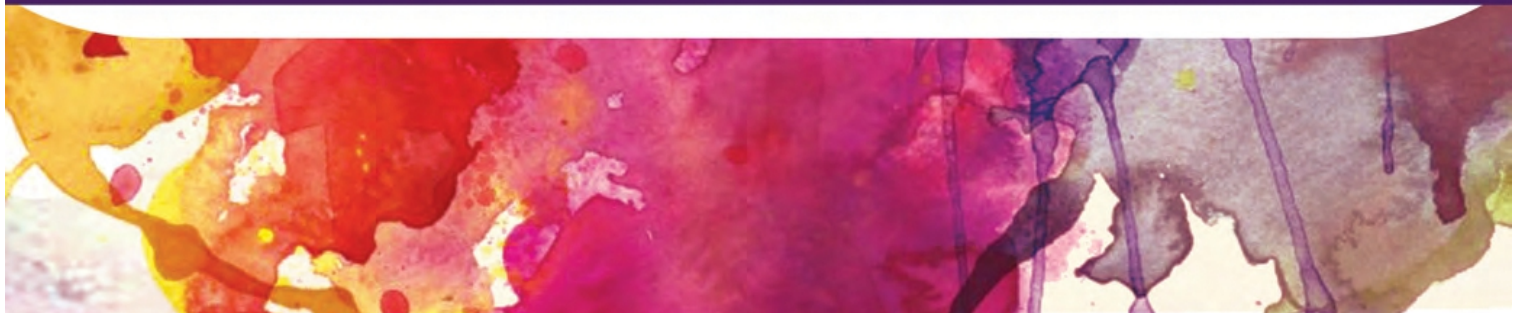




## Master of Science in Fire Safety Engineering (Mixed-Mode)



## **USM's Vision**

**Transforming Higher Education  
for a Sustainable Tomorrow**

## **USM's Mission**

**USM is a pioneering, transdisciplinary research  
intensive university that empowers future  
talents and enables the bottom billions  
to transform their socio-economic well-being**

## GRADUATE STUDY AT USM

Universiti Sains Malaysia (USM) was established in June 1969 as the second university in the country. Since then, the university has undergone tremendous transformation in terms of infrastructural development, academic program and R&D facilities. As one of the research universities in Malaysia, USM envisions itself to be a world-class university by embarking on world class research programmes via strategic planning and implementation of its R&D agenda. USM has gained reputation for providing excellent graduate programmes since its inception in 1969. Students are enrolled in masters or doctorate degree programs in over 26 schools and 24 research centres or institutes in the areas of applied sciences, applied arts, pure arts, pure sciences, health, medical, dental and engineering. Graduate students have been attracted to the excellent state-of-the-art facilities for research and the highly qualified and well recognized academic staffs.

Engineering Campus of Universiti Sains Malaysia offers postgraduates programmes through the following six schools of engineering:

- School of Civil Engineering
- School of Chemical Engineering
- School of Aerospace Engineering
- School of Electrical and Electronic Engineering
- School of Materials and Mineral Resources Engineering
- School of Mechanical Engineering

and one research center :

- River Engineering and Urban Drainage Research Center

**Master of Science in Fire Safety Engineering**  
***(Mixed-Mode)***

## 1. MODE OF STUDY

The mixed-mode program is a structured programme which combines coursework and research. Mixed-mode program is only offered at MSc level. The mixed-mode program is aimed at providing postgraduate students with expertise and advanced knowledge in the respective field of specialization. At the same time, the program also aims at providing postgraduate education to those who plan to pursue their studies at PhD level. Under mixed-mode programs, students are required to attend lectures, sit for examinations and submit a dissertation. The programme is run on semester system. Candidature period for Full Time and Part Time students is shown in Table 1.

**Table 1: Candidature Period of MSc (Fire Safety Engineering)**

Duration of Study	Minimum	Maksimum
Full Time	1 year 2 Semester	2 years (4 Semester)
Part Time	2 years (4 Semester)	4 years (8 Semester)

## 2. STRUCTURE OF PROGRAMME

The programme structure for MSc Fire Safety Engineering by Mixed-Mode consists of two (2) components(as shown in Table 2):-

- i. Core Courses (20 units)
- ii. Dissertation (20 units)

**Table 2: Program Structure of MSc(Fire Safety Engineering)**

Courses	Unit
EAF522: Materials Behaviour in Fire	4
EAF523: Fire Protection Technology	4
EAF524 : Fire Disaster Management	4
EAF525: Structural Design for Fire Safety	4
EAF526: Fire Behaviour	4
<b>CORE COURSES</b>	<b>20</b>
<b>DISSERTATION</b>	<b>20</b>
<b>TOTAL</b>	<b>40</b>

For the award of the MSc Fire Safety Engineering (FSE), a student has to accumulate 40 units out of which 20 units should come from core courses (5 courses with 4 units each) and 20 units from dissertation.

#### **Core Courses**

Core Courses are advanced courses of the respective field of specialization. These courses are compulsory and selected to provide students with advanced knowledge in the specific area.

#### **Dissertation**

Under the course Dissertation, students are required to conduct a piece of research study on a specific topic of their choice. Total units for this compulsory course is **TWENTY (20)**. Students are required to carry out research, analyze results, write and present the results in the form of a dissertation. The dissertation will be subjected to examination by a panel of examiners in a viva-voce session. Dissertation will be graded PASS or FAIL. Student are required to select a topic and perform intensive research study under the guidance of a supervisor. The supervisor can be selected from the following schools:

- School of Civil Engineering
- School of Chemical Engineering
- School of Aerospace Engineering
- School of Electrical and Electronic Engineering
- School of Materials and Mineral Resources Engineering
- School of Mechanical Engineering

### **3. LANGUAGE**

All courses will be conducted in English. Dissertation must also be written in English.

### **4. ASSESSMENT**

Core courses are assessed based on coursework (CW) and final examination (EW). The component coursework constitutes 60% of the total mark which includes test, assignment, laboratory report, and project. On the other hand, final examination constitutes another 40% of the total mark. It is assessed through a two hour examination during semester examination week. Only EAF524 (Fire Disaster Management) constitutes 100% CW. Table 3 shows the core courses and the method of assessment.

