COLLEGE OF ENGINEERING:
SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

1.4.1 Degree programmes and requirements

M.Sc. (Communication Software and Networks)

Overview of programme

The M.Sc. (Communication Software and Networks) programme equips graduates with essential software engineering techniques and in-depth understanding of computer networks for design and development of communication software and network systems. It integrates classroom lectures with software development, programming practice, and project management to provide graduates with ready competencies and skill sets for careers in the Information Communication industry.

The programme offers two distinct study options to match our students' career aspirations. Those who opt for "Coursework with Dissertation" will benefit from the experience of conducting and writing up a dissertation on a research topic, while those in the "Coursework Only" option will gain the experience of development and managing a group software project. These options prepare students for careers in application and software development, technical and specialist support, top and middle management, consultancy, education and research in information communication.

Curriculum structure

All students are required to take four core courses and four elective courses, each of which is 3AUs. In addition, students are required to undertake either a group software development project or an individual dissertation research project of 6AUs each. For successful completion of the programme of study, candidates must obtain a total number of 30AUs.

Core courses

EE6108 Computer Networks
EE6701 Software Requirements Analysis and Design
EE6703 Multimedia Networking
EE6711 Object-Oriented Software Development

Electives (select any four courses)

EE6104 Network Performance Analysis
EE6125 Network Planning and Management
EE6205 Real Time and Embedded Systems
EE6403 Distributed Multimedia Systems
EE6712 Distributed Computing
EE6713 Network Design and Simulation
EE6715 Network Traffic Engineering
EE6731 Network Programming

M.Sc. (Communications Engineering)

Overview of programme

The M.Sc. (Communications Engineering) programme is designed for practising engineers and information technologists who wish to improve their knowledge and skills in the broad area of communications engineering. The courses offered cover various important topics in telecommunications, RF engineering and wireless communications.

An accredited bachelor's degree in electrical/electronic engineering (or such qualifications as the Academic Board may approve) is required. Relevant working experience is preferred but not necessary.

Curriculum structure

Candidates are admitted to the programme either on a full-time or a part-time basis at the beginning of an academic year. Classes are conducted in the evenings and examinations are carried out at the end of each semester.

The degree requires satisfactory completion of a total of 30AUs. This may be fulfilled in one of two ways:

(a) Four core and four elective courses with 3AUs each and a research project of 6AUs based on which a dissertation must be submitted. The project for the dissertation may be undertaken either in NTU or in the industry.

(b) Four core and five elective courses with 3AUs each and a Independent Study Module (ISM) of 3 AUs.

Core courses

EE6101 Digital Communication Systems
EE6105 RF Engineering Techniques
EE6108 Computer Networks
EE6124 Satellite, Fixed and Mobile Radio Systems

Electives (select four or five courses)

EE6104 Network Performance Analysis
EE6107 RF Circuit Design
EE6109 MIC and Printed Antenna Design
EE6122 Optical Fibre Communications
EE6125 Network Planning and Management
EE6126 Wireless Multiple Access Communications
EE6303 Electromagnetic Compatibility and Interference
EE6401 Advanced Digital Signal Processing
EE6425 Speech Analysis and Processing
EE6427 Video Signal Processing
EE6703 Multimedia Networking
EE6713 Network Design and Simulation

M.Sc. (Computer Control and Automation)

Overview of programme

The M.Sc. (Computer Control and Automation) programme provides practising engineers with advanced yet practical tools in the development, integration, and operation of computer-based control and automation systems.

Candidates with a good bachelor's degree in electrical/electronic engineering (or equivalent qualifications in related disciplines) are encouraged to apply. Relevant working experience is preferred but not necessary.

The programme is offered on both part-time and full-time basis.

Curriculum structure

The requirements for the degree include satisfactory completion of 30 AUs. This may be fulfilled in two different ways:

(a) Four core and four elective courses with 3 AUs each and a research project of 6 AUs based on which a dissertation must be submitted. The project for the dissertation may be undertaken either in NTU or in the industry.

(b) Four core and five elective courses with 3 AUs each and an Independent Study Module (ISM) of 3 AUs.

Part-time candidates typically register for two courses per semester, while full-time candidates register for four courses. All the courses listed below carry 3 AUs each.

All classes are conducted in the evenings. The examinations will require attendance during office hours. Part-time candidates are expected to obtain their employer's permission for this before admission to the programme.

The minimum and maximum periods of candidature for a full-time candidate are one year and three years respectively. The minimum and maximum periods of candidature for a part-time candidate are two years and four years respectively.

