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## *Introduction*

**W**e have prepared this booklet to assist candidates in their applications for admission to the Doctor of Philosophy and Master of Engineering courses in the Faculty of Engineering. The information found here is for applicants applying for admission to the **August 2010 Intake** and **January 2011 Intake (Session 2010-2011)**.

In this booklet, we will let you know more about the Republic of Singapore and the National University of Singapore. The individual departments in the Faculty of Engineering will also be featured.

The University has a very active research environment. Its R&D activities have contributed significantly towards increasing Singapore's stature in the scientific world.

The graduate courses are designed for university graduates who wish to advance their knowledge and careers in research-related fields.

## *About Singapore*

**S**ingapore is a small country situated at the southern tip of the Malaysian peninsula, just above the Equator. The climate here is like summer all year round. Rain falls throughout the year, with more consistent rain coming during the monsoon season from November to January. Showers are usually sudden and heavy, but also brief and refreshing. Singapore's climate is warm and humid, with only slight variations between the average maximum of 31 degrees Celsius and minimum of 23 degrees Celsius.

The population of Singapore is about 4.84 million, comprising of a multi-racial mix of nationals. There are four main races here in Singapore: Chinese (75%), Malay (14%), Indian (9%) and other ethnic groups (2%). The four main languages spoken on the island are Mandarin, Malay, Tamil and English. The national language of Singapore is Malay while English is the language of administration and business, and is widely spoken and understood. Most Singaporeans are bilingual, and speak their mother tongue as well as English.

Strategic location, coupled with a small but dynamic population, has enabled the country to experience rapid economic development. Many factors (such as political and social stability, good international communications and transportation, infrastructure and an English-speaking skilled workforce) have attracted foreign investments and multi-national corporations to Singapore. Singapore is also a regional centre for business and technical consultancy, professional, engineering and computer services, and research and development activities.

The rich cultural heritage of Singapore has also made her a strong attraction to tourists from all parts of the world. Singapore is known as a shopper's paradise - you can find a full range from arts and crafts, antiques, electronic goods, computer software to fashion. Singapore will offer visitors a culinary experience of a lifetime - distinctive dishes from the Chinese, Malay, Indian, Indonesian, Nonya, Japanese, Korean, Vietnamese, Thai, Filipino and Western culture can all be sampled here. Restaurants can be found alongside the ubiquitous hawker centres around the island.

# *National University of Singapore*

The National University of Singapore is currently operating from two main campus - Kent Ridge and Bukit Timah. Kent Ridge Campus occupies approximately 150 hectares of land and overlooks the western coast of Singapore, while Bukit Timah Campus, located near the centre of Singapore island, occupies 5 hectares of land and offers the perfect garden/park campus. The University was inaugurated when the University of Singapore and Nanyang University merged to form one University on 8 August 1980. The University of Singapore's roots date all the way back to 1905 when the King Edward VII College of Medicine was established.

## **Vision and Mission**

### Vision

Towards a Global Knowledge Enterprise – A leading global university centred in Asia, influencing the future

### Mission

To transform the way people think and do things through education, research and service

## **Faculties and Schools**

It has 14 faculties offering undergraduate and graduate programmes. Currently, it has five overseas colleges at major entrepreneurial hubs in Silicon Valley, Bio Valley, Shanghai, Stockholm and Bangalore.

## **Student Population**

The student population (AY2008/2009) was some 25,190 undergraduates and 9,869 postgraduates. Of the foreign student population, the majority are from the neighbouring ASEAN countries, although there is also a significant number from the People's Republic of China, India, and Bangladesh.

## **Teaching and Research**

The University strives to inspire a love for learning and achievement that extend beyond the campus, both in teaching and research programmes.

At the University, it is believed that a personalised approach to teaching should be adopted. As such, tutorial classes are kept small to allow students ample opportunity for participative and independent learning. A lot of emphasis is placed on the teaching of fundamentals and their applications to real life problems. This is done so as to encourage students to be more creative, analytical and innovative. To enhance the quality and range of teaching, Information Technology (IT) is widely used here.

Research is vigorously promoted in the University, supporting the national policy of developing a high technology and knowledge intensive economy. Having the highest concentration of R&D manpower in Singapore has enabled the University to achieve excellent results and recognition for its research both in Asia and the world. These research results find their way into commercial applications in industry through a proactive policy of actively searching for partners in industry.

## Facilities Available on campus

The University's campus has a wide range of facilities available. The *National University of Singapore Libraries* are a group of multi-disciplinary libraries which comprise seven libraries located across the Kent Ridge campus: 1) Central Library, 2) Chinese Library, 3) C J Koh Law Library (Bukit Timah Campus, 4) Hon Sui Sen Memorial Library, 5) Medical Library, 6) Science Library and 7) Music Library.

The *Computer Centre* spearheads the development of an IT-intensive environment on campus and provides a comprehensive computing and networking infrastructure to enable the University community to fully exploit IT for effective teaching, learning, research and administration.

The *Sports & Recreation Centre* provides both outdoor and indoor facilities. The outdoor facilities include an Olympic-sized swimming pool, eight-lane running track, multi-purpose field, tennis courts, basketball courts, netball courts and others. The indoor facilities include a competition hall, gymnasium, multi-purpose hall, squash courts, and an indoor rock climbing wall.

## The NUS Degree

Students, after graduation, will find that the degree is a key to the opening of numerous opportunities. The NUS degree is much sought after by the industry, particularly the multi-national corporations. Graduates will, therefore, not encounter much difficulty in finding a rewarding job. Singapore needs well-trained people and welcomes personnel of various nationalities. A majority of foreign students look for jobs here after obtaining their degrees and stay on in this country.

## Website

For further information regarding the National University of Singapore, you may wish to visit our website at: <http://www.nus.edu.sg>

# Faculty of Engineering

### **Faculty's vision:**

"To be a globally-distinguished engineering school."

The Faculty of Engineering's mission is to nurture Engineer-Leaders with a global perspective and to lead in technology through high-impact research. Established in 1968, the Faculty of Engineering has contributed substantially to the rapid industrial and economic growth of the nation while continuing to contribute to a knowledge-based economy.

The Faculty comprises nine departments/divisions, namely: Bioengineering, Chemical & Biomolecular Engineering, Civil Engineering, Electrical & Computer Engineering, Engineering & Technology Management, Environmental Science & Engineering, Industrial & Systems Engineering, Materials Science & Engineering and Mechanical Engineering.

# Division of Bioengineering

## About the Division

The Division of Bioengineering was formally launched as a University department in July 2002, with strong participation from the Faculties of Engineering, Medicine, Sciences and Dentistry, along with the local Research Institutes. It was founded on the basis that traditional engineering disciplines can provide, by working in a multidisciplinary team, innovative solutions to biomedical/bioengineering problems.

The Division has 28 academic staff, the majority of whom have joint appointments with various departments such as Mechanical Engineering, Chemical & Biomolecular Engineering, Electrical & Computer Engineering, Orthopaedic Surgery, Surgery, Biochemistry, Diagnostic Radiology, Biological Sciences and research institutes such as IMRE and CIRC. It is supported by almost 30 researchers, 4 technical staff, and 7 administrative staff.

## About the Graduate Programme

Bioengineering is a discipline in which the principles and tools of traditional engineering disciplines are applied to the analysis and solution of problems in biology and medicine. A bioengineering education aims to train engineers who can analyse and overcome complex problems from engineering, biological and medical perspectives. The graduate bioengineering curriculum is designed to teach fundamental concepts and approaches, adapted from both engineering and the life sciences, in an integrative manner to achieve these objectives. Our integrated approach provides a good balance between the requirements of a broad bioengineering perspective and the chosen research specialisation.

## Areas of Research

Research within the Division of Bioengineering has been broadly classified into the following four major research focus areas:

- (1) Biomaterials / Tissue Engineering & Repair
- (2) Biosignal Processing / Bioimaging
- (3) Nanobioengineering
- (4) Biomechanics / Computational Bioengineering

The Division has high quality staff in each of these areas and details of our research activities can be found in the Laboratories pages on our website. The Division also actively collaborates with research groups at the Faculty of Science, Faculty of Dentistry, Yong Loo Lin School of Medicine, National University Hospital, NUS Life Sciences Institute as well as the Institute of Materials Research and Engineering, Institute of Molecular and Cell Biology, Institute of Medical Biology and the Institute of High Performance of Computing at A\*STAR. In addition, we have active collaborations with overseas institutions such as MIT, Duke University, Institut Pasteur, Tohoku University, Peking University and many others.

## Our facilities

To facilitate research in bioengineering, the Division has set up a Bioengineering & Nanobioengineering Corridor and a new Bioengineering Cluster using a multi-disciplinary joint-laboratory concept to bring the various bioengineering research groups under one roof. The aim is to develop core competencies in bioengineering and to facilitate the exchange of ideas among the various research groups, not only within but also outside of the University and in the process, foster multi-disciplinary teaching, learning and research.

Housed within the Bioengineering & Nanobioengineering Corridor are the Chemotherapeutic Engineering Lab, Computational Functional Anatomy Lab, Nano Biomechanics Lab, Healthcare and Energy Materials Lab, Microhemodynamics Lab, Regenerative NanoMedicine Lab and the Tissue Repair Lab.

The new Bioengineering Cluster comprises the Biofluids Lab, Optical Bioimaging Lab, Nano Bioanalytics Lab, Cellular & Molecular Bioengineering Lab, Computational Bioengineering Lab, Biomedical Mechanics & Materials Lab and the Supramolecular Biomaterials Lab.

A number of sophisticated state of the art instruments and facilities are housed in these labs giving the Division an edge in performing frontline research. The lab concept includes shared facilities such as a BSL2 lab and imaging hardware with easy access for researchers, thus adding to the collaborative research environment at the Division of Bioengineering. The wide range of facilities and specialised staff allows students to be exposed to and pursue their chosen area of research.

## How to apply

Students who are interested to pursue graduate studies may enrol through the Faculty of Engineering for a research-based program (<http://www.gse.nus.edu.sg/applications.html>). Applicants are encouraged to apply on-line. Priority for scholarships is given to Ph.D applicants.

You may also visit our website (<http://www.bioeng.nus.edu.sg/>) for more information and our contact details.

## Faculty Members (Based on Research Specialisation)

### **Biomaterials/Tissue Engineering & Repair**

- CHAN Casey, University of Toronto, Canada
- GOH Cho Hong, James, University of Strathclyde, UK
- LI Jun, Osaka University, Japan
- RAGHUNATH Michael, Mainz University, Germany
- SCHANTZ Jan-Thorsten, National University of Singapore, Singapore
- TOH Siew Lok, University of Strathclyde, UK
- TONG Yen Wah, University of Toronto, Canada
- YIM Evelyn King Fai, John Hopkins University, USA

### **Bio-Signal Processing/Biolmaging**

- CHEN Nanguang, Tsinghua University, China
- HUANG Zhiwei, Nanyang Technological University, Singapore
- LI Xiaoping, University of New South Wales, Australia
- ONG Sim Heng, University of Sydney, Australia
- QIU Anqi, John Hopkins University, USA
- SHEPPARD Colin James Richard, University of Cambridge, UK

### **Nanobioengineering**

- FENG Si-Shen, University of Columbia, USA
- HAN Ming Yong, Jilin University, Changchun, China
- LIM Chwee Teck, University of Cambridge, UK
- TRAU Dieter Wilhelm, Hong Kong University of Science & Technology
- YIM Evelyn King Fai, John Hopkins University, USA
- ZHANG Yong, Zhejiang University, China

### **Biomechanics/Computational Modelling**

- BUIST, Martin, University of Auckland, New Zealand
- GOH Cho Hong, James, University of Strathclyde, UK
- KIM Sangho, Drexel University, USA
- LEE Taeyong, University of Wisconsin-Madison, USA
- LEO Hwa Liang, Georgia Institute of Technology, Atlanta, Georgia, USA
- LOW Hong Tong, McGill University, Canada
- ROY Partha, State University of New York, Buffalo, USA
- SAWADA Yasuhiro, University of Tokyo, Japan
- TOH Siew Lok, University of Strathclyde, UK

# Department of Chemical & Biomolecular Engineering

## ABOUT OUR DEPARTMENT

The Department of Chemical & Biomolecular Engineering at the National University of Singapore is one of the largest in the world, with more than 40 faculty members, about 80 research and support staff, more than 250 graduate students and over 1100 undergraduate students.

The Department possesses a comprehensive research infrastructure with top-notch facilities for carrying out cutting-edge research. It strives to provide graduate students with an environment that is conducive for dynamic creativity. With research activities that are comparable to those in the best universities in the world and with partnerships with leading universities around the globe, the Department enjoys a pre-eminent status in the profession. Moreover, the mission of the Department calls for further enhancement of its standing internationally, and to be ranked as one of the best in the world within the next few years.

### OUR SCOPE: From Classical to Contemporary

Intellectually, the Department provides the critical link between engineering and the sciences, particularly the chemical and life sciences, by bridging the gap between molecular-level, laboratory-scale studies of chemical and biological transformations and the large-scale industrial production operations. With the recent revolution in molecular biology and life sciences, the Department has expanded its traditional scope to include solutions to problems in biomedicine, biotechnology, systems biology, protein engineering, drug-delivery systems, and chemotherapeutic engineering, among others.