**Table 3: Core Courses of MSc(Fire Safety Engineering)**

Courses	Unit Credit	CW	EW
EA522: Materials Behaviour in Fire	4	60 %	40 %
EA523: Fire Protection Technology	4	60 %	40 %
EA524 : Fire Disaster Management	4	100 %	.
EA525: Structural Design for Fire Safety	4	60 %	40 %
EA526: Fire Behaviour	4	60 %	40 %

**In order to graduate, students MUST:**

- (i) **Pass All The Courses (Core) with Minimum Grade C+ Based on Grading Scheme Given in Table 4.**
- (ii) **Pass the Dissertation Examination**
- (iii) **Achieve a Cumulative Grade Point Average (CGPA)  $\geq 3.0$**

**Table 4: Grading Scheme**

GRADE	GPA	RANGE	CATEGORY
A	4.00	80-100	<b>PASS</b>
A-	3.67	70-79	
B+	3.33	64-69	
B	3.00	58-63	
B-	2.67	52-57	
C+	2.33	46-51	
F	0	0-45	<b>FAIL</b>

A student who fails to achieve minimum grade of C+ in any course is required to repeat the corresponding course in the following academic session provided that the candidature period is still valid. For dissertation, a student who fails the dissertation examination will need to register again the subject in the second semester of the following session and complete a new research project. The student will need to sit for dissertation examination again and pass the examination in order to fulfill partially the requirement of graduation.

## **5. ADMISSION REQUIREMENTS**

Applicants should possess the following:

### **A. Bachelor degree in STEM**

1. CGPA of at least 2.75 / 4.00;

For CGPA < 2.75, the following additional requirements are imposed:

2a. CGPA between 2.50 - 2.74:

- a) Research experience for at least one year; or
- b) Work experience in related field for at least one year; or
- c) At least one (1) academic publication in the relevant field; or
- d) Grade B for major / elective courses; or
- e) Grade B+ for final year project

2b. CGPA between 2.00 - 2.49 (Bachelor's Degree with Honours) :

- a) Research experience for at least five (5) years; or
- b) Work experience in related field for at least five (5) years; AND
- c) At least one (1) academic publication in the relevant field; or
- d) Grade B for major / elective courses; or
- e) Grade B+ for final year project

OR

### **B. Non-STEM Bachelor degree**

1. A CGPA of at least 2.75 / 4.00 with at least three (3) years of working experience in the relevant field;

For CGPA < 2.75, the following additional requirements are imposed:

2a. CGPA between 2.50 - 2.74:

- a) Research experience for at least three (3) years; or
- b) Work experience in related field for at least three (3) years; or
- c) At least one (1) academic publication in the relevant field; or
- d) Grade B for major / elective courses; or
- e) Grade B+ for final year project

2b. CGPA between 2.00 - 2.49 (Bachelor Degree with Honours):

- a) Research experience for at least five (5) years; or
- b) Work experience in related field for at least five (5) years; AND
- c) At least one (1) academic publication in the relevant field; or
- d) Grade B for major / elective courses; or
- e) Grade B+ for final year project

OR

### C. APEL A (Level 7)

APEL stands for Prior Experiential Learning under Malaysian Qualifications Agency (MQA). Detailed information about accreditation under APEL (Level 7) can be found at the following website: <https://www2.mqa.gov.my/apel/index1.cfm>

## 6. ADMISSION PROCEDURE

Application is accepted online. Procedures for application are available at <http://www.ips.usm.my>. Registration for graduate studies by research is open throughout the year. Application for MSc (Mixed-Mode) program is open throughout the academic year. However, application received after deadline specified by USM for a current academic session intake will be processed for subsequent academic session intake. Registration for mixed-mode program follows the normal academic calendar of USM (<http://www.usm.my/index.php/en/portals/current-students> - Academic Calendar)

## 7. TUITION FEES

For MSc(Mixed-Mode) programme, total fees payable for each semester will be based on the registered credit hours per semester. Total maximum credit hours for each Semester I and II are 20 units.

Malaysian (MYR)	International (USD)
<ul style="list-style-type: none"><li>• Registration Fee : 340.00</li><li>• Tuition Fee : 300.00 X 40 Units = 12,000.00</li><li>• Convocation Fee : 200.00</li></ul>	<ul style="list-style-type: none"><li>• Registration Fee : 227.50</li><li>• Personal Bond : 1000.00</li><li>• Tuition Fee : 160.00 X 40 Units = 6,400.00</li><li>• Convocation Fee : 50.00</li></ul>

As fees may change at time of application, students are advised to check the latest information on fees at the office of Institute of Postgraduate Studies, USM or at - <http://www.ips.usm.my/index.php/download/category/5-fees-structure>.

## 8. FINANCIAL ASSISTANCE

There is no financial assistance for MSc (Mixed Mode) programme. Please visit <http://www.ips.usm.my/index.php/financial-assistance/other-scholarships> for more information.

## **9. ACCOMMODATION**

The University has a limited number of student hostels/housing. Students are advised to contact Department of Student Affairs and Alumni (HEPA) upon receiving the offer letter for assistance regarding accommodation matter.

## **10. VISA**

Foreign students who are offered admission into USM are advised to contact Institute of Postgraduate Studies, USM and Malaysian Embassy for further details pertaining to their visas before their departure to Malaysia.

Please visit <http://www.ips.usm.my/index.php/download/category/8-student-visa> for complete information regarding visa application.

## **11. ENQUIRES**

For details on general matters related to postgraduate studies at USM, please contact:

Dean  
Institute of Postgraduate Studies  
Universiti Sains Malaysia  
11800 USM, Penang, MALAYSIA  
Tel. No : 604-6533888 (Ext. 2943) Fax No : 604-6532931  
Email : [dean\\_ips@usm.my](mailto:dean_ips@usm.my) ; Website : <http://www.ips.usm.my>  
Application forms and details of the admission procedures can be downloaded from <http://www.ips.usm.my>

Dean  
School of Civil Engineering  
Universiti Sains Malaysia  
Engineering Campus  
14300 Nibong Tebal, Penang, MALAYSIA  
Tel. No.: 604-5996201 ; Fax. No.: 604-5996906  
Email: [dean\\_civil@usm.my](mailto:dean_civil@usm.my) ; Website: <http://civil.eng.usm.my>

LIST OF LECTURERS  
MASTER OF SCIENCE ( FIRE SAFETY ENGINEERING)

1.EAF522: Materials Behaviour in Fire

Prof. Ir. Dr. Mariatti Jaafar@Mustapha  
*Expertise : Polymer, Polymer Composite*  
Phone : 04-599 5262  
Email : mariatti@usm.my



Prof. Dr. Khairunisak Abdul Razak  
*Expertise : Electroceramics Smart Materials Ceramics*  
Phone : 04-599 6126  
Email : khairunisak@usm.my



Prof. Dr. Badorul Hisham Abu Bakar  
*Expertise : Concrete Technology, Timber Engineering, Masonry*  
Phone : 04-599 6298  
Email : cebad@usm.my



