Vision

To set a new standard for international collaboration in graduate education and research in engineering and science, and in accomplishing this goal, place SMA’s programmes at the forefront of graduate education in Asia and the world.
Mission

To educate engineering leaders who combine academic excellence in the engineering sciences with the entrepreneurial spirit and a global outlook
Objectives

- Educate young engineers to be the leaders of a technologically advanced economy which will form the heart of this region’s future

- Create a cohort of excellent students and faculty with creativity and entrepreneurial spirit

- Develop a nucleus for students and faculty conversant in global collaborative education and research
Introduction

- Singapore-MIT Alliance (SMA) is a global partnership between Massachusetts Institute of Technology (MIT), National University of Singapore (NUS) and Nanyang Technological University (NTU)

- Founded in November 1998, SMA is the world’s largest interactive distance education initiative

- It provides graduate studies leading to:
  - Professional Master’s (S.M.) degree by coursework and project
  - Research Doctorate (Ph.D.) degree by research and coursework
The Five programmes offered by SMA are:

• Advanced Materials for Micro- and Nano- Systems (AMM&NS)

• High Performance Computation for Engineered Systems (HPCES)

• Innovation in Manufacturing Systems and Technology (IMST)

• Molecular Engineering of Biological and Chemical Systems (MEBCS)

• Computer Science (CS)
Advanced Materials for Micro- and Nano- Systems (AMM&NS)

- Unique and modern in content
  - focus on Micro- and Nano-Systems for microelectronic applications
  - encompass processing, microstructure, properties and performance
  - Emphasis in fundamental principles involving thermodynamics, kinetics, electronic, optical and magnetic properties

- Web-based capabilities for characterisation at a distance

- Additional electives for Ph.D candidates can be chosen from MIT list of courses

Eligibility: Science, Electrical & Electronic Eng, Physics, Chemistry
High Performance Computation for Engineered Systems (HPCES)

- Engineering Science and Systems Optimization
- Modeling, Simulation, Design, Optimisation, Visualisation
- Professional Master’s focuses on the critical and effective application of existing simulation and optimization software
- Research doctorate emphasizes the formulation, analysis and implementation of existing and new computational techniques
- Students gain access to state-of-the-art HPC resources at IHPC and work closely with experienced engineers and scientists

Eligibility: Maths, Engineering, Science
Innovation in Manufacturing Systems & Technology (IMST)

- Emphasis on innovation and entrepreneurship
- Couple engineering to business
- Exposure to strategies in global manufacturing
- Pro-seminars by prominent personnel from industry
- To develop understanding in adv manufacturing processes (mfg physics); supply chain issues (mfg systems); global design approaches and issues (product design); business issues (business fundamentals); strategies and critical issues in global mfg (pro-seminar) and provide valuable practical exposure through theme projects

Eligibility: All fields of Engineering, Business
Molecular Engineering of Biological and Chemical Systems (MEBCS)

• Unique, multidisciplinary programme at the cutting edge of Life Science and Chemical Technologies

• New courses which integrate a molecular-level understanding of biological and chemical phenomena with advances in process engineering

• Exposure to state-of-the-art concepts in structured fluids, surface functionalisation, microstructure tailoring and materials design, molecular and cellular aspects of biotechnology, genomics, bioinformatics, proteomics, drug design and delivery

• Graduates are poised to be become leading researchers and professionals in chemical and life science industries

Eligibility: Chemical Eng, Chemistry, Materials Eng
Computer Science (CS)

- Train students to discover and develop new, marketable technology
- Provide solid foundation to enable adaptation
- Web applications and infrastructure
- Embedded systems
- Ph.D. students require additional elective at MIT
- Project - either with industry or faculty
- Research (Ph.D.)

**Eligibility:** Computer Science and related subjects (ECE and Maths)
Candidature

The S.M. degree (Professional Master’s degree)
• Requires one academic year of study
• To read certain number of prescribed subjects
• To participate in an industry or research project for a period of 6 months or 1 year depending on the programme. A dissertation is to be submitted at the end of the academic year.