The Department has also responded to the emergence of nanoscience and technology as a viable new frontier by expanding the classical role of chemical engineering in “scaling up” processes to include problems that require “scaling down” phenomena and processes for applications in labs-on-chips and plants-on-chips devices. While consolidating and extending its scope in biological and life sciences, the Department continues to maintain and enhance its strengths in traditional core areas such as process and systems engineering, catalysis and reaction engineering, advanced separation processes and transport phenomena.

At the same time, it supports innovative activities in functionalized and smart materials (e.g., for biosensors, molecular and polymer electronics, novel smart membranes for separation processes and novel optoelectronic and photonic materials) and nanostructured materials (e.g., for new catalysts and fuel cells).

## MAJOR RESEARCH & EDUCATIONAL THRUSTS

The Department’s activities may be classified under the following major themes:

1. Chemical Engineering Sciences
2. Biomolecular and Biomedical Engineering
3. Chemical & Biological Systems
4. Nanostructured Materials & Devices
5. Energy and Environmentally Sustainable Processes

### 1. Chemical Engineering Sciences

Chemical engineering as a distinct discipline has evolved from industrial chemistry and empiricism into a field that combines the understanding and predictive capabilities of fundamental physical sciences with the final goal of design and control of industrial scale applications. Research in Chemical Engineering Sciences in the Department covers the classical topics, such as thermodynamics, reaction engineering and catalysis, transport phenomena, separation processes and colloidal and interfacial phenomena, often with a modern twist. Many of the activities in Chemical Engineering Sciences also provide the foundation for other thrusts. The Department interacts closely, through research activities and faculty joint appointments, with the Institute of Chemical and Engineering Sciences (a national Research Institute) funded by the Agency for Science, Technology and Research (A\*STAR) of Singapore.

Examples of activities in this thrust include

- Thermodynamics of submicroscopic systems and macromolecular solutions (e.g., folding and conformation of polymeric and protein structures)
- Heterogeneous and homogeneous catalysis and ab initio mechanistic studies; photocatalysis for environmental pollution control; asymmetric reactions for fine chemicals & pharmaceuticals; Chemometrics
- Computational fluids dynamics; crystallization kinetics; dynamics of complex fluids
- Asymmetric and composite membranes for gas separation; liquid membranes for metal extraction and bioproduct recovery; Novel biomimetic membranes; Adsorptive separations.
- Self-assembly and surfactant solutions; electrokinetics; electrophoretic separation of proteins

## **2. Biomolecular and Biomedical Engineering**

The transformation of biology from a descriptive to a molecular science and the current, unprecedented ability to manipulate biological cells at the genetic level have revolutionized the interaction between chemical engineering and biology and life sciences. The research and educational programmes in the Department in Biomolecular and Biomedical Engineering recognize that biology at the molecular level is a chemical science and that biological cells are cellular factories. The Department has a long-standing record of research and education in areas that cut across disciplinary boundaries in biological and life sciences and has played a major role in shaping the direction of research in the nation. An example is A\*STAR's Bioprocessing Technology Institute, which evolved out of the Bioprocessing Technology Centre within the Department, and the Joint BTI-ChBE Research and Educational Laboratory.

Current research activities include

- Development of drug delivery systems
- Biomolecular functionalization for biosensors
- Molecular level control of biomolecules for fabricating biomolecular micro/nanodevices
- Modification of proteins to target them for desired materials; Protein biosynthesis from genetically modified microbes
- Genetic data mining for systems biology
- Tissue engineering with synthetic and natural polymers; Biomaterials for biomedical applications
- Biocatalysis for selective and environmentally benign transformations

## **3. Chemical & Biological Systems Engineering**

The Department has one of the largest research groups in the world in Process Systems Engineering (PSE), an area central to chemical and biochemical process industries. With the emerging focus on biomolecular engineering, our PSE group has reshaped itself as the Chemical and BioSystems Thrust (ChemBioSys) to provide the much-needed systems perspective in biology and biotechnology.

The main objective of the thrust is the development of efficient methodologies and tools to obtain innovative and non-intuitive solutions for the design and operation of chemical and biomolecular systems. Recent developments in life sciences have opened up formidable challenges and unique opportunities in areas such as systems biology and bioinformatics, which require systems approach. Therefore, chemical sciences coupled with sophisticated computational techniques – ranging from statistical data analysis and optimization to artificial intelligence – provide an excellent platform for deriving deep insight into biological systems.

Some of the ongoing activities include

- Process modeling, simulation & parameter estimation; Process optimization
- Process dynamics & control of macroscopic systems as well as microsystems
- Process design & development; Process operations & safety

- Artificial intelligence (AI) applications
- Genetic data mining for systems biology

#### **4. Functionalized and Nanostructured Materials & Devices**

Another major area of research in the Department focuses on specially functionalized materials for biosensors, polymer electronics, novel tunable membranes and for applications in life sciences. This thrust also encompasses activities in synthesis of nanostructured materials for catalysis, separations technology and fuel cells.

The research programmes span a wide range of length scales, from molecular-level synthesis and manipulation of materials to the macroscopic fabrication of surfaces and bulk materials and nanocomposites. Excellent in-house analytical and characterization facilities provide support for cutting-edge research endeavours in

- Molecular, nano- and surface/interfacial engineering; Functionalized surfaces for biotechnology; Surface-wired biomolecules
- Functional materials for separations, energy conversion, optics, electronics and sensing
- Biomaterials, catalysts and membranes; Polymeric scaffolds for tissue engineering
- Nano-structured, hybrid and composite materials for biological and biomedical applications
- Processing methodologies, self-assembling processes, nano- and molecular patterning

#### **5. Energy and Environmentally Sustainable Processes**

Environmentally benign processing and sustainability is a major research thrust in the Department. This programme deals with both "upstream" design and "downstream" treatment and involves chemical syntheses, chemical engineering, biomolecular engineering, and cross-disciplinary interactions. Several faculties have research projects in the areas related to energy, carbon dioxide capture and utilization, and sustainable materials and processes. Specific research topics include natural gas processing, advanced membranes for water production and recycle, smart energy systems, fuel cells, energy efficiency, engineering reactions and processes on the molecular scale, bio-based chemicals and fuels, desulfurization including biodesulfurization, biodegradation, process integration, water/fuel/CO<sub>2</sub> networks, life cycle assessment and sustainability studies, bioextractive waste treatment, etc.

#### **WHOM TO CONTACT**

For further information on the application procedure or departmental research activities, please contact –

Programme Manager (Research)  
 Department of Chemical & Biomolecular Engineering  
 Blk E5 #02-09  
 4 Engineering Drive 4  
 National University of Singapore  
 Singapore 117576  
 Phone: (65) 6516 5031  
 Fax: (65) 67791936  
 E-mail: [chbe\\_grad\\_programs@nus.edu.sg](mailto:chbe_grad_programs@nus.edu.sg)

You can find out more about the Department and our academic staff at our Homepage:  
 Chemical & Biomolecular Engineering home page: [www.chbe.nus.edu.sg](http://www.chbe.nus.edu.sg)

Details about application for graduate studies and financial assistance are available at:  
<http://www.gse.nus.edu.sg/postgradprog.html>

## Department of Civil Engineering

The Department of Civil Engineering is actively involved in the education and training of its students, in research and development work as well as in providing consultancy and advisory services. As at Apr 2009, the department has 36 academic staff, 43 research staff, 43 support staff, 360 BEng students, 151 MSc students and 173 MEng/PhD graduate research students.

The Department has strength and expertise in the following broad areas:

- ♦ Offshore Engineering
- ♦ Protective Engineering
- ♦ Hazards, Risks and Mitigation
- ♦ Structural Engineering
- ♦ Geotechnical Engineering
- ♦ Hydrology and Hydraulic Engineering
- ♦ Infrastructure Systems

The major topics of research carried out in the Department are:

### **Offshore Engineering**

Innovative Structural Systems; Jack-Up Platform and Floating Production Systems; Marine Operations and Installation; Very Large Floating Structures

### **Protective Engineering**

Advanced and New Protective Materials; Airblast and Groundshock Effects, including Blast-Induced Liquefaction; Hardening and Protective Measures for Structures, Personnels and Vehicles; Rapidly Deployable Protective Structures

### **Hazards, Risks and Mitigation**

Design and Protection of Infrastructures against Natural and Manmade Hazards; Disaster Prevention and Mitigation; Earthquake Effects on Soils, Foundations and Structures; Earthquake Tectonics; Hazards Induced by Climate Change; Risk Analysis and Management; Tsunami Forecasting, Propagation and Run-Up

### **Structural Engineering**

High Strength, Lightweight and High-Performance Materials; Novel Composite Structural Systems; Repair and Strengthening; Smart Materials and Structural Health Monitoring

### **Geotechnical Engineering**

Land reclamation and Coastal & Offshore Geotechnics; Underground Construction

### **Hydrology and Hydraulic Engineering**

Coastal Engineering & Protection; Modelling of Hydrodynamic and Transport Process; Environmental Hydraulics; Hydroinformatics; Water Resources Planning and Management

### **Infrastructure Systems**

Intelligent Transportation Systems; Transportation Logistics; Infrastructure & Project Management; Performance-based Asset Management

Approximately S\$39 million in research funding was received over the past five years, during the period 2004 to 2008. The Department participates in synergistic collaborations with local and overseas partners involving academia, industry, government bodies and international agencies to seek expertise from around the world and to enhance existing capabilities.

Staff also engage in multidisciplinary collaborative research with national research institutes and centres, including the Singapore-Delft Water Alliance (SDWA), The Logistics Institute - Asia Pacific, Tropical Marine Science Institute, Laboratory for Concurrent Engineering and Logistics, and Centre for Remote Imaging, Sensing and Processing.

The Department contributes to the transfer of technology to industry and the public through conferences, workshops, seminars, short courses, and consultancy services. Staff achievements include patents granted for discoveries and inventions, successful commercialisation and licensing of technological innovations, and launching of spin-off companies.

Several staff members have been honoured with international awards in recognition of contributions made in their respective fields of expertise, including the Honorary Degree from Clarkson University, USA 2007, Defence Technology Prize 2006 Team Research and Development Award, the Normal Medal 2005 and Frank M. Masters Transportation Engineering Award 2005 from the American Society of Civil Engineers, USA, the Stanley Gray Medal 2005 from the Institute of Marine Engineering, Science and Technology, UK, the James Watt Medal 2005 and Webb Prize 2003 from the Institution of Civil Engineers, United Kingdom.

A notable number of staff have also been invited to deliver keynote lectures and to serve on international advisory boards and technical committees, and as editors or reviewers of several reputable international journals.

### Academic Staff

- (1) Prof T Balendra, PhD Northwestern, MEng AIT, BSc(Eng) Ceyl
  - (2) Prof Chan Eng Soon, ScD MIT, MEng NUS, BEng Sing
  - (3) Prof Cheong Hin Fatt, PhD Colorado State, MSc Cinc, BEng Sing, PEng
  - (4) Prof Choo Yoo Sang, PhD MSc BSc Manc, PEng
  - (5) Prof Chow Yean Khaw, PhD MSc BSc Manc, PEng
  - (6) Prof Fwa Tien Fang, PhD Purdue, MSc Waterloo, BEng Sing, PEng
  - (7) Prof Koh Chan Ghee, PhD MSc UC Berkeley, MEng NUS, BEng Sing, PEng
  - (8) Prof Lee Fook Hou\*, PhD MPhil Camb, MEng NUS, BEng Monash, PEng
  - (9) Prof Leung Chun Fai, PhD BEng Liv, PEng
  - (10) Prof Liew Jat Yuen, Richard, PhD Purdue, MEng BEng NUS, CEng, PEng
  - (11) Prof Ong Say Leong, PhD Toronto, MSc Western Ontario, BEng Sing, PEng
  - (12) Prof Quek Ser Tong, PhD MS UIUC, MEng NUS, BEng Monash, PEng
  - (13) Prof Somsak Swaddiwudhipong, PhD Hong Kong, MEng AIT, BEng Chulalongkorn, PEng
  - (14) Prof Tan Thiam Soon, PhD MS Caltech, BEng Canterbury, PEng
  - (15) Prof Wang Chien Ming, PhD MEngSc BE Monash
  - (16) Prof Yong Kwet Yew, PhD BEng Sheff, PEng
  - (17) A/Prof Ang Kok Keng, PhD NSW, MEng NUS, BEng Sing, PEng
  - (18) A/Prof Vldan Babovic, Dip HE Delft, MSc IHE-Delft, PhD TU Delft and UNESCO-IHE
  - (19) A/Prof Chan Weng Tat, PhD MSc Stanford, MEng NUS, BEng Sing
  - (20) A/Prof Chin Hoong Chor, PhD S'ton, MEng NUS, BEng Sing
  - (21) A/Prof Chua Kim Huat, David, PhD MSc UC Berkeley, MEng NUS, BEng Adel, PEng
  - (22) A/Prof Lee Der-Hong, PhD Illinois, MSc Nat Cen, BBA Tamkang
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  - (24) A/Prof Phoon Kok Kwang, PhD Cornell, MEng BEng NUS
  - (25) A/Prof Tan Kiang Hwee, Dr Eng Tokyo, MEng NUS, BEng Tokyo IT, PEng
  - (26) A/Prof Tan Siew Ann, PhD MSc UC Berkeley, MEng NUS, BEng Auck, PEng
  - (27) A/Prof Wee Tiong Huan, Dr Eng Tokyo IT, MEng NUS, BEng Tokyo IT, PEng
  - (28) A/Prof Zhang Min Hong, Dr Ing NTNU Norway, BSc Tongji China
  - (29) Dr. Michael Beer, Dr.-Ing. Dipl.-Ing. TU Dresden Germany
  - (30) Dr Chew Soon Hoe, PhD MSc UC Berkeley, MEng BEng NUS
  - (31) Dr Meng Qiang, PhD Hong Kong UST, MSc Chinese Acad of Sc, BSc East China
  - (32) Dr Pang Sze Dai, PhD Northwestern, MEng NUS, BEng NUS
  - (33) Dr. Qian Xudong, PhD BEng NUS
  - (34) Dr. Szeto Wai Yuen, PhD MPhil BEng HKUST
  - (35) Dr. Bai Wei, PhD BEng Dalian UT
  - (36) Dr. Goh Siang Huat, PhD Cornell, MEng BEng NUS
- Emer Prof Lee Seng Lip (Professorial Fellow), PhD UC Berkeley, MSE Mich, BSCE Mapua IT Manila, PEng
- Prof P Paramasivam (Professorial Fellow), PhD IIT Kanpur, MSc BE Madr, PEng
- Prof N E Shanmugam (Professorial Fellow), PhD Wales, MSc(Eng) BE Madr
- A/Prof Tam Chat Tim (Assoc Professorial Fellow), PhD Calgary, MEng BEng Adel, PEng

\*Head of Department (acting)

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Website: <http://www.eng.nus.edu.sg/civil/>

# Department of Electrical & Computer Engineering

## Introduction

Electrical and Computer Engineering (ECE) are among the most exciting and challenging areas of engineering, and are key disciplines in a highly technological society. Electrical and computer engineers have been driving the evolution of technology by being able to effectively apply fundamental concepts and integrate knowledge from various disciplines while pursuing frontier research, creating new ideas and innovations, and designing and developing new products.

