Final Year Option Briefing

Professor Tan Yap Peng
Associate Chair (Academic)

13 March 2018
B.Eng (EEE) Program Educational Objectives

• To equip graduates with a solid foundation in mathematics, sciences, engineering and soft-skills such as communication and management for diverse careers and life-long learning.

• To develop graduates ready to practice and for employment in industries in electrical and electronic engineering.

• To develop graduates with a good understanding of their roles in society and a strong sense of ethical and professional responsibilities.
B.Eng (EEE) Final Year Curriculum

3 Choices

- Electrical & Systems Engineering
- Electronic Engineering
- Infocommunication Engineering
Final Year Course Structure

- EE0040 Engineers & Society
- HW0288 Engineering Communications II (Semester 1)
- EE4080 Final Year Project
- 2 Design Electives
- 3 Technical Electives
- GER-PE & UE Electives
Area of Specializations within the Option Group

Electrical & Systems Engineering
- Biomedical Electronics
- Intelligent Systems & Control Engrg
- Electrical Power & Energy

Electronic Engineering
- Integrated Circuit Design
- Microelectronics

Infocommunication Engineering
- Communication Engineering
- Computer Engineering
- Digital Media Processing
## Electrical & Systems Engineering Option (ECAL)

### Biomedical Electronics
- EE4901 Biomedical Control System Design
- EE4902 Design of Medical Information Process System
- EE4903 Physiological System Analysis
- EE4904 Biomedical Instrumentation
- EE4840 Biophotonics
- EE4265 Process Control System
- EE4266 Computer Vision

### Intelligent System & Control Engineering
- EE4207 Control Engrg Design
- EE4208 Intelligent System Design
- EE4265 Process Control System
- EE4266 Computer Vision
- EE4268 Robotics & Automation
- EE4273 Digital Control Systems
- EE4285 Computational Intelligence

### Electrical Power & Energy
- EE4503 Power Engrg Design
- EE4504 Design of Clean Energy Systems
- EE4530 Power System Analysis & Control
- EE4532 Power Electronics & Drives
- EE4534 Modern Distribution System with Renewable Energy
- EE4265 Process Control Systems
- EE4273 Digital Control Systems
- EE4285 Computational Intelligence
- EE4001 Software Engineering
Electronic Engineering Option (ENIC)

**Integrated Circuit Design**
- EE4303 Mixed-Signal IC Design
- EE4304 Radio Frequency Integrated System Design
- EE4305 Digital Design with HDL
- EE4340 VLSI Systems
- EE4341 Advanced Analog Circuits
- EE4343 Radio Frequency Circuit Design
- EE4344 Analysis & Design of Integrated Circuits
- EE4694 IC Reliability & Failure Analysis

**Microelectronics**
- EE4613 CMOS Process & Device Simulation by Technology CAD
- EE4614 Device Parameter Extraction & Layout Implementation
- EEE4645 Microfabrication Engineering
- EE4646 VLSI Technology
- EE4647 Microelectronic Devices
- EE4694 IC Reliability & Failure Analysis
- EE4001 Software Engineering
Infocommunication Engineering Option (INON)

Communication Engineering
- EE4105 Cellular Communication System Design
- EE4109 Wireless System Design
- EE4110 Optical Communication System Design
- EE4152 Digital Communications
- EE4153 Telecommunication Systems
- EE4188 Wireless Communications
- EE4190 Introduction to Modern Radar

Computer Engineering
- EE4717 Web Application Design
- EE4718 Enterprise Network Design
- EE4756 Computer Architecture
- EE4758 Information Security
- EE4761 Computer Networking
- EE4791 Database Systems
- EE4455 Embedded Systems
- EE4483 AI & Data Mining
- EE4490 Multimedia Systems
- EE4001 Software Engineering

Digital Media Processing
- EE4413 DSP System Design
- EE4105 Cellular Communication System Design
- EE4455 Embedded Systems
- EE4475 Audio Signal Processing
- EE4476 Image Processing
- EEE4478 Digital Video Processing
- EE4483 AI & Data Mining
- EE4490 Multimedia Systems
Final Year Option Selection

Select 1 of the 3 option groups.

Select 2 design electives from the chosen option group.

Select 3 technical electives from the chosen option group.
For detailed information, ...

FINAL YEAR OPTION (AY2018-2019)

FINAL YEAR CURRICULUM

In the new knowledge-based economy, engineering has become increasingly multi-disciplinary in nature. To better prepare you for this new environment, a new broad-based curriculum was introduced. The aim is to produce engineers who are flexible across disciplines; who are not constrained by the boundaries between traditional disciplines but are able to apply their knowledge and skills to lead multi-disciplinary teams to solve increasingly complex problems; to apply existing technologies in novel ways; and to create new technologies for the future.

