO1, 2, 3 and 7
2. Generic Skills : PLO 4, 5, 6, 8, 9, 10 and 11.
3. X – year of study ;

Y – 1st or 2nd semester;

*** List of University General Courses**

1. UBSS 6013 : Organization Behaviour and Development
2. UBSS 6023: Business Ethics, Responsibility and Sustainability
3. UHMS 6013: Seminar on Global Development, Economic and Social Issues
4. UHMZ 6023: Malaysian Society and Culture
5. UHIS 6013: Philosophy of Science and Civilization
6. UHPS 6013: Dynamics of Leadership
7. UHLM 6013: Malay Language for Post Graduates
8. URTS 6013: Environmental Ethics
9. UECS 6013: IT Project Management
10. UECS 6023: Introduction to Technopreneurship
11. UMJJ 6013: Basic Japanese Language & Culture

19. Support for students and their learning

Students and their learning are supported by:

- Briefing of all new post-graduate students during registration week.
- Student Prospectus Book for every academic session.
- Information services provided by the Graduate School (SPS) and through the university's web site.
- Student Support provided by counselors and psychologists at 'Unit Perkhidmatan Sokongan Pelajar' (UPSP), UTM Medical Centre, accommodation officers and University Library and others.
- Student Advisors Programme: Selected academic staff provides advice on academic progress and monitoring students' performance and achievements.
- Special programmes on career development conducted by the university to ensure students acquire necessary skills during their academic and future career.
- Staff student ratio for teaching of 1:12.
- Extensive library and other learning resources and facilities
- Each student is assigned an academic advisor (programme tutor) whose role is to assist and advice on programme of study.

20. Career Prospects

Graduate of the programme can work as:

- Research officer – Research Institute, university and industries
- Science Officer -- Research Institute, university and industries
- Physics Teacher – Schools and colleges
- Quality control officer – Industries
- Industrial materials scientist
- Material testing and analysis expert

OR

They can further their education by doing a PhD programme in the related field of study.

21. Regulation of Assessment

Assessment rules and degree classification applies for every course with the minimum passing mark of 60%. To qualify for the degree award, students should complete all of the programme's requirements; achieve passing mark for every courses examination. Dissertation will be examined by a panel of internal examiners appointed by the Department's Post-graduate Committee; their roles include evaluating candidates' viva-voce and written project dissertation.

Summary of marks, grades and their evaluation points

Marks	Grade	Evaluation 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

For further information on academic regulations please refer to the graduate school website: http://www.sps.utm.my/

22. Facilities available List of laboratories:

Laboratories

- Modern Physics Laboratory
- Optics Laboratory
- Basic & Advanced Electronic Laboratories
- Optoelectronics Devices Laboratory
- Nuclear Physics Laboratory
- Radiation Dosimetry Laboratory
- Laser Technology & Research Laboratories
- Fiber Optics Technology Laboratory
- Thin Film & Low Temperature Laboratory
- Vacuum Laboratory
- Material Science & Material Analysis Laboratories
- Computer & Microcomputer Laboratory
- Photonics Training & Research Laboratories
- Optical Crystal Research Laboratory
- Electronic & Mechanical Workshops

Major Equipments

- X-ray diffractometer (XRD)
- Automated Control Crystal growth CZ machine

- Infrared Spectrophotometer
- UV-VIS Spectrometer
- CNC Machine Equipment
- Photoluminescence Spectrometer
- High Precision Grinding and Polishing Machine
- Ellipsometer
- High Temperature Furnaces
- Differential Thermal Analyzers (DTA)
- Vickers Hardness Equipment
- General Mechanical Testing Machine
- Hyperpure Germanium Detector
- Atomic Force Microscope (AFM)
- Rapid Thermal Process (RTP)
- Tensile Machine
- Corrosion Machine

23. Methods for Evaluating and Improving the Quality and Standards of Teaching and Learning

Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards

1. Students' performance in terms of:

- KB/KS/KG –Pass/conditional pass/fail
- CPA – Cumulative point average
- Graduating students' performance
- GOT – Graduate on time
- Completion Rate
- Analysis of course performance

2. Employability

- Exit survey
- Alumni survey
- Market survey

3. Lecturer's performance

- Teaching evaluation by students (e-PPP)
- Annual staff appraisal (e-LPPT)
- Teaching Evaluation System (TES)

4. Curriculum review

- Faculty academic committee
- External examiner reports
- CO achievement survey by students

5. Delivery system

- Academic Quality Assurance Committee
- Malaysia Quality Assurance (MQA) standards

24. Regulation of Programme Assessment

Board of Study (BoS) Faculty of Science:

- External Examiners
- IAP
- Alumni

BoS panels are appointed by the Faculty Academic Committee to:

- review and evaluate program curriculum,
- review and evaluate methods of students assessment,
- make necessary recommendations to the Academic Committee.

25. Programme Assessment Tools

Measurement Tools	Programme Learning Outcomes (PLO)											Duration	Action by
	1	2	3	4	5	6	7	8	9	10	11		
Course Exit Survey (SCO)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Course Assessment Report (CAR)	x	x	x	x	x	x	x	x	x	x	x	Per semester	Lecturer
Annual Programme Assessment Report (APAR)	x	x	x	x	x	x	x	x	x	x	x	Yearly	Faculty
Exit Survey	x	x	x	x	x	x	x	x	x	x	x	Final Semester	Faculty
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x	Once/ 3 year	Director

CURRICULUM STRUCTURE

This is a 3-semester full-time course comprising a total of 42 credits that include 4 core subjects (12 credits), 2 elective Physics subjects (6 credits), 1 general university subject (3 credits) and Dissertation (21 credits). Specialised topics for the dissertation can be selected from any of the five areas of research in the mathematical sciences, described in the M.Sc and Ph.D by Research programmes. Typical distribution of subjects beginning in Semester 1, are as follows:

SEMESTER 1

COURSE CODE	COURSE	CREDIT
MSCF 1123	Quantum Mechanics	3
MSCF 1423	Semiconducting Bulk Materials	3
MSCF 1XY3	Elective Physics subject	3
**Uxxx 6XY3	University general course	3
MSCF 1010	Seminar	0
Total		**12**

**University general course

SEMESTER 2

COURSE CODE	COURSE	CREDIT
MSCF 1413	Electrodynamics	3
MSCF 1XY3	Elective Physics subject	3
MSCF 1813	Research Methodology	3
MSCF 1020	Seminar	0
Total		**9**

SEMESTER 3

COURSE CODE	COURSE	CREDIT
MSCF XY80	Dissertation	21
Total credits		**42**

X – year of study ;
Y – 1st or 2nd semester;

LIST OF COURSES

Core courses

COURSE CODE	COURSE	CREDITS
MSCF 1813	Research Methodology	3
MSCF 1123	Quantum Mechanics	3
MSCF 1423	Semiconducting Bulk Materials	3
MSCF 1413	Electrodynamics	3
MSCF XY80	Dissertation	21

Elective courses

COURSE CODE	COURSE	CREDITS
MSCF 1313	Acoustics & Ultrasonics	3
MSCF 1413	Analytical Techniques	3
MSCF 1433	Semiconductor Devices	3
MSCF 1123	Elementary Particles	3
MSCF 1443	Thin Film Physics	3
MSCF 1453	Non-Crystalline Solid	3
MSCF 1463	Phase Transformation	3
MSCF 1513	Optoelectronics	3

MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY
Field of Research: Physics
- By Research (Full time)

Department of Physics offers full time research programmes leading to M.Phil. and Ph.D. degree for students interested in pursuing research careers. To ensure the suitability of the research for the given academic level, students are required to present their research proposal to be evaluated by experts in the related area. This usually takes place in the second semester for M.Phil. student and third semester for Ph.D. student. Students are expected to disseminate the output of their research through writing of research articles and presentations in conferences. On completion of the research project, students are required to submit their dissertation/thesis for evaluation by external and internal examiners appointed by the Faculty of Science. The programmes are MQA accredited.

Programme	NEC Code	MQA Reference Number (Certificate Number)
M.Phil.	441 (Physics)	MQA/SWA0305 (20721)
Ph.D.	441 (Physics)	MQA/SWA0501 (20673)

Field of Research
The research project of the student may fall into one or more aspects of the following field:

Applied Optics Research Group (AORG)
- Applied optics: laser–matter interaction, optical fibre sensors, Fibre lasers and optical spectroscopy analysis for solid, liquid and gas (FTIR, OES, laser)
- Plasma physics: Non-thermal plasma technology and applications
- All-optical fibre sensors for liquid & gas sensing, temperature and pressure monitoring.
- Development of medical monitoring devices based on optical techniques using near infrared laser diodes and LED as light sources.
- Gases and volatile organic compounds (VOCs) analysis using high resolution FTIR coupled with long optical path length gas cell
- Non-thermal plasma technology in agriculture, food treatment and wire cleaning.
- Laser induced breakdown spectroscopy technique in food and environmental analysis.
- Fibre laser development based on novel saturable absorber material.

Scientific Computing and Instrumentation (SCNI)
- Computational Condensed Matter and Nuclear Physics
- Scientific Instrumentation
- ESR Quantum Computing
- Nanostructured Materials
- Applied Optics Materials
- Thin Film Physics
- Vacuum Science
- Plasma Physics
- Space Weather

Nuclear & Radiation Physics Research Group

- Environmental Radioactivity monitoring and Nuclear Siting
- Medical Physics/Imaging by gamma and X-rays
- Nuclear Safety/Security Assessment
- Nuclear Structure and Reaction
- Nuclear Waste Materials
- Muon Physics
- Radiation Dosimetry (TLD/OSLD)
- Sensor / Biosensor

Advanced Optical Materials Research Group (AOMRG)

- Glass synthesis and characterizations
- Crystal growth and characterizations
- Nanomaterials analyses using analytical techniques
- Semiconductor nanostructures
- Noncrystalline solids and ceramics
- Thin film and Nanotechnology
- Thin film solar cell
- Proton batteries and wastewater treatment
- Biopolymer membrane
- Computational Methods in Amorphous and Polymeric Materials
- Metamaterials
- Perovskite-based Thin Film Solar Cell

Courses and duration of study

The normal duration of study is 2–8 semesters (1–4 years) for M.Phil. and 6–16 semesters (3–8 years) for the Ph.D. programme.

Students must register a Research Course with the following code in each semester.

