BEng (EEE) Third Year Electives and Internships Talk

Tan Yap Peng
Associate Chair (Academic), EEE

10 March 2017
MAJOR COMPONENTS

- 2 or 3 Year-3 Core Courses + 2 Prescribed Elective Courses

- 4 Core Experiments (2 for each Core) + 2 Elective Experiments associated with the 2 Prescribed Elective courses

- Design & Innovation Project

- Professional Internship (PI) – 20 Weeks
### Third Year Courses

<table>
<thead>
<tr>
<th>Year 1 Intake</th>
<th>Poly Direct-Entry Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester 1 or 2</strong></td>
<td><strong>Semester 1 or 2</strong></td>
</tr>
<tr>
<td>EE3001 Engineering Electromagnetics</td>
<td>EE2003 Semiconductor Fundamentals</td>
</tr>
<tr>
<td>EE3002 Microprocessors</td>
<td>EE2007 Engineering Mathematics II</td>
</tr>
<tr>
<td>EE3080 Design &amp; Innovation Project</td>
<td>EE3001 Engineering Electromagnetics</td>
</tr>
<tr>
<td>EE3xxx Prescribed Elective 1</td>
<td>EE3080 Design &amp; Innovation Project</td>
</tr>
<tr>
<td>EE3xxx Prescribed Elective 2</td>
<td>EE3xxx Prescribed Elective 1</td>
</tr>
<tr>
<td>ET0001 Enterprise And Innovation (Online)</td>
<td>ET0001 Enterprise And Innovation (Online)</td>
</tr>
<tr>
<td>ML0002 Career Power-Up (Online)</td>
<td>ML0002 Career Power-Up (Online)</td>
</tr>
<tr>
<td>Unrestricted Elective</td>
<td>HY0001 Ethics And Moral Reasoning (Online)</td>
</tr>
<tr>
<td></td>
<td>ML0002 Career Power-Up (Online)</td>
</tr>
</tbody>
</table>

**Semester 1 or 2**

EE3179 Professional Internship
# PRESCRIBED ELECTIVE COURSES

Choose two (2)

<table>
<thead>
<tr>
<th>PRESCRIBED ELECTIVE COURSES</th>
<th>PRE-REQUISITE</th>
<th>LAB. CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE3010 ELECTRICAL DEVICES AND MACHINES</td>
<td>EE2001</td>
<td>E3010L</td>
</tr>
<tr>
<td>EE3011 MODELLING &amp; CONTROL</td>
<td>EE2006</td>
<td>E3011L</td>
</tr>
<tr>
<td>EE3012 COMMUNICATION PRINCIPLES</td>
<td>EE2010</td>
<td>E3012L</td>
</tr>
<tr>
<td>EE3013 SEMICONDUCTOR DEVICES AND PROCESSING</td>
<td>EE2003</td>
<td>E3013L</td>
</tr>
<tr>
<td>EE3014 DIGITAL SIGNAL PROCESSING</td>
<td>EE2010</td>
<td>E3014L</td>
</tr>
<tr>
<td>EE3015 POWER SYSTEMS AND PROTECTION</td>
<td>EE2001</td>
<td>E3015L</td>
</tr>
<tr>
<td>EE3017 COMPUTER COMMUNICATIONS</td>
<td>-</td>
<td>E3017L</td>
</tr>
<tr>
<td>EE3018 INTRODUCTION TO PHOTONICS *</td>
<td>-</td>
<td>E3018L</td>
</tr>
<tr>
<td>EE3019 INTEGRATED ELECTRONICS</td>
<td>EE2002</td>
<td>E3019L</td>
</tr>
</tbody>
</table>

* EE3018 is only offered in Semester 1
CHOICE OF PRESCRIBED ELECTIVES

- Select two Prescribed Electives.

- Third Year Electives are pre-requisites for some Final Year Design & Technical Electives.

- Your choice should be guided by your intended Final Year Option.