In the final year curriculum, you will be given more flexibility to select your elective courses to better suit your interest and inclinations. The elective courses are now grouped under 3 broad option groups:

- Electrical and Systems Engineering (ECAL)
- Electronic Engineering (ENIC)
- Infocommunication Engineering (INON)

Courses from related specializations are classified under one of the three broad groups and students are given the flexibility to mix-and-match the Design and Technical Electives, within their chosen option group. However, students who prefer a more in-depth study can select the courses from one of the 8 areas of specialization, within their chosen broad group.

In addition to the elective technical courses, final year students are required to take compulsory courses such as Final Year Project, Engineering Communication II, and Engineers and Society.

Declaration Period for AY2018-2019

13 March (5 pm) - 25 March (11.59 pm)

No Declaration = Registration Placement Not Guaranteed

StudentLink > Academic Matters

Courses with limited interest will be closed.

Enquiries: eeeundgrad@ntu.edu.sg
Outline

• Why This FYP Presentation?
• FYP and Final Year Option
• FYP Matters Before Project Allocation/Selection
• FYP Matters During Project Allocation/Selection
• FYP Matters After Project Allocation/Selection
• FYP Requirements
• FYP Assessments
Why this FYP Presentation?

• Every final year student of EEE is required to undertake a project supervised by one or two faculty members.

• You may start your FYP in the next semester, and it will spread over one academic year (two semesters).

• It may be important for you to know the relationship between Final Year Project (FYP) and Final Year Option.
Final Year Project (EE4080/IM4080)

• Final year courses are classified according to options (Electrical and Systems Engineering, Electronic Engineering, Infocommunication Engineering), but not FYPs.

• How to tell whether an FYP is in your chosen option?
  1. By the project title/summary
  2. By the main supervisor’s area affiliation and his/her research interest

• Should you choose an FYP from your final year option? Useful, but not necessary or always possible!

Try to choose an FYP close to your final-year option!
Before Project Allocation/Selection

• Each project must have a main/sole full-time supervisor from the School of EEE.

• Project Types
  
  - **Type A**: Projects proposed by faculty members
  - **Type B**: Projects proposed by external partners such as research institutes and industries, such as RI/SMP, URECA-FYP, ISP.

Check with your potential EEE supervisor!
During Project Allocation/Selection

- Two phases (see next slide)

- Do your homework before selecting project/supervisor.

- RI-FYP projects may require interviews by RI supervisors. They may be more **demanding** and **challenging**.

- For RI-FYP, ISP-FYP, you may need to go to RI or company outside NTU regularly, say, **once a week**.
Allocation/Selection Phases

• **Phase 1** – Selection by Supervisor *(April 2 to 20, 2018)*
  - Discuss with your potential supervisor
  - You will receive a confirmation email if the project is successfully allocated to you

• **Phase 2** – Selection by Students and Allocation by Computer *(May 12 to 31, 2018)*

Check your NTU emails regularly (daily), and the FYP website for the real-time allocation information!

**Final Announcement: Mid June 2018**
FYP Requirements (Prerequisite after Exam Results)

• Year 4 standing, or in the final study year, meeting all the AU requirements for the BEng degree upon completion of FYP.

• Balance of no more than 44 AUs (46 AUs for IEM students) inclusive of 8-AU FYP at the point of registration of FYP.

• Completed Professional Internship (PI)*
  * ABP students are allowed to register for FYP concurrently with PI at any given time.
  * Double Degree/Major students are allowed to register for FYP if they are taking up Professional Attachment (PA) during the May - July period.
FYP Assessments

• **Interim Assessment**
  ✓ Project Plan/Strategy: Submit to Supervisor around 6 week
  ✓ Interim Report: Submit to both Supervisor and Examiner near the end of the first semester

• **Main Assessment**
  ✓ Project Final Report: Submit to both Supervisor and Examiner in early April 2018
  ✓ Project Demonstration: To Examiner after report submission
  ✓ Oral Presentation: To both Supervisor and Examiner
FYP Assessments

• Evaluation Criteria
  ✓ Carry out preparatory work, such as literature search and review
  ✓ Evaluate materials of relevance and understand the background
  ✓ Focus on the main issues, formulate the problem, and identify key tasks
  ✓ Validate the problem statement through analytical studies, simulations, experiments etc.
  ✓ Write a report and present the work
Useful FYP Information & Guidelines

• Check your emails regularly, particularly those starting with FYP

• Visit the EEE FYP website regularly (FAQ, Guidelines, and others). It contains essentially all the information on FYP.

  http://www3.ntu.edu.sg/eee/fyp/

• Alternatively, search “NTU EEE FYP” in Google
Electrical & Systems Engineering (ECAL)