Year/ Semester (Total Semester)	M.Phil.	Ph.D.
1/1 (Sem. 1)	MSCF1100	PSCF1100
1/2 (Sem. 2)	MSCF1200	PSCF1200
2/1 (Sem. 3)	MSCF2100	PSCF2100
2/2 (Sem. 4)	MSCF2200	PSCF2200
3/1 (Sem. 5)	MSCF3100	PSCF3100
3/2 (Sem. 6)	MSCF3200	PSCF3200
4/1 (Sem. 7)	MSCF4100	PSCF4100
4/2 (Sem. 8)	MSCF4200 (**maximum semester**)	PSCF4200
5/1 Sem. (9)	-	PSCF5100
5/2 (Sem. 10)	-	PSCF5200

6/1 (Sem. 11)	-	PSCF6100
6/2 (Sem. 12)	-	PSCF6200
7/1 (Sem. 13)	-	PSCF7100
7/2 (Sem. 14)	-	PSCF7200
8/1 (Sem. 15)	-	PSCF8100
8/2 Sem. (16)	-	PSCF8200 **(maximum semester)**

All research students must enrol in Research Methodology (USCP 0010) and at least one of the University's General Courses (subjected to courses offered in each semester listed in SPS website). Examples of General Courses offered are:

No.	Course code	Faculty	Course name
1	UBSS 6013	AHIBS	Organization Behaviour and Development
2	UBSS 6023	AHIBS	Business Ethics, Responsibility and Sustainability
3	UHMS 6013	FSSK/SHARP	Seminar on Global Development, Economic and Social Issues
4	UHMZ 6023	FSSK/SHARP	Malaysian Society and Culture
5	UHIS 6013	FSSK/ATI	Philosophy of Science and Civilization
6	UHP S6013	FSSK/SP	Dynamics of Leadership
7	UHLM 6013	FSSK/AB	Malay Language for Post Graduates
8	URTS 6013	FTIR	Environmental Ethics
9	UECS 6013	FE/SC	IT Project Management
10	UECS 6023	FE	Introduction to Technopreneurship
11	UMJJ 6013	MJIIT	Basic Japanese Language & Culture

In addition to the above, PhD students in the Department of Physics need to sit for one of the following department courses before the **second** semester:

No.	Course code	Course name
1	MSCF1133	Advanced Numerical Method and Modelling
2	MSCF1473	Advanced Spectroscopic Technique
3	MSCF1483	Advanced Condensed Matter

Credit transfer of Research Methodology and the University's General Courses

Students can apply for credit transfer if the course(s) taken in another M.Phil. programme(s) prior to the current study with at least 80% identical learning outcomes.

Deferment of study

- Students may apply for deferment of the programme registration for not more than **TWO SUBSEQUENT** semesters subject to University's approval.
- Students who do not register for any courses in a semester must apply for deferment. The deferred semester will be counted as a part of the total study period.
- Students who withdraw (TD) from **ALL** courses in a semester will automatically be given a deferment. The deferred semester will be counted as a part of the total study period.
- Students may apply for deferment of study due to health reasons. The application has to be accompanied with a medical report certified by a Medical Officer recognised by the University. The deferred semester may not be counted as a part of the total study period.

Conversion from M.Phil. to Ph.D. programme

M. Phil. students can apply for conversion to a Ph.D. programme in the second semester upon achieving the requirement listed in the table below.

Bachelor's Degree CGPA	**Requirements**
CGPA ≥ 3.33	Presented **TWO** conference articles in proceedings with ISBN. **OR** published **ONE** article in a SCOPUS/WOS/ERA indexed journal.
3.00 ≤ CGPA ≤ 3.32	Published **ONE** article in a WOS indexed journal.

Students will be requested to defend the research proposal to the evaluation panels. Passing the evaluation is necessary for successful conversion to Ph.D. programme.

Assessments and evaluation

(i) First Assessment

Students are required to present a research proposal (with preliminary/expected results) for evaluation purposes within the duration specified by the University, according to the following schedule:

Programme	**Semester**
M.Phil.	2nd semester
Ph.D.	3rd semester

If the students failed to present without any valid reasons, the student may be given a TM status by the Faculty.

(ii) Progress Report Assessment

All postgraduate research students are required to submit a progress report online (GSMS system) before the due date. The online system will usually be opened in week 10–13 of each semester, unless specified otherwise in the academic calendar.

The supervisor shall evaluate the progress report. A student whose progress is satisfactory (MM status) will be recommended for the continuation of his/her candidature.

A student may be given a TM or GG status if he/she does not submit his/her progress report.

The Faculty shall terminate the candidature of a student whose progress is not satisfactory (TM status) for **TWO** consecutive semesters.

(iii) Qualifying Assessment (Fast Track Ph.D.)

Fast track students in the Ph.D. programme must undergo a qualifying assessment after 6 to 18 months of registration in the Ph.D. programme. The result of the assessment can be one of the following:

a. **Pass** - The student will continue their Ph.D. programme and proceed with the First Assessment in the following semester.

b. **Fail** - The student will be transferred to the M.Phil. programme and a new study period begins.

(iv) Viva Voce (Oral Examination)

A student should submit Notice for Thesis Submission (NHT) approved by the supervisor at least three months prior to submission of the dissertation/thesis for examination, or three months before expiry of the maximum study duration. Dissertation/Thesis report must follow the guidelines prescribed in the UTM Thesis Manual 2018 and the report must be written in English. Students shall apply for a permission if the dissertation/thesis is to be written in other languages, i.e. Bahasa Malaysia. The Turnitin score for each chapter shall not be more than 20%. The publication criteria for the M.Phil. and Ph.D. programme is listed below.

Programme	Publication criteria
M. Phil.	Students may submit their dissertation after 12 months with at least one publication that has been accepted or published in either journal, conference, or book chapters for the purpose of the viva voce.

Ph.D.	**Submission of thesis for normal duration of study (within 6 - 16 semesters)** Students can submit their thesis for viva voce after having: • at least **ONE** accepted or published article in a WOS indexed journal, or • **TWO** accepted or published articles in Scopus/ERA/Malaysia Journal Management System indexed journals. **Early thesis submission (in the Semester 5)** Students can submit their thesis for viva voce after having: • accepted or published **TWO** articles in WOS/Scopus/ERA indexed journals. **Submission of thesis using publication format** Students can submit their thesis for viva voce using publication format if the following condition is fulfilled: • At 24 months after the student enrols; a minimum of **THREE** journal articles indexed in Scopus/WOS with at least **TWO** articles accepted or published in Q1/Q2 WOS indexed journals. • At least 30 months after the student enrols: a minimum **THREE** journal articles indexed in Scopus/WOS with at least **ONE** journal article accepted or published in Q1/Q2 WOS indexed journal.

Dissertation/Thesis examination for M.Phil. and Ph.D. programmes should be made according to the criteria set for the programme as approved by the Senate. For instance, oral defence cannot be held more than twice. The thesis examiner should consist of at least one internal and one external examiner, unless specified in *Peraturan Akademik Pengajian Siswazah* 2020. Please refer to the Faculty on the fee imposed for viva voce.

Change of supervisor

During the study period, students may apply for a change of supervisor if necessary. The application is made by filling in the specific form available at the Faculty's Postgraduate Office. The application needs to be supported and approved by the Faculty's Academic Committee. However, students have to take note that the application for a change in supervisor can only be made with the following restrictions (except for special cases):

- Change of supervisor can only be made **ONCE** throughout the study period.
- Application can only be made **BEFORE** the First Assessment.

Abbreviations

ERA	: Excellence in Research Australia
GG	: *Gagal* (Fail)
GSMS	: Graduate Studies Management System
MM	: *Memuaskan* (Satisfactory)
M.Phil.	: Master of Philosophy
MQA	: Malaysian Qualifications Agency
NEC	: National Education Code
NHT	: Notis Hantar Thesis (Notice for Thesis Submission)
Ph.D.	: Doctor of Philosophy
TD	: *Tarik Diri* (Withdraw)
TM	: *Tidak Memuaskan* (Unsatisfactory)
WOS	: Web of Science

GENERIC PROGRAMMES

MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY

Field of Research: Generic

- By Research (Full time)

Faculty of Science offers full time research programmes leading to M.Phil. and Ph.D. degree for students interested in pursuing research careers. To ensure the suitability of the research for the given academic level, students are required to present their research proposal to be evaluated by experts in the related area. This usually takes place in the second semester for M.Phil. student and third semester for Ph.D. student. Students are expected to disseminate the output of their research through writing of research articles and presentations in conferences. On completion of the research project, students are required to submit their dissertation/thesis for evaluation by external and internal examiners appointed by the Faculty of Science.

Programme	NEC Code
M.Phil.	440 (Physical Science (broad programmes))
Ph.D.	440 (Physical Science (broad programmes)

Field of Research

The research project of the student may fall into more than one aspects of the following field :

- Biotechnology
- Catalysis
- Chemometrics
- Computational Chemistry
- Environmental Chemistry
- Forensic Science
- Nanostructured Materials
- Natural Products
- Organic Synthesis
- Organometallics
- Polymer Electrolytes
- Separation Science
- Solid State Chemistry
- Zeolites
- Applied optics: laser–matter interaction, optical fibre sensors, Fibre lasers and optical spectroscopy analysis for solid, liquid and gas (FTIR, OES, laser)
- Plasma physics: Non-thermal plasma technology and applications

- All-optical fibre sensors for liquid & gas sensing, temperature and pressure monitoring.
- Development of medical monitoring devices based on optical techniques using near infrared laser diodes and LED as light sources.
- Gases and volatile organic compounds (VOCs) analysis using high resolution FTIR coupled with long optical path length gas cell
- Non-thermal plasma technology in agriculture, food treatment and wire cleaning.
- Laser induced breakdown spectroscopy technique in food and environmental analysis.
- Fibre laser development based on novel saturable absorber material.
- Computational Condensed Matter and Nuclear Physics
- Scientific Instrumentation
- ESR Quantum Computing
- Nanostructured Materials
- Applied Optics Materials
- Thin Film Physics
- Vacuum Science
- Plasma Physics
- Space Weather
- Environmental Radioactivity monitoring and Nuclear Siting
- Medical Physics/Imaging by gamma and X-rays
- Nuclear Safety/Security Assessment
- Nuclear Structure and Reaction
- Nuclear Waste Materials
- Muon Physics
- Radiation Dosimetry (TLD/OSLD)
- Sensor / Biosensor
- Glass synthesis and characterizations
- Crystal growth and characterizations
- Nanomaterials analyses using analytical techniques
- Semiconductor nanostructures
- Noncrystalline solids and ceramics
- Thin film and Nanotechnology
- Thin film solar cell
- Proton batteries and wastewater treatment
- Biopolymer membrane
- Computational Methods in Amorphous and Polymeric Materials
- Metamaterials
- Perovskite-based Thin Film Solar Cell

Courses and duration of study

The normal duration of study is 2–8 semesters (1–4 years) for M.Phil. and 6–16 semesters (3–8 years) for the Ph.D. programme.

Students must register a Research Course with the following code in each semester.