- Additional Third Year Elective courses can be taken as Unrestricted Electives (UE), subjected to availability of vacancies.
FINAL YEAR CURRICULUM

3 Options

- ELECTRICAL & SYSTEMS ENGINEERING
- ELECTRONIC ENGINEERING
- INFOCOMMUNICATIONS ENGINEERING
# FINAL YEAR CURRICULUM

## 8 Specialisations:

### ELECTRICAL & SYSTEMS ENGINEERING
- Intelligent Systems and Control Engineering
- Biomedical Electronics
- Electrical Power and Energy

### ELECTRONIC ENGINEERING
- Integrated Circuits Design
- Microelectronics & Photonics

### INFO-COMMUNICATIONS ENGINEERING
- Communication Engineering
- Computer Engineering
- Digital Media Processing
PRE-REQUISITES FOR FINAL YEAR OPTION

ELECTRICAL & SYSTEMS ENGINEERING

Intelligent Systems & Control Engineering
  EE3011 Modelling & Control
  Any other EE30xx

Biomedical Electronics
  EE3011 Modelling & Control
  Any other EE30xx

Electrical Power and Energy
  EE3010 Electrical Devices & Machines
  EE3015 Power Systems & Protection
PRE-REQUISITES FOR FINAL YEAR OPTION

ELECTRONIC ENGINEERING

Integrated Circuits Design
- EE3013 Semiconductor Devices & Processing
- EE3019 Integrated Electronics

Microelectronics
- EE3013 Semiconductor Devices & Processing
- EE3018 Introduction to Photonics
PRE-REQUISITES FOR FINAL YEAR OPTION

INFOCOMMUNICATIONS ENGINEERING

Communication Engineering
- EE3012 Communication Principles
- EE3017 Computer Communications

Computer Engineering
- EE3014 Digital Signal Processing
- EE3017 Computer Communications

Digital Media Processing
- EE3012 Communication Principles
- EE3014 Digital Signal Processing
FINAL YEAR COURSES

ELECTRICAL & SYSTEMS ENGINEERING

ELECTRONIC ENGINEERING

INFOCOMMUNICATION ENGINEERING

EE0040 Engineers & Society

HW0288 Engineering Communication II

EE4080 Final Year Project

Two Design Electives

Three Technical Electives
<table>
<thead>
<tr>
<th>Design Electives (Choose 2)</th>
<th>Technical Electives (Choose 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE4207   Control Engineering Design</td>
<td>EE4001  Software Engineering</td>
</tr>
<tr>
<td>EE4208   Intelligent System Design</td>
<td>EE4265  Process Control Systems</td>
</tr>
<tr>
<td>EE4503   Power Engineering Design</td>
<td>EE4266  Computer Vision</td>
</tr>
<tr>
<td>EE4504   Design of Clean Energy Systems</td>
<td>EE4268  Robotics and Automation</td>
</tr>
<tr>
<td>EE4901   Biomedical Control System Design</td>
<td>EE4273  Digital Control Systems</td>
</tr>
<tr>
<td>EE4902   Design of Medical Information Processing</td>
<td>EE4285  Computational Intelligence</td>
</tr>
<tr>
<td>Systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EE4530  Power System Analysis &amp; Control</td>
</tr>
<tr>
<td></td>
<td>EE4532  Power Electronics &amp; Drives</td>
</tr>
<tr>
<td></td>
<td>EE4534  Modern Distribution Systems with Renewable Resources</td>
</tr>
<tr>
<td></td>
<td>EE4903  Physiological Systems Analysis</td>
</tr>
<tr>
<td></td>
<td>EE4904  Biomedical Instrumentation</td>
</tr>
<tr>
<td></td>
<td>EE4840  Biophotonics</td>
</tr>
</tbody>
</table>
ELECTRONIC ENGINEERING

Design Electives
(Choose 2)
- EE4303 Mixed-Signal IC Design
- EE4304 Radio Frequency Integrated System Design
- EE4305 Digital Design with HDL
- EE4613 CMOS Process & Device Simulation
- EE4614 Device Parameter Extraction & Layout Implementation