Core courses

EE6203 Computer Control Systems
EE6204 Systems Analysis
EE6205 Real Time and Embedded Systems
EE6401 Advanced Digital Signal Processing

Electives (Select four or five courses)

EE6221 Robotics and Intelligent Sensors
EE6222 Machine Vision
EE6223 Computer Control Networks
EE6224 Neural and Fuzzy Systems
EE6225 Process Control
EE6402 Real-Time DSP Design and Applications
EE6503 Modern Electrical Drives

M.Sc. (Electronics)

Overview of programme

The M.Sc. (Electronics) programme is offered on a part-time and full-time basis for engineers in the electronics industry who would like to have graduate training in various topics, amongst others, in integrated circuit design, microelectronics fabrication and manufacture of electronic and photonic products.

Applicants are expected to have obtained a good bachelor's degree in electrical/electronic engineering or other relevant disciplines as the Board of Graduate Studies may approve. Relevant working experience is preferred but not necessary.

Curriculum structure

Classes for each course are held once a week in the evenings. The examinations require attendance during office hours at the end of each semester. The minimum and maximum periods of candidature for a full-time candidate are one year and three years respectively. The minimum and maximum periods of candidature for a part-time candidate are two years and four years respectively.

The requirements for the degree include satisfactory completion of 30 AUs. This may be fulfilled in two different ways:

(a) Four core and four elective courses with 3 AUs each and a research project of 6 AUs based on which a dissertation must be submitted. The project for the dissertation may be undertaken either in NTU or in the industry.

(b) Four core and five elective courses with 3 AUs each and an Independent Study Module (ISM) of 3 AUs.

Core courses

EE6306 Digital IC Design
EE6601 Advanced Wafer Processing
EE6602 Quality and Reliability Engineering
EE6604 Advanced Topics in Semiconductor Devices

Electives (Select four or five courses)

EE6203 Computer Control Systems
EE6303 Electromagnetic Compatibility and Interference
EE6307 Analog IC Design
EE6328 Signal Integrity in High-Speed Digital Systems
EE6401 Advanced Digital Signal Processing
EE6506 Power Semiconductor & Passive Devices
EE6608 Advanced Semiconductor Physics
EE6610 IC Packaging
EE6617 Nanoelectronics
EE6801 Modern Optics
EE6802 Laser Technology and Applications
EE6808 Display Technologies
ES6102 Advanced Digital System Design
M6401   Product Design & Development

M.Sc. (Power Engineering)

Overview of programme

The M.Sc. (Power Engineering) programme is designed for Electrical Engineering graduates who are practicing engineers, R&D managers, power system designers or industry planners who seek an in-depth understanding of power electronics and drives technology, issues of power quality, power system modelling, planning, operation and control. The programme aims to equip students to adapt to the challenging demands of modern power industries.

Although this programme started only four years ago, it has been extremely successful in attracting applications from 14 countries in its last admission exercise. It has also been successful in forging a 3.5 + 1.5 joint education collaboration between NTU and Wuhan University of China. Under this Memorandum of Understanding (MOU) signed for an initial period of three years, the first batch of selected students from Wuhan University started their final year undergraduate studies at NTU in January 2007. These students study for the full-time M.Sc. (Power Engineering) programme since August 2007.

Curriculum structure

The lectures are conducted in the evenings. The degree requires satisfactory completion of a total of 30AUs. This may be fulfilled in two different ways:

(a) Four core and four elective courses with 3 AUs each and a research project of 6 AUs based on which a dissertation must be submitted. The project for the dissertation may be undertaken either in NTU or in the industry.

(b) Four core and five elective courses with 3 AUs each and an Independent Study Module (ISM) of 3 AUs.

Part-time candidates typically register for two courses per semester, while full-time candidates register for four courses.

Core courses

EE6501 Power Electronic Converters
EE6509 Renewable Electrical Energy Systems
EE6510 Power System Operation and Planning
EE6512 High Voltage Engineering and System Protection

Electives (Select four or five courses)

EE6203 Computer Control Systems
EE6204 Systems Analysis

EE6225 Process Control
EE6303 Electromagnetic Compatibility & Interference
EE6401 Advanced Digital Signal Processing
EE6503 Modern Electrical Drives
EE6506 Power Semiconductor and Passive Devices
EE6508 Power Quality
EE6511 Power System Modelling and Control

M.Sc. (Signal Processing)

Overview of programme

The M.Sc. (Signal Processing) programme is designed for practicing engineers, hardware and software designers, R&D managers, and industry planners who seek an understanding of current approaches and evolving directions for DSP technologies. It is also intended for engineers who anticipate future involvement in this area.