Year/ Semester (Total Semester)	M.Phil.	Ph.D.
1/1 (Sem. 1)	MSCG 1100	PSCG 1100
1/2 (Sem. 2)	MSCG 1200	PSCG 1200
2/1 (Sem. 3)	MSCG 2100	PSCG 2100
2/2 (Sem. 4)	MSCG 2200	PSCG 2200
3/1 (Sem. 5)	MSCG 3100	PSCG 3100
3/2 (Sem. 6)	MSCG 3200	PSCG 3200
4/1 (Sem. 7)	MSCG 4100	PSCG 4100
4/2 (Sem. 8)	MSCG 4200 **(maximum semester)**	PSCG 4200
5/1 Sem. (9)	-	PSCG 5100
5/2 (Sem. 10)	-	PSCG 5200
6/1 (Sem. 11)	-	PSCG 6100
6/2 (Sem. 12)	-	PSCG 6200
7/1 (Sem. 13)	-	PSCG 7100
7/2 (Sem. 14)	-	PSCG 7200
8/1 (Sem. 15)	-	PSCG 8100
8/2 Sem. (16)	-	PSCG8200 **(maximum semester)**

All research students must enrol in Research Methodology (USCP 0010) and at least one of the University's General Courses (subjected to courses offered in each semester listed in SPS website). Examples of General Courses offered are:

No.	Course code	Faculty	Course name
1	UBSS 6013	AHIBS	Organization Behaviour and Development
2	UBSS 6023	AHIBS	Business Ethics, Responsibility and Sustainability
3	UHMS 6013	FSSH/SHARP	Seminar on Global Development, Economic and Social Issues
4	UHMZ 6023	FSSH/SHARP	Malaysian Society and Culture
5	UHIS 6013	FSSH/ATI	Philosophy of Science and Civilization
6	UHPS 6013	FSSH/SOE	Dynamics of Leadership
7	UHLM 6013	FSSH/LA	Malay Language for Post Graduates
8	URTS 6013	RFTI	Environmental Ethics
9	UECS 6013	FE/SC	IT Project Management
10	UECS 6023	FE	Introduction to Technopreneurship
11	UMJJ 6013	MJIIT	Basic Japanese Language & Culture

Credit transfer of Research Methodology and the University's General Courses

Students can apply for credit transfer if the course(s) taken in another M.Phil. programme(s) prior to the current study with at least 80% identical learning outcomes.

Deferment of study

- Students may apply for deferment of the programme registration for not more than **TWO SUBSEQUENT** semesters subject to University's approval.
- Students who do not register for any courses in a semester must apply for deferment. The deferred semester will be counted as a part of the total study period.
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Assessments and evaluation

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Programme	Semester
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Ph.D.	3rd semester

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All postgraduate research students are required to submit a progress report online (GSMS system) before the due date. The online system will usually be opened in week 10–13 of each semester, unless specified otherwise in the academic calendar.

The supervisor shall evaluate the progress report. A student whose progress is satisfactory (MM status) will be recommended for the continuation of his/her candidature.

A student may be given a TM or GG status if he/she does not submit his/her progress report.

The Faculty shall terminate the candidature of a student whose progress is not satisfactory (TM status) for **TWO** consecutive semesters.

(iii) Qualifying Assessment (Fast Track Ph.D.)

Fast track students in the Ph.D. programme must undergo a qualifying assessment after 6 to 18 months of registration in the Ph.D. programme. The result of the assessment can be one of the following:

(a) **Pass** - The student will continue their Ph.D. programme and proceed with the First Assessment in the following semester.
(b) **Fail** - The student will be transferred to the M.Phil. programme and a new study period begins.

(iv) Viva Voce (Oral Examination)

A student should submit Notice for Thesis Submission (NHT) approved by the supervisor at least three months prior to submission of the dissertation/thesis for examination, or three months before expiry of the maximum study duration. Dissertation/Thesis report must follow the guidelines prescribed in the UTM Thesis Manual 2018 and the report must be written in English. Students shall apply for a permission if the dissertation/thesis is to be written in other languages, i.e. Bahasa Malaysia. The Turnitin score for each chapter shall not be more than 20%. The publication criteria for the M.Phil. and Ph.D. programme is listed below.

Program	Publication criteria
M. Phil.	Students may submit their dissertation after 12 months with at least one publication that has been accepted or published in either journal, conference, or book chapters for the purpose of the viva voce.
Ph.D.	**Submission of thesis for normal duration of study (within 6 - 16 semesters)** Students can submit their thesis for viva voce after having: • at least **ONE** accepted or published article in a WOS indexed journal, or • **TWO** accepted or published articles in Scopus/ERA/Malaysia Journal Management System indexed journals. **Early thesis submission (in the Semester 5)** Students can submit their thesis for viva voce after having: • accepted or published **TWO** articles in WOS/Scopus/ERA indexed journals. **Submission of thesis using publication format** Students can submit their thesis for viva voce using publication format if the following condition is fulfilled: • At 24 months after the student enrols; a minimum of **THREE** journal articles indexed in Scopus/WOS with at least **TWO** articles accepted or published in Q1/Q2 WOS indexed journals.

	• At least 30 months after the student enrols: a minimum **THREE** journal articles indexed in Scopus/WOS with at least **ONE** journal article accepted or published in Q1/Q2 WOS indexed journal.

Dissertation/Thesis examination for M.Phil. and Ph.D. programmes should be made according to the criteria set for the programme as approved by the Senate. For instance, oral defence cannot be held more than twice. The thesis examiner should consist of at least one internal and one external examiner, unless specified in *Peraturan Akademik Pengajian Siswazah* 2020. Please refer to the Faculty on the fee imposed for viva voce.

Change of supervisor

During the study period, students may apply for a change of supervisor if necessary. The application is made by filling in the specific form available at the Faculty's Postgraduate Office. The application needs to be supported and approved by the Faculty's Academic Committee. However, students have to take note that the application for a change in supervisor can only be made with the following restrictions (except for special cases):

- Change of supervisor can only be made **ONCE** throughout the study period.
- Application can only be made **BEFORE** the First Assessment.

Abbreviations

ATI : Academy of Islamic Civilisation
AHIBS : Azman Hashim International Business School
ERA : Excellence in Research Australia
FE : Faculty of Engineering
FSSH : Faculty of Social Sciences and Humanities
GG : *Gagal* (Fail)
GSMS : Graduate Studies Management System
LA : Language Academy
MJIIT : Malaysia-Japan International Institute of Technology
MM : *Memuaskan* (Satisfactory)
M.Phil. : Master of Philosophy
MQA : Malaysian Qualifications Agency
NEC : National Education Code
NHT : Notis Hantar Thesis (Notice for Thesis Submission)
Ph.D. : Doctor of Philosophy
RFTI : Razak Faculty of Technology and Informatics
SC : School of Computing
SHARP : School of Human Resource Development & Psychology
SOE : School of Education
TD : *Tarik Diri* (Withdraw)
TM : *Tidak Memuaskan* (Unsatisfactory)
WOS : Web of Science

SYNOPSES OF COURSES

BIOTECHNOLOGY

MMBT 1713: BIOINFORMATICS

This is a practical "hands-on" course in Bioinformatics that will emphasize on how to use computers and the web as tools to analyze and represent large collections of biological sequence and structure data. Prerequisites include a basic understanding of protein and nucleic acid structure, and some mathematics and statistics, but no prior knowledge of computer programming or computer hardware is necessary. This course presents the principles and methodology for Bioinformatics. It focuses on the application of computational methods to study biological problems. It will introduce the principles, scope, application and limitations of bioinformatics. This course is designed to introduce bioinformatics at a level appropriate for biology undergraduates having completed an undergraduate core, and for chemistry, computer science, and math undergraduates with an interest in biology. This course is designed so that the content and curricula can rapidly adjust as required to meet changing circumstances during the course of the semester and to evolve with the topics of interest in bioinformatics over time. Students will learn to use conventional software, web-based applications, and software which they download to their machine. By using the well-tested and successful approach of problem-based learning, students will learn through applying the strategies and tools used in bioinformatics to topical problems drawn from ongoing research and applications in a variety of fields. There is to be an integration of the basics of computation and analysis along with chemistry and biology throughout the course.

MMBT 1173: BIOCHEMISTRY AND MICROBIAL PHYSIOLOGY

This course is designed to apply knowledge in basic cellular organization of microorganisms, growth and central metabolic processes to their existence in diverse environment. Knowledge on the genetics, growth and metabolism of microorganisms will be integrated to explain cellular growth and metabolism under normal living conditions to various stressful environments. Hands-on experience in laboratory on several aspects of microbial functions will be provided.

MMBT 1153: MOLECULAR MECHANISMS IN GENE EXPRESSION AND REGULATION

This course is designed to expose the master 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 looked into. The expression and regulation of proteins is the major theme of the lecture. Regulation and the control of gene expression will be discussed by using several selected operons as model. A general discussion on the biochemical adaptation and gene expression will be given using extreme environmental conditions. Gene expression in recombinant microorganisms will also be discussed.

MMBT 1683: PROTEIN ENGINEERING

This course presents an introduction to protein structure and function which is the basis for design of modified proteins for practical use in medicine or biotechnology as well as fundamental studies. The developing discipline of protein engineering and in particular enzyme engineering has concerns ranging from prediction of protein conformation from primary structure to cost-effective recovery and purification of recombinant proteins. Several successfully case studies on protein engineering will also be discussed. Finally students are required to carry out a guided mini project where they will be introduced to protein *in silico* homology modeling and mutagenesis.

MMBT 1233: INDUSTRIAL TECHNOLOGY AND BIOREACTOR DESIGN

The course will emphasize on industrial technology and bioreactor design for microbial, plant and animal cell cultures. The gene transfer method into animal and plant tissue culture will be discussed. The physiology of microbial growth and product formation in batch, continuous and fed-batch culture will be explained in detail. The students will have knowledge on bioreactor design for microbial, immobilized cell, plant and animal cell tissue engineering and waste water treatment. Subsequently, student will be exposed to the industrial processes flow sheet and emphasis on advance downstream unit operation such as membrane separation and chromatography. Lastly, current Good Manufacturing Practice (cGMP) will be described. This course offers a combination of theoretical (lecture) and practical work.

MMBT 1563: ENVIRONMENTAL BIOENGINEERING

In this course, conventional and recent advances the technology for waste treatment, biodegradation and waste utilization will be discussed. Since pollution is a direct or indirect consequence of waste production, the demand for 'zero discharge' can be interpreted as an unrealistic demand for 'zero waste'. As wastes continues to exist, attempts to abate the subsequent pollution by converting them to less noxious forms are more important. Application of bioengineering will be instilled in biotransformation process of wastes to commodity products or other value-added compounds evaluated based on selected case studies obtained from publications. Bioremediation technologies will be reviewed based on their applicability, performance and limitations. The role of microbes and microbial enzymes used in the processing unit will be described and distinguished. The use of microbiological and molecular techniques in monitoring microbial population and evolution will also be reviewed.

MMBT 2180: DISSERTATION

This research project allows students to be involved in research under the supervision of knowledgeable and widely experienced lecturers in specialized fields such as Molecular Biology and Genetic Engineering, Enzyme Technology, Environmental Biotechnology, Plant Molecular Biology and Tissue Culture. Students must prepare a written research proposal approved by the panel of examiners before executing the research. This enriching research experience will enable students to utilize library facilities for updating literature search, to plan and conduct research independently. Research data are collected and analysed before finalizing the research dissertation. Students must complete a written dissertation on the research project to be evaluated by examiners via *viva-voce*.