Technical Electives
(Choose 3)
- EE4001 Software Engineering
- EE4340 VLSI Systems
- EE4341 Advanced Analog Circuits
- EE4343 Radio Frequency Circuits
- EE4344 Analysis & Design of Integrated Circuits
- EE4645 Microfabrication Engineering
- EE4646 VLSI Technology
- EE4647 Microelectronic Devices
- EE4694 IC Reliability and Failure Analysis
- EE4838 Laser Engineering and Applications
- EE4840 Biophotonics
INFOCOMMUNICATIONS ENGINEERING

Design Electives (Choose 2)

- EE4105 Cellular Communication System Design
- EE4109 Wireless System Design
- EE4110 Optical Communication System Design
- EE4413 DSP System Design
- EE4717 Web Application Design
- EE4718 Enterprise Network Design

Technical Electives (Choose 3)

- EE4001 Software Engineering
- EE4152 Digital Communications
- EE4153 Telecommunication Systems
- EE4188 Wireless Communications
- EE4190 Introduction to Modern Radar
- EE4455 Embedded Systems
- EE4475 Audio Signal Processing
- EE4476 Image Processing
- EE4478 Digital Video Processing
- EE4483 Artificial Intelligence & Data Mining
- EE4490 Multimedia Systems
- EE4756 Computer Architecture
- EE4758 Information Security
- EE4761 Computer Networking
- EE4791 Database Systems
PROFESSIONAL INTERNSHIP
PRE-REQUISITES FOR INTERNSHIP

- Engineering Year-1 Intake: Year-3 standing & likely to complete 4 semesters of study
- Poly Direct-Entry: Year-3 standing & likely to complete 2 semesters of study

Important Note:

- A PASS mark in Internship is necessary for the award of the degree (except for students who are exempted).
- Internship is ungraded, i.e. PASS/FAIL.
# PROFESSIONAL INTERNSHIP

<table>
<thead>
<tr>
<th><strong>PERIOD</strong></th>
<th>20 WEEKS [SEM 1 / SEM 2]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACADEMIC UNIT (CORE)</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>GRADING</strong></td>
<td>PASS / FAIL</td>
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<tr>
<td><strong>ASSESSMENTS</strong></td>
<td>TWICE</td>
</tr>
<tr>
<td><strong>SUBMISSION OF FINAL REPORT</strong></td>
<td>YES</td>
</tr>
<tr>
<td><strong>ESTIMATED APPLICATION PERIOD</strong></td>
<td>MAR (for Sem 1 Applications) SEP (for Sem 2 Applications)</td>
</tr>
</tbody>
</table>
THIRD YEAR ELECTIVES’ SELECTION

Online Selection Period:

System opens on 10 March (5:00 pm)
System closes on 19 March (11:59 pm)

http://www.ntu.edu.sg/studentlink

> Year 3 Prescribed Electives Selection

- This selection exercise is compulsory to all EEE Year 2 students.
- Students who fail to make their selection during the period may not be given priority during the AY2017/2018 registration exercises.
- The School reserves the right to de-register any student’s registered courses during the registration period, if he/she did not indicate them during the Third Year Elective Declaration Period.
Q & A
Thank You
Overview of EEE Design & Innovation Project (DIP) EE3080

Prof Wen Changyun
Chairman, DIP Committee
Introduction

• The EEE DIP (EE3080) is a compulsory program for all full-time third year EEE students (2 AU).

• Currently, the program requires each student to undertake a project in a group environment.

• Each project group is supervised by up to two staff.

• Through DIP, students will design, prototype, and test innovative electronic, electrical or IT products.
Introduction

• The 2017/2018 DIP will be carried out during
  o Semester 1, or
  o Semester 2

• Students are required to work on DIP for 6 hours per week over the 13 weeks
  o 1.30 pm - 4.30 pm on every Wednesday
  o The other 3 hours are flexible
Thematic Programmes

• All DIP projects are classified according to Thematic Programmes.