Chan Chok You, John
Associate Professor

13 March 2018
Electrical & Systems Engineering (ECAL) Option

- Students are required to take 2 DESIGN elective courses, and 3 TECHNICAL elective courses.
- The design elective courses for students choosing a particular option group must be those under that option group.
- Students must choose all design and technical elective courses from their chosen option group.
- For specialization, students must choose the design and technical elective courses from the respective areas of specialization.
Final Year Specializations

- Biomedical Electronics
- Power & Clean Energy
- Intelligent Systems & Control Engineering

ECAL
Biomedical Electronics

Biomedical Engineering is multiple discipline & high technology

Provides solution to healthcare industries & services

Health-Caring & Life Saving

Exciting, Profound & Challenging

Health care industry is robust & resilient during economic crisis

Career (Medical R&D; Hospitals; Academic Inst./Govt Boards; Companies; Sales & Marketing (Medical Instruments/Products))
Power & Clean Energy

Power Engineer (Power system control, building services & electrical consulting, energy traders/brokers, power electronics, energy alternatives & renewable energy, intelligent energy system, oil refineries and related companies)

Register as a Professional Engineer (PEng) with PEB

Career (Oil refineries; Building services; Electrical consulting companies; Power equipment sales; Engineering firms; Hospitals; Shipyards; Singapore Power, MINDEF, SMRT, PSA, JTC, CAAS, LTA)
Intelligent Systems & Control Engineering

Heart of many engineering systems; synergistically integrates the plants (electro-mechanical, chemical, etc), with sensors, actuators, computers, communication, & software to yield optimal responses

Control systems enables integrations of mechanics, electronics, & computer hardware & software to revolutionize technology in the new economy

Career (Robotics & automated manufacturing; Aerospace & automotive industries; Precision engineering & manufacturing; Process industries; Building automation)
Final Year Electronic Specializations

Integrated Circuit (IC) Design

Microelectronics & Photonics

ENIC
IC Design Specialization (ENIC)

Third Year Elective *
- EE3019 Integrated Electronics

Design Electives (Choose any 2)
- EE4303 Mixed-Signal IC Design *
- EE4304 Radio Frequency Integrated Syst Design *
- EE4305 Digital Design with HDL

Technical Electives (Choose any 3)
- EE4340 VLSI Systems
- EE4341 Advanced Analog Circuits *
- EE4343 Radio Frequency Circuit Design *
- EE4344 Analysis & Design of Integrated Circuits *
- EE4694 IC Reliability & Failure Analysis
Microelectronics & Photonics Specialization (ENIC)

Third Year Elective *

• EE3013 Semiconductor Devices & Processing

Design Electives (Choose any 2)

• EE4613 CMOS Process & Device Simulation by Tech CAD
• EE4614 Device Parameter Extraction & Layout Implementation

Technical Electives (Choose any 3)

• EE4645 Microfabrication Engineering *
• EE4646 VLSI Technology *
• EE4647 Microelectronic Devices
• EE4694 IC Reliability & Failure Analysis *
• EE4838 Laser Engineering & Applications
• EE4840 Biophotonics
• EE4001 Software Engineering
A Career that Revolutionises & Improves Lives

Scientists investigate that which already is,
Engineers create that which has never been.

- Albert Einstein

Electronics is part of our everyday life
Wide Range of Career Opportunities in Electronics Sector with Global Leaders

R&D + Manufacturing + Headquarters

Logos of Texas Instruments, STMicroelectronics, Infineon, Panasonic, Marvell, Qualcomm, Broadcom, Xilinx, Avago, STATSchipPAC, and EDB Singapore.
16 of top 20 global companies have R&D, manufacturing or HQ in Singapore

- **Intel**
  - World #1
  - USA #1
  - CPU #1

- **Samsung**
  - World #2
  - Asia #1

- **Texas Instruments**
  - World #4
  - USA #2

- **Renesas**
  - World #5
  - Japan #2

- **STMicroelectronics**
  - World #7
  - Europe #1

- **Micron**
  - World #8
  - USA #3
  - Memory #2

- **Qualcomm**
  - World #9
  - USA #4
  - Comms #1

- **Broadcom**
  - World #11
  - USA #5
  - Comms #2

- **AMD**
  - World #12
  - USA #6
  - CPU #2

- **Infineon Technologies**
  - World #13
  - Europe #2

- **Panasonic**
  - World #15
  - Japan #5

- **Freescale**
  - World #17
  - USA #7

- **NXP**
  - World #17
  - Europe #3

- **Marvell**
  - World #18
  - USA #8

- ** MediaTek**
  - World #19
  - Taiwan #1

- **Nvidia**
  - World #20
  - USA #9
  - Graphics #3

Companies representing >50% of ww semicon revenue are in Singapore
Singapore’s Semiconductor Ecosystem

Strong, comprehensive base of top companies

- IC Design
- Wafer Fabrication
- Assembly and Test

Have focused on engaging top companies to build up a semiconductor ecosystem in Singapore