CHEMISTRY

MSCK 1413: ADVANCED PHYSICAL CHEMISTRY

Advanced physical chemistry provides insight into the fundamental reason that chemical systems and materials behave the way they do. This course gives students an advanced understanding of the properties and characteristics of solids, liquids and gases from a fundamental level right through to methodology for materials preparation and characterization. It emphasises on the key preparation processes, which include sol gel process, coprecipitation method, thin film techniques and solid state process. The course features essential characterization tools including X-ray techniques, electron microscopy and photo electron spectroscopy. Illustrations of the preparation and characterization techniques will be discussed in detail based on real researched materials through individual project works.

MSCK 1613: ADVANCED ORGANIC CHEMISTRY

This course focuses on the advanced knowledge and application of organic chemistry. This cover stereochemistry analysis including conformation and stereoelectronic effects, followed by asymmetric synthesis. Types of organic reactions and mechanisms of reactions such as oxidation-reduction, substitution, elimination, and rearrangements which emphasis special reactive intermediates will also be discussed.

MSCK 1713: ADVANCED INORGANIC CHEMISTRY

The course will cover the theoretical aspects of chemical bonding, molecular structure and symmetry. Emphasis is given on the chemistry of transition metals, including coordination and organometallic compounds. Primary reactions of organometallic compounds will be highlighted. Examples of important catalytic reactions involving organometallics as catalyst will be discussed. The students will be given a group assignment related to the topics discussed during lectures and an oral presentation will be executed.

MSCK 1303/USCP 0010: RESEARCH METHODOLOGY

This course is to provide a platform for furtherance to knowledge with regards to research skills. It consists of introduction (problem statement, objective and scope), literature review, methodology and expected results. Students are required to attend lectures on research methodology and information retrieval. At the end of the course, students are required to submit a research proposal of not more than 1,500 words (50 pages) and defend their research proposal orally. Students must take this subject before they are allowed to proceed to register Dissertation Course.

MSCKXY80/ MSCK XY90: DISSERTATION

Dissertation is the final stage of the Masters degree. Students are required to execute a research project under an identified supervisor/supervisors in an agreeable field of chemistry and submit a research dissertation report. It should demonstrate the skill in identifying an area suitable for research: setting research objectives; locating, organising and critically analysing relevant data and authoritative literature; devising an appropriate research methodology; presenting the results and findings; drawing conclusions; and making relevant recommendations and indications of areas for further research. Students must have a main

supervisor from Department of Chemistry and/or a co-supervisor from other related faculty or school. The student will need to defend his/her dissertation in a viva voce.

MSCK 1213: ADVANCED ANALYTICAL CHEMISTRY

This course covers technical aspects and applications of analytical separation methods, spectroscopy and analytical electrochemistry for qualitative and quantitative analysis. The analytical separation methods include sample preparation in analytical chemistry, gas chromatography (GC), high performance liquid chromatography (HPLC), and capillary electrophoresis (CE). The spectroscopic methods include mass spectrometry, atomic absorption spectroscopy (AAS), atomic emission spectroscopy (AES), inductively-coupled plasma-atomic emission spectroscopy (ICP-AES), inductively-coupled plasma-mass spectrometry (ICP-MS. Analytical electrochemistry covers the development and applications of finite-current-controlled techniques including linear sweep and cyclic voltammetry, pulse and differential pulse voltammetry, stripping analysis and chemical sensors with emphasis on chemically modified electrodes.

MSCK 1243: ADVANCED SEPARATION METHOD

This course provides platform to deepen the knowledge to develop various powerful chromatographic and sample preparation methods adapted to various types of samples such as environmental waters and soils, biological fluids and foodstuff. The course is aimed at students who target industrial or academic careers in the field of separation sciences. Typical topics are advances in Microextraction techniques, Multi-dimensional Gas Chromatography (GC x GC), Ultra Performance Liquid Chromatography (UPLC), Tandem mass spectrometry (MS/MS), advances in Capillary Electrophoresis (CE), as well as Microfluidic and lab-on-a-chip. Application areas include food, pharmaceuticals, proteomics, metabolomics, forensics and environmental. This course will also cover the usage of digital skill such as modelling software for prediction of the separation profile.

MSCK 1223: ADVANCED ELECTROANAYLTICAL CHEMISTRY

This course is designed to provide students with an understanding of the principles of analytical electrochemistry. Fundamental aspects of electrode reactions and structure of the interfacial region and application of electrode reactions to electrochemical characterization are included. Major electroanalytical techniques will be discussed including potentiometry, amperometry, polarography, cyclic voltammetry, pulse and differential pulse voltammetry, square wave voltammetry, and stripping analysis. Introduction to the principles of chemical and biochemical sensors will also be discussed. Students will work in small groups in undertaking electronalytical based experiments that may relate to real industrial problems and activities.

MSCK 1323: ADVANCED BIOCHEMISTRY

This course focuses on the integration of the major metabolic processes in mammals. It begins with an overview of metabolic processes and a description of the major metabolic contributions of several major organs. This is followed by a discussion of the feeding fasting cycle, which illustrates several important control mechanisms. It ends with a brief review of the major mammalian hormones and their mechanisms of action.

MSCK 1333: ADVANCED BIOTECHNOLOGY

This course discusses the importance of industrial enzymes in biotechnology. Some of the enzymes that have importance in industrial biotechnology include lipases, proteases and amylases. As enzymes are proteins, an introduction to protein chemistry will first be discussed. This is followed by methods of protein extraction, separation and purification. Some important features of enzymes including nomenclature, kinetics and factors affecting enzyme activity will be elaborated. Lastly, a discussion on preparation and application of enzymes used in the industry will be discussed.

MSCK 1423: QUANTUM CHEMISTRY AND SPECTROSCOPY

This course is designed as an introduction to quantum mechanics and its application in the molecular spectroscopy. It begins with an examination of the historical development of quantum theory, properties of particles and waves, wave mechanics and applications on simple systems, including the particle in a box, the harmonic oscillator, the rigid rotor and the hydrogen atom. The lectures continue with a discussion of the different types of spectroscopy and covers atomic, vibration, rotation and electronic spectroscopy for diatomic and polyatomic molecules. Besides, the final lectures cover the nuclear and electron magnetic resonance. This course is essential course for the theoretical and experimental chemists.

MSCK 1473: ADVANCED SURFACE AND COLLOID CHEMISTRY

This course is offered as an elective for students who are interested in expanding their basic knowledge in surface and colloid chemistry. The course will discuss on the fundamentals of surface and colloid chemistry, adsorption isotherms and their application in related technologies such as environmental remediation, detergency, biological system, food, and agriculture. Attempting to better understand these technologies gives the impetus to investigate the underlying theories, principles and methods of surface and colloid chemistry. Upon completion, students should be able to develop and apply knowledge in describing processes related to interfacial phenomena and colloidal system.

MSCK 1653: ADVANCED ORGANIC SPECTROSCOPY

This course revises the concepts and applications of infrared (IR), mass spectrometry (MS) and one dimensional nuclear magnetic resonance (1D NMR) together with elemental analysis for structural determination of organic compounds. Advanced theory and application of two dimensional nuclear magnetic resonance (2D NMR: HMQC, HMBC and NOESY) as well as mass spectrometry (MS) technique including EIMS, CIMS and FABMS will also be discussed.

MSCK 1743: BIOINORGANIC CHEMISTRY

Bioinorganic chemistry is the study of inorganic species especially metal ions in biological system. The course will begin with the principles of coordination chemistry and a survey of biological molecules and ligands. Study on metalloproteins: metal storage and transport; dioxygen transport in mammals and lower organisms. Electron transfer in biology: iron cytochromes, and iron-sulfur clusters. Metalloenzymes: copper enzymes, zinc enzymes and hydrolytic enzymes Vitamin B_{12}, nitrogenases and hydrogenases. the use of metal complexes as therapeutic agents.

MSCK 1753: INORGANIC REACTIONS MECHANISM

The course review and discuss inorganic and organometallic reactions, their mechanisms and kinetic characteristics. Basic chemical kinetics including rate laws, integrated rate expression is discussed. Reaction energetics and determination of rate laws are also discussed. **Ligand substitution reactions**: dissociative, associative and interchange mechanisms. Substitution reactions in square planar complexes: factors influencing reactivity – *trans* influence, *cis* effect, leaving and entering group effects. Stereochemistry of products. Substitution reactions in octahedral complexes: rate law and Eigen-Wilkins mechanism. Ligand steric and electronic effect. Stereochemistry of products. pH effects on substitution in aqueous media. Organometallic reactions: oxidative-additions, reactions of metal carbonyls, insertion reactions. **Redox reactions**: Inner and outer sphere mechanisms. Rate law, Marcus theory. Reaction mechanisms in selected bioinorganic and catalytic processes will be reviewed

MSCK XY80: INORGANIC REACTIONS MECHANISM

Dissertation is the final stage of the Masters degree. Students are required to execute a research project under an identified supervisor/supervisors in an agreeable field of chemistry and submit a research dissertation report. It should demonstrate the skill in identifying an area suitable for research: setting research objectives; locating, organising and critically analysing relevant data and authoritative literature; devising an appropriate research methodology; presenting the results and findings; drawing conclusions; and making relevant recommendations and indications of areas for further research. Students must have a main supervisor from Department of Chemistry and/or a co-supervisor from other related faculty or school. The student will need to defend his/her dissertation in a viva voce.

DISSERTATION CODES

CODE	NAME	STUDENT'S SEMESTER
MSCK 2180	DISSERTATION	3
MSCK 2280	DISSERTATION	4
MSCK 3180	DISSERTATION	5
MSCK 3280	DISSERTATION	6

Guidelines for Dissertation codes:

MSCK **XY**80
X – year of study ;
Y – 1st or 2nd semester;

FORENSIC SCIENCE

MSCN 1033: RESEARCH METHODOLOGY

This course is to provide a platform for furtherance to knowledge with regards to research skills. It consists of introduction (problem statement, objective and scope), literature review, methodology and expected results. Students are required to attend lectures on research methodology and information retrieval. At the end of the course, students are required to submit a research proposal of not more than 1,500 words (50 pages) and defend their research proposal orally. Students must take this subject before they are allowed to proceed to register Dissertation Course.

MSCN 1803: FORENSIC EVIDENCE AND THE ASPECTS OF LAW

This course introduces forensic science in the law aspects. The course covers the legal aspects of forensic science including the admissibility of scientific evidence, laboratory reports and expert testimony. This course also focuses on recognizing, protecting and preserving all physical evidence at a crime scene.

MSCN 1813: FORENSIC ANALYTICAL INSTRUMENTATION

This course provides the basic principles and application of various instrumental methods for examination of physical evidence, including microscopy, spectrophotometric and chromatographic techniques, electrophoresis and mass spectrometry.

MSCN 1823: FORENSIC CHEMISTRY

This course covers the principal areas of forensic chemistry, whereby physico-chemical properties of important evidences such as colorant, polymers and blood alcohol will be explored. Student will be introduced to qualitative and quantitative chemical analysis. This subject introduces to principles of forensic chemistry, basic analytical chemistry procedures, sampling, sample preparation, data analysis, immunoassay, analysis of color and colorants, analysis of polymers, analysis of blood alcohol concentration and statistical analysis. Case examples will also be presented and discussed.