The ECE Department is the largest department in the Faculty of Engineering, comprises a team of over 100 faculty members (see list of academic staff) recruited from all over the world. They are well respected in their areas of research and education, and engage in research activities encompassing a wide range of areas such as adaptive control, biomedical engineering, communications, computer-human interaction, humanoids, machine vision and image processing, computer systems, digital signal processing, electrical energy, evolutionary computation, information networking, intelligent systems, interactive digital media, parallel & distributed processing, microelectronic materials & devices, magnetoelectronics, microwave engineering, nanotechnology, neural networks, optical communications & networks, sensor networks, spintronics and VLSI design.

## Doctor of Philosophy (Ph.D) and Master of Engineering (M.Eng) Programme

The **Doctor of Philosophy** (Ph.D) and **Master of Engineering** (M.Eng) programme is research based (curricula and application details can be obtained from <http://www.ece.nus.edu.sg>) and it aims to train human resource, future leaders and technopreneurs in R&D with a strong foundation in the relevant science and technology, who are able to contribute to society at large and a rapidly evolving knowledge-based Singapore economy through innovation, enterprise and leadership. The department also offer **Joint Ph.D programmes** with Eindhoven University of Technology (TU/e) in Netherland and Ecole Superieure D'Electricite (Supelec) in France. Currently, we have around 400 Ph.D students and more than 100 M.Eng students, who are avail with a comprehensive research infrastructure and the opportunities to conduct creative and dynamic research.

## Research

We have over 30 research centres/laboratories within the department and many of them are equipped with top-notch facilities. Our research activities are comparable to those in the best universities in the world and have led to our faculty members garnering international recognitions. Some of these awards include the 2008 Best Paper Award (from Multimedia Communications Technical Committee, IEEE Communications Society); Young Global Leader Award 2008 (from the World Economic Forum, Cancun, Mexico); IBM Faculty Award 2008 (USA); IEEE Fellow 2007 (USA); Best Poster Presentation (IEEE International Conference on Fuzzy Systems 2006, Vancouver, Canada); Best Paper Award (Vehicular Technology Conference 2004, LA, USA); Best Paper Award 2003 (IEEE Transactions on Industrial Electronics, USA); and 1st place (Humanoid Robot Competition, FIRA Robot World Cup 2003, Austria).

In addition, our Ph.D/M.Eng students have also won international awards. These awards include the Best Student Paper (International Conference on Multimedia & Expo 2007, Beijing, China); Best Student Paper (2007 IEEE International Conference on Ultra-Wideband, Singapore); 2<sup>nd</sup> Prize, Best Student Poster Paper Award (2007 IEEE International Conference on Electron Devices and Solid-State Circuits, Taiwan); 2<sup>nd</sup> Prize (Nanopositioning Competition, 5<sup>th</sup> International Symposium on Nanomanufacturing, 2008, Singapore); IEEE Antennas and Propagation Society Graduate Fellowship 2006 (USA); IEEE Electron Device Society Graduate Student Fellowship (2005, 2003 and 2002, USA); IEEE Antennas and Propagation Society SUMMA Graduate Fellowship (Advanced Electromagnetics in 2005, USA); and Best Student Paper Award (2005 IEEE International Conference on Fuzzy Systems, Reno, USA).

Presently, we have over around 160 on-going funded research projects with a total funding of around \$53.6m. ECE actively collaborates not only with national research institutes, industries, government bodies in Singapore but also internationally. Our overseas collaborations include teams from Stanford University, Massachusetts Institute of Technology, Cambridge University, Technical University Eindhoven, French Grandes Ecoles and Tsinghua University among others.

Department is organized administratively into the following five groups, namely, Biomedical Engineering; Communications & Information Engineering; Drives, Power and Control Systems; Microelectronics; and Microwave and RF. The focused research areas are as follows:

Research Group	Focused Research Areas
<b>Biomedical Engineering</b>	<ul style="list-style-type: none"> <li>• Biosignal processing</li> <li>• Biomedical Instrumentation</li> <li>• Biomedical systems</li> </ul>
<b>Communications &amp; Information Engineering</b>	<ul style="list-style-type: none"> <li>• Wireless Communications</li> <li>• Embedded &amp; Real-time Systems</li> <li>• Man-Machine Interaction</li> <li>• Signal &amp; Multimedia Processing</li> <li>• Networking: Optical &amp; Wireless</li> </ul>
<b>Drives, Power and Control Systems</b>	<ul style="list-style-type: none"> <li>• Intelligent Control Systems</li> <li>• Computational Intelligence, Autonomous Systems &amp; Social Robotics</li> <li>• Renewable Energy Conversion, Control, Management &amp; Utilization</li> <li>• Microactuators and Precision Servo Systems</li> <li>• Assistive Technologies</li> </ul>
<b>Microelectronics</b>	<ul style="list-style-type: none"> <li>• Nanoelectronics</li> <li>• Photonics</li> <li>• Spintronics</li> <li>• VLSI Systems</li> <li>• Plasmonics</li> <li>• MEMS &amp; NEMS</li> </ul>
<b>Microwave/RF</b>	<ul style="list-style-type: none"> <li>• EM Theory and Fast Computational Algorithms Development</li> <li>• High-Performance RF microwave and Subsystem Design and Characterization</li> </ul>

## ACADEMIC STAFF

### Biomedical Engineering Group

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% Head of Department; # Deputy-Head; \* Group Head

**For further information on staff research areas, please visit -**

[http://www.ece.nus.edu.sg/staff/staff\\_main\\_A.htm](http://www.ece.nus.edu.sg/staff/staff_main_A.htm)

### **Contact**

For further information on ECE department and our Ph.D./M.Eng programme, please visit -

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Faculty of Engineering, National University of Singapore  
Block E4, Level 5, Room 45  
4 Engineering Drive 3  
Singapore 117576

## Division of Engineering & Technology Management

The Division leads academic research in the broad areas of Technology Change, Innovation Policy, Innovation Strategy and Engineering Systems. As the nature is inter-disciplinary, our academic staffs have research collaborators from different departments of engineering, as well as those from the School of Business. Adjunct professors from industry also enhance our programs with industry relevance and insights. The Division has also initiated strategic research collaborations with international partners on a project basis. These partners include academic staff from Rensselaer Polytechnic Institute, Tokyo Institute of Technology, Zhejiang University and National Chiao Tung University. The Division is also fortunate to attract several visiting professors from abroad and they bring years of experience, in either academia or industry, to enrich our research.

**Research in Technology Change** focuses on how industries emerge and evolve. We are particularly interested in how technological discontinuities and vertical disintegration emerge and their implications for both incumbents and entrepreneurs. This includes an understanding of the factors driving the emergence of discontinuities and vertical disintegration and the strategies for effectively dealing with them.

**Research in Innovation Policy** focuses on the dynamics of emergence and growth of high-tech industrial clusters, and the role played by Singapore as the innovation hub in Asia. The commercialization of university technology is new and it forms a major topic of our research in entrepreneurship. Special attention is paid to new areas such as Interactive and Digital Media, Solar Energy and Environmental Engineering.

**Research in Innovation Strategy** focuses on the study on barriers and facilitators of Discontinuous Innovation which drives company growth as well as entrepreneurship. In view of its importance in Singapore and Asia, a special research effort is expanded on Disruptive Innovation with regards to the fuzzy front-end challenge of creating disruptive technologies, relevant open innovation strategy, IP strategy, and development of appropriate core competence. The topic of secondary innovation focusing on process innovation in Singapore and China is also included. The theoretical understandings will be applied to identify innovation opportunities in new fields such as MEMS, OLEDs, Specialty Chemicals, Biomedical Devices, and Solar Cells.

### Faculty Members of the Division

**Marcelo H ANG Jr** *PhD MS Rochester, MS Hawaii, BS De La Salle* Associate Professor

- Robotics
- Mechatronics
- Automation and computer control
- Applications of intelligent systems methodologies
- Creativity and Innovation

**Seiko ARAI** *PhD Saïd Business School & Templeton College, University of Oxford, UK* Assistant Professor

- International R&D Management

**Vladan BABOVIC** *Dip HE Delft, MSc IHE-Delft, PhD TU Delft and UNESCO-IHE* Associate Professor

- Artificial intelligence
- Machine learning
- Data mining and knowledge discovery, Data-driven modelling and Data assimilation
- Data assimilation
- Computational hydraulics
- Hydroinformatics

**John BAULY** *PhD MSc BSc (UK) C.Eng* Adjunct Associate Professor

- New Product Management/ Development

**Charanjit S Bhatia** *PhD MSc University of Minnesota*

- Fabrication, Characterization and Performance of Thin film Si Photovoltaic cells

**Frans CARPAY** *PhD MSc Utrecht* Visiting Professor

- Management of Industrial R&D

**CHAN Weng Tat** *PhD MSc Stanford, MEng BEng NUS* Associate Professor

- Construction management and site safety
- Resource allocation, planning and scheduling
- Soft systems computing: evolutionary search & artificial neural networks
- Distributed computing & intelligence
- Constraint logic programming
- Spatial decision support systems

**Jeffrey Lee FUNK** *PhD MSc Carnegie Mellon, BSci California Polytechnic State* Associate Professor

- Entrepreneurship and New Industry Creation
- Innovation/Technology Management
- Network/Information Industries
- Internet Strategy
- Organizational Design, Quality Control and Manufacturing Strategy

**HANG Chang Chieh** *DSc PhD Warwick, BEng NUS* Professor and Head of Department

- Intelligent Automatic Tuning and Adaptive Control Systems
- Control of Processes with Long Dead Time Multivariable Control Systems
- Innovation Strategy and Management
- Relay-FFT Technique for Intelligent Auto-tuning
- Intellectual Properties and Innovation
- Framework for Analyzing Disruptive Technologies

**Joseph KASSER** *Doctor of Science, The George Washington University* Visiting Professor

- Systems Engineering
- Systems thinking
- Improving and applying systems engineering and systems thinking
- Distance education and learning

**Stanley LAI** *PhD Cambridge, LLM LLB Leicester, Barrister (Lincoln's Inn)* Adjunct Associate Professor

- E-commerce transactions
- Telecommunications regulatory compliance
- Intellectual property and technology litigation
- Licensing (including open-source) and franchising
- On-line and off-line enforcement against piracy and counterfeiting

**Charles LEE** Visiting Professor

- Corporate Entrepreneurship

**LIU Shang-Jyh** *BS MS LLB National Taiwan, PhD Texas A&M* Visiting Professor

- Legal, Technological and Managerial/Economical Aspects of Intellectual Property Rights
- National Innovation System and IP Policy
- Competitive Strategy and Organizational Management of High-Tech Industry

**LOW Teck Seng** *PhD BS, Southampton University* Adjunct Research Professor

- Data Storage

**Andrew NG** *MBA NUS* Adjunct Associate Professor

- Strategic business development
- International Marketing
- Nurturing High Tech start-ups and E Business

**Ron SANCHEZ** *PhD MS BS MIT, MBA Saint Mary's College of California* Visiting Professor

- Theory and practice of competence-based strategic management
- Modularity in product, process and knowledge architectures
- Knowledge management and strategic organizational learning
- Options theory in strategic management
- Strategic flexibility

**Budiman SASTRA** *MSc Delft University of Technology* Adjunct Research Professor

- Mechatronics
- Information Storage
- Precision Engineering
- Displays

**SOO Kok Leng** *MBA Strathclyde, BEng NUS* Adjunct Associate Professor

- Systemic Strategic Management and Cultural Fluency

**THAM Ming Po** *PhD MA Illinois, BA Calgary* Adjunct Associate Professor

- Error analyses
- Visual displays
- Information processing and operator's performance in complex systems
- Decision-aiding and the dynamics of creative collaboration in distributed and multi-cultural product development teams

### **Who to Contact**

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## Division of Environmental Science & Engineering

The Environment of the Globe is the focus of education and research programs in Environmental Science and Engineering (ESE) at the NUS Faculty of Engineering. This includes global climate change, water reclamation, portable-water development, barriers to infectious-disease transmission, human health-effects, water resources, sensors for monitoring contaminants, membranes innovation, alternative energy systems, industrial ecology and more. ESE provides integrated interdisciplinary education and research based programs at Bachelor, Master and Doctoral levels.