9 of the top 15 fabless semiconductor companies

3 of the top wafer foundries

4 of the top 6 OSATs

Outsourced Semiconductor Assembly and Test
**IC Design Centres**

~40

~1200 IC designers in Singapore

<table>
<thead>
<tr>
<th>N. America</th>
<th>Europe</th>
<th>Singapore</th>
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<tbody>
<tr>
<td>Avago</td>
<td>Qualcomm</td>
<td>Advinno</td>
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<td>Broadcom</td>
<td>Silicon Labs</td>
<td>BlueChips</td>
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<td>Finisar</td>
<td>SMSC</td>
<td>ComSOC</td>
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<td>Intel</td>
<td>Texas Instruments</td>
<td>DSO</td>
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<td>Linear Tech</td>
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<td>FreeSystems</td>
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<td>O₂Micro</td>
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<td>MEDS Tech</td>
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<th>ROW</th>
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<tr>
<td>HiSilicon</td>
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<td>Panasonic Semiconductor</td>
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<td>MediaTek</td>
<td>Panasonic Electric Works</td>
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<td>Solomon Systech</td>
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**Top 25 Fabless Companies (2011) are highlighted in pink**

**Top 10 IDM's (2010) are highlighted in blue**
14 Silicon Wafer Fabs

~ 867,000 wafers per month output (200mm equivalent)
~ 1,000 R&D engineers

<table>
<thead>
<tr>
<th>Ten ≤ 8” (200mm) Fabs</th>
<th>Four 12” (300mm) Fabs</th>
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<tr>
<td>GLOBALFOUNDRIES - 5 Fabs</td>
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<tr>
<td>Micron</td>
<td>UMC</td>
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<tr>
<td>SSMC (NXP-TSMC)</td>
<td>IM Flash Singapore</td>
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<td>STMicroelectronics - 3 Fabs</td>
<td>Micron</td>
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Black – Logic Fabs; Blue – Memory Fabs
Assembly & Test Companies
R&D engineers: ~300 in assembly and ~400 in test

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<th>3rd Party A&amp;T</th>
<th>In-house</th>
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<td>Ardentec</td>
<td>AMD</td>
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<td>ASE</td>
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<td>Delphi</td>
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<td>ChipPAC</td>
<td>Automotive</td>
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<td>Infineon</td>
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Black refers to companies with both A & T
Pink refers to companies with only Assembly
Blue refers to companies with only Test
Singapore’s Electronics Industry in 2016

4.4% of Singapore’s GDP

S$90B manufacturing output

~66,000 employment

17% of total manufacturing jobs

Breakdown of Electronics Industry

- Semiconductors (53%)
- Infocomms & Consumer Electronics (14%)
- Electronic Modules & Components (11%)
- Data Storage (11%)
- Computer Peripherals & EMS (11%)

A Key Pillar of our Economy

1 in 10 chips worldwide are made in Singapore

singstat.gov.sg, 2016
Infocommunications Engineering (INON)

Teh Kah Chan
Associate Professor

13 March 2018
Final Year Infocommunications Specializations

INON

- Communication Engineering
- Computer Engineering
- Digital Media Processing
### Infocommunication Engineering Option (INON)

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NANYANG TECHNOLOGICAL UNIVERSITY | SINGAPORE
Communication Engineering

Network Comm. Internet
Optical Communications
Mobile Communications
Satellite Communications
Wireless Communications
Digital Media Processing

- Apps:
  - Media Search Engine
  - Mobile Audio
  - Video on-demand
  - Social Network
  - HDTV
  - On-line Gaming
  - Smart Phones

- Inputs:
  - Consumer Electronics
  - Communication
  - Computer
  - Contents (digital)
Smart Phone as an Example

Coding
- Transmission
- Storage

Analysis
- Speech Recognition
- Bar Code Analysis
- Song Identification

Pre-Processing
- Enhance quality
- Reduce cost

Synthesis
- Sound Synthesizer
- 2D & 3D Graphics

Post-Processing
- Enhance quality
- Reduce cost
Career Opportunities (INON)

**Research Centres**
- IME, I2R, DSTA, DSO, CSIT, DSI, MNC R&D

**Consumer Electronics Industry**
- Siemens, NEC, HP, Agilent, OKI, Sony, Creative, Philips, Infineon

**Communications & Broadcasting**
- SingTel, StarHub, M1, Agilis, Ericsson

**Infocomm – Computers & Comms.**
- IBM, HP, Lucent, Siemens, NEC, Fujitsu, Phillips

**Government & Statutory Boards**
- IMDA, PSA, HDB, MRTC, Singapore Power

**Banking & Financial Institutions**
- Banks, Stock Exchanges, Financial Institutions

**Private Communication Networks**
- Petrochemical Companies, Private MNC Networks
Industries that requires Infocommunication
END