• For AY 2017/2018, there will be 6 thematic programmes.
Thematic Programmes

• **TP01: Smart and Micro Grids for Integration of Renewable Energy Sources**
  ✓ Only to be offered in **Sem 1 with a quota of 100 students**
  ✓ Programme Coordinator: Professor Wang Peng

• **TP02: Smart Electronics Programme**
  ✓ Only to be offered in **Sem 1 with a quota of 100 students**
  ✓ Programme Coordinator: Professor Gwee Bah Hwee
Thematic Programmes

• **TP03: Electromedical and Mobile Computing Technologies**
  ✓ Offered in both semesters
  ✓ Programme Coordinators: Justin Dauwels

• **TP04: UAVIONICS**
  ✓ Only to be offered in Sem 1 with a quota of 100 students
  ✓ Programme Coordinator: Professor Lim Meng Hiot
Thematic Programmes

- **TP05: Photonics, Radar and Satellite Systems**
  - Offered in both semesters
  - Programme Coordinators: Professor Ng Boon Poh (Sem 1)
    Professor Wang Qijie (Sem 2)

- **TP06: Robotics**
  - Only offered in Sem 2
  - Programme Coordinator: Professor Wang Han
Selection and Allocation of Thematic Programmes and Projects

Stage 1: Selection and Allocation of Thematic Programmes

- Each student inputs up to 3 choices and also indicates the semester of doing DIP in Studentlink by a specified deadline: 21 March 2017.
- After the deadline, allocation will be done by the DIP system randomly, based on the choices of students.

Remarks:
Some programmes may be offered only in Semester 1 or 2 and/or may have a quota on the number of students set by its programme coordinator.
Stage 2: Selection and Allocation of Projects

• Each student will be informed to choose 3 projects from the list of available projects in his/her thematic programme through Studentlink by a specified deadline, 17 April 2017 (only for students doing DIP in Sem 1).

• After the deadline, project allocation will be done by the DIP system randomly, based on the choices of students.
Remarks:

1. The number of students in each project ranges from 8 to 10;

2. Students with allocated DIP projects will be registered to the course EE3080. At a later date, if a student does not want to do DIP for reasons like oversea exchange, IA and so on, he/she needs to inform the EEE Undergraduate Office and the project supervisor.

3. Students will not form groups and propose projects;
DIP Competition

• One DIP competition will be held among projects within respective thematic programme, managed by respective programme coordinators.

• Each student of the winning project will receive a certificate.

• *Competition result* will be used as *reference* during assessment.

Official Date of Competition:

The *first Monday* after the *final exam* of each semester.

(Sem 1: 11 Dec. 2017; Sem 2: 14 May 2018)
DIP Assessment

• The performance of each *individual student* will be closely and continuously monitored and assessed during the project.

• The overall grade of each student in EE3080 consists of two components:
  - Assessment by Supervisor
  - Assessment by Moderator
DIP Assessment

• Assessment Areas by project supervisor:

  ➢ Technical Knowledge and Skills
  ➢ Attendance and Participation
  ➢ Project Report
  ➢ Oral Presentation
DIP Assessment

• Assessment areas by moderator:
  ➢ Logbook/Interview
  ➢ Demonstration
  ➢ Project Report

So, please keep logbook!
Project Report

- **Each student** needs to write an *individual* report of 4 to 5 pages (excluding appendices)

- A group report about the entire project must also be submitted.

- **Submission Deadlines:**

  Friday of Week 13 in each semester
Each student is required to give peer reviews to all the members in the project, including the student himself/herself. (Compulsory)

Deadlines for peer reviews:

Friday of Week 13 in each semester
Remarks:

• Every student should do the peer review ranking seriously and independently, based on each individual member’s contributions such as information gathering, initiative/motivation to learn and participate, responsibility, positive collaboration with team members, application of creative/innovative ideas, technical knowledge & skills, problem solving ability, achievement and work quality, personal discipline and attendance, and so on.

• Students who purposely manipulate the peer review outcome will face serious consequence including disciplinary action from the School.
During assessment by supervisor and moderator, the following results will be considered as references:

- Competition Result
- Peer Review Result in terms of ranking

**Official Date of Assessment:**

- The *first Tuesday* after the final exam of each semester, i.e., after the competition.