Dr Aslina Anjang Ab Rahman  
*Expertise : Composite Material, Fire Structural Behaviour of Composites*  
Phone : 04-599 5595  
Email : aeaslina@usm.my



2.EAF523: Fire Protection Technology

Assoc. Prof. Dr. Nor Muzlifah Mahyuddin  
*Expertise : Miniaturization of microwave devices; low power 5G wireless system; signal/power integrity techniques; amplifier oscillation symptoms.*  
Phone : 04-5995789  
Email : eemnmuzlifah@usm.my



Ir. Dr. Hussin Mamat  
*Expertise : Thermal Comfort, Indoor Air Conditions, Heat Transfer*  
Phone : 04-599 5876  
Email : hussinm@usm.my



Dr. Mohamad Khairi Ishak

*Expertise : Embedded System, Real-Time Control Communication,  
Ethernet, Network System, Internet of Things (IoT)*

Phone : 04-599 5737

Email : khairiishak@usm.my



Dr. Mohd Azmi Ismail

*Expertise : Electronic Cooling, Anti-Icing, Spillway dam, Computational  
Fluid Dynamic (CFD), Heating, Ventilation and Air-Conditioning  
(HVAC)*

Phone : 04 -5996319

Email : azmi\_meche@usm.my



### 3. EAF524: Fire Disaster Management

Dr. Sharifah Akmam Binti Syed Zakaria

*Expertise : Building and Construction Management, Engineering  
Management , Technology Management, Behavioural  
Economics, Decision Governance*

Phone : 04-599 6253

Email : akmam@usm.my



Professor Ir. Dr. Taksiah A. Majid

*Expertise : Structural Engineering, Earthquake Engineering, Wind  
Engineering*

Phone : 04-599 6200/6282

Email : taksiah@usm.my



Dr. Noorhazlinda Abd Rahman

*Expertise : Structural Engineering, Modeling and Simulation - Human  
Crowd Behavior and Dynamics*

Phone : 04-599 6261

Email : celindarahman@usm.my



#### 4.EAF525: Structural Design for Fire Safety

Ir. Dr. Shaharudin Shah Bin Zaini

*Expertise : Structural Engineering, Low Velocity Impact, Wind Engineering*

Phone : 04-599 6221

Email : ceshaharudin@usm.my



Professor Dr. Badorul Hisham Abu Bakar

*Expertise : Concrete Technology, Timber Engineering, Masonry*

Phone : 04-599 6298

Email : cebad@usm.my



Dr. Mustafasanie M Yussof

*Expertise : Finite Element Modeling, Structural Glass Façade Systems, Structural Analysis*

Phone : 04-599 6220

Email : cemustafa@usm.my



#### 5.EAF526: Fire Behaviour

Assoc. Prof. Dr. Mohamad Zailani Abu Bakar

*Expertise : Process Integration, Process Safety, Computational Fluids Dynamics (CFD)*

Phone : 04-5996402

Email : chmohdz@usm.my



Assoc. Prof. Dr. Farzad Bin Ismail

*Expertise : Computational Fluid Dynamics (CFD)*

Phone : 04-5995900

E-mail : aefarzad@usm.my



Dr. Norazwan Md Nor

*Expertise : Process Safety, Fault Detection and Diagnosis, Neural Network & Artificial Intelligence*

Phone : 04-5995750

E-mail : chnorazwan@usm.my



## LIST OF LECTURERS FROM FIRE AND RESCUE DEPARTMENT OF MALAYSIA and INDUSTRY MASTER OF SCIENCE ( FIRE SAFETY ENGINEERING)

### 1.EAF522: Material Behaviour in Fire

PgKB II Shamsul Nizar Bin Zubir  
Email : snizar@bomba.gov.my



PgKB II Muhammad Khairul Nizam Bin Mardi  
Email : mknizam@bomba.gov.my



### 2.EAF523: Fire Protection Technology

PPjB Awang Hidzel Bin Awang Bujang  
Email : ahab.bomba@1govuc.gov.my



PPjB Abdul Khair Bin Osman  
Email : ako-bkk.bomba@1govuc.gov.my



PgKB I Farid Asyhadi Bin Assa'ad  
Email : asyhadi.bomba@1govuc.gov.my



### 3.EAF524: Fire Disaster Management

PPJB Farhan Sufyan Bin Borhan  
E-mail : farhan.sufyan.bomba@1govuc.gov.my



Mr. Faizal Bin Musa  
Email : faizal.musa@gmail.com



### 4.EAF525: Structural Design For Fire Safety

PPJB Abdul Khair Bin Osman  
Email : ako-bkk.bomba@1govuc.gov.my



### 5.EAF526: Fire Behaviour

PKPJB Ahmad Izram Osman  
Email : izram@bomba.gov.my



## APPENDIX A: COURSE DESCRIPTION

### **MASTER OF SCIENCE (FIRE SAFETY ENGINEERING)**

**1.0 SYNOPSIS OF COURSE**

This course covers comprehensive information on all aspect of materials behaviour in fire, particularly fire retardant materials. The course emphasis on burning behaviour and flame retarding of polymers, composites, natural materials including wood and lignocellulosics materials, and recent fire retardant materials. The understanding of the behaviour of these materials in fire allows future development in materials and design of fire retardant materials. The mechanisms and modes of action of these materials in flame retardancy are also explained. Performance-based test methods for material flammability are explained both theoretically and practically throughout this course. The course also covers fire safety design requirements of flame-retarded materials, toxicity of fire retardants in relation to life, health and environment and risk assessment of fire retardant materials.

**2.0 COURSE COMPONENT:**

Unit : 4

Coursework : 60%

Final Exam : 40%

**3.0 TOPICS TO BE COVERED :**

TOPIC	SYLLABUS
1	Introduction to fire retardant materials
2	Fire retardant methods and theories of fire retardancy
3	Fire retardant materials: polymers, composites, nanocomposites, fabric, concrete
4	Natural fire retardant materials: polymers, wood and lignocellulosic materials
5	Recent development in fire retardant materials
6	Mechanisms and modes of action in flame retardancy
7	Performance-based test methods for material flammability
8	Fire safety design requirements of flame-retarded materials
9	Toxicity of fire retardants in relation to life, health and environment
10	Risk assessment of fire retardant materials

#### **4.0 COURSEWORK COMPONENTS:-**

- 4.1 Assignment
- 4.2 Tests
- 4.3 Laboratory report

Details will be given in teaching plan to be distributed to students at the start of semester.

#### **5.0 FINAL EXAMINATION:-**

Students are required to sit for a two hour final examination.