ESE emphasizes multi-disciplinary approaches to solving complex environmental problems. The overall objective of ESE is to impart to students a sound scientific knowledge, combined with advanced engineering capabilities, so that they may understand current and emerging environmental issues confronting the Earth. ESE provides opportunities for development of appropriate technologies and systems to address these issues. It promotes unique research and educational opportunities in the following fields:

- Aerosol science & technology
- Air pollution assessment & control
- Environmental chemistry & biochemistry
- Environmental microbiology & biotechnology
- Climate change
- Energy resources, conservation & alternatives
- Hazardous & solid waste
- Human & environmental health
- Industrial ecology
- Marine & coastal systems
- Membrane separations & technologies
- Nano-biotechnology & nano-materials
- Renewal energy
- Sensor systems in air, land & water
- Separation science & technologies
- Sustainable Development
- System modelling & simulation
- Water quality & treatment
- Wastewater reclamation & reuse
- Water resources

Thus, ESE has a strong capability in all key areas relevant to environmental science and engineering.

The faculty members of ESE are engaged in basic and applied research, organized into broad research clusters. These clusters are related to engineering applications in all relevant environmental media – air, water, and soil and embedded in each would be the capability to investigate the sciences behind problems in the three media. In its focus areas, ESE adopts a comprehensive, holistic view when attempting to solve complex environmental problems.

Faculty research activities are a reflection of the expertise of its faculty members, who are multi-national, highly trained, and well regarded in both academia and industrial sectors. ESE has been actively involved in facilitating interaction and collaboration between researchers, students, and industry. In research, this interaction allows faculty members to undertake translational engineering so as to facilitate the effective transfer of research findings to the industry. ESE faculty members have an excellent record of successful technology transfers to the industry.

Graduate study of the environment and the transformation, removal, effects and fate of organic and inorganic contaminants are pursued at NUS in ESE. Local, regional and global aspects of air, land and water systems are pursued at master and doctoral degrees levels. State-of-the-art laboratory facilities permit computer modelling and laboratory experiments. These are augmented with opportunities for students to work on pilot- and full-scale test facilities. Undergraduate students are encouraged to actively engage in applied research projects, together with postgraduate students and faculty members to gain “hands-on-experience” in the research and development of new technologies.

Environmental problems are some of the most complex, challenging, and pressing issues that are of concern to engineers, scientists and policy makers. Achieving environmental sustainability is a key priority for Singapore and the world. ESE is committed to providing excellence in education and research and preparing young environmental scientists and engineers for leadership positions in academia and industrial research and development.

### Academic Staff

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You can find out more about the division and our academic staff at our Homepage:

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Graduate Research & Scholarship page: <http://www.gse.nus.edu.sg/postgradprog.html>

## Department of Industrial & Systems Engineering

The Department is organized into three research groups; namely, **Quality Engineering, Systems Engineering and Engineering Management**. While these research groups indicate the current strengths and future development of the Department, faculty members work closely together across research groups. Currently, the Department has collaboration with a number of research institutes such as The Logistics Institute - Institute - Asia Pacific (TLI - Asia Pacific) and Temasek Defence Systems Institute. The Department also maintains strong ties with major industries with on-going collaborative projects in air and sea cargo operations, and quality and reliability issues in product design and manufacturing. Graduates of the Department are highly sought after by industry as prospective employment spans across manufacturing, logistics, finance, health-care and IT industries. Job titles of recent graduates include Industrial Engineer, Systems Engineer, Manufacturing Manager, Six Sigma Black Belt, Financial Engineer, Market Development Manager, Quality Manager, MIS Manager, Business Analyst, Logistics Engineer, Software Engineer, etc.

Research in the area of Quality Engineering is driven by the need of industry to provide better quality products and services. Current research concentrates on statistical methodologies for quality design, control and improvement to achieve six-sigma quality. The Department is known internationally for its work in quality and reliability engineering as evident from the representation of its faculty members on the editorial boards of many leading international journals in this area and the books they have written. The strengths of the Quality Engineering Group lie not only in methodological research in statistical process control, design of experiments, accelerated reliability testing, robust design, and software reliability; but also in the application of these methodologies to real life problems in a wide spectrum of industries including design and development centres, service industry and high-tech manufacturing. There are strong linkages between the Department and several public and private sector organizations which have strategic interests in quality and reliability engineering, and the department is widely regarded as a leading resource centre in this area.

Research in the Systems Engineering seeks to maximize the benefits obtainable from the effective and timely utilization of limited resources. Current research concentrates on both the methodological and management aspects. Operations research tools are being applied to solve a wide range of real-life problems, from those encountered at the organizational and industry levels to the national level. In logistics and supply chain management, research areas include air-cargo logistics and supply chain systems, military logistics, inventory systems, material handling and order picking systems, yield management, factory physics and facilities scheduling. Methods for integrating inventory control policies with warehouse facilities planning for efficient utilization of space requirements have been successfully applied in industry. Results in heavy traffic queueing analysis have also been applied to scheduling and dispatching in a wafer fabrication plant. Faculty members are collaborating with researchers in Georgia Institute of Technology on issues related to air-cargo logistics. Research in systems and optimization focuses on energy systems, decision systems and optimization techniques. Faculty members have published some of the most original work in the area of index decomposition analysis applied to energy. In decision systems, research conducted seeks to understand and enhance the intelligent problem solving capabilities of human and human-computer systems. Activities in this area include work on methods to automate the construction of situation-specific decision models from knowledge bases, time-critical decision making in medicine, valuation of dynamic decision model abstractions and refinements, and intelligent multiple criteria decision systems.

Research in the Engineering Management area focuses on Service and Innovation Management (SIM) which addresses the challenges of developing and introducing services and innovation. There exists a broad and diverse range of activities that are necessary for the successful undertaking of innovative product and service development. These range from the macro strategic aspects of R&D portfolio planning to the detailed operational issues of design decision. The theoretical basis for SIM research is drawn predominantly from the fields of statistics, organizational behavior, marketing, ergonomics, communication, and technology transfer. Interdisciplinary work involving the engineering, business, and social science disciplines are necessary to achieve significant progress in innovation. Within the product life cycle, a focus on service innovation brings into consideration the increasing emphasis on service quality. The blending of products and services from the consumer's point of view leads to new challenges in conceptualizing consumer demand. Research in SIM will have increasing impact on the marketing of products and services. Faculty members in this area collaborate with industry, overseas universities, research institutes and other Faculties in a multidisciplinary approach to the research questions.

Our Doctor of Philosophy (Ph.D) and Master of Engineering (M.Eng) programme is research based and provides rigorous training of our students. Candidates from science and engineering with

outstanding first degree and research potential and those with relevant master degree are welcome to apply. You are welcome to contact potential advisors below.

### **Faculty Members of the Department**

**TANG Loon Ching** *PhD MS Cornell, MEng BEng NUS* Associate Professor and Head of Department

- Applied probability and statistics
- Quality and reliability engineering; Six sigma
- OR techniques for operational control and revenue management
- Queueing and its applications

**ANG Beng Wah** *PhD Cambridge, BSc Nan.* Professor and Leader of Systems Engineering Group

- Energy economics and policy
- Energy and climate change
- Energy efficiency potential study
- Development of energy and sustainability indicators
- Systems analysis and modelling

**CHAI Kah Hin** *PhD Cambridge, MEng UniSA, BEng UTM* Assistant Professor

- New product development
- Innovation and knowledge management
- International manufacturing
- Quality management

**CHEW Ek Peng** *PhD MS Georgia IT, MEng BEng NUS* Associate Professor

- Logistics and inventory management
- Systems modeling and simulation
- Analysis of order picking systems
- Optimization

**GOH Thong Ngee** *PhD Wisconsin, BE Sask.* Professor and Leader of Quality Engineering Group

- Experimental design for product and process optimization
- Quality engineering; Taguchi methods; Robust design
- Statistical methodologies for quality and productivity in manufacturing
- Systems modeling and forecasting
- Six sigma methodologies

**HUANG Boray** *PhD Northwestern, MS Nat'l Tsing Hua, BS Chung-Yuan*

- Supply chain and inventory management
- Stochastic modeling and optimization
- Service system management

**HUANG Huei Chuen** *PhD MPhil MA MS Yale, BS Taiwan* Associate Professor

- Combinatorial optimization
- Logistics

**HUNG Hui-Chih** *PhD Ohio State, MS National Tsing Hua, BS National Taiwan* Assistant Professor

- Facility layout design
- Stochastic resources allocation
- Queueing systems
- Industrial ecology networks and resilient optimization

**KIM Sujin** *PhD MS Cornell University, BS Ewha Women's University*

- Stochastic simulation
- Simulation based optimization
- Applied probability

**LEE Loo Hay** *PhD SM Harvard, BS Nat'l Taiwan* Associate Professor

- Simulation based optimization
- Ordinal optimization
- Logistics and supply chain modelling

**NG Kien Ming** *PhD MS Stanford, BSc NUS* Assistant Professor

- Integer and nonlinear optimization
- OR applications in military and logistics
- Optimization models in telecommunication and medicine
- Numerical algorithms and techniques

**NG Szu Hui** *PhD MS BS Michigan* Assistant Professor

- Design of experiments
- Quality engineering
- Stochastic simulation
- Applied statistics

**NG Tsan Sheng, Adam** *PhD BEng NUS* Assistant Professor

- OR applications in production and logistics
- Integer optimization, stochastic programming

**POH Kim Leng** *PhD MS Stanford, MEng BEng NUS* Associate Professor

- Decision analysis
- Intelligent decision systems
- Systems optimization and meta-heuristics

**TAN Kay Chuan** *PhD VPI, MS BS Mass.* Associate Professor

- Human-machine systems design, testing and evaluation
- Human-computer interaction
- Quality management especially of IT-based systems
- QFD and other quality measurement tools

**XIE Min** *PhD Lic Linkoping, MSc Stockholm* Professor and Leader of Engineering Management Group

- Quality engineering and management
- Reliability modeling and data analysis
- Engineering statistics
- Statistical process control
- Software quality and reliability

**YAP Chee Meng** *PhD MS Pittsburgh, BEng NUS* Senior Lecturer

- Management of technology
- New product development management
- Financial impact of R & D investment

## Who to Contact

Officer in-charge (Research Program)  
Department of Industrial and Systems Engineering  
Tel: (65) 6516 2206  
Fax: (65) 6777 1434  
e-mail: [iseowlc@nus.edu.sg](mailto:iseowlc@nus.edu.sg)  
Web: <http://www.ise.nus.edu.sg>

# Department of Materials Science and Engineering

## ABOUT OUR DEPARTMENT

Since the dawn of civilization, the power of understanding and using materials allowed human beings to progress steadily from the stone age to bronze age to iron age to the silicon age. Today, the “understanding” (fundamental science) and “using” (applied engineering) materials are transformed into a specialized niche yet interdisciplinary area known as Materials Science and Engineering. Currently, there are 14 faculty members and the department is presently actively recruiting world class academics. The number of academic staff within the Department will eventually rise to approximately 15-20; sufficient to reach the necessary critical mass for the Department to fulfil its mission. The anticipated size of the undergraduate enrolment is 50-70 students per year, along with a total number of postgraduate students in the region of 80. The Department enjoys a comprehensive research infrastructure with top-notch facilities for carrying out cutting-edge research and strives to provide graduate students with facilities and an environment that are conducive for creative and dynamic research. Many of the academic staff are internationally renowned in their fields and recent bench marking of the research activities of the Department show it to be comparable to the best universities in the world.

## Department's Scope

The Materials Science and Engineering is a dynamic, interdisciplinary study that combines the fundamental sciences; chemistry, physics and life sciences; with the applied engineering; electronic, mechanical, chemical and bioengineering. It strives for basic understanding of how the science of structures and processes on atomic, nano- and micro- scales result in the properties and functions familiar at the engineering level. Materials scientists and engineers are interested in physical and chemical phenomena acting across large magnitudes of space and time scales. In this regard it differs from physics or chemistry where the emphasis is more on explaining the properties of pure substances. Likewise in materials science and engineering, there is also an emphasis on developing and using knowledge to understand how the properties of materials can be controllably designed by varying the compositions, structures, and the way in which the bulk and surface phase materials are processed during fabrication, this separates it from the other branches of engineering where the stress is on applications.

## MAJOR RESEARCH & GRADUATE EDUCATIONAL THRUSTS

The Department pursues world class research and education in main stream areas of materials science and selected areas of engineering science relevant to Singapore. The Department's activities are built on three major platforms, namely

1. Biotechnology
2. Infocom Technology
3. Sustainable Energy

These platforms will enable the Department's activities to adapt to the changing needs of the Singapore economy. The ultimate goal of the Department is in the integration of these three platforms into interdisciplinary niche areas for advanced scientific and engineering applications. The present niche areas are Nanostructured Materials / Biomedical Materials.