  Sem 1: 12 Dec 2017  ;  Sem 2: 15 May 2018
DIP Budget

• Existing resources in labs should be used.

• **Budget**: Each Thematic Programme will be provided a total budget of **S$2000 x No. of Projects**.

• Depending on the need, the programme coordinator may provide a different budget amount to a project.
• Purchasing Procedure:

- Every purchasing should be approved by project supervisor.

- To purchase the components required by the project, supervisor may make petty cash claim if the cost does not exceed $200 per claim.

- If it is more than $200 per claim, supervisor needs to first seek approval from the respective Area Lead.
DIP Management Lecture

There will be a 3-hour lecture on project management in the first week of each semester.

It is compulsory for all the DIP students to attend the lecture.
More information and updates on DIP can be found in the DIP Website:

http://www.eee.ntu.edu.sg/Programmes/CurrentStudents/undergraduate/undergraduatefull-time/DIP2017/Pages/Home.aspx
OPTION GROUP B
– ELECTRONIC ENGINEERING

presented by

K Radha Krishnan
Associate Professor, EEE

27 Feb 2017
Specialization in Electronics Option

2 specializations

- Microelectronics
- IC Design
- Microelectronics Courses
- Photonics Courses
- IC Design Courses
# Courses in IC Design Specialization

<table>
<thead>
<tr>
<th>IC Design</th>
<th>Design Electives (Choose any 2)</th>
<th>Technical Electives (Choose any 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferably had taken in Third Year:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1EE3019 Integrated Analog Electronics (Pre-requisite)</td>
<td>1EE4303 Mixed-Signal IC Design</td>
<td>EE4340 VLSI Systems</td>
</tr>
<tr>
<td></td>
<td>1EE4304 Radio Frequency Integrated System Design</td>
<td>1EE4341 Advanced Analog Circuits</td>
</tr>
<tr>
<td></td>
<td>EE4305 Digital Design with HDL</td>
<td>1EE4343 Radio Frequency Circuits</td>
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<tr>
<td></td>
<td></td>
<td>1EE4344 Analysis &amp; Design of Integrated Circuits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE4694 IC Reliability &amp; Failure Analysis</td>
</tr>
</tbody>
</table>

 Scholarships Available!
Design Electives

**EE4613  CMOS Process and Device Simulation by Technology CAD**
- Workstation Based Design & Simulation Course
- Virtual Wafer Fabrication & Device Characterization of a 2 µm CMOS Process
- Virtual Process Integration for MOS Technology Development & Device Optimization

**EE4614  Device Parameter Extraction & Layout Implementation**
- Workstation Based Design & Simulation Course
- Virtual Device Characterization
- Transistor Parameter Extraction
- Circuit Simulation & Mask Layout

**Pre-requisite:** EE3013 Semiconductor Devices and Processing
Technical Electives (Microelectronics)

1EE4645 Microfabrication Engineering
1EE4646 VLSI Technology (Choose any 3)
EE4647 Microelectronic Devices
1EE4694 IC Reliability and Failure Analysis

1Pre-requisite: EE3013 Semiconductor Devices and Processing
Courses in Microelectronics/Photonics Specialization

Technical Electives (Photonics)

✓ EE4838 LASER ENGINEERING AND APPLICATIONS
✓ EE4839 FIBRE OPTIC COMMUNICATIONS
✓ EE4840 BIOPHOTONICS

No Pre-requisite required
Wide Range of Career Opportunities in Electronics Sector with Global Leaders
Singapore’s Electronics Industry Continues to Attract Investments

The sector that attracts the largest share of investments

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics FAI</td>
<td>S$6.2b</td>
<td>S$3.3b</td>
<td>S$1.6b</td>
<td>S$3.3b</td>
</tr>
<tr>
<td>Electronics TBE</td>
<td>S$1.2b</td>
<td>S$0.6b</td>
<td>S$0.2b</td>
<td>S$0.7b</td>
</tr>
</tbody>
</table>