Applicants with a good bachelor's degree in Electrical Engineering, Electronic Engineering, Computer Engineering, or other relevant disciplines, and a strong foundation in Introductory Digital Signal Processing or Signals and Systems are encouraged to apply.

Curriculum structure

The lectures are conducted in the evenings. It offers twelve courses (six courses per semester for selection) covering a wide spectrum of signal processing areas. Lectures on each course will be held once (3 hours) per week for 14 weeks per semester, including a one-week recess.

The requirements for the degree include satisfactory completion of 30 AUs. This may be fulfilled in two different ways:

(a) Four core and four elective courses with 3 AUs each and a research project of 6 AUs based on which a dissertation must be submitted. The project for the dissertation may be undertaken either in NTU or in the industry.

(b) Four core and five elective courses with 3AUs each and an Independent Study Module (ISM) of 3 AUs.

Part-time candidates typically register for two courses per semester, while full-time candidates register for four courses. All the courses listed below carry 3AUs each.

Core courses

EE6401 Advanced Digital Signal Processing
EE6402 Real-Time DSP Design and Applications
EE6403 Distributed Multimedia Systems
EE6404 VLSI Digital Signal Processors

Electives (Select four or five courses)

EE6101 Digital Communication Systems
EE6108 Computer Networks
EE6222 Machine Vision
EE6224 Neural and Fuzzy Systems
EE6421 Statistical Signal Processing
EE6422 Adaptive Signal Processing
EE6423 Array Signal Processing
EE6424 Digital Audio Signal Processing
EE6425 Speech Analysis and Processing
EE6426 Image Processing and Pattern Recognition
EE6427 Video Signal Processing

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<u>**Following courses will be offered to research students**</u>
EE7201 Computational Methods in Engineering
EE7204 Linear Systems
EE7205 Research Methods
EE7206 System Modeling and Identification
EE7401 Probability and Random Processes
EE7601 Optical Methods in Research
EE7602 Design, Fabrication and Analysis of Electronic Devices

These courses may not be offered in every semester:

EE9309 Special Topics in Integrated Circuits and Systems
EE9901 Special Topics – Complex Adaptive System
EE9902 Special Topics – Quantum Physics in Modern Technology
EE9903 Special Topics in Defect Chemistry of Metal Oxides

Joint Nanyang Technological University - Technische Universität München Master of Science (IC Design)

<u>Overview</u>

During the last decade, the rapid technological advancement associated with portable and compact computers, communications, audio and video products has drawn increasing interest from the electronics industry in the Integrated Circuits (IC) design area as evidenced by the continued and accelerated integration of electronic hardware (digital, analog and RF).

To meet the new demands, the School has worked with the Technical University of Munich (TUM) to prepare a new Master of Science (IC Design) joint programme with a strong technical emphasis on both the theory and practice of Integrated Circuit design. The German Institute of Science and Technology (GIST) will provide the management and administration of this self-financed programme.

The new programme prepared for an 18-month full-time candidature will include two semesters of course work and practical modules, and a full-time 6-month thesis. The thesis must be on a topic related to Integrated Circuit Design. The programme was launched in July 2005. The first batch of ten students has graduated in May 2007. Due to the high tuition fees, only foreign students have registered for this programme so far. We are currently seeking for scholarships from EDB to attract local students to this programme.

Prof Do Manh Anh, Programme Director and Assoc Prof Siek Liter, Deputy Programme Director manages the Programme. The following courses, 45 hours each are conducted for this programme:

<u>Core courses</u>

- NM 6001 Digital IC Design (NTU)
- NM 6002 Analog IC Design (NTU)
- NM 6003 System-on-Chip Solutions and Architecture (TUM)
- NM 6004 Design Methodology and Automation (TUM)
- NM 6005 Digital Signal Processing (NTU)
- NM 6006 Mixed Signal Circuit Design (TUM)
- NM 6007 Laboratory 1: Analog IC Design
- NM 6008 Laboratory 2: Digital IC Design

<u>Electives</u> (select four courses)

- NM 6009 RF IC Design (NTU)
- NM 6010 IC Packaging (NTU)
- NM 6011 IC Marketing/ Business/ Management (NTU)
- NM 6012 Advanced MOSFET and Novel Devices (TUM)