MSCN 1831: FORENSIC TESTIMONY AND MOOT COURT

This course enables students to provide expert testimony, presenting evidence in a moot court, and to be examined by trial attorneys. This will provide them with the necessary skills for testifying forensic evidence as forensic experts.

MSCN 1853: FORENSIC PRACTICAL

This course covers the practical areas of forensic science related to the theory discussed in class – examinations of glass, paints, plastics, soil, hairs, drugs, fibres, accidents and alcohol analysis, as well as body fluid analysis (blood, saliva and semen). Upon analyses of exhibits in a simulated case, students are required to prepare a scientific and court report for preparation as an expert witness in a moot court.

MSCN 1913: CRIME SCENE INVESTIGATION

This course deals with advanced topics relating to the role physical evidence in the criminal justice system. Topics include philosophical aspects of crime scene investigation and reconstruction, as well as the practical crime scene searching techniques, evidence collection, handling and

management, and the legal framework as it relates to physical evidence. Real case studies will also be discussed.

MSCN 1923: BIOLOGICAL ASPECTS OF FORENSIC SCIENCE

This course discusses the principles of forensic serology, DNA, pathology, anthropology, odontology, toxicology as well as special topics in entomology. The role of the forensic laboratory in the identification of human remains; determination of the time, cause, and manner of death; individualization of biological materials.

MSCN 1933: EXAMINATION OF QUESTIONED DOCUMENTS

This course introduces the fundamental concepts and principles of examining questioned documents. It focuses on the detection of handwriting, forgery and its execution, typewriting identification, document alteration, and counterfeiting, as well as the significance or role of a questioned document expert in the administration of justice, as well as the care and preservation of related evidence for court litigation.

MSCN 1943: QUALITY ASSURANCE IN FORENSIC SCIENCES

This course provides a preparation for the forensic scientists to develop and implement quality assurance and quality control procedures to ensure the excellence of a laboratory. Covers preparation of laboratory procedures and policies, use of appropriate standards and controls, and validation methods for establishing an effective quality assurance program in their laboratory.

MSCN 1953: FORENSIC ENGINEERING

This course introduces the students to problems that can arise from product failure caused by inadequate materials, poor manufacturing or assembly methods, or poor design. This course also provides guidance for good product design before development. Case studies on historical catastrophes and failures will be presented.

MSCN 1963: COMPUTER FORENSICS

This course introduces the students to computer evidence issues, computer incident responses and security risk assessments. Expert witness testimony is touched upon during the course. This course also stresses on computer evidence preservation, cross validation of forensic tools and the documentation of computer evidence findings. Solid computer evidence processing methodologies are also taught to help overcome legal "junk science" attacks against the admissibility of computer-related evidence.

MSCN: 1973 FIRE AND EXPLOSION INVESTIGATION

This course covers the investigation of the causes of fires, whether accidental or deliberate. This involves the study of the dynamics of fires and explosions as a basis for interpretation of fire / explosion scenes in order to ascertain their cause (accidental or malicious) and who if anyone is to blame. The module will also explore the health and safety implications of such scenes and the identification and recovery of evidential materials. The investigation of accidental or illegal explosions are also dealt with in this course.

MSCN 1983: FIREARMS AND FORENSIC BALLISTICS

Firearms and Forensic Ballistics involves the examination of evidence from firearms that may have been used in a crime. This course will cover the basic overview of firearms and forensic ballistic, the mechanism and design aspect of firearm, evidence characteristic, types of examination, presentation of evidence in court and related case studies. The students are expected to identify the types and mechanics of firearms, indicate suitable analytical techniques and evaluate the forensic evidential value of firearms and forensic ballistic.

MSCN 1993: FORENSIC TOXICOLOGY AND DRUGS OF ABUSE

This course introduces the student to the general practices of Forensic Toxicology. It also includes a study of the qualitative and quantitative principles and procedures used in the detection of drugs commonly abused or as toxins in body fluids and human organs.

MSCN 1X80: FORENSIC RESEARCH PROPOSAL

Each student is expected to prepare the forensic research proposal under the guidance of at least one supervisor and produce a proposal relevance to forensic science. The student will need to defend his/her proposal in a presentation. The areas of research may include (but not limited to) Forensic Chemistry, (analytical method development and validation for various analytes etc.), Forensic Biology (e.g. Entomology, Diatomology, DNA, etc), Physics (e.g. LIBS etc.), Chemometrics (forensic provenance), Crime Scene Reconstruction, Criminalistics (impression evidence, glass, paints, soil, gunshot residues, questioned documents, terminal ballistics etc.). Specific area of research can also be explored, subject to availability of supervisors.

MSCN XX80: DISSERTATION

This course enables the student to carry out a research project in any areas of forensic relevance. Each student is expected to perform the forensic research under the guidance of at least one supervisor and produce a dissertation. The research can also be supervised by officers from industries/stakeholders like the Royal Malaysia Police. The student will need to defend his/her dissertation in a viva voce. The areas of research may include (but not limited to) Forensic Chemistry, (analytical method development and validation for various analytes etc.), Forensic Biology (e.g. Entomology, Diatomology, DNA, etc), Physics (e.g. LIBS etc.), Chemometrics (forensic provenance), Crime Scene Reconstruction, Criminalistics (impression evidence, glass, paints, soil, gunshot residues, questioned documents, terminal ballistics etc.). Specific area of research can also be explored, subject to availability of supervisors.

DISSERTATION CODES

CODE	NAME	STUDENT'S SEMESTER
MSCN2180	DISSERTATION	3
MSCN2280	DISSERTATION	4
MSCN3180	DISSERTATION	5
MSCN3280	DISSERTATION	6

Guidelines for Dissertation codes:

MSCN **XX**80
XX – year and semester of study

FORENSIC SCIENCE (TAUGHT COURSE)

MSCQ 1033: RESEARCH METHODOLOGY

This course is to provide a platform for furtherance to knowledge with regards to research skills. It consists of introduction (problem statement, objective and scope), literature review, methodology and expected results. Students are required to attend lectures on research methodology and information retrieval. At the end of the course, students are required to submit a research proposal of not more than 1,500 words (50 pages) and defend their research proposal orally. Students must take this subject before they are allowed to proceed to register Dissertation Course.

MSCQ 1803: FORENSIC EVIDENCE AND THE ASPECTS OF LAW

This course introduces forensic science in the law aspects. The course covers the legal aspects of forensic science including the admissibility of scientific evidence, laboratory reports and expert testimony. This course also focuses on recognizing, protecting and preserving all physical evidence at a crime scene.

MSCQ 1813: FORENSIC ANALYTICAL INSTRUMENTATION

This course provides the basic principles and application of various instrumental methods for examination of physical evidence, including microscopy, spectrophotometric and chromatographic techniques, electrophoresis and mass spectrometry.

MSCQ 1823: FORENSIC CHEMISTRY

This course covers the principal areas of forensic chemistry, whereby physico-chemical properties of important evidences such as colorant, polymers and blood alcohol will be explored. Student will be introduced to qualitative and quantitative chemical analysis. This subject introduces to principles of forensic chemistry, basic analytical chemistry procedures, sampling, sample preparation, data analysis, immunoassay, analysis of color and colorants, analysis of polymers, analysis of blood alcohol concentration and statistical analysis. Case examples will also be presented and discussed.

MSCQ 1833: FORENSIC TESTIMONY AND MOOT COURT

This course enables students to provide expert testimony, presenting evidence in a moot court, and to be examined by trial attorneys. This will provide them with the necessary skills for testifying forensic evidence as forensic experts.

MSCQ 1853: FORENSIC PRACTICAL

This course covers the practical areas of forensic science related to the theory discussed in class – examinations of glass, paints, plastics, soil, hairs, drugs, fibres, accidents and alcohol analysis, as well as body fluid analysis (blood, saliva and semen). Upon analyses of exhibits in a simulated case, students are required to prepare a scientific and court report for preparation as an expert witness in a moot court.

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MSCQ 1923: BIOLOGICAL ASPECTS OF FORENSIC SCIENCE

This course discusses the principles of forensic serology, DNA, pathology, anthropology, odontology, toxicology as well as special topics in entomology. The role of the forensic laboratory in the identification of human remains; determination of the time, cause, and manner of death; individualization of biological materials.

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MSCQ 1943: QUALITY ASSURANCE IN FORENSIC SCIENCES

This course provides a preparation for the forensic scientists to develop and implement quality assurance and quality control procedures to ensure the excellence of a laboratory. Covers preparation of laboratory procedures and policies, use of appropriate standards and controls, and validation methods for establishing an effective quality assurance program in their laboratory.

MSCQ 1953: FORENSIC ENGINEERING

This course introduces the students to problems that can arise from product failure caused by inadequate materials, poor manufacturing or assembly methods, or poor design. This course also provides guidance for good product design before development. Case studies on historical catastrophes and failures will be presented.

MSCQ 1963: COMPUTER FORENSICS

This course introduces the students to computer evidence issues, computer incident responses and security risk assessments. Expert witness testimony is touched upon during the course. This course also stresses on computer evidence preservation, cross validation of forensic tools and the documentation of computer evidence findings. Solid computer evidence processing methodologies are also taught to help overcome legal "junk science" attacks against the admissibility of computer-related evidence.

MSCQ: 1973 FIRE AND EXPLOSION INVESTIGATION

This course covers the investigation of the causes of fires, whether accidental or deliberate. This involves the study of the dynamics of fires and explosions as a basis for interpretation of fire / explosion scenes in order to ascertain their cause (accidental or malicious) and who if anyone is to blame. The module will also explore the health and safety implications of such scenes and the

identification and recovery of evidential materials. The investigation of accidental or illegal explosions are also dealt with in this course.

MSCQ 1983: FIREARMS AND FORENSIC BALLISTICS

Firearms and Forensic Ballistics involves the examination of evidence from firearms that may have been used in a crime. This course will cover the basic overview of firearms and forensic ballistic, the mechanism and design aspect of firearm, evidence characteristic, types of examination, presentation of evidence in court and related case studies. The students are expected to identify the types and mechanics of firearms, indicate suitable analytical techniques and evaluate the forensic evidential value of firearms and forensic ballistic.

MSCQ 1993: FORENSIC TOXICOLOGY AND DRUGS OF ABUSE

This course introduces the student to the general practices of Forensic Toxicology. It also includes a study of the qualitative and quantitative principles and procedures used in the detection of drugs commonly abused or as toxins in body fluids and human organs.

MSCQ 1180: FORENSIC RESEARCH PROJECT 1

Each student is expected to prepare the forensic research proposal under the guidance of at least one supervisor and produce a proposal relevance to forensic science. The student will need to present his/her proposal in a writing or presentation. The areas of research may include (but not limited to) Forensic Chemistry, (analytical method development and validation for various analytes etc.), Forensic Biology (e.g. Entomology, Diatomology, DNA, etc), Physics (e.g. LIBS etc.), Chemometrics (forensic provenance), Crime Scene Reconstruction, Criminalistics (impression evidence, glass, paints, soil, gunshot residues, questioned documents, terminal ballistics etc.). Specific area of research can also be explored, subject to availability of supervisors.