FAI commitments by industry in 2015

- Chemicals: 31.3%
- HQ service: 31.3%
- Electronics: 28.6%

TBI commitments by industry in 2015

- HQ services: 46.5%
- Electronics: 12.5%

FAI= Fixed Assets Investment (typically for manufacturing); TBE = Total Business Expenditure (mainly expenditure by HQ and R&D operations)
16 of top 20 global companies have R&D, manufacturing or HQ in Singapore

Companies representing >50% of worldwide semiconductor 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
## IC Design Centres

~40 IC Design Centres

~1200 IC designers in Singapore

### N. America
- Avago
- Broadcom
- Finisar
- Intel
- Linear Tech
- LSI
- Marvell
- O₂Micro
- Qualcomm
- Silicon Labs
- SMSC
- Texas Instruments
- Volterra
- Xilinx

### Europe
- CSR
- Infineon
- Lantiq
- ST-Ericsson
- STMicro-Electronics

### Singapore
- Advinno
- BlueChips
- ComSOC
- DSO
- FreeSystems
- FTD Technology
- MEDS Tech
- Yuliantic

### ROW
- HiSilicon
- Lite-On
- MediaTek
- Solomon Systech

### Japan
- Fujitsu Semiconductor
- Panasonic Semiconductor
- Panasonic Electric Works

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Top 25 Fabless Companies (2011) are highlighted in pink

Top 10 IDMs (2010) are highlighted in blue
14 Silicon Wafer Fabs

~ 867 000 wafers per month output (200mm equivalent)
~ 1000 R&D engineers

<table>
<thead>
<tr>
<th>Ten ≤ 8” (200mm) Fabs</th>
<th>Four 12” (300mm) Fabs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GLOBALFOUNDRIES - 5 Fabs</td>
<td></td>
</tr>
<tr>
<td>• Micron</td>
<td></td>
</tr>
<tr>
<td>• SSMC (NXP-TSMC)</td>
<td></td>
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<tr>
<td>• STMicroelectronics - 3 Fabs</td>
<td></td>
</tr>
<tr>
<td>• GLOBALFOUNDRIES</td>
<td></td>
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<tr>
<td>• UMC</td>
<td></td>
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<tr>
<td>• IM Flash Singapore</td>
<td></td>
</tr>
<tr>
<td>• Micron</td>
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</tr>
</tbody>
</table>

Black – Logic Fabs; Blue – Memory Fabs
# Assembly & Test Companies

R&D engineers: ~300 in assembly and ~400 in test

<table>
<thead>
<tr>
<th>3rd Party A&amp;T</th>
<th>In-house</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ardentec</td>
<td>AMD</td>
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<tr>
<td>ASE</td>
<td>Avago</td>
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<tr>
<td>STATS</td>
<td>Delphi Automotive</td>
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<tr>
<td>ChipPAC</td>
<td>Infineon</td>
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<td></td>
<td>Linear Tech</td>
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<tr>
<td></td>
<td>Micron</td>
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<tr>
<td></td>
<td>Panasonic Semiconductor</td>
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<td>Renesas</td>
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<td>Seiko-Epson</td>
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<td></td>
<td>STMicroelectronics</td>
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<tr>
<td></td>
<td>Xilinx</td>
</tr>
<tr>
<td></td>
<td>Silicon Labs</td>
</tr>
</tbody>
</table>

*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 2014

- 5.1% of Singapore’s GDP
- S$78B manufacturing output
- 80,000 employment
- 19% of total manufacturing jobs

Breakdown of Electronics Industry

- Semiconductors (61%)
- Infocomms & Consumer Electronics (24%)
- Electronic Modules & Components (3%)
- Data Storage (5%)
- Computer Peripherals & EMS (7%)

1 in 10 chips worldwide are made in Singapore

A Key Pillar of our Economy
Many graduates, who did not take the Electronics option, have also ended up in Electronics Sector for employment! - *Recent survey*

Look at long-term career plan and Job satisfaction

Follow your interest & heart!