### 1. Biotechnology

Materials which are used in the human body are generally known as biomedical materials. In recent years there have been tremendous advances in the fields of chemistry, physics, biology and engineering which have a direct impact on advances in biomaterials science. Many areas of healthcare depend upon the development of novel biomedical materials. Examples include bone graft substitutes, dental materials, biosensors, and materials for controlled delivery of drugs and synthetic genes. The Department of Materials Science and Engineering plans to be in the vanguard of developments in Biomedical Materials with a platform for high quality, interdisciplinary research. Currently, the Department has a number of research groups working on the following areas: (1) Biosensors, (2) Biomagnetism, (3) Corrosion & degradation of surgical implants, (4) Advanced simulation of cell deformation, (5) Modelling of adhesion on cell membranes (6) Surface and bulk characterisation of biomolecules and (7) Nanosized particles for drug delivery

## 2. Infocom Technology

Information and communications related industries play an important role in the Singapore economy. This vital area is expected to continue to grow with the introduction of new devices and applications, without doubt advanced materials and sophisticated materials processing techniques will be at the heart of all this new innovations. The faculty members in Department of Materials Science and Engineering have demonstrated a strong track record in the research of infocom related materials. Strategic areas include electronics, sensors, and data storage. Current research topics include: (1) Electronic properties of self-assembled quantum dots, (2) Development of advanced magnetic materials for high-density recording media, (4) Novel optical thin films (5) Functional & electroceramic materials, (6) Magneto-electronic and magneto-optical properties, (7) Diluted magnetic materials, (8) Ferroelectric, relaxors and piezoelectric materials, and (9) MEMS / NEMS technology.

## 3. Sustainable Energy

There is an increasing need to find environmentally friendly replacements for fossil fuels. This is especially true in Singapore with its high population density. Presently the most promising sources for sustainable primary energy are hydroelectric, solar power, wave power and wind power. Unfortunately only the second of these, solar power, is likely to be practical in Singapore. Furthermore in order for these primary sources to truly replace fossil fuels, there a need to develop transportable secondary power sources; most notably fuel cells, advanced batteries and techniques for safe hydrogen storage. The development of environmentally friendly advanced materials is the key to all these sustainable energy systems. The Department is currently working in the areas of: (1) dye sensitized solar cell, (2) the dynamics of disordered materials in relation to sustainable energy, (3) Thin film and Bulk nanostructured mesoporous materials, (4) Advanced thin film photovoltaic materials, and (5) Novel semiconductor thick film solar cells.

## 4. Nanostructured Materials / Biomedical Materials

Advances in nanoscience and nanotechnology enable the development of many potential technologies across a wide spectrum of sectors. The unique properties in nanostructured materials provide the essential driver for these advances, which enable the successful integration with biotechnology. The faculty members in DMSE have demonstrated a strong track record in the synthesis, processing and characterization of nanostructures with desirable properties. Current research areas within the Department include:(1) Effects of size and interface on properties of nanostructure, (2) Self-assembly process of nano-crystalline materials, (3) Thin film gas sensors, (4) Bulk nano-structured materials, (5) Porous silicon templates for nanomaterials, (6) Nanohybrids and mesoporous ceramics, (7) Magnetic nanoparticles, nanocomposites and nanotubes, (8) Metal-based amorphous and nano-structural materials, (9) Mechanical properties of micro-and nano-materials & structures, (10) Nanoparticles for biomedical applications, (11) Nanohybrid structure for gene delivery and (12) Effects of particle size and surface coatings on cytotoxicity

### WHOM TO CONTACT

For further information on the application procedure or departmental research activities, please contact -

Department of Materials Science & Engineering  
7 Engineering Drive 1  
Block E3A, #04-10  
National University of Singapore  
Singapore 117574

Phone: (65) 6516 5192  
Fax: (65) 6776 3604  
E-mail: msebox6@nus.edu.sg

You can find out more about the Department and our academic staff at our Homepage:

Materials Science & Engineering home page: [www.mse.nus.edu.sg](http://www.mse.nus.edu.sg)

Graduate Research & Scholarship page: <http://www.gse.nus.edu.sg/postgradprog.html>

## Department of Mechanical Engineering

### ACHIEVEMENTS AND STRENGTHS

Although broadly comprising six academic groups, namely, Applied Mechanics, Control & Mechatronics, Energy & Bio-Thermal Systems, Fluid Mechanics, Manufacturing and Materials, the Department of Mechanical Engineering emphasises multidisciplinary research activities. In recent years, the Department has continued to consolidate major research efforts with a strategic focus on micro-systems technology, where many staff members are engaged in different facets of multi-disciplinary projects. Other research areas of strong interest are bioengineering, materials engineering, nano-technology, intelligent products and manufacturing, micro thermo-fluid systems and computational mechanics.

The vibrant research environment of the Department continues to attract and sustain funding from both the public and private sectors. There are currently over 100 ongoing funded research projects with a total funding of \$33 million. Research collaborators include Vestas Technology, Stanford University, Schlumberger-Doll Research, Queensland University of Technology, The John Hopkins University, Monash University, Ningbo University, Institut Pasteur, Indian Institute of Science, Brown University, Imperial College of London, University of Basel, Technion-Israel, Seagate Technology International, Stemlife – Malaysia, Micron Technology, DSO, DSTA, SIMTech, IHPC, IMRE, IME, NUH, NTU, KAIST, Airbus, MPA, BCA, SNSL, Think Composites, Hitachi Ltd, APL, et cetera.

The academic staff strength of the Department grew to its current number of 76 by end March 2009. Many staff members have taken on the roles of principal investigators and key collaborators in research projects. Research efforts are supported by some 76 research staff, 58 technical support staff, and 303 graduate students (261 Ph.D and 42 M.Eng). Emphasis is placed on training high-quality graduates with a broad background and depth in engineering fundamentals. The Department seeks to develop their critical thinking skills to enhance their ability to contribute to Singapore's economic development and to advance science and technology. A capable, creative and dynamic staff team with distinguished credentials, supported by advanced facilities, will definitely continue to raise the international standing of the Department.

The Department has also produced several spin-off companies, examples are: Manusoft Technologies Pte Ltd which develops and markets IMOLD for the design of plastic injection molds; and Mikrotools Pte Ltd which develops and manufactures advanced machine tools and systems for ultra-precision and micro-machining applications.

### AREAS OF RESEARCH

#### Applied Mechanics

Structural and machinery vibration, dynamical systems, acoustics, flight mechanics, fracture mechanics, optical non-destructive testing, optical and image processing techniques, micro-mechanics, micro-electromechanical systems, micro-optics, impact mechanics, computational mechanics, mechanics of composite materials, progressive failure of composites, multi-scale modelling of materials, molecular dynamics of polymers, cell & molecular biomechanics, mechanobiology and nanobiomechanics.

#### Control & Mechatronics

Robotics and humanoid systems, control theory including robust control, intelligent control and supervisory control, mechatronics, machine vision, computational intelligence, scheduling and their applications.

#### Energy & Bio-Thermal Systems

Absorption and adsorption chillers, compact heat exchangers for waste heat recovery and dehumidification, co-generation systems, ice storage for cooling and air-conditioning, and energy performance of buildings and building envelopes; solar drying, solar desalination, solar air-conditioning and hot water heating; combustion in the micro-scale, micro thermophotovoltaic power generators, solid propellant micro-thrusters, and miniaturization of electro-adsorption chillers; bone drilling and cryo-surgery and cryoprobe development; heat transfer analysis in electronic packaging, moisture migration and its effects on electronic packaging, electronic cooling using phase change materials, thermo-mechanical reliability analysis of integrated chip packages, and thermal analysis in the wafer level packaging.

### Fluid Mechanics

Bluff body aerodynamics, flow instability, vortical flow, micro-flow, near-wall turbulence measurements, bio-fluid mechanics of blood flow, rheology, complex microstructured fluids, development of numerical methods and computational fluid mechanics, bio-fluid engineering.

### Manufacturing

Intelligent manufacturing areas in distributed manufacturing systems, computer-aided process planning, intelligent fixture, die and mould design, augmented reality in manufacturing applications; automation technology areas including multi-axis NC machining, virtual prototyping, Stewart platforms, design and fabrication of ultra-precision machines and systems for hybrid, compound and micro/nano machining; machine intelligence in the form of multi-sensory fusion, knowledge-based systems, fault recovery and diagnosis, emerging intelligent and information communication technologies; advanced manufacturing processes covering ultra-precision machining, micro/nano, hybrid and compound machining, additive manufacturing targeting at microfabrication and bio-manufacturing.

### Materials

Synthesis and characterisation of advanced materials, non-conventional methods to engineer new materials, functionally graded materials, Nano-/Micromechanics of Advanced Materials, nanocrystalline materials, nano-composites, shape memory materials, flexible and tough composite materials, biomaterials technology and production of medical prostheses, wear resistant coatings, solid lubricants, lubrication of hard disk drives, microsystems and cutting tools, wear mapping and ordering of wear data.

## ACADEMIC STAFF

APPLIED MECHANICS		CONTROL & MECHATRONICS	ENERGY & BIO-THERMAL SYSTEMS
A/Prof Chau Fook Siong*	A/Prof Quan Chenggen	A/Prof Ang Jr, Marcelo H	Prof Chou Siaw Kiang*
A/Prof Cheng Li	Prof Shim Phiau Wui, Victor	A/Prof Chew Chee Meng	Dr Chua Kian Jon, Ernest
A/Prof Chew Chye Heng	Dr Srikanth Vedantam	Dr Chui Chee Kong	A/Prof Hawlader, MNA
Dr Joshi Shailendra Pramod	A/Prof Tan Beng Chye, Vincent	A/Prof Hong Geok Soon	A/Prof Ho Juay Choy
A/Prof Lee Heow Pueh	A/Prof Tay Cho Jui	A/Prof Lim Kah Bin	Dr Lee Poh Seng
A/Prof Leng Siew Bing, Gerard	Prof Tay Tong Earn	A/Prof Ong Chong Jin*	Prof Mujumdar, Arun S
A/Prof Lim Chwee Teck	A/Prof Toh Siew Lok	Prof Poo Aun Neow	Prof Ng Kim Choon
A/Prof Lim Kian Meng	Dr Zhou Guangya	A/Prof Teo Chee Leong	Dr Palani Balaya
A/Prof Lim Siak Piang		Dr Subramaniam Velusamy	Prof Tay Ah Ong, Andrew
Prof Liu Gui-Rong		Dr Peter Chen	A/Prof Yap, Christopher
Dr Prakash Thamburaja			

FLUID MECHANICS	MANUFACTURING		MATERIALS
#Prof Chew Yong Tian	Prof Fuh Ying Hsi, Jerry	A/Prof Tay Eng Hock, Francis	A/Prof Gupta, Manoj*
Prof Khoo Boo Cheong	A/Prof Gibson, Ian	Prof Wong Yoke San*	A/Prof Lai Man On
A/Prof Lee Thong See	A/Prof Lee Kim Seng	A/Prof Zhang Yunfeng	A/Prof Lim Leong Chew
Prof Lim Tee Tai	Prof Li Xiaoping		Prof Lim Seh Chun
A/Prof Loh Wai Lam	A/Prof Loh Han Tong		A/Prof Lim Yui Hung, Christina
A/Prof Low Hong Tong	A/Prof Lu Wen Feng		Prof Lu Li
A/Prof Luo Siao Chung	Prof Mustafizur, Rahman		Prof Ramakrishna, Seeram
Dr Shah, Dilip A	Prof Nee Yeh Ching, Andrew		Dr Sinha, Sujeet Kumar
Prof Shu Chang	A/Prof Ong Soh Khim		Prof Teoh Swee Hin
Dr Teo Chiang Juay	A/Prof Seah Kar Heng		Dr Thian Eng San
A/Prof Winoto, SH	A/Prof A Senthil Kumar		Dr Zeng Kaiyang
A/Prof Yeo Khoon Seng*			

# Head of Department

\* Group Head

WHO TO CONTACT:

For information on application procedure or department research activities, please contact:-

Programme Manager (Research)

Department of Mechanical Engineering

National University of Singapore

Block EA, #07-08

9 Engineering Drive 1

Singapore 117576

Phone : (65) 6516 2577

Fax : (65) 6779 1459

E-mail: [mpelaimo@nus.edu.sg](mailto:mpelaimo@nus.edu.sg)

Website Address: Mechanical Engineering home page: <http://www.me.nus.edu.sg>

# *Ph.D./M.Eng. Programmes*

## **Graduate Education**

The Faculty of Engineering is committed to the pursuit of academic excellence in a vibrant research community actively engaged at the forefront of ideas and innovation. The graduate experience helps students realize their full potential and prepare them for an increasingly borderless and innovation-driven global economy.

We believe it is just as important to infuse our students with a spirit of enterprise and the mindset needed to thrive in an ever-changing global landscape. Our scholars have opportunities to learn from the best minds, not just in Singapore but beyond, because of our strong global partnerships with Illinois at Urbana-Champaign (UIUC); Massachusetts Institute of Technology; US Naval Postgraduate School, Monterey; French Grandes Ecoles; Technische Universiteit Eindhoven (TU/e), Tsinghua University (TU), Australian National University (ANU), Indian Institute of Technology, Bombay (IITB) and Indian Institute of Technology Madras (IITM).