MSCQ 2180: FORENSIC RESEARCH PROJECT 2

This course enables the student to carry out a research project in any areas of forensic relevance. Each student is expected to perform the forensic research under the guidance of at least one supervisor and produce a project report. The research can also be supervised by officers from industries/stakeholders like the Royal Malaysia Police. The student will need to defend his/her research project in a presentation session. The areas of research may include (but not limited to) Forensic Chemistry, (analytical method development and validation for various analytes etc.), Forensic Biology (e.g. Entomology, Diatomology, DNA, etc), Physics (e.g. LIBS etc.), Chemometrics (forensic provenance), Crime Scene Reconstruction, Criminalistics (impression evidence, glass, paints, soil, gunshot residues, questioned documents, terminal ballistics etc.). Specific area of research can also be explored, subject to availability of supervisors.

MATHEMATICAL SCIENCES

MSCM 1033: RESEARCH METHODOLOGY

This course covers the general principles of Research Methodology particularly in the field of mathematics or other related areas of the mathematical sciences. It discusses the fundamental process in conducting an academic research. The theoretical and practical aspects of preparing a research proposal will be presented. Amongst topics that will be covered are introduction to research and its philosophy, problem formulation and research objective, literature review, techniques for saving and retrieving information, research methodology and design, preparing research proposal and writing research technical report. The expectation is not mastery of research methodology, but rather improvement in competencies to conduct disciplined research in a chosen area under supervision.

MSCM 1043: MATHEMATICAL METHODS I

The course discusses special functions comprising of Appel's symbol, Vandermonde's theorem, Hypergeometric series, Gamma function, analyticity, limit formulas, reciprocal of the Gamma function, duplication theorem, Eurler's reflection formula and the solutions of various important differential equations expressible in terms of the hypergeometric series. The course also covers integral transforms such as the Laplace transform and Fourier transform. The properties of transformations, the inversion integrals, Bromwich integral, Calculus of Residues and the application of integral transforms to initial or boundary value problems of engineering science are also considered. Topics on conformal mapping, invariance of Laplace Equation and Dirichlet problem and Poisson Integral formula are also to be included in the course materials.

MSCM 1053: COMPUTATIONAL MATHEMATICS

The course begins with introducing the software stuctures which include concepts, conventions that support object-oriented programming, identification of class structure, problem partitioning, and abstraction. Students will be exposed to components of object-oriented language using C++ to algorithmic program design such as objects, methods and events, as well as program control that include abstraction of data, variable types, arrays, functions and pointers. The course provide opportunities to students to develop user inferface using Visual C++ for visualizing the problems as well as their solutions. C++ techniques for providing solutions to numerical-intensive mathematical problems, design of algorithms and schematic techniques in solving numerical problems, scientific problem modeling and simulation, and graphical-user interface design for data visualization will also be discussed. The students' programming skills are challenged by solving case studies and developing software on selected problems in numerical methods, graph theory and discrete-event simulations

MSCM 1113: ADVANCED ENGINEERING MATHEMATICS

The course begins with the pertubation methods consisting of ordering, asymptotic sequences and expansions, together with Landau order symbols and Gauge functions. Solution of algebraic equations will be discussed such as the regular pertubation problems and singular pertubation problems. The course will also touch on the solutions of trancendental equations and the solutions of initial value problems. In addition regular pertubation will be discussed specifically on the projectile oscillators and pendulum problems. Further, linear damped oscillator and non-linear Duffing equations are handled by methods of multiple scales while the singular pertubation in boundary- value problems namely equations with constant coefficients are solved by the method of matched asymptotic expansion, where as equations with variable coefficients are treated by

boundary layer theory. Finally the application of the above methods to partial differential equations will be shown.

MSCM 1123: THEORETICAL MECHANICS

This course deals with three parts: the mechanics of particles and rigid bodies, oscillations and wave motions and analytical mechanics of material systems whose behaviour is governed by Newton's Law of Motion. The mechanics of particles and rigid bodies: The course begins with Newton's Law of Motion. Emphasis is given to ideas of conservation of linear and angular momentum, energy, and to the relation between these conservation laws and Newton's Laws. These laws are formulated in general vector notation, and applications include a study on planetary motion. The notions of inertial and non-inertial frames are discussed and illustrated by considering motion relative to the rotating earth. The discussion of rigid body problems is mainly concerned with planar motions but somenon planar motions will also be considered. Oscillations and wave motions: Discussion on simple harmonic motion which is later generalised to include frictional damping, forcing terms and nonlinear effects. Emphasis will be put on demonstrating unification obtained as a result of the mathematical formulation of a variety of physical phenomena. The analysis will be extended to study a variety of harmonic and more general wave motion. Analytical mechanics of material systems: Attention is given to the advanced mathematical developments of the subject that are due, especially to Lagrange and Hamilton. The applications considered include such diverse problems as the dynamics of crystal (atomic) structures, the solar system and gyroscopes. Classical mechanics is a key subject in scientific enquiry; and it is, moreover, the gateway to the study of many important subjects in applied mathematics (fluid mechanics, solid mechanics, control theory) and mathematical physics.

MSCM 1133: SOLITONS & NONLINEAR WAVES

The course introduces student to the basic theories and principles of nonlinear waves. It will examine some underlying general concepts related to solitons and nonlinear waves equations. These include topics in linear waves, some nonlinear equations of evolutions, soliton interaction, general equation of evolution, group velocity and nonlinear waves.

MSCM 1143: FLUID MECHANICS AND HEAT TRANSFER

This course aims to equip students with the required skills to develop mathematical models for fluid flow and heat transfer problems, and the ability to interpret their solutions and physical meanings. Emphasis is on the derivation of the governing equations of motion for fluid flows and heat transfer in forced, free and mixed convection. The approximate and exact methods of solutions in the limiting case of low and high Reynolds number flows are discussed. These include the Oseen and Stokes flows and the boundary layer flows in various situations.

MSCM 1153: APPLIED AND COMPUTATIONAL COMPLEX ANALYSIS

This course is a continuation of a typical undergraduate Complex Variables course. This course introduces more advanced topics on Laurent series, residue theory, conformal mapping and their applications. Topics include Laurent series (with applications to Bessel function and Fourier series), residue theory (with applications to improper integrals and summing of series), numerical complex integration, conformal mapping (bilinear transformation, symmetry principle, Schwarz-Christoffel transformation, Riemann map) with applications in solving boundary value problems of science and engineering. This course also integrates the use of Mathematica software to study numerical complex integration, conformal mapping and boundary value problems.

MSCM 1163: MATHEMATICAL METHODS II

This course teaches advanced mathematical methods techniques that graduate students will find useful in their research. We will aim to cover topics on complex variables – Bromwich integral & residues on branch cuts and on various asymptotic methods – integration by parts, Watson Lemma, Laplace methods and steepest descent method.

MSCM 1173: PARTIAL DIFFERENTIAL EQUATIONS

This course begins by introducing the basic elements of the element method. It covers topics that include Laplace's equation in two dimensions, Green's functions and theorem, integral equation formulation and boundary element formulation. Each student will be required to do a small project to gain experience in the implementation of the method for specific applications.

MSCM 1213: GROUP THEORY I

This course consists of two parts. The first part includes introduction to groups, types of groups, isomorphisms between groups, composition of groups to form a direct product, and types of subgroups including normal subgroups and factor groups. Furthermore, some advanced topics in group theory are included which are rings and integral domains.The second part is a selected topic of Sylow Theorems and their applications, topics on generators and relations, and some applications of group theory.

MSCM 1223: GALOIS THEORY

The course introducesgeneral properties of rings, integral domains and fields. Fundamental homomorphism theorem, quotient rings, prime and maximal ideals are exposed. The fundamentals of Galois theory, polynomial rings, principle ideal domain, Euclidean domain,test for irreducibility, polynomial factorizations and zeros of polynomials are covered. The field of quotients of an integral domain, the underlying properties offield extensions, Kronecker's Theorem, minimal polynomial, algebraic and transcendental extensions, evaluation homomorphism,primitive element, splitting fields, normal and separable extensions constitute the ideas behind Galois Theory. The final part of the course includes the Theorem of primitive element, Galois group, Galois correspondence and extensions.

MSCM 1233: MATHEMATICAL ANALYSIS

This course begins with introducing the metric spaces which include open set, closed set, convergence, Cauchy sequences and completeness. These are followed by the normed spaces which cover vector space, normed space, Banach space, finite dimensional normed space and subspaces, compactness and finite dimension, linear operators, bounded and continuous linear operators, linear functionals, linear operators and functionals on finite dimensional spaces, Hahn-Banach theorem, open mapping theorem and closed graph theorem. The course ends with Banach Fixed Point Theorem which include contraction mapping and error bound in iterations. The course also emphasize on the applications of Banach Fixed Point Theorem to system of linear equations (Jacobi and Gauss-Siedal iterations), differential equations (Picard's existence and uniqeness theorem) and integral equations (Fredholm integral equation and Volterra integral equation).

MSCM 1253: THEORY OF MATRICES

Introduction to linear algebra for the graduate students which covers linear algebra on complex numbers and finite fields, eigen vectors and values, quadratic and normal forms, simalirity and selected topics will be exposed. Further topics such as modules and spectral theorem are included.

MSCM 1263: POINT SET TOPOLOGY

This is an advanced course in Topology. It covers the metric spaces which include the normed vector spaces, subspace metrics, open subsets and continous maps, and metrics on product, as well as the topological spaces which include the continuous maps, bases, the axiom of countability, product topologies. It also covers compact spaces that include the Hausdorff separation axiom, compactness, products of compact spaces, the one-point compactification and properness. Quotient topology and gluing are also the main interest of the course that discussthe quotient topology, gluing surfaces out of charts, compatibility of quotient topology with products. The course ends with the identification of topological and quotient groups.

MSCM 127 : GROUP THEORY II

Advanced group theory which covers simple groups, series of groups, group action on a set, isomorphism theorems, free abelian groups, free groups, group presentations are exposed. Properties ofrings and field, integral domains, rings of polynomials,factor rings and ideals,Grobner bases for ideals are covered. The final part of the course exposes the students to the underlying theory of extension fields, vector spaces and algebraic extensions.

MSCM 1313: NUMERICAL ORDINARY DIFFERENTIAL EQUATIONS

This course exposes student to the basic theory of the general linear multi-step methods, explicit/implicit methods, order and the convergence of the methods to solve initial value problems for first order ordinary differential equations. Problems in applying the methods, local and global truncation error, and weak stability theory of the methods will be discussed. The application of some implicit methods such as the predictor-corrector method including step-control policy will be highlighted. The students will derive the classical Runge-Kutta method (explicit/implicit), determine order and convergence of methods and their error estimates. The course also covers extrapolation methods such as polynomial and rational extrapolations and the existence of asymptotic expansion. The students will eventually be able to solve higher order ordinary differential equation problems and the problem of stiffness arising in first order system. Further, the students will solve two-point boundary value problems using shooting method and finite difference method.