#### **6.0 REFERENCES:-**

1. Richard Horrocks D. Price, Fire Retardant Materials, 1st Edition, Hardcover ISBN: 9781855734197
2. A.R. Horrocks and D. Price, Advances in Fire Retardant Materials, A volume in Woodhead Publishing Series in Textiles ISBN: 978-1-84569-262-9
3. De-Yi Wang (Editor), Novel Fire Retardant Polymers and Composite Materials (Woodhead Publishing Series in Composites Science and Engineering) 1st Edition, Publisher: Woodhead Publishing; 1 edition (September 27, 2016), ISBN-10: 0081009771
4. P. M. Visakh (Editor), Yoshihiko Arao (Editor), Flame Retardants: Polymer Blends, Composites and Nanocomposites (Engineering Materials) 2015th Edition, Publisher: Springer; 2015 edition (February 5, 2015), Language: English, ISBN-10: 3319034669, ISBN-13: 978-3319034669
5. Alexander B. Morgan (Author), Charles A. Wilkie (Author), The Non-halogenated Flame Retardant Handbook 1st Edition, Publisher: Wiley-Scrivener; 1 edition (April 28, 2014), ISBN-10: 1118686241, ISBN-13: 978-1118686249

**1.0 SYNOPSIS OF COURSE**

This course reviews the topics on fire protection technology. It focuses on fire extinguishing system and fire alarm system. Acts and regulations as well as mechanism and structure in the fire extinguishing system also will be focused on.

**2.0 COURSE COMPONENT:**

Unit : 4

Coursework : 60%

Final Exam : 40%

**3.0 TOPICS TO BE COVERED :**

TOPIC	SYLLABUS
1	Acts and regulations of fire protection system which includes Fire Service Act (Act 1988) and Uniform Building By-Laws (Act 133). General overview of the fire protection system.
2	Introducing the system concept of automatic fire detection and alarm system. The design requirements and design checklist are also focused on.
3	Learn the purpose and general requirement of fire alarm system including wiring, power supply, electrical hazard, structural point of view of the system, and the important component blocks in the system such as voice alarm system.
4	Identify various type of detectors (heat and smoke) as well as their functions and connections.
5	Identify other components in the fire alarm system such as audio and visual alarm system, manual call points and exit signage.
6	Introducing the fire protection system especially the fire extinguishing system such as: <ul style="list-style-type: none"><li>- Portable fire extinguishers</li><li>- Fire hydrant system</li></ul> Hose reel system
7	Learn about the active fire protection system such as: <ul style="list-style-type: none"><li>- Dry and wet riser systems</li></ul>

- 4) Evacuation Modeling Trends, Editors: Cuesta, Arturo, Abreu, Orlando, Alvear, Daniel (Eds.)
- 5) Fires and Human Behaviour, by David V. Canter
- 6) Society of Fire Protection Engineers, 2019. SFPE Guide to Human Behavior in Fire. Springer International Publishing.
- 7) Hurley, M.J., Gottuk, D.T., Hall Jr, J.R., Harada, K., Kuligowski, E.D., Puchovsky, M., Watts Jr, J.M. and WIECZOREK, C.J. eds., 2015. SFPE handbook of fire protection engineering. Springer.

**1.0 SYNOPSIS OF COURSE**

This course is intended to provide the fundamental knowledge of fire dynamic and safety. Physical and chemical behavior of combustion systems: fire growth, combustion chemistry, smoke behavior, compartment fires and heat transfer will be addressed. Student will acquire skills for quantitative estimation of the different variables of fire growth. Basic principles of fire dynamics will be used to provide analytical formulations and empirical correlations that can serve as tools for design calculations.

**2.0 COURSE COMPONENT:**

Unit : 4

Coursework : 60%

Final Exam : 40%

**3.0 TOPICS TO BE COVERED :**

TOPIC	SYLLABUS
1	Fundamental of process safety and how gases burn, including basic chemistry.
2	How liquids burn, including convection and radiation heat transfer
3	How solids burn, including conduction heat transfer
4	Spontaneous ignition and piloted ignition
5	Fire spread and fire plumes
6	Compartment fires, including flashover
7	Ceiling jet, structural interactions, backdraft
8	Smoke
9	Fire safety engineering applications and case study

**4.0 COURSEWORK COMPONENTS:-**

4.1 Assignment

4.2 Tests

4.3 Practical Reports

4.4 Projects

Details will be given in teaching plan to be distributed to students at the start of semester.

**5.0 FINAL EXAMINATION:-**

Students are required to sit for a two hour final examination.

**6.0 REFERENCES:-**

1. Drysdale, D.D. "Introduction to fire Dynamics", 3rd Edition, John Wiley and Sons, 2011.
2. Gregory E. Gorbett, James L. Pharr, Scott Rockwell. "Fire Dynamics", 2<sup>nd</sup> Edition, Brady Fire Series, 2016.
3. Bjorn Karlsson, James Quintiere. "Enclosure Fire Dynamics (Environmental & Energy Engineering)", 1<sup>st</sup> Edition, CRC Press, 2000

## APPENDIX B: SCHOOLS OF ENGINEERING



1.

## SCHOOL OF CIVIL ENGINEERING

[www.civil.eng.usm.my](http://www.civil.eng.usm.my)



### **School of Civil Engineering's Mission**

*"To nurture and sustain excellence in delivering comprehensive education, imparting knowledge, exploring frontiers of technology, and providing services to the industry and community, at the local and international levels, by applying the most advanced knowledge and leading expertise, creating innovative ventures, being truthful and upholding USM's motto, We Lead*

#### **➤ BACKGROUND**

The School of Civil Engineering, Universiti Sains Malaysia, was established in the early 1989 and first started its operation at Perak Branch Campus at Seri Iskandar, Perak by the end of 1989. In May 2001, Perak Branch Campus was moved to Seri Ampangan, Nibong Tebal, Penang and later renamed as Engineering Campus. The School of Civil Engineering is a well-established school with a long tradition of providing high quality postgraduate programmes in a very wide range of topics across the spectrum of civil engineering disciplines. The school regularly attracts both local and overseas research students from industries, private institutions or government institutions. Academic staffs of the school are actively involved in both basic and applied research studies. Much of the research studies are funded by government agencies and some portions are carried out in collaboration with industries. All academic staffs are experts in their respective fields backed up by years of teaching, research and industrial experiences. All areas of research in the school are supported by well-equipped laboratories which are handled by highly trained technical personnel.