The Ph.D. degree (Doctor of Philosophy)
• Requires to pass the Ph.D. Qualifying Examination prior to confirmation of Ph.D. candidature
• To read certain number of prescribed subjects
• Requires completion of original research of high quality in the form of an acceptable thesis
• Normally, it takes about three to four years to complete
Joint-Teaching & Co-Supervision

• Some 50 professors from MIT and another 50 from NUS, NTU, and the national research institutes (RIs) co-teach the courses and co-supervise the research students.

• Lectures are delivered through a combination of
  - Face-to-face classroom teaching and
  - State-of-the-art interactive distance learning technology via internet2

• MIT fellows spend up to a semester in Singapore each year to conduct classes and research.
SMA’s Uniqueness

Immersion Programme - The MIT Experience

• All SMA students spend two and a half weeks at MIT for Immersion.

• A series of entrepreneurship seminars is delivered by Chief Executive Officers and founders of start-up companies

• Attend classes held at MIT’s campus

Semester-Stay

• Ph.D. students spend up to six months at MIT to attend graduate courses and conduct research

• Experience of working with MIT faculty

• Opportunity to interact with MIT students
Resources

• Access to the combined resources at the three premier academic institutions

• Interactive Distance Education Environment

• Student Atheneum
Distance Education

• Synchronous learning via video conferencing
  • High speed Internet2 connectivity
  • H.323 conferencing over packet network
  • H.320 conferencing over ISDN for backup
  • T.120 data sharing for presentation materials
  • Dual screen setup
  • Multi-party linkup

• Asynchronous learning

• Research Interaction

• Lessons Learnt
Synchronous Learning Platform

Room A

- view 1
- view 2

PC

via Internet2

Video conference

Room B

- view 2
- view 1

PC

via ISDN

Video conference
Synchronous Learning Platform

Room A

- view 1
- view 2

PC

Video conference

Real time digitization

Video Server

Access via web for revision

network
Synchronous Learning Platform

• Mode of Interaction

  • Face to face via video

  • Shared viewing and annotation of a physical document

  • Wacom tablet (LCD display with graphics tablet) for easier annotation of powerpoint presentation
Multi-Party Linkup
Multi-Party Linkup

• MIT Industrial Liaison Programs

  • Entrepreneurship in a Global Economy: an examination of today’s economic environment
    Prof Lester Thurow, Professor of Management & Economics; Dean Emeritus of the MIT Sloan School of Management

  • Project Oxygen: Towards Pervasive, Human-Centred Computing
    Prof Victor Zue, Professor of Electrical Engineering & Computer Science; Director, MIT Laboratory for Computer Science

  • Sustaining Creative Communities
    Dean William J Mitchell, Dean, School of Architecture and Planning; Architectural Advisor to MIT’s President
Multi-Party Linkup

- **MIT Enterprise Forum**
  Solving the Weakest Link: Sales
  MIT panelist:
  - Howard Anderson, Founder & Chairman of The Yankee Group; Founding Partner & Senior Managing Director of YankeeTek Ventures
  - Ken Morse, Managing Director of the MIT Entrepreneurship Centre
  - Tim Kraskey, Managing Director of Yankee Ventures; Founder & General Partner of The Mentor Group

- **Lectures held between NUS, MIT, Cambridge University (UK)**
  - Offered 2 modules, SMA5107 and SMA5108
  - Each module has two 1½ hrs sessions per week
  - SG time: 8:30pm - 10:00pm
  - MIT time: 8:30am - 10:00am
  - UK time: 1:30pm - 3:00pm
SMA Network Configuration

- Internet2 is the backbone that was built by US to facilitate a high speed connection for research and education network. It is a subset of the commodity internet.

- SingAREN, the Internet2 service provider

- SingAREN operates a OC-3 packet over SONET link from Singapore POP to Seattle POP, WA, USA.

- From Seattle POP, it is connected to Internet2 at 155 Mbps
SMA Network Configuration

- NUS
- NTU
- Singapore POP
  - OC-3 POS
  - 155 Mbps
- Seattle POP
- MIT

THE SINGAPORE - MIT ALLIANCE

Internet2
SMA Network Configuration

- SMA subscribes to premium service from SingAREN with a 3Mbps bandwidth to operate video conferencing.

- Premium service used to cost SGD 5000 per Mbps.

- Revised to SGD 2000 per Mbps since April 2003.

- Bandwidth utilization is rate-limited. Routers will drop data packets when subscribed bandwidth is exceeded.