MSCM 1323: FINITE DIFFERENCE METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS

This course discusses finite difference methods for solving partial differential equations. The models used for equations of the parabolic, hyperbolic, and elliptic used are the heat conduction, wave, and Poisson's equations, respectively. For each of these equations, the corresponding finite difference methods are developed. Discussion begins with one-dimensional problems for the parabolic and hyperbolic equations and two-dimensional problems for the elliptic equations. Extensions to two- and three-dimensional problems are then made for the former. Nonlinear parabolic equations are also discussed. For two-dimensional problems finite-difference methods based on polar coordinates are also covered. For one-dimensional hyperbolic equations, finite-difference schemes based on characteristic curves are given preference over those based on rectangular coordinates. Discussion includes convergence, stability, and consistency as well as the relevant theorems. Methods of numerical linear algebra specific to the structures of the algebraic linear systems in each category are reviewed; specifically, tridiagonal systems, block tridiagonal systems, and results on eigenvalues.

MSCM 1333: FINITE ELEMENT METHOD

Solutions to the one- and two-dimensional boundary value problems using the finite element approximation method. Strong and weak forms of the problems, and their approximating functions. Formation of elements and nodes for approximation. Discussions on the integral and variational methods. Finite element formulation using the Galerkin method in 1- and 2-dimensional boundary value problems involving ordinary and partial differential equations. Case studies on one-dimensional problems including heat transfer, string displacement, linear elasticity, beam bending and truss analysis. Nonlinear problems: Burger's equation is discussed. Case studies on two-dimensional problems involving mesh elements formation, and their representations in the form of isoparametric and serendipity elements. Case studies on two-dimensional problems including heat transfer, fluid dynamic and plate/plane formulation. Finally, FEM error analysis is discussed.

MSCM 1353: PARALLEL COMPUTING

The course will familiarize the knowledge and concept in the field of parallel and distributed algorithm on high performance computing platform. This course will emphasize on parallel architecture, parallel programming models, system software, and parallel algorithms for mathematical modelling, graph theory, computational geometry, numerical analysis and combinatorial optimization in solving the grand challenge applications. Issues such as synchronization, data distribution, load balancing, data partitioning, interconnection networks and data communication will be considered for shared memory and distributed architectures. Problems are deal with bus-based computing platforms, communication and computational complexity analysis. Discussion on intelligent system and emergent technologies as tools for fast, stable and robust solutions. The course will also include a significant laboratory component involving the design, implementation and evaluation of parallel programs on message passing paradigm using parallel virtual Machine (PVM), Message Passing Interface (MPI), Matlab Distributed Computing and Multicore Programming.

MSCM 1363: NUMERICAL INTEGRAL EQUATION

The course introduces linear integral equations and their classifications. The topics covered are Fredholm alternative theory, Fredholm equations of the second kind, quadratures rules, finite difference methods, expansion methods, linear programming solutions and variationalmethods.It also discusses singular equations. Voltera equations of the second kind and integral equations of the first kind.Further, eigenvalue problems.nonlinear integral equations,integro-differential equations and iterative integral equations will be discussed.

MSCM 1393: NUMERICAL LINEAR ALGEBRA

A fundamental course in Numerical Analysis in the sense that most numerical approaches to solving problems invariably reduce the problems to solving or analysing systems of algebraic equations. Covers four main topics, namely the numerical solution of systems of linear algebraic systems, the least squares problem, the algebraic eigenvalue problem, and the singular value decomposition. The backward error analysis will be introduced. The problem of conditioning of a problem will be discussed. The quest for a stable algorithm usually involves a transformation using unitary matrices, such as the Householder matrix. Naturally the MATLAB is used extensively as a blackbox as well as for programming purposes.

MSCM 1413: MATHEMATICAL STATISTICS

This course stresses on mathematical aspects of statistics, emphasizing on probability, probability distributions and densities, as well as classical statistical inference. Bayesian approach to analysis is also introduced as an alternative approach to the classical approach. The course begins with a review of probability concepts, followed by the explorations of random variables, extending from univariate to multivariate phenomena. Common probability distributions are also covered in terms of their properties and moment generating functions, if exist. Properties of estimators and different methods of parameter estimation are also discussed in detail. Finally, the course also investigates the hypothesis test and its possible errors.

MSCM 1423: PROBABILITY THEORY

This course begins with the theory of sets in introducing sample space, event and probability. These are followed by the discussion on the probability measures, basic rules of probability calculus, sampling, counting subsets, discrete distributions, conditional probabilities, independence and Bayes Theorem, the principle of maximum likelihood, random variables, distribution functions, continuous random variables, expectation and moments, covariance and correlation, the law of large numbers, moment generating functions, multivariate distributions, bivariate normal distributions and stochatic process. Upon completion students should be able to understand the mathematical concepts that are used in deriving certain techniques and methods in statistics.

MSCM 1433: STOCHASTIC PROCESSES

This course begins with the fundamental of stochastic processes that is the probability theory, and proceeds to discussing major stochastic processes, including Markov chains; discrete and continuous Markov chains, Poisson processes, Brownian Motion, and renewal theory. Applications to inventory problems, equipment replacement and queuing theory are also dealt with through examples. Upon completion, students should be able to recognize the relevance of mathematical techniques presented in solving real-world problems, apply the techniques, and demonstrate knowledge of various random processes.

MSCM 1453: GENERALIZED LINEAR MODELS

Pre-requisite: Mathematical Statistics, Linear Algebra, Calculus.
This course begins by introducing generalized linear models and presenting a unifying framework for many commonly used statistical techniques. Linear regression models and many other models are special cases of GZLM. The main ideas of statistical modelling and theoretical background are covered in the first half of the course. The other half of the course deals with applications of GZLM on multiple linear regression (MLR), analysis of variance (ANOVA), analysis of covariance (ANCOVA)and binary data analysis. The examples used in the lecture involve analysis of relationships between measurements on group of subjects or objects, dealing with one response and several explanatory variables.

MSCM 1463: TIME SERIES

This course begins with introduction to forecasting, statistics background for forecasting, introduction to stochastic model and deterministic model: the fundamentals of model construction, stationary process, autocorrelation function, linear model: Autoregression process, moving average process, autoregression process and integrated moving average. Forecasting functions: Forecasting correlation error. Model determination: Technique in model determination and model estimation, non-linear model estimation and computer usage in time series.

MSCM 1473: MULTIVARIATE STATISTICAL ANALYSIS

The course comprises of two parts, namely the theory of multivariate statistics and the applications of multivariate methods. The theoretical part consists of conceptualizing multivariate data from the geometrical aspect and use of matrices to handle multivariate data, multivariate normal distribution, inferences about the mean vector and comparisons of several multivariate means. The application part consists of multivariate data exploration, multivariate linear regression models, principal components, factor analysis and inference for structured covariance matrices and canonical correlation analysis.

MSCM 1613: ADVANCED OPTIMIZATION TECHNIQUES

This course is an advanced course in optimization techniques. The subject matter of the course is optimization algorithms meant for solving unconstrained and constrained optimization problems.. The course will start with some preliminary results from multivariable calculus and discussions on a few basic algorithms for unconstrained problems. The discussion is then geared towards the solution of constrained problems. Amongst the topics discussed in the course are Lagrange multipliers, Kuhn-Tucker conditions, convexity, transformation methods, linearization methods, and direction generation methods. Students will be encouraged to use MATLAB, C or MATHEMATICA to write programs on the algorithms. Upon completion, students should be at ease to use these methods for solving the majority of unconstrained and constrained optimization problems.

MSCM 1633: GAME THEORY

The game theory topics first covers the different types of games, the impartial combinatorial games, take-away games, the game of Nim, graph games, sums of combinatorial games and two-person zero-sum games. Then the strategic form of a game, matrix games, domination and the principle of indifference will be learned. The course also include applications and extensions of game theory by considering the extensive form of a game and solving finite games. The course also intends to further include recursive and stochastic games, two-person general-sum games, bimatrix games - safety levels, noncooperative Games -- equilibria.models of Duopoly, cooperative games, games in coalitional forms and many-person TU games. Imputations and the core, the Shapley value and the nucleolus will also be discussed.

MSCM 1643: HEURISTIC OPTIMIZATION METHODS

This subject discusses various types of heuristic optimization techniques, their basic concept, algorithm and implementation. The topics include: Introduction to Heuristic Methods; Computational Experiments with Heuristics; Constructive Heuristics: Descent Method, Composite Heuristic, Multi-level Heuristic, Perturbation Heuristic; Meta-heuristics: Simulated Annealing, Tabu Search, Genetic Algorithms; Introduction to other meta-heuristic methods: Ant Colony, Variable Neighbourhood Search, Neural Network.

MSCM 1663: SUPPLY CHAIN MODELLING

This course begins with basic elements of supply chain modeling – logistic system, demand forecasting and collaborative planning, including the component of logistic systems; the interaction between these components; models and techniques for the analysis of logistics systems and the development of information and decision support systems. Demand forecasting - Role of demand forecasting in supply chain, identify the component of a forecast, qualitative and quantitative forecasting, forecast accuracy and explains collaborative planning, forecasting and replenishment in supply chain modeling.

MSCM XY80: DISSERTATION

In the second semester of study, supervisors will be assigned to respective students by the postgraduate program committee. The assignment is based on his area of research preferences revealed by his coursework enrolment and performance. However the students can only register for dissertation in the third semester upon completing all his courseworks with a cumulative grade point average exceeding 3.0. The dissertation intends to expose and consolidate basic research skills such as doing literature review and formulating research problems, doing preliminary dissertation research work prior to the final dissertation research. At the final stage of the dissertation, the student will be required to submit a research dissertation report. Assessment by elected postgraduate committee members will be based on the student's Dissertation presentation and report.

DISSERTATION CODES

CODE	NAME	STUDENT'S SEMESTER
MSCM2180	DISSERTATION	3
MSCM2280	DISSERTATION	4
MSCM3180	DISSERTATION	5
MSCM3280	DISSERTATION	6

Guidelines for Dissertation codes:

MSCM **XY**80
X – year of study ;
Y – 1st or 2nd semester;

ENGINEERING MATHEMATICS

MSCJ 1033: RESEARCH METHODOLOGY

This course covers the general principles of Research Methodology particularly in the field of mathematics or other related areas of the mathematical sciences. It discusses the fundamental process in conducting an academic research. The theoretical and practical aspects of preparing a research proposal will be presented. Amongst topics that will be covered are introduction to research and its philosophy, problem formulation and research objective, literature review, techniques for saving and retrieving information, research methodology and design, preparing research proposal and writing research technical report. The expectation is not mastery of research methodology, but rather improvement in competencies to conduct disciplined research in a chosen area under supervision.