#### **➤ POSTGRADUATE PROGRAMMES**

The School of Civil Engineering offers the following two modes of postgraduate study:

- (a) Master of Science and Doctor of Philosophy Program by Research
- (b) Master of Science Program by Mixed-Mode

##### **Mode of study**

Students are required to carry out research study on topics of their choice. They will be under the supervision of a main supervisor and co-supervisor/supervisors(if necessary). Field supervisors are sometimes appointed by the school wherever necessary. Students are not required to take any course. In some cases, students may be required to take prerequisite courses (if necessary) concurrently or before undertaking the research activities. At the end of the research study, a student has to submit a thesis to be examined by a panel of examiners in a viva-voce session. Application for admission and registration for research mode programmes are open throughout the year. The research study can be undertaken either on full-time or part-time basis.

### Period of Candidature & Residency for Research Programme

The periods of candidature for the Masters and Doctor of Philosophy Degree Programmes for both part-time and full-time candidates are shown in Table 1.

**Table 1: Period of candidature (MSc and PhD by research mode)**

Mode	MSc		PhD	
	Min	Max	Min	Max
Full Time	12 months	36 months	24 months	60 months
Part Time	24 months	72 months	36 months	90 months

### Area of Research

Specific areas of studies for the Master of Science and Doctor of Philosophy Degree Program by Research are as follows:

#### Environmental Engineering

Landfill Technology, Composting, Water and Wastewater Treatment, Industrial Wastewater Treatment, Solid Waste Management, Environment Impact Assessment (EIA) and Environmental Management Plan (EMP), Air Quality and Water Quality Studies, Sludge Management, Noise Pollution Control and Management, Geo-environment, Water Quality Modeling.

#### Geotechnical Engineering

Slope stabilization (soil/rock), Ground Improvement, Reinforced Soil, Landslide Risk Management and Application of Geosynthetics, Rock Mechanics, Blasting and Vibrations, Foundation Engineering, Land Reclamation and Rehabilitation, Spatial Analysis, Probabilistic Methods in Geotechnical Engineering, Geostatistics, Shear Strength of Soft Clay, Collapsing Soil, Risk Assessment in Geotechnical Engineering, Geotechnical Assessment, Piling Vibrations.

#### Water Resources Engineering

Water Supply, Urban Storm Water Management, Hydrological Modeling, Flood Forecasting, River Engineering, GIS Applications in Water Resources, Irrigation and Drainage, Urban Hydrology, Modeling of Pumping Station, Land Use Hydrology, Urban Hydrology, Sediment Transport, Ecohydrology.

#### Highway and Transportation Engineering

Pavement Engineering, Asphalt Technology, Traffic Engineering, Road Safety, Intelligent Transport Systems, Public Transport Study, Highway Capacity Studies, Travel Behavior Studies, GIS Applications in Transportation, Sustainable Transport.



## SCHOOL OF CHEMICAL ENGINEERING



## Mission of the School of Chemical Engineering

*The mission is to provide high-quality education and research and to produce well-trained chemical engineering graduates who are critical thinkers, problem solvers, innovators, entrepreneurs, leaders and life-long learners in a global society to meet the technological and societal expectations.*

### ➤ BACKGROUND

Established on 1<sup>st</sup> May 1992 during the Sixth Malaysian Five-Year Plan (1991-1995), the School of Chemical Engineering at Universiti Sains Malaysia was founded to further meet the country's growing demand for highly competent chemical engineers in the chemical and/or petrochemical industries and to explore various fields of research in chemical engineering that would ultimately benefit the nation.

In 1993, the school received its first 37 undergraduate students at the Perak Branch Campus in Seri Iskandar, Perak, and since then, the school has grown and developed into becoming one of the leading chemical engineering departments in the country. Educating not only future chemical engineers but also conducting cutting edge research and providing chemical engineering related consultancies, the school is always seeking to enhance itself in offering a balanced and up-to-date educational experience for its students.

The school also seeks to provide an education that is relevant and cognizant of contemporary issues such as the impact of Industry 4.0 and current technology on the manufacturing and production industries so that students and future talents would be well equipped and empowered once they graduate to face current realities and challenges of the industrial world.

### ➤ POSTGRADUATE PROGRAMMES

The school offers programmes of graduate studies through the research mode in various engineering areas leading to the Master of Science (M.Sc.) or Doctor of Philosophy (PhD) degrees. Both programmes are available as fulltime or part time studies. The school has comprehensive expertise in the following research areas of chemical engineering – Chemical Reaction Engineering; Zeolite Catalysis; Environmental Engineering; Membrane Separation Processes; Biochemical Engineering; Modelling, Simulation and Optimisation; Plant Safety and Risk Assessment Studies; Process Control; Product and Process Development and Nano Technology. The school has modern and well-equipped analytical facilities for a wide range of analysis and testing for industry including catalyst

characterization, environmental monitoring and complete analysis of industrial chemicals and related products.

#### ➤ TECHNICAL / LABORATORY FACILITIES

The School of Chemical Engineering is well-equipped with laboratory facilities for teaching purposes. The principal teaching laboratories are:

1. Unit Operations Laboratory
2. Process Control Laboratory
3. Chemistry Laboratory
4. Central Analytical Laboratory
5. Computer Laboratory

Besides the teaching laboratories, the school has research laboratories for students to carry out their research work. These laboratories are as follows:

1. Sustainable Energy Research Laboratory
2. Sustainable Biocatalysis & Biotransformation Research Laboratory
3. Sustainable Environment Research Laboratory
4. Process Control & Modelling Research Laboratory
5. Advanced & Computational Purification Research Laboratory
6. Membrane Technology Research Laboratory
7. Reaction Engineering & Adsorption Research Laboratory
8. Gas & Vapour Separation Research Laboratory
9. Enzyme Technology Research Laboratory
10. Research MTDC Aerospace
11. Sustainable Waste Conversion Research Laboratory
12. Pilot Plant Research Space (PPRS)
13. Environmental Engineering Research Laboratory (EnviE)
14. Adsorption and Electrochemistry Research Laboratory (AdEc)
15. Catalysis and Petroleum Research Laboratory (CatP)
16. Nanotechnology and Membrane Science Research Laboratory (NanoMemS)
17. Tissue Culture and Mammalian Cell Research Laboratory (TCMC)
18. Fabrication Workshop



## SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING



The mission of the School of Electrical and Electronic Engineering is:-

*“To provide quality education and sustainable research that produces professionals with the necessary knowledge, skills and character that is required for the advancement of engineering and technology”*

## ➤ BACKGROUND

Since the academic session of 2000/2001, the School of Electrical and Electronic Engineering offers two study programmes, i.e the Electronic Engineering Programme leading to the Bachelor of Engineering (Honours) (Electronic Engineering) and Electrical Engineering Programme leading to the Bachelor of Engineering (Honours) (Electrical Engineering). As of 2002/2003, another programme has been offered, which is the Mechatronic Engineering Programme leading to the Bachelor of Engineering (Honours) (Mechatronic Engineering). The duration of the three mentioned programmes are four years or eight semesters.