Apart from benefiting from an international exchange of ideas with a vibrant community of international faculty and students, prospective graduate students will discover a mosaic of graduate programmes – Master of Engineering and Doctor of Philosophy as well as several Joint programmes with renowned international universities – covering various engineering disciplines to meet their areas of interests and needs.

## **Research Programmes**

The Faculty has built a comprehensive research infrastructure with top-notch facilities for carrying out cutting-edge research and strives to provide graduate students with facilities and an environment that are conducive for the pursuit of creative research.

Graduate students have the opportunity to work closely with faculty members on a wide variety of exciting research projects. Excellent opportunities are available for students to be immersed in a vibrant research-intensive environment in the following departments/divisions:

- Division of Bioengineering
- Department of Chemical & Biomolecular Engineering
- Department of Civil Engineering
- Department of Electrical & Computer Engineering
- Division of Engineering & Technology Management
- Division of Environmental Science & Engineering
- Department of Industrial & Systems Engineering
- Department of Materials Science & Engineering
- Department of Mechanical Engineering

or be attached to one of the Research Institutes/Centres, in the pursuit of a higher degree leading to:

- **Doctor of Philosophy (Ph.D.)**
- **Master of Engineering (M.Eng.)**

These higher degrees are awarded based on coursework and supervised research on an approved topic, culminating in the submission of a thesis.

## **Eligibility for Application**

The minimum requirement for admission is a Bachelor's Degree with Honours (at least 2<sup>nd</sup> Class Lower) or its equivalent.

Applicants who are applying for the NUS Research Scholarship are expected to have at least a Bachelor's Degree with Honours (at least 2<sup>nd</sup> Class Upper) or its equivalent.

## **IMPORTANT NOTE**

Candidates with good first degree may apply for direct admission to the Ph.D. programme. Do note that priority for the competitive NUS Research Scholarship will be given to applicants for the Ph.D. programme.

International candidates are expected to submit their TOEFL and GRE test scores to support their applications.

Candidate should have the ability to pursue research in the candidate's proposed field of advanced study.

### **Joint Programmes**

The Faculty has created exciting opportunities for students to embark upon joint programmes to venture, to learn from the best of both worlds, to gain exposure to foreign culture, to network with the best students at some of the best institutions around the world.

#### NUS-UIUC Joint Ph.D Programme

The NUS-UIUC Joint Ph.D. programme is only open to Singaporeans/Singaporean Permanent Residents, with a good bachelor's Degree in Chemical Engineering (at least 2<sup>nd</sup> Class Upper Honours) or its equivalent. Candidates who are interested in pursuing graduate studies in the NUS-UIUC Joint Ph.D. programme are welcome to visit the website at:

[http://www.chee.nus.edu.sg/educational\\_program/phd\\_prog.html](http://www.chee.nus.edu.sg/educational_program/phd_prog.html) for further details.

#### NUS-TU/e Joint Ph.D Programme

The NUS-Eindhoven University of Technology (TU/e) Joint Ph.D. programme is a synergy of two excellent study programmes. It is open to candidates with a good bachelor's Degree (at least 2<sup>nd</sup> Class Upper Honours) or its equivalent. Candidates would spend at least 2 semesters of their candidature each at NUS and TU/e, either reading modules and / or undertaking research. For further details, please peruse the website at: <http://www.gse.nus.edu.sg/tue.html>

#### NUS-ANU Joint Ph.D Programme

The Australian National University (ANU) is one of the world's foremost research universities. The Joint Degree programme will be offered by the Faculty of Engineering at NUS and College of Engineering & Computer Science at ANU.

Applications for the Joint Ph.D. programme should be submitted to either NUS or ANU whichever is the university the candidate wishes to be registered with as their home university. The minimum admission criteria is at least a relevant Bachelor's degree with Honours (at least 2<sup>nd</sup> Class Upper) or its equivalent.

Candidates who are interested in pursuing graduate studies in the NUS-ANU Joint Ph.D. programme are welcome to visit the website at <http://www.gse.nus.edu.sg/ANU.htm>

#### NUS-IITB Joint Ph.D. Programme

The Indian Institute of Technology, Bombay (IITB) is well known around the world as one of the centres of academic excellence in the country. The Joint Doctoral programme will be offered by the Faculty of Engineering at NUS and the Indian Institute of Technology Bombay (IITB).

Applications for the Joint Ph.D. programme should be submitted to either NUS or IITB whichever is the university the candidate wishes to be registered with as their home university. The minimum admission criteria is at least a relevant Bachelor's degree with Honours (at least 2<sup>nd</sup> Class Upper) or its equivalent.

Candidates who are interested in pursuing graduate studies in the NUS-IITB Joint Ph.D. programme are welcome to visit the website at <http://www.gse.nus.edu.sg/NUS-IITB.htm>

#### NUS-IITM Joint Ph.D. Programme

Another joint programme we have with a renowned IIT is NUS-IITM Joint Ph.D. programme. The Indian Institute of Technology, Madras is yet another excellent University.

Applications for the Joint Ph.D. programme should be submitted to either NUS or IITM whichever is the university the candidate wishes to be registered with as their home university. The minimum admission criteria is at least a relevant Bachelor's degree with Honours (at least 2<sup>nd</sup> Class Upper) or its equivalent.

Candidates who are interested in pursuing graduate studies in the NUS-IITM Joint Ph.D. programme are welcome to visit the website at <http://www.gse.nus.edu.sg/NUS-IITM.htm>

## Scholarships

### (A) Lee Kong Chian Graduate Scholarships (available for August 2010 Intake only)

The Lee Kong Chian Graduate Scholarships are NUS' most prestigious scholarship awards for graduate students. Up to 5 new awards will be given each year and in keeping with the donor's desire to see its scholars with the appropriate balance of intellect and character, scholarship recipients are selected on the basis of demonstrated academic excellence, leadership, exceptional promise as well as commitment to service.

The bond-free Scholarships are open to all nationalities who will be admitted as a candidate for a **Ph.D. programme** at NUS. Shortlisted candidates will be notified for a scholarship interview either in Singapore or their home country. Award of the Scholarship is based on competition among eligible candidates and performance at the Scholarship interview.

Each award covers:

- (i) A monthly stipend of S\$3,300;
- (ii) Research, examination fees and other approved fees at NUS as stated on the NUS Student Bill;
- (iii) An annual book allowance of S\$500;
- (iv) A one-off air travel allowance of two return tickets of up to S\$4,000 (only for overseas students); and
- (v) A one-off laptop allowance of S\$1,500.

If you wish to apply for the Lee Kong Chian Graduate Scholarship, please also submit the following documents:

- (a) A **personal statement** to describe, in less than 300 words, an exceptional achievement that highlights your academic interests and intellectual capacity that would be of value to the NUS community.
- (b) A **report (with documentary evidence) on your extra-curricular activities** (e.g. committee served, community service, sports etc), and a statement (less than 300 words) about how you have benefited from such participation, and hope to return something to society.

### (B) President's Graduate Fellowship (PGF)

The PGF is awarded to candidates who show exceptional promise or accomplishment in research. A number of Ph.D. research students are selected each semester by University for the award.

- Monthly stipend may range from S\$3,000 – S\$3,300 (actual award depends on the quality of candidates)
- Air Ticket (single journey) } for international students
- Settling-in Allowance }
- Fully paid Tuition Fees & No Bond

The award is tenable for up to a maximum of 4 years, subject to an annual review of the scholar's satisfactory progress. Short-listed candidates will be invited to an interview either in Singapore or their home country.

### (C) NUS Research Scholarships

The NUS Research Scholarship is available on a competitive basis to **full-time** research students who meet the requisite criteria. Tuition fees are fully paid. There is no bond.

	Monthly stipend for Ph.D. Research Scholars	
	Pre-QE*	Post-QE*
Singapore Citizens	S\$2,300	S\$2,800
Singapore Permanent Residents	S\$2,200	S\$2,700
International Students	S\$2,000	S\$2,500

\*QE-Stipends are increased upon passing the Ph.D. qualifying examination

**The main focus of the Faculty is the Ph.D. programme. Priority for the competitive NUS Research Scholarship will be given to applicants for the full-time Ph.D. programme, while only a limited number may be awarded to applicants for the M.Eng. programme. The NUS Research Scholarship for M.Eng will carry monthly emoluments of S\$1,500, plus full research fee subsidy.**

#### (D) NUS-DSO PGF Scheme

This scholarship scheme is offered by the Defence Science Organisation (DSO) National Laboratories and NUS to Singaporean students of first class honours standing or who have a good honours degree for the Ph.D. programme.

Under this scheme, candidates awarded the NUS PGF and the DSO PhD Research Award, will have their monthly stipends augmented to \$4,000 per month.

Interested candidates must undertake Ph.D. topics related to defence science and technology. They will be co-supervised by a DSO researcher and a NUS faculty member, and will spend the majority of their time at DSO.

The **bond-free** Award will provide each successful candidate with:

- Monthly stipend, full tuition fees, and other compulsory fees and allowances for attending both local and international conferences
- Monthly stipend of \$4,000 per month
- Conference support of up to \$4,000 per year

The sponsorship period is for 4 years. Upon successful completion, students will be conferred a Ph.D. degree by NUS. You may view further details on this scheme at [http://www.gse.nus.edu.sg/NUS\\_DSO\\_Presidents\\_Graduate\\_Fellowship\\_Scheme.html](http://www.gse.nus.edu.sg/NUS_DSO_Presidents_Graduate_Fellowship_Scheme.html)

#### (E) NRF (Clean Energy) Ph.D. Scholarships

Candidates may apply for the NRF (Clean Energy) Ph.D. Scholarships. Please apply separately on-line at <http://www.cepo.sg>

Candidates may indicate in the form if they wish to apply for both the NRF (Clean Energy) Ph.D. Scholarships and NUS Research Scholarships.

#### (F) Singapore International Graduate Award (SINGA)

Candidates may apply for the Singapore International Graduate Award (SINGA). Please apply separately on-line at <https://www.singa.a-star.edu.sg>

#### (G) Singapore Millennium Foundation Scholarship (SMF)

Candidates may apply for the Singapore Millennium Foundation Scholarship (SMF). Please apply separately on-line at <http://www.smf-scholar.org>

Candidates may indicate in the form if they wish to apply for both the SMF and NUS Research Scholarships.

#### (H) Other sponsorships

A limited number of sponsorships from private organisations (having tie-ups with NUS) are also available for suitable candidates. If selected, applicants will receive further information from the sponsoring companies.

For more details and a list of scholarship available, please visit the following website [http://www.gse.nus.edu.sg/financial\\_assistance.html](http://www.gse.nus.edu.sg/financial_assistance.html)

### **Period of Candidature**

The minimum and maximum period of candidature for Ph.D. is two years and five years respectively. M.Eng. students' minimum and maximum period of candidature is one and three years respectively. The period of candidature is the same for full-time and part-time programmes.

### **Coursework Requirements – Graduate Modules**

Candidates are required to conduct research in their area of interest and submit a thesis before the maximum period of candidature for examination. Besides the research requirement, candidates must also attend a prescribed number of courses which the supervisor thinks will be useful for the candidate.

It is a requirement that Ph.D. and M.Eng. students should take **at least** six and four modules respectively (*or its equivalent of 24 and 16 modular credits respectively*) (non-CELC modules), unless exemption has been granted by the University. For further details, please check with the Departments/Divisions upon admission.