MSCJ 1523: METHOD OF ENGINEERING MATHEMATICS

This course introduces Appel's symbol, Vandermonde's theorem, Hypergeometric Series, Gamma Function, Analyticity, Limit formulas, Reciprocal of the gamma function, Duplication theorem, Eurler's reflection formula, Solutions of various important differential equations expressible in terms of the hypergeometric series. Integral Transform: Laplace transform, Fourier transform and Mellin, Inversion Integral, Bromwich Integral & Calculus of Residues. Properties of transformations, application of integral transforms to initial or boundary value problems. z-transform, solving difference equation using . z-transform and method of convolution

MSCJ 1533: NUMERICAL METHODS IN ENGINEERING

A fundamental course of numerical methods in engineering.
The first part covers the initial value problem (IVP), error analysis, single step, multistep method as well as the system of ordinary differential equation (ODE). The second part covers finite difference technique in boundary value problem (BVP). A simple irregular boundary is introduced. The third part covers the finite element method (FEM) with applications focus on heat problem as well as eigenvalues calculation for dynamic finite element analysis. The last part covers finite volume method in two-dimension diffusion equation. Truncation error is discussed.

MSCJ 1513: PARTIAL DIFFERENTIAL EQUATIONS

This course introduces the basic elements of the various solutions techniques are adopted by the process engineers to solve the partial differential equations. The solution methods include the method of characteristics, separation of variables, Laplace and Fourier transforms, perturbation and asymptotic methods. Topics include Laplace's equations, Green's functions and theorem. Each student will be required to do small project so that they gain experience in the implementation of the method for specific applications.

MSCJ 1733: SOLITON & NONLINEAR WAVES

The course introduces student to the basic theories and principles of nonlinear waves. It will examine some underlying general concepts related to solitons and nonlinear wave equations. These include topics in linear waves, some nonlinear equations of evolutions, methods of solutions, soliton interaction, general equation of evolution, group velocity and nonlinear waves.

MSCJ 1543: FLUID MECHANICS AND HEAT TRANSFER

This course aims to equip students with the required skills to develop mathematical models for fluid flow and heat transfer problems, and the ability to interpret their solutions and physical meanings. Emphasis is on the derivation of the governing equations of motion for fluid flows and heat transfer in forced, free and mixed convection. The approximate and exact methods of solutions in the limiting case of low and high Reynolds number flows are discussed. These include the Oseen and Stokes flows and the boundary layer flows in various situations.

MSCJ XY80: DISSERTATION

Dissertation is a follow-up research work to Research Methodology. At the end of the semester the student will be required to submit a research dissertation based on the research topic that would be assigned and approved by the postgraduate committee. Topics must be related to ongoing research projects carried out in the FKA, FKM, FKE or Mathematics Department. The committee will only approve topics, which have substantial combination of mathematics and engineering aspects. Many areas of applied mathematics such as fluid dynamics, magneto hydrodynamics and wave phenomena can be considered for this research project.

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MSCJ 2280	DISSERTATION	4
MSCJ 3180	DISSERTATION	5
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PHYSICS

MSCF 1813: RESEARCH METHODOLOGY

This course intends to cover the general principles of research methodology that are applicable to diverse branches of basic and applied sciences such as biology, chemistry, mathematics and physics. It discusses the fundamental aspects of conducting good scientific research with novelty and ethics. The theoretical and practical aspects of preparing research proposals and writing research articles will be presented. The course will start with an introduction to research methods, approaches, procedures and philosophy, setting title, problem formulation and research objectives, literature review, research methodology and design, data collection and analysis, writing research papers for workshops, conferences and thesis as well as research management. Making an effective presentation and submission of research articles in high impact journal and research proposal for acquiring grants will be discussed.

MSCF 1113: QUANTUM MECHANICS

This course reinforces the basic quantum mechanics at the undergraduate level and extends further topics to the course. Basic formalism of quantum mechanics will be reviewed. Harmonic oscilator, hydorgen atom and identical partilces will be covered. The approximation methods which include perturbation theory, variational principle and WKB aproximation will be studied. Lastly scattering theory will be discussed.

MSCF 1423: SEMICONDUCTING BULK MATERIAL

The course begins with Atomic bonding: Ionic, covalent and mixed bonding. Band structure: Ideal, real semiconductors, energy gap, direct and indirect gaps, cyclotron resonance. It is followed by discussion on Extrinsic semiconductors: Impurity atoms and ionization energy. Thermal equilibrium of electrons and holes concentrations, degenerate and non-degenerate semiconductors, compensated semiconductors, Fermi level positions, excitons. Carrier transport phenomena in semiconductors: Drift current density, mobility, conductivity, diffusion current density, total current density, the Einstein relation. Non-equilibrium excess carriers in semiconductors: Excess carrier generation and recombination, traps and recombination centres, kinetics of electron traps, kinetics of recombination centres, The Shockley-Read-Hall theory, space charge in semiconductors, relaxation effects. Optical properties of semiconductors: Photoemission, photoconductivity, practical photoconductors, luminescence, characteristic and non-characteristic luminescence, electroluminescence. Amorphous semiconductors: Electronic states, defects and structure, charge transport are discussed towards the end of the course.

MSCF 1143: ELECTRODYNAMICS

Electromagnetic Theory (EMT) is fundamentally involved everywhere and is perhaps one of the largest branches of modern physics. The course starts with a brief introduction in explaining the basic notions of electromagnetic wave equations, their solution in different medium and Poynting theorem. The state of polarization, dispersion, reflection, refraction and scattering will be explored in depth. Theory of gauge, waveguides, covariant formulation, conservation laws, power loss and electromagnetic field generation are the recurring theme. Finally, the theory of vector and scalar potentials, moving charges, multi-pole fields and their detailed applications will be presented.

MSCF 1313: ACOUSTICS & ULTRASONICS

The course will emphasizes on the theory and the applications of acoustic waves and focusing on the ultrasonic range. The course begin with introduction on the physical properties of the

acoustic waves and its interaction with the surrounding media. This will be followed by the discussion on the physical principles of acoustic and ultrasonic wave transduction and their transduction behaviour. The ultrasonic wave interaction with media will be further discussed to establish the foundation for the various ultrasonic processes and measurement principles. The principles of various ultrasonic measurement system and instrumentations will be described. In general the course provides a deep understanding of acoustic and ultrasonic wave behaviour and the underlying physical principles of various applications.

MSCF 1413: THIN FILM

This course is intended for the advanced students, covering the basic physics and theories and techniques of deposition processes and topics related to a very rapidly growing area - thin film applications in materials science. Essentially, it consists of the Background, Nucleation theories, Formations of Thin Films, PVDs and CVDs Deposition Techniques, Properties and Characterization and Thin Film Devices.

MSCF 1413: ANALYTICAL TECHNIQUES

Introduction to advanced analytical techniques in all branches of physics. Student will get working knowledge on advanced tools like, Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM). Students will be familiar with Nuclear Magnetic Resonance (NMR), Electron Spin Resonance (ESR), Scintillation and Gamma ray spectroscopy, Secondary Ion Mass Spectroscopy (SIMS), Mass spectrometry, X-ray and Small Angle X-ray Scattering (SAXS) Spectroscopy. They will acquire good understanding on the principle of Laser Spectroscopic Methods, Raman Spectroscopy, Surface Enhanced Raman Spectroscopy (SERS), UV-Vis spectroscopy, for the examination of bulk and nanomaterials. In addition, they will be introduced to the basic concepts on Electron Energy Loss Spectroscopy (EELS), Internal Reflection Spectroscopy and X-ray fluorescence. They will gain specific knowledge on Photo-Acoustic Spectroscopy, X-ray Photoelectron Spectroscopy (XPS), Photoluminescence (PL), UV and Inverse Photoemission Spectroscopy, Rutherford Backscattering Spectroscopy (RBS) and Low Energy Electron Diffraction.

MSCF 1433: SEMICONDUCTOR DEVICES

This course is designed to review the semiconductor field, semiconductor growth and the physical properties of semiconductor. Special focus will be on semiconductor device: Schottky, ohmic contacts, metal-semiconductor junction, p-n Junction; fabrication, photolithography, doping layering, patterning, heat treatment, Principle and operation; equilibrium condition, forward and reserve bias, junction capacitance, varactor, Type of Diode; Junction diode, Tunnel diode, Zener diode, Photo diode, Light Emitting Diode (LED), Laser diode, Photovoltaic. Transistor; Bipolar Junction Transistors (BJT), Field Effect Transistors (FET).

MSCF 1123: ELEMANTARY PARTICLE

This course is designed to expose student to understand the most fundamental components of nature using the quark model. Some topics of interest would be: The structure, definition, flavor and the combination of quarks to form other particles, Classifications of particles and their interactions into a number of easily identifiable categories, and a number of empirical rules will also be studied, Interactions between particles will be dealt with in terms of the four types of forces and the exchange of particles between them including the conservation theory of various interactions in terms of lepton number, parity, charge conjugate and time reversal. Also included in the course will be the technique for nuclear and particle physics experiments by radiation

detectors, calorimeters and radiation facilities. At the end of the course, the student will be exposed to the understanding of unification theory of forces which incorporate the mechanics of the strong, weak, and electromagnetic interactions into a single theory.

MSCF 1453: NON-CRYSTALLINE SOLID

The course starts with a brief classification of solids and the amorphous state. The transition of liquid to crystal and glass will be explained kinetically which is temperature dependent. Then, the theory for glass formation, structure of liquid and glass using a radial distribution function will be given. Next is the optical properties which include the inter-band absorption edge and the activation energy of the system. Then the amorphous part will be discussed especially that which of carbon and silicon especially in term of their structure and the electro-optical properties. Finally some applications of amorphous thin films material will be discussed.

MSCF 1463: PHASE TRANSFORMATION

The course starts with a brief classification of solids and the amorphous state. The transition of liquid to crystal and glass will be explained kinetically which is temperature dependent. Then, the theory for glass formation, structure of liquid and glass using a radial distribution function will be given. Next is the optical properties which include the inter-band absorption edge and the activation energy of the system. Then the amorphous part will be discussed especially that which of carbon and silicon especially in term of their structure and the electro-optical properties. Finally some applications of amorphous thin films material will be discussed.

MSCF 1513: OPTOELECTRONICS

This course is designed to expose the students to optoelectronics with emphasis on the functions of components and devices in optoelectronic and fibre optic systems. The basic working principles of the various components and devices are described. At the end of this course, students should be able to describe the principles involved in the operation of optoelectronics and fiber optics components, devices and systems. The various types of fibre optic sensors for different applications and the working principles of various components in fibre optic sensing systems. The students should also be able to analyze the functional components of optoelectronic and fiber optics systems and should be grateful to the Creator for the knowledge attained on optoelectronics and fibre optics, together with their applications.

MSCF 2180: DISSERTATION

This course is designed to expose the students to the focus study of the research works. Students need to conduct the research work in a laboratory and analyze the data critically to solve the research problem. At the end of the course, students are required to submit the final research dissertation and sit for an oral examination (viva voce). Student is also required to complete a technical paper for publication in a scientific journal.

DISSERTATION CODES

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MSCF 2180	DISSERTATION	3
MSCF 2280	DISSERTATION	4
MSCF 3180	DISSERTATION	5
MSCF 3280	DISSERTATION	6

Guidelines for Dissertation codes:

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Y – 1st or 2nd semester;

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