- NM 6013 Nano-Electronics (TUM)
- NM 6014 Design for Testability of VLSI (NTU/TUM)
- NM 6015 Embedded Systems (TUM)

Broadening courses

Enrichment

- NM 6020 Business and Technical English (GIST) (80 hours)

Cross Discipline Modules

- International Patent Law (GIST) (10 hours)
- Selected topics in Business and Administration (GIST) (10 hours)
- Selected topics in Management Methods (GIST) (10 hours)
- Cultural, Social and Economical Aspects of Globalisation (GIST) (10 hours)
- Aspects of European and Asian Culture and History (GIST) (10 hours)

Joint Nanyang Technological University - Technische Universität München Master of Science (Microelectronics)

Overview

The MSc (Microelectronics) programme is a highly specialized programme offered on a full-time basis for training engineers to work in silicon wafer fabrication industries, engage with the related research institutions and pursue further studies.

Admission requirements

- For those with a good bachelor's degree in electrical/electronic engineering or equivalent degree in other relevant disciplines as the Board of Graduate Studies may approve.
- Preferably for those who have at least 6 months of relevant working experience.

Programme structure

Students are required to take twelve modules in microelectronics topics, including six core modules, four elective modules, and two laboratory modules, and to complete a one-semester project. Each technical module has 45 contact hours. The project should be on a topic related to microelectronics, may be undertaken either at NTU or at TUM or in the industry. In addition, students will take an English module of 80 hours and five other non-technical short modules of 10 hours each. The technical modules are as follows:

Core courses

- NM 6601 Microfabrication Technology (NTU)
- NM 6602 Quality and Reliability Engineering (NTU)
- NM 6603 Modern Semiconductor Devices (NTU)
- NM 6604 Laboratory 1: Semiconductor Process and Device Simulation (NTU)
- NM 6605 Laboratory 2: Design and Modelling of Nanodevices (NTU-TUM)
- NM 6606 Integrated Circuit Manufacturing (TUM)
- NM 6607 Optomechatronic Measurement Systems (TUM)
- NM 6608 Physical Electronics (TUM)

Electives (select four courses)

- NM 6610 Integrated Circuit Packaging (NTU)
- NM 6611 Failure Mechanisms and Device Characterization (NTU)
- NM 6612 Silicon Photonics (NTU)
- NM 6613 ULSI Technology (NTU)

- NM 6614 RF Silicon Electronics (TUM)
- NM 6615 Simulation and Optimization of Analog Circuits (TUM)
- NM 6616 Nanoelectronics (TUM)
- NM 6617 Advanced MOSFETs and Novel Devices (TUM)

Broadening courses

Enrichment

- NM 6062 Business and Technical English (GIST) (80 hours)

Cross Discipline Modules

- International Patent Law (GIST) (10 hours)
- Selected topics in Business and Administration (GIST) (10 hours)
- Selected topics in Management Methods (GIST) (10 hours)
- Cultural, Social and Economical Aspects of Globalization (GIST) (10 hours)
- Aspects of European and Asian Culture and History (GIST) (10 hours)

Programme duration

The programme will be conducted over 3 semesters. The students will complete the twelve modules in Semester 1 and Semester 2. The project will be carried out for the full Semester 3 either at NTU, or TUM, or in a company.

Programme management

The programme will be managed by the Programme Management Committee. The German Institute of Science and Technology (GIST) will handle the finance and administration.

Fees

S$30,000 for the full programme of 1.5 years.

Graduate Diploma In Information-Communication Technology

Overview of programme

The Graduate Diploma Programme in Information Communication Technology is a conversion programme designed to equip graduates from other disciplines with the knowledge and application of both IT and telecommunications technologies to serve the rapid growth of the Info-communications industry in Singapore. The programme also serves as a bridge for students interested in the M.Sc. (Communication Software and Networks) degree programme but who do not satisfy the entry requirements.

Curriculum structure

This programme comprises six courses offered over two semesters. Course participants will read three courses per semester. The examinations will be held at the end of each semester in accordance with the University's academic calendar.

Students will be admitted to the programme on a part-time basis. All classes are conducted in the evenings on campus. The requirements for the graduate diploma include satisfactory completion of all six courses. The minimum period of candidature is one year and the maximum is three years, effective from the date of the candidate's admission to the programme.

Core courses

EE5701 Data Communications and Network Protocols
EE5702 Foundations of Software Engineering

EE5703 Object-Oriented Programming
EE5704 Multimedia Communications
EE5705 Internet Business Technology
EE5706 Web Technology