### **Electronic Engineering**

The Electronic Engineering Programme covers Microelectronics, Computers, Communications and Control and Automation.

#### **Microelectronics:**

- includes Design and Analysis of Electronic Circuits, Digital Systems Design, Semiconductors, Electronic Devices and Circuits and various aspects of Integrated Electronics.

#### **Computers:**

- includes Computer Organization, Computer Networking, Microprocessor Systems Design, Digital Signal Processing and Software Engineering.

#### **Communications:**

- includes Theory of Communication Systems, Antenna and Propagation, Microwave Engineering, Radar and Satellite Communications.

#### **Control and Automation:**

- includes Analysis and Design of Control Systems, Robotics and Automation, exposure to the Flexible Manufacturing Systems (FMS) and the industrial sector.

### **Electrical Engineering**

The Electrical Engineering Programme covers Power Generation (both conventional and unconventional methods), Transmission, Distribution and Consumption, Electrical Machines, Analysis,

Design, Applications, Power System Stability, High Voltage Engineering, Renewable Energy, Electrical Instrumentation and Measurement, and Power Electronics.

### **Mechatronic Engineering**

The Mechatronic Engineering Programme covers fundamentals of electrical, electronic, mechanical and computer engineering, system and control engineering, mechatronic system and design, sensors and transducers, robotics, machine vision and manufacturing.

### ➤ **POSTGRADUATE PROGRAMMES**

The school also offers Graduate Study Programmes through research in various engineering fields for the Masters in Science Degree (M.Sc) or Doctor of Philosophy Degree (Ph.D). Both courses may be taken in full-time or part-time mode in the areas as listed below:

- Microelectronics
- Microwave Engineering and RF
- Image Processing
- Power Engineering
- Control, Robotics and Automation
- Neural Networks
- Embedded Systems Design
- Mechatronic Engineering
- Communication Systems
- Antennas and Propagation

Every candidate of the Masters in Science Degree (M.Sc) programme must fulfil the University enrolment requirements, and are usually graduates with good honours degree (at least with CGPA of 2.75) or equivalent qualifications in the science or engineering courses. Candidates with qualifications lower than Second Class will also be considered if they have vast experience in some specific areas of specialisation and approved by the School Board.

To further enhance the Post Graduate programmes, a Masters in Science Degree Programme by Coursework has been introduced. This degree is known as Masters in Science (M.Sc) Electronic Systems Design Engineering starting from the Academic Session 2003/2004.

➤ **TECHNICAL / LABORATORY FACILITIES**

All of the labs at the school are equipped with modern and advanced facilities to support the Undergraduate and Post Graduate study programmes as well as serve the needs for academic excellence.

The school has a number of laboratories for both teaching and research purposes. Among the labs are:-

- (a) Microelectronic Lab in CEDEC
- (b) Electronic Lab
- (c) Communications System Lab
- (d) Microwave and RF Lab (Donated by Agilent)
- (e) Circuit Board Processing Lab
- (f) Microprocessor Lab (Donated by Intel)
- (g) Microcomputer Lab
- (h) Automation Lab
- (i) Instrumentation & Control Lab
- (j) Robotics Lab
- (k) Power and Machines Lab
- (l) Workstation Lab
- (m) Data Communications Lab
- (n) Electronic Systems Design Lab
- (o) Mechatronic Lab
- (p) Digital Signal Processing Lab (Donated by Motorola)
- (q) Satellite Research Lab (Donated by the Japanese Government)



## SCHOOL OF MATERIALS AND MINERAL RESOURCES ENGINEERING



### **Mission of SMMRE**

*To be globally recognized as a dynamic engineering school that produces creative, innovative and resourceful intellectuals with an ethos towards life-long learning that will contribute towards the creation of knowledge based society.*

#### **➤ BACKGROUND**

The School of Materials and Mineral Resources Engineering (SMMRE) started its program since 1984 in Universiti Sains Malaysia (USM), Penang under the School of Industrial Technology and Engineering Sciences. With the advancement of technology and market demand for skilled engineers in the country, USM took the initiative to fulfill the requirement by having its own engineering school separated from other disciplines of applied sciences.

In March 1986, the engineering disciplines under the School of Industrial Technology were separated to form their own schools, which include the formation of the School of Materials and Mineral Resources Engineering. USM had then housed the new campus at Ipoh before moving to Seri Iskandar, Perak. However, after a lapsed of 15 years, in May 2001, the campus was moved to the new site situated at Nibong Tebal, Seberang Perai Selatan, Penang.

Compared to other schools or faculty in other Institutes of Higher Learning in Malaysia, the School of Materials and Mineral Resources Engineering is unique because it offers three programs, these are Materials Engineering, Mineral Resources Engineering and Polymer Engineering at bachelor degree (honours) level for each programme.

Polymer Engineering program is the latest addition to the school that commenced in April 2002. The program is an upgrading of Polymer Technology program that was originally under the School of Industrial Technology in USM Penang.

In general, the three programs include specialization as follows:

- (i) The Material Engineering emphasizes on materials such as metal, ceramic, composite, polymer and semiconductor and electronic materials. These involve design and production of materials, quality control and the materials properties.
- (ii) Mineral Resources Engineering focuses on areas of mining, processing and management of mineral resources and the environment.
- (iii) Polymer Engineering focuses on polymeric materials such as plastics, rubber, latex and composites. These involve synthesis, processing, design and production of polymer products, quality control and the properties of polymers.

## ➤ POSTGRADUATE PROGRAMMES

SMMRE also offers opportunities for postgraduate study for locals and foreign graduates who wish to further their studies at higher level. Therefore, SMMRE offers M.Sc and Ph.D programmes through research mode for all the three programmes and M.Sc programmes through mix-mode (for Materials Engineering).

Areas of research offered through research mode are (amongst others):

- [1] Traditional Ceramic and Advanced Ceramics
- [2] Physical Mechanical and Applied Metallurgy
- [3] Extractive Metallurgy
- [4] Glass and Glass Ceramic
- [5] Composite (ceramic, metal and polymer)
- [6] Semiconductor Material and Electronic Material
- [7] Metal Coatings
- [8] Mining
- [9] Blasting
- [10] Geochemistry
- [11] Exploration
- [12] Environment and Pollution Control
- [13] Material Processing
- [14] Plastic
- [15] Rubber and Latex
- [16] Polymer Alloy and Mixture
- [17] Polymer Composite
- [18] Biomaterials

The Institute of Postgraduate studies of USM has the following entry requirements in considering application by candidates:

- (1) Candidates for master's programme must attain at least CGPA of 2.75 or related qualification, which are recognized by the University's Senate and Ministry of Higher Learning or Public Services Department.
- (2) For candidates having lower qualification, the application may also be considered through working experiences or vast research background in related area and endorsed by the School Board of SMMRE.