For fulfilment of the coursework component of the research degrees :

1.	<p><b>Modular Credits</b> Each graduate module of 39 hours of lecture is to be assigned 4 modular credits (MC).</p>																																				
2.	<p><b>Grades and Grade Points</b> The following grades are adopted for award to individual module:</p> <table border="0" data-bbox="292 389 1249 779"> <thead> <tr> <th style="text-decoration: underline;">Grade</th> <th style="text-decoration: underline;">Grade Point</th> <th></th> </tr> </thead> <tbody> <tr> <td>A+</td> <td>5.0</td> <td></td> </tr> <tr> <td>A</td> <td>5.0</td> <td></td> </tr> <tr> <td>A-</td> <td>4.5</td> <td></td> </tr> <tr> <td>B+</td> <td>4.0</td> <td></td> </tr> <tr> <td>B</td> <td>3.5</td> <td>Cumulative Average Point (CAP) for Graduation</td> </tr> <tr> <td>B-</td> <td>3.0</td> <td>M.Eng. – 3.0</td> </tr> <tr> <td>C+</td> <td>2.5</td> <td>Ph.D. – 3.5</td> </tr> <tr> <td>C</td> <td>2.0</td> <td></td> </tr> <tr> <td>D+</td> <td>1.5</td> <td></td> </tr> <tr> <td>D</td> <td>1.0</td> <td></td> </tr> <tr> <td>F (Fail)</td> <td>0</td> <td></td> </tr> </tbody> </table>	Grade	Grade Point		A+	5.0		A	5.0		A-	4.5		B+	4.0		B	3.5	Cumulative Average Point (CAP) for Graduation	B-	3.0	M.Eng. – 3.0	C+	2.5	Ph.D. – 3.5	C	2.0		D+	1.5		D	1.0		F (Fail)	0	
Grade	Grade Point																																				
A+	5.0																																				
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B-	3.0	M.Eng. – 3.0																																			
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D	1.0																																				
F (Fail)	0																																				
3.	<p><b>Academic Warning, Termination and Graduation</b></p>																																				
(a)	<p>For <b>continuation</b> of candidature:            (i) In the 1<sup>st</sup> semester of study, the CAP should not fall below 1.5; or            (ii) for M.Eng.: CAP should not fall below 2.5 for 2 consecutive semesters; or                              CAP should not fall below 3.0 for 3 consecutive semesters                  for Ph.D. : CAP should not fall below 3.0 for 2 consecutive semesters; or                              CAP should not fall below 3.5 for 3 consecutive semesters</p> <p>Students whose CAP does not meet the requirements as stated above will be recommended for termination of candidature.</p> <p>For any semester in which the student's CAP falls below the CAP required for graduation (i.e. 3.0 for M.Eng. and 3.5 for Ph.D.), he/she will be issued an academic warning. A student may also be issued an academic warning or placed on probation for poor performance in the Qualifying Examination, research, or other programme requirements.</p>																																				
(b)	<p>For <b>graduation</b>,</p> <p>(i) M.Eng. students must:</p> <ul style="list-style-type: none"> <li>• obtain at least 16 MCs (Graduate Seminars and Graduate English Course modules are not included), of which at least 12 MCs must be at graduate level within the subject or in related disciplines and the remaining credits may be from other levels in the same or other disciplines subject to the approval of the Department; &amp;</li> <li>• obtain CAP <math>\geq</math> 3.0 in best 4 modules (or equivalent of 16 MCs); &amp;</li> <li>• pass the M.Eng. thesis; &amp;</li> <li>• obtain minimum Grade C in the Graduate English Course (Intermediate Level), where applicable: &amp;</li> <li>• Satisfactory Grade for Graduate Seminars</li> </ul>																																				
	<p>(ii) Ph.D. students must:</p> <ul style="list-style-type: none"> <li>• obtain at least 24 MCs (Doctoral Seminars and Graduate English Course modules are not included), of which at least 18 MCs must be at graduate level within the subject or in related disciplines and the remaining credits may be from other levels in the same or other disciplines subject to the approval of the Department; &amp;</li> <li>• obtain CAP <math>\geq</math> 3.5 in best 6 modules (or equivalent of 24 MCs); &amp;</li> <li>• pass the Comprehensive Examination (written); &amp;</li> </ul>																																				

	<ul style="list-style-type: none"> <li>• pass the Qualifying Examination (oral); &amp;</li> <li>• pass the Ph.D. thesis and Oral Examination; &amp;</li> <li>• obtain minimum Grade C in the Graduate English Course (Intermediate and Advanced Level), where applicable</li> <li>• Satisfactory Grade for Doctoral Seminars</li> </ul>
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Notes:

CAP = Cumulative Average Point

Formulae for CAP = 
$$\frac{\text{Sum (Grade Pt x MC)}}{\text{Sum (MC)}}$$

All letter grades (including Grade F) are computed in the CAP computation for students who have yet to accumulate the minimum number of modular credits for graduation. Students who have achieved more than the minimum number of modular credits for graduation, the CAP is computed on the best modules equivalent to minimum number of modular credits (inclusive of foundation/core modules, where required).

CELC modules (i.e. Graduate English Courses) are excluded from the computation of the average grade for fulfilment of coursework requirement.

All courses are normally conducted in the evenings from 6:00 pm to 9:00 pm from Mondays to Fridays. Candidates should discuss with and obtain approval from their supervisor(s) on the type of courses that they would be required to attend.

### Language of Instruction

The graduate courses are conducted in English.

### English Language Requirements

All international students are required to take a Diagnostic English Test (unless exemption has been granted. Any exemption from this requirement would be indicated in the letter of offer for admission to the M.Eng./Ph.D. programme).

### Fees

The fees for AY2009/2010 are currently under review. The fees for AY2008/2009 were as follows:

#### ***Tuition Fees (per Annum)***

Category of Graduate Programme	Per Annum Amounts (S\$) <small>Note 1</small>			
	Full Fees <small>Note 3</small>	Subsidised Fees		
		Singapore Citizens	Singapore Permanent Residents	International Students <small>Note 2</small>
Non-Clinical	25,290	4,490	4,940	6,740 (with service obligation) 11,230 (without service obligation)

**Mandatory Miscellaneous Fees** <sup>Note 4</sup>

	<b>Full time Students</b>	<b>Part time students</b>	<b>Remarks</b>
Registration	S\$50	S\$50	one-time fee, payable in semester of admission only
Student Activity and Services			
- Graduate Students Activity	S\$10	-	
- Sports	S\$24	S\$12	
- Transport (Internal Shuttle)	S\$30	-	
Health and Insurance	S\$117.70	-	For local and international students
Academic Related			
- CLASS <sup>Note5</sup>	S\$13	S\$13	
- Computer Account	S\$10	S\$10	
Examination Fees			one-time fee
- M.Eng.	S\$250	S\$250	
- Ph.D.	S\$500	S\$500	
Late Fee	S\$10	S\$10	For part-payment
	S\$25	S\$25	For non-payment (These may be waived on a case-by-case basis)

Notes:

- All fee amounts quoted here are exclusive of prevailing GST. The GST is absorbed by the Ministry of Education (MOE).
- In some programmes, the University may deem it feasible, based on industry demand, to implement a service obligation where the international student is required to work in Singapore-based companies for 3 years upon graduation. Singapore-based companies refer to local and international companies that have a base in Singapore that is registered with the Accounting & Corporate Regulatory Authority (ACRA) as well as companies of such local and international companies registered with ACRA that are based overseas. The determination of this feasibility is at the sole discretion of the University.  
In such programmes, the international student may be offered the option of signing the service obligation agreement in exchange for reduced tuition fees as stated above.
- Students who have previously enjoyed government subsidy in graduate programme will not be eligible for government subsidy in another graduate programme at the same or lower level. Instead, such students will be liable to pay "Full Fees" for the graduate programme that they now undertake.
- (a) Unless otherwise indicated as one-time fee, mandatory miscellaneous fees are payable per annum.  
(b) If fees are not paid or only partially paid, by the due date indicated in the bill each semester, a late fee may be imposed.  
(c) All fees shown here are excluding prevailing GST, unless otherwise indicated.
- Fees quoted in these marked categories are inclusive of prevailing GST.

## Deferment

Should you require a deferment to register as a higher degree candidate, you will be advised to reapply for the next intake.

## University Term

The University's academic year for 2010-2011 is as follows:

### Academic Calendar 2010/2011

<b>Semester 1</b>	<b>Mon 2 Aug - Sat 4 Dec 2010</b>	<b>18 weeks</b>
Orientation Week:	Mon 2 Aug - Sat 7 Aug 2010	1 week
Instructional Period:	Mon 9 Aug – Fri 13 Aug 2010	6 weeks
Recess Week:	Sat 18 Sep – Sun 26 Sep 2010	1 week
Instructional Period:	Mon 27 Sep – Fri 1 Oct 2010	7 weeks
Reading Week:	Sat 13 Nov - Fri 19 Nov 2010	1 week
Examination:	Sat 20 Nov - Sat 4 Dec 2010	2 weeks
<b>Vacation:</b>	<b>Sun 5 Dec 2010 - Sun 9 Jan 2011</b>	<b>5 weeks</b>

<b>Semester 2</b>	<b>Mon 10 Jan – Sat 7 May 2011</b>	<b>17 weeks</b>
Instructional Period:	Mon 10 Jan – Fri 14 Jan 2011	6 weeks
Recess Week:	Sat 19 Feb – Sun 27 Feb 2011	1 week
Instructional Period:	Mon 28 Feb – Fri 4 Mar 2011	7 weeks
Reading Week:	Sat 16 Apr - Fri 22 Apr 2011	1 week
Examination:	Sat 23 Apr - Sat 7 May 2011	2 weeks
<b>Vacation:</b>	<b>Sun 8 May - Sun 31 Jul 2011</b>	<b>12 weeks</b>

<b>Special Term</b>	<b>Mon 9 May - Sat 18 Jun 2011</b>	<b>6 weeks</b>
	<b>Mon 20 Jun – Sat 30 Jul 2011</b>	<b>6 weeks</b>

# *The Application Material*

## **Application Form**

The application material comprises the following:

- this application booklet
- application fee form
- acknowledgement slip
- application checklist
- application form
- overseas interview form
- transcript request form
- referee's report (2 copies)

Candidates who wish to apply for more than one programme are required to submit **separate** sets of application forms. Each set of application form should be accompanied by all the documents outlined in the application checklist.

Any omission of information requested in the application forms or supporting documents will render the application form void and therefore should be avoided.

## **Documentary Evidence**

Applicants should submit an official transcript of academic records from each university attended. You are responsible for requesting your transcript from the university concerned. Graduates from this University can submit certified copies of the official transcripts of their academic records with their applications. For foreign graduates, the official transcript must be enclosed in a SEALED envelope with its flap bearing the security seal of the University and the signature of the Registrar or his representative. All documents should reach us no later than the stipulated closing dates.

Supporting documents, if not in English, should be accompanied by copies of the English translation of the documents.

## **TOEFL and GRE Tests**

The quantity and quality of academic work at NUS cannot be accomplished without mastery of the English language. This point is deliberately emphasized because graduate students at NUS submit regular reports, take written examinations and are expected to participate actively in classroom discussions. International applicants may demonstrate their English proficiency by means of TOEFL and GRE/GATE test scores.

Applicants can either:

- (a) submit TOEFL and GRE scoresheets certified by their Universities with an original stamp; or
- (b) request the NUS Department to certify their scoresheets if they are in Singapore; or
- (c) request Educational Testing Services (ETS) to send original TOEFL and GRE scores to NUS. (Scores should be sent to the Department in which the applicant is interested in pursuing his/her research. Institution code of NUS is 0677 [for GRE] and 9084 [for TOEFL] and with specific department code).

Graduates from Indian Universities may send either GRE or GATE scoresheets.

Applicants who graduated from English-medium universities and have yet to sit for the tests, may be required at the discretion of the Department/Division Head or Vice-Dean (Graduate Studies), Faculty of Engineering, to undergo such tests as may be set to assess their suitability for University study and to appear for interviews.

## Overseas Interview

The University will be conducting overseas interviews for international students who have applied for the Research Scholarship. These interviews will be held at the beginning of **March 2010** and end **September 2010** for the August 2010 Intake and January 2011 Intake respectively. Applicants will be notified of the date, time and venue of the interviews in late February 2010/mid September 2010 via email or post. Applicants should, therefore, inform the University of any change to their email/postal addresses.

## Referee's Reports

Recommendations from 2 academic referees are required for the application. Please use the referee reports in the application package. Kindly ask your referees to send to you their reports enclosed in sealed envelopes whose openings bear their signatures. The University may write to the academic referees for further information.

## Closing Dates

All applications must reach the Departmental Offices by the following dates:

Applicants and Closing Dates	August 2010 Intake	January 2011 Intake
<ul style="list-style-type: none"><li>For <b>international</b> applicants; &amp;</li><li>For <b>applicants residing in Singapore*</b> and applying for the <b>NUS Research Scholarship</b></li></ul>	15 November 2009	15 May 2010
<ul style="list-style-type: none"><li>For <b>applicants residing in Singapore*</b> and applying for <b>admission</b> (without scholarship) only</li></ul>	1 April 2010	1 September 2010

\* For example:

(1) NUS/NTU graduates; or

(2) graduates of other universities and whose domicile is Singapore etc

An application received after the deadline will be considered for the **next** Intake.

## Submission of Application

Completed applications should be submitted directly to the **individual divisions/departments**. Please refer to the Annex for their mailing address.

## Confirmation of Application

An acknowledgement slip will be issued to you to acknowledge receipt of your application and to inform you when you can expect to hear from us on the outcome of your application.

## Notification of Application Results

You will be notified of the results of your applications from end-**March 2010** and mid-**October 2010** if you are applying for the August 2010 Intake and January 2011 Intake respectively. Due to the large number of applications received, we regret that no enquiries will be entertained. We will notify you of the result by post.

### Listing of Publications (Format)

If you have any publications, please complete Section (4) of the application form and enclose a copy of each publication. When listing your publications, please follow the format below:

#### BOOK

Ke, KCM. *The Kushan Buddhist Political Tradition and Mahayana Buddhism*. Taipei: Asian Cultural Publication. 702 pp.

Author: Ke, KCM.  
 Title of book: *The Kushan Buddhist Political Tradition and Mahayana Buddhism*.  
 Place of Publisher: Taipei.  
 Publisher: Asian Cultural Publication.  
 Total No. of Pages: 702 pp.

#### ARTICLE IN BOOK

Foley, JA. The English language survey: An overview of the pilot survey. In *Words in a Cultural Context*, ed by A Pakir. Pp. 74-83. Singapore: Unipress

Author: Foley, JA.  
 Title of Publication: The English language survey: An overview of the pilot survey.  
 Source: *Words in a Cultural Context*, ed by A Pakir.  
 Editor: A Pakir.  
 Pages nos. of contribution in book: Pp. 74-83.  
 Place of Publication: Singapore.  
 Publisher: Unipress.

#### CONTRIBUTION IN JOURNAL

Liang, TY. Development of knowledge-based systems in Singapore. *The Management Development Journal of Singapore*. 3, no. 1: 461-475., ( )

Author: Liang, TY.  
 Title of paper: Development of knowledge-based systems in Singapore.  
 Source: *The Management Development Journal of Singapore*.  
 Vol. No.: 3.  
 Serial/Issue no.: no. 1.  
 Page nos.: 461-475.  
 Place of publication: ( )

#### REVIEW

Ng, PKL. Review of *Entrepreneurship Development in Public Enterprises*, ed, by L Pavlin. *Asia Pacific Journal of Management*, 9, no 1: 121-122.