- Loss of data packets lead to audio/video breakage, thus degrading the quality of beaming sessions.
Network Monitoring

- PingPlotter provides graphical output
Network Monitoring

• Standardized MRTG graphing
Room Facilities

Singapore

- NUS - CIT Auditorium
- NUS - CIT Smart Classroom
- NTU - CED Smart Classroom
- NUS - Engineering Smart Classroom
- NUS - School of Computing Conference Room

MIT

- Bechtel Lecture Hall, 1-390
- Park Room for Innovative Education, 3-370
- SMA Classroom, 8-404
- Learning Networks Central (LiNC), 9-057
Room Facilities
Asynchronous Learning

- Asynchronous learning is achieved using **Stellar**, MIT’s web delivery system.

- **Stellar** allows posting and reviewing materials.

- Materials includes class videos, lecture notes, reading materials and assignments.

- Includes rich feature such as discussion forum to promote student interaction.

- Classes are recorded and archived for on-demand viewing within 12 hours.
Asynchronous Learning

SMA.5104 Materials - Microsoft Internet Explorer

Address: http://stellar.mit.edu/S SMA/SMA.5104/materials.html?toolset=hidden

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LOGOUT

Goh

Student View | show instructor view

Materials

Show: video Go

Jump:
- all documents
- assignments
- lecture note
- reading
- study material

Gen

Chapter 1
This chapter discusses the basic band theory of solids.
Last modified: 26 August 2003 9:48 p.m. by Wee Kong Choi

Chapter 2 Electrical Properties of Semiconductors (lecture note - ppt - 1 M)
In this chapter, the topics to be covered are: drift and diffusion, generation and recombination, carrier injection and minority carrier lifetimes and continuity equations
Video-On-Demand

- Video format
  - Single screen streaming
  - Dual screen streaming (Sept 2001)
  - Video Segmentation (Feb 2002)
Video-On-Demand

• Single screen streaming at a resolution of 640x480
Video-On-Demand

- Dual screen streaming

Find $u$ such that

\[-\nabla^2 u = f \quad \text{in } \Omega\]
\[u = 0 \quad \text{on } \Gamma\]

for $\Omega$ a polygonal domain.
Video-On-Demand

- Video segmentation

Student clicks to play segment of video
Research Interaction

- Promote frequent and easy interaction between students and professors outside class hours

- Students and professors are able to meet at their own convenience

- Available facilities
  - NUS - SMA Office
  - NTU - Student Atheneum
  - NUS - School of Computing
  - MIT - 8-408
  - MIT - 66-319
Research Interaction

Frequency of Research Interactions

Jan Feb Mar
Lessons Learnt in Distance Education

• Joint Technical Committee

  • Committee comprises members from various faculty and department
  • Adhoc meetings to discuss arising issues
  • Regular meetings (at least once a year) to discuss areas of improvement
Lessons Learnt in Distance Education

- Pedagogical Issues
  - Adaptation is required by teaching staff
  - Usage of new equipment in teaching
  - Disruption in the flow of lessons due to glitches
  - Interaction with remote students is a challenge
  - Faculty Liaison Officers work with lecturers on pedagogical and technical aspects

- Logistical Issues
  - Timetabling and time zones
  - Dissemination of information via single point of contact
  - Last minute change in schedule should be avoided
Lessons Learnt in Distance Education

• Technical Issues in Synchronous Learning

  • Lecture rooms are huge. Multiple cameras are required for good ‘line of sight’ for the audiences.

  • Adopt open microphone system initially for audience. It picks up too much ambient noise
    Remedy: Replace to push-to-talk system to reduce ambient noise and shorten delay in camera tracking for improved Q&A sessions

  • Ambient sound is required to improve sense of presence. This is especially important when teaching staff cracks a joke and expects response from students.
    Remedy: Place one to two microphones in the room to pick up ambient sound.
Lessons Learnt in Distance Education

• Technical Issues in Synchronous Learning (cont.)

  • Bandwidth restriction (100 Mbps) of campus firewall. Remedy: Video conference equipment are not behind firewall

  • Video conference is a time sensitive application. Change in network configuration may affect session quality. For example, upgrade in router firmware had affected our sessions.
Hallmark of remote interactive education and research