## ➤ TECHNICAL / LABORATORY FACILITIES

The school is equipped with modern equipments for its undergraduate and postgraduate programmes and for research purposes. To date, there are 36 laboratories equipped with, among others, included:

- [1] Scanning Electron Microscope (SEM) & Energy Dispersive X-Ray (EDX)
- [2] Field Emission Electron Microscope (VPFESEM) & Energy Dispersive X-Ray (EDX)
- [3] X-Ray Diffractometer (XRD)
- [4] X-Ray Fluorescence Spectrometer (XRF)
- [5] Servohydraulic Testing Machine
- [6] Spray Forming Machine
- [7] Particle Size Analyser
- [8] Microhardness Tester
- [9] Magnetic Separator
- [10] Ultrafine Grinding Machine
- [11] Furnaces
- [12] Hot Press
- [13] Plastic Injection Molding Machine
- [14] Rubber Injection Molding Machine
- [15] Hot & Cold Isostatic Press
- [16] Twin Screw Extruder
- [17] Internal Mixer
- [18] Crusher & Grinder
- [19] Autoclave Reactor
- [20] Potentiostat
- [21] Semiconductor Parametric Analyser
- [22] Scanning Probe Microscope
- [23] Corrosion Tester
- [24] Optical Microscopes
- [25] Dynamic Mechanical Analyser (DMA)
- [26] Differential Thermal Analysis (DTA) & Thermogravity Analyser (TGA)
- [27] UV-VIS Spectrometer
- [28] Atomic Absorbtion Spectrometer (AAS)
- [29] Fourier Transform Infrared Analyser (FTIR)
- [30] Surface Area Analyser
- [31] Density Meter
- [32] Rheometer
- [33] Single Screw Extruder
- [34] Energy Dispersive X-Ray Fluorescence (EDXRF)
- [35] Semiconductor Parametric Analyser (SPM, AFM, STM)
- [36] Differential Scanning Calorimeter (DSC)

- [37] 500kN Dynamic Universal Testing Machine (UTM)
- [38] Nano Particle Size Analyser
- [39] Zeta Potential Analyser
- [40] Benchtop X-Ray Diffraction (XRD)
- [41] Atomic Absorption Spectrometer (AAS + Graphite Furnace)
- [42] Inductively Coupled Plasma Optical / Atomic Emission Spectroscopy (ICP-OES)
- [43] Pultrusion
- [44] Twin Screw Extruder
- [45] Auto Dilute Viscometer
- [46] Differential Thermal Analyser (DTA)

Apart from the above, the school has a range of support equipments including well equipped workshop. These equipments are operated by trained and knowledgeable technical staff.



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## SCHOOL OF MECHANICAL ENGINEERING



## ➤ BACKGROUND

The School of Mechanical Engineering was established on the first day of 1989. The initial main objective for the establishment of the school is to produce graduates in the field of mechanical engineering and manufacturing engineering. This is to fulfil the specialised knowledge workers required by most industries in Malaysia especially the industries that involve in design, development, manufacturing, production, service and maintenance that are related to mechanical and mechatronic goods such as devices, tools, equipments, components, machines, support system and infra-structure development.

The development of the school is also aimed to be the centre for acquiring and dissipating knowledge in the field pertaining to mechanical and manufacturing engineering. The acquisition is through the activities of research, development, project works and professional networking. The dissemination is through consultancy work, workshops, seminars and professionals writing.

For manufacturing engineering, this philosophy is achieved through a broad curriculum with emphasis on various discipline involving studies on organization and manufacturing management, manufacturing technology and manufacturing systems. In summary, this program is aimed at educating and training engineers as technologists for the manufacturing industry. The application of engineering and manufacturing principles in solving industrial problems is the main theme in this program whilst the management aspect focuses on the study on human, financial and communication factors. Similarly, for mechanical engineering, the philosophy is embodied in a rigorous curriculum with emphasis fundamental knowledge in fluid, thermal, electrical and mechanics of materials, mechanical system principles and design and engineering analysis involving of mechanical systems. The School of Mechanical Engineering offers engineering academic qualifications at Bachelor, Master and Philosophical Doctorate levels.

## ➤ POSTGRADUATE PROGRAMMES

School of Mechanical Engineering offers Postgraduate Studies by Research in various fields of Mechanical Engineering and Manufacturing Engineering for the Degree of M.Sc. and Ph.D. Both these programmes are offered either full time or part time. The School of Mechanical Engineering has formed research units as research thrusts to spear head research in the field of Mechanical Engineering and Manufacturing Engineering including:

### **Energy**

- Energy Resources - Biomass
- Energy Conversion Technologies
- Internal Combustion Engine
- Alternative Fuel Combustors
- Gas Turbine, Incinerators
- Aerofoil, Flow in Passages, Micro Flow Sensor, Two Phase Flow

**Bio-Engineering & Applied Mechanics**

Experimental and Numerical Stress Analysis  
Dynamic Characteristics of Materials  
Instrumentation and Automatic Control  
Structural Optimization  
Impact Studies and Fracture Mechanics  
Experimental Mechanics  
Noise and Vibration  
Crack Analysis  
Biomechanics

**Manufacturing System & Automation**

Design for Manufacture and Assembly  
Industrial Automation  
CAD/CAM and Reverse Engineering  
Manufacturing System Design and Analysis  
Manufacturing Planning and Control  
Technology Management  
Machine Vision & Metrology

**Manufacturing Processes**

Advanced Manufacturing Process  
Laser Applications  
Rapid Prototyping & Tooling  
CNC Machine  
Tool and Die  
Casting

**Industrial Engineering**

Production Management  
Lean, Agile and Six Sigma  
Quality and Reliability  
Smart Manufacturing  
Artificial Intelligence, Data Mining and Optimization  
Production Planning and Control  
Operational Analytics  
Production Maintenance  
Ergonomics

Project Management  
Facility Design and Planning  
Computer-Integrated Manufacturing  
System Automation  
Supply Chain Management  
Production Simulation and Augmented Reality

#### **Nanofabrication and Functional Materials**

Nano Engineering (Nano Science, Engineering and Technology)  
Nanofabrication  
Lithography Techniques  
Nanodevices  
Thin Films  
Functional Materials  
Shape Memory Alloys  
Coating and Surface Engineering