Author: Ng, PKL.  
 Article reviewed: *Entrepreneurship Development in Public Enterprises*, ed, by L Pavlin.  
 Editor of article: L Pavlin.  
 Source: *Asia Pacific Journal of Management*.  
 Vol. No.: 9.  
 Serial/Issue no.: no 1.  
 Page nos.: 121-122.

## THESIS

Name of postgraduate student      Title of thesis

Lim Lee Yee.      Mineral Nutrition of tropical orchids. MSc thesis, National University of Singapore.

University from which degree is awarded

## CONFERENCE PAPER

Author      Title of paper      Full title of published proceedings

Tan, S.      A combined PID and neural control scheme for nonlinear dynamical systems. In *Proceedings of Singapore International Conference on Intelligent Control and Instrumentation*. 17-21 February 1992. Singapore, Vol. 1, pp. 377-383. Singapore: IEEE Singapore Section.

Venue of conference      Vol. No.      Page nos.      Country of publication      Publisher      Date of conference

## EDITING WORK FOR BOOK

Editor      Title of book      Place of publication      Publisher

Wee, YC (ed).      *A Guide to the Ferns of Singapore*. 2nd revised ed. Singapore: Singapore Science Centre. 72 pp.

Total no. of pages

## OCCASIONAL PAPER

Authors      Title of paper      Publisher

Ang, CH and KP Tan.      *Internal B-Tree: A New Time Index Structure*. TR C2/92. Singapore: DISCS. NUS. 15 pp.

Paper no.      Total no. of pages

## GUIDE FOR INTERNATIONAL STUDENTS

### **Immigration**

Candidates' admittance to the programme is conditional upon the approval of their student pass. Candidates will require a valid passport for entry into Singapore. Upon arrival in Singapore, candidates will be given a Social Visit Pass valid for two weeks to one month. During this period, candidates must proceed to the Registrar's Office to complete the registration formalities and they will then be given a letter to apply for a Student Pass.

For nationals of countries who require an **entry visa** (such as PR China, India, Bangladesh and Myanmar etc, please refer to [http://app-stg.ica.gov.sg/travellers/entry/visa\\_requirements.asp](http://app-stg.ica.gov.sg/travellers/entry/visa_requirements.asp) for confirmation), our Registrar's Office will be applying the visa for you via the Student Pass On-Line Application & Registration (SOLAR) system administered by the Immigration & Checkpoints Authority (ICA) and will write to successful candidates on how to complete the application process. For candidates accepting our offer, our Registrar's Office will send the visa approval after the application is approved by the ICA.

### **Students Accompanied by Spouse**

The Office of Student Affairs (OSA) provides assistance to international students in their application of their student's pass but does not provide sponsorship of any kind. For students receiving the NUS Research Scholarship (i.e. research scholars) and are accompanied by their spouse, Registrar's Office (RO) will sponsor the spouse for a social visit.

For more information:

- i) on application for student pass, please email [international@nus.edu.sg](mailto:international@nus.edu.sg) or check website at <http://www.nus.edu.sg/osa/international/>
- ii) on sponsorship conditions and clarifications, please email to [regbox2@nus.edu.sg](mailto:regbox2@nus.edu.sg) or check the website at: <http://www.nus.edu.sg/registrar/graduate/socialvisitpass.htm>
- iii) on immigration matters, please contact Immigration and Checkpoints Authority (ICA) at **Tel: 6391 6100** or check the website at <http://app.ica.gov.sg/index.asp>

Immigration and Checkpoints Authority (ICA) is located at :

### **Immigration and Checkpoints Authority Building**

Visitor Service Centre  
4<sup>th</sup> Storey, 10 Kallang Road  
Singapore 208718  
[www.ica.gov.sg](http://www.ica.gov.sg)

Operating hours :

Mon – Fri : 8am – 5pm

Sat : 8am – 1pm

### **Immigration Enquiry Service**

Tel : 6391 6100

Transport Services to ICA :

MRT	- Alight at Lavendar MRT Station
Bus No. 7	- From Clementi Bus Interchange
Bus 33	- From Kent Ridge Bus Terminal
Bus 145	- From Clementi Avenue 2 (near the Mosque)
Bus 197	- From Ayer Rajah Expressway

### **Estimated Cost of Living**

In addition to the research and miscellaneous fees, an international graduate student can expect to incur the following expenses:

<b>Expenditures (Per Month)</b>	<b>Amount in S\$ (approximately)</b>
<b><i>Accommodation</i></b>	
<b><u>NUS Graduate Student Residences</u></b>	
Off-Campus: Boon Lay Hostels - Triple Sharing	From \$260
On-campus: PGPR Graduate Student Apartments	\$700 - \$860
<b><u>Off-campus Private Accommodation</u></b>	
Room rental	\$300 - \$400
Apartment rental	\$1000 - \$1200
<b><i>Food</i></b>	
University Canteens/Food Courts	\$200 - \$300
Meals outside campus	\$450 - \$550
<b><i>Books/Supplies</i></b>	
(depends on course of study)	\$80 - \$100
<b><i>In-country transportation</i></b>	
Public bus/MRT	\$100 - \$150
<b><i>Personal expenses</i></b>	
(Toiletries, clothing, miscellaneous)	\$100 - \$150
<b><i>Estimated Cost of Living</i></b>	<b>\$1,500 - \$2,000</b>

Note: The costs have been derived based on a conservative estimate for a reasonably comfortable lifestyle. The actual amount could be higher or lower depending on the individual student's expenditure and lifestyle pattern. For graduate students whose spouses are also living here, the expenses would be approximately twice as much.

### **Accommodation**

The Office of Student Affairs (OSA) will provide assistance in locating suitable accommodation. An application form will be sent to all successful applicants.

All enquiries about accommodation should be directed to:

Residential Services  
Office of Student Affairs  
National University of Singapore  
Yusof Ishak House, 3<sup>rd</sup> Level  
31 Lower Kent Ridge Road  
Singapore 119078  
E-mail address : [osabox4@nus.edu.sg](mailto:osabox4@nus.edu.sg)  
Fax : (65) 6778 5902

Further information on international student services provided by OSA is also available from <http://www.nus.edu.sg/osa/international/>

## Annex

### Departments'/Divisions' Mailing Addresses

Please mail your application(s) to the respective Departments/Divisions.

- 1) Division of Bioengineering**  
National University of Singapore  
7 Engineering Drive 1, Block E3A #04-15  
Singapore 117574
- 2) Department of Chemical & Biomolecular Engineering**  
National University of Singapore  
4 Engineering Drive 4, Block E5 #02-09  
Singapore 117576
- 3) Department of Civil Engineering**  
National University of Singapore  
No.1 Engineering Drive 2, Block E1A #07-03  
Singapore 117576
- 4) Department of Electrical and Computer Engineering**  
National University of Singapore  
4 Engineering Drive 3, Block E4 #05-45  
Singapore 117576
- 5) Division of Engineering & Technology Management (D-ETM)**  
National University of Singapore  
7 Engineering Drive 1, Block E3A #04-09  
Singapore 117574
- 6) Division of Environmental Science & Engineering**  
National University of Singapore  
9 Engineering Drive 1, Block EA #03-12  
Singapore 117576
- 7) Department of Industrial & Systems Engineering**  
National University of Singapore  
1 Engineering Drive 2, Block E1A #06-25  
Singapore 117576
- 8) Department of Materials Science and Engineering**  
National University of Singapore  
7 Engineering Drive 1, Block E3A, #04-10  
Singapore 117574
- 9) Department of Mechanical Engineering**  
National University of Singapore  
9 Engineering Drive 1, Block EA #07-08  
Singapore 117576

**Department/Division/Programme Office**

Graduate Studies Office, Faculty of Eng ①  
Bioengineering ②  
Chemical & Biomolecular Eng ⑤  
Civil Eng ③  
Electrical & Computer Eng ④  
Engineering & Technology Management ②  
Environmental Science & Eng ①  
Industrial & Systems Eng ③  
Materials Science & Eng ②  
Mechanical Eng ①  
University Health Centre ⑦  
- UHC Clinic (medical examination)  
Yusof Ishak House ⑥

**Location**

EA 06-16  
E3A 04-15  
E5 02-09  
E1A 07-03  
E4 05-45  
E3A 04-09  
EA 03-12  
E1A 06-25  
E3A 04-10  
EA 07-08

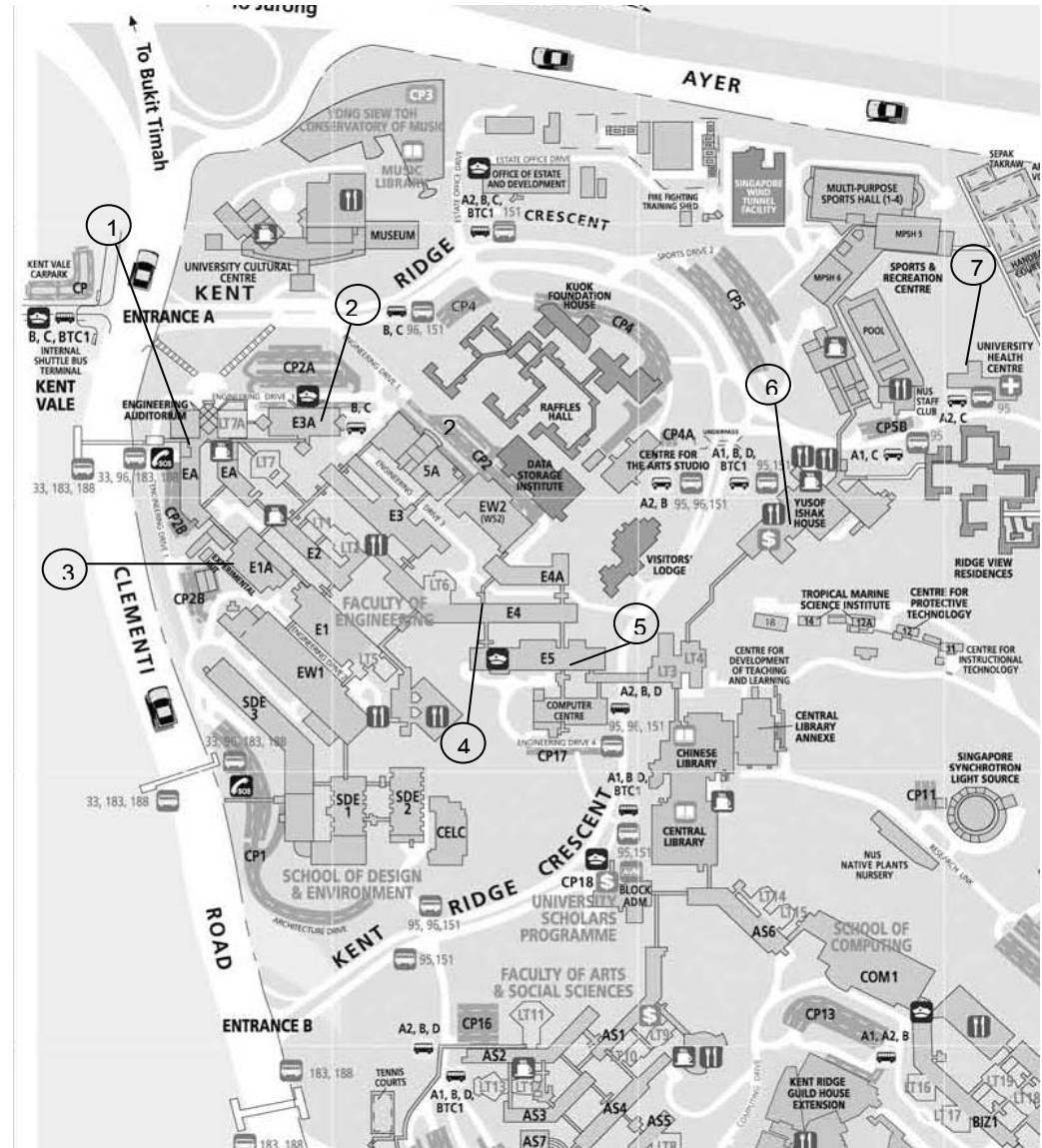
- Level 1 : Student Service Centre (*paying fees*)
- Level 3 : Office of Student Affairs (*apply student pass*)

C1 Engineering Canteen  
EW1 Engineering Workshop 1  
EW2 Engineering Workshop 2

**Internal Shuttle Services**

Service A – Prince George’s Park → Science → Arts & Social Sciences  
→ Business School → Prince George’s Park  
Service B – Kent Vale → Arts & Social Sciences → Business School →  
Arts & Social Sciences → Kent Vale  
Service C – Kent Vale → Science → Kent Vale  
Service BTC – Kent Vale → Arts & Social Sciences → Business School →  
Prince George’s Park → Bukit Timah Campus → Kent Vale

**NUS Faculty of Engineering, 10 Kent Ridge Crescent**



For the latest campus map, please check the NUS website at <http://www.nus.edu.sg/campusmap/>

For all internal shuttle bus services, please check the NUS website at <http://www.nus.edu.sg/oed/services/csd/transportation/internlShuttleBusService.htm>