#### **Advanced Packaging & SMT**

Electronic Packaging  
Electronic Cooling and Refrigeration System  
Heat Transfer with High Heat Flux  
Computational Fluid Dynamics  
Surface Mount Technology (SMT)  
Micro Devices

#### **➤ TECHNICAL / LABORATORY FACILITIES**

In addition to the facilities for the basic and general teaching of engineering, the School of Mechanical Engineering also has modern and sophisticated equipments for teaching as well as research. It ensures a complete engineering education that is significant to the industries, is inclusively provided to the students. Among the laboratory facilities in the school are:

1. Aerodynamic Laboratory
2. Heat Transfer Laboratory
3. Energy Conversion Laboratory
4. Engine Laboratory
5. Applied Mechanic Laboratory
6. Proton-USM Research & Design Centre
7. Vibration Laboratory
8. Metrology & Precision Engineering Laboratory

9. Manufacturing Process and Surface Mount Technology Laboratory
10. Failure Analysis Laboratory
11. Lithography Laboratory
12. Computer Aided Design and Manufacturing Laboratory
13. Electron and Optical Microscopies Laboratory
14. Nanofabrication and Functional Materials Laboratory
15. Materials Characterisation Laboratory
16. Agilent Technologies Instrumentation Laboratory
17. Robotic Laboratory
18. Automation Control Laboratory
19. Bioenergy Laboratory
20. Forging Laboratory
21. CNC Machining/Rapid Prototyping
22. Machine Shop I [Milling]
23. Machine Shop II [Lathe]
24. Fitting Shop
25. Welding Shop



## SCHOOL OF AEROSPACE ENGINEERING



*Mission:*

- 1) *To provide quality and innovative teaching and maintain accreditation for all its degree programme.*
- 2) *To achieve research excellence.*
- 3) *To establish and enhance the collaboration with industries for education input and research.*
- 4) *To serve the society and country by providing the latest knowledge and technology.*

➤ **BACKGROUND**

The School of Aerospace Engineering was known as The Aerospace Engineering Unit that was established and operated between 13 May 1998 until 28 February 1999. Within the same year, the unit was upgraded to School of Aerospace Engineering on the 1st March 1999 with the establishment of Universiti Sains Malaysia, Engineering Campus. The school was established in realizing the needs to produce aerospace engineering graduates with high expertise, creativity with societal values, and competent in following the rapid technology development in aerospace industry. This program not only focuses on aerospace courses, but also emphasizes the multidisciplinary engineering concept that combines Mechanical, Electrical and Electronic Engineering. Non-technical subjects that are of equal importance to an engineer, such as Management, Language, Computer, Accounting and Engineer in Society are also included as part of the overall educational program.

In order to produce engineers who are competent to face the challenges in the workplace, students will be thought not only with theoretical knowledge but also exposed in practical and hands-on activities in the labs. In addition, they are required to undergo ten (10) weeks practical training during long semester break preferably in aerospace industries to obtain real-working experience.

After graduation, the graduates shall be eligible to work in engineering sector within the government institution, half-government bodies, or private institutions which are actively involved in aerospace industry and related engineering industries.

➤ **POSTGRADUATE PROGRAMMES**

The School of Aerospace Engineering is offering Master of Science and Doctor of Philosophy degree by research in the field of aeronautics and astronautics.

An applicant for Master of Science degree should achieve a CGPA of at least 2.75 in Bachelor of Engineering degree obtained in Universiti Sains Malaysia or university, which is recognized by the Senate of Universiti Sains Malaysia. However, applicant who has relevant experiences and who is found to be capable in following the higher degree shall also be considered.

An applicant who wishes to pursue a Doctoral of Philosophy degree should have already obtained a Master's degree or equivalent from the Universiti Sains Malaysia or university which is recognized by the Senate of Universiti Sains Malaysia. In special cases, the Senate shall also consider applications from those who possessed a Bachelor's degree with CGPA over 3.67.

An applicant should provide some form of evidence that he or she has sufficient practice and is capable in pursuing the higher degree program proposed and shall be required to fulfil the Malay Language requirement as put forward by the University as well as other additional requirements from the school if necessary.

For further information about the higher degree program, applicants can contact the Dean of Institute of Graduate Studies, Universiti Sains Malaysia, or the Programme Chairman of Higher Degree, School of Aerospace Engineering, Universiti Sains Malaysia.

At present, the postgraduate education offers only MSc and PhD programs via research mode. Usually, the duration study for MSc program is 2 years while the PhD program takes 3 years to be completed. The main areas of research include Algorithm Development and Engineering Application in CFD, Vibration, Aerospace Structures, Aeroelasticity, Experimental Fluid Dynamics, Control Systems, Spacecraft Subsystem Elements, Aircraft Design and Composite Materials and Design or any engineering related field that is agreed by the supervisor. Students can choose any of abovementioned areas but with a specific topic and will be supervised and guided by qualified faculty members of the school. Financial assistance is also available to the students in the form of either fellowships, teaching assistantships, or through research grants.

#### ➤ **TECHNICAL / LABORATORY FACILITIES**

The School of Aerospace Engineering has excellent facilities for research and teaching. Multiple laboratories are available for student access focusing on research area such as structures, aerodynamics, control systems, instrumentation, applied mechanics and propulsion. Experimental research is well supported by well-equipped workshops and computer modeling resources. The workshops are utilized for engineering practice module such as welding, threading, milling, and sheet metal works. Workshops are also used for research activities for fabricating and modifying research models. Enquiries about the use of facilities may be directed to the school dean or by contacting the relevant Lab Manager. List of laboratories available are as follows:

1. Aerodynamics 1
2. Aerodynamics 2
3. Propellant and propulsion
4. Computer Numerical Control (CNC) Machine
5. Light Structure Lab
6. Composite Lab
7. Flight Mechanic Lab

8. Space System Lab
9. Electronics, Instrumentation and Avionics Lab
10. Wind Tunnel Testing Room

The laboratories are adequately supported by multiple engineering workshop as listed below:

1. Workshop 2
2. Workshop 3
3. Aircraft Hangar

Apart from the laboratories located at the school, student can also use facilities provided by the School of Mechanical Engineering.

The School of Aerospace Engineering provides sufficient computer and software facilities for teaching and learning purposes. There is a dedicated computer laboratory opened to all School members. Furthermore, students are also provided with an additional access to the computer laboratories in the School of Mechanical Engineering and Centre of Knowledge, Communication & Technology (PPKT). Technical software are available in the computer laboratories such as CATIA for Computer Assisted Design (CAD), ANSYS and NASTRAN/PATRAN for Finite Element Analysis (FEA) and, Fluent and Ansys CFX for Computer Fluid Dynamics (CFD) analysis.



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