Thank you!
INFOCOMMUNICATION ENGINEERING

School of EEE
Nanyang Technological University

Teh Kah Chan
Assistant Chair (Academic), EEE

10 March 2017
Infocommunication Engineering

Three Specializations

- Communication Engineering
- Digital Media Processing
- Computer Engineering
Digital Media Processing

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

Infocomm Engineering

Multimedia

Digital Media

Computer

Communication

Consumer Electronics

Contents (digital)
Smart Phone as an Example

Coding
- Transmission
- Storage

Pre-Processing
- Enhance quality
- Reduce cost

Analysis
- Speech Recognition
- Bar Code Analysis
- Song Identification

Synthesis
- Sound Synthesizer
- 2D & 3D Graphics

Post-Processing
- Enhance quality
- Reduce cost
Prescribed Elective Courses in Infocomm – 3rd Year

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE3012</td>
<td>Communication Principle</td>
</tr>
<tr>
<td>EE3014</td>
<td>Digital Signal Processing</td>
</tr>
<tr>
<td>EE3017</td>
<td>Computer Communications</td>
</tr>
</tbody>
</table>

Select any two courses

Recommendation:

- Communication Engineering: EE3012 + EE3017
- Computer Engineering: EE3014 + EE3017
- Digital Media Processing: EE3012 + EE3014
# Elective Courses in Infocomm Engineering – 4th Year

## Design elective courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>EE4105</td>
<td>Cellular communication system design</td>
</tr>
<tr>
<td>EE4109</td>
<td>Wireless system design</td>
</tr>
<tr>
<td>EE4110</td>
<td>Optical communication system design</td>
</tr>
<tr>
<td>EE4413</td>
<td>DSP system design</td>
</tr>
<tr>
<td>EE4717</td>
<td>Web application design</td>
</tr>
<tr>
<td>EE4718</td>
<td>Enterprise network design</td>
</tr>
</tbody>
</table>

## Technical elective courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE4001</td>
<td>Software engineering</td>
</tr>
<tr>
<td>EE4152</td>
<td>Digital communications</td>
</tr>
<tr>
<td>EE4153</td>
<td>Telecommunication systems</td>
</tr>
<tr>
<td>EE4188</td>
<td>Wireless communications</td>
</tr>
<tr>
<td>EE4190</td>
<td>Introduction to modern radar</td>
</tr>
<tr>
<td>EE4455</td>
<td>Embedded systems</td>
</tr>
<tr>
<td>EE4475</td>
<td>Audio signal processing</td>
</tr>
<tr>
<td>EE4476</td>
<td>Image processing</td>
</tr>
<tr>
<td>EE4478</td>
<td>Digital video processing</td>
</tr>
<tr>
<td>EE4483</td>
<td>Artificial intelligence and data mining</td>
</tr>
<tr>
<td>EE4490</td>
<td>Multimedia systems</td>
</tr>
<tr>
<td>EE4756</td>
<td>Computer architecture</td>
</tr>
<tr>
<td>EE4758</td>
<td>Information security</td>
</tr>
<tr>
<td>EE4761</td>
<td>Computer networking</td>
</tr>
<tr>
<td>EE4791</td>
<td>Database systems</td>
</tr>
</tbody>
</table>
Infocomm Industry in Singapore

Total Infocomm Industry Revenue, 2010 - 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (S$Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>82.8</td>
</tr>
<tr>
<td>2011</td>
<td>94.5</td>
</tr>
<tr>
<td>2012</td>
<td>113.3</td>
</tr>
<tr>
<td>2013</td>
<td>156.3</td>
</tr>
<tr>
<td>2014</td>
<td>167.1</td>
</tr>
<tr>
<td>2015</td>
<td>189.6</td>
</tr>
</tbody>
</table>

Source: IDA Singapore

Note: Figures were revised due to a change in methodology and may be different from previously published figures.
Infocomm Employment in Singapore

**Employed Infocomm Manpower, 2013 - 2015, Annual**

<table>
<thead>
<tr>
<th>Year</th>
<th>Manpower</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>146,700</td>
<td>1.7%</td>
</tr>
<tr>
<td>2014</td>
<td>150,200</td>
<td>2.4%</td>
</tr>
<tr>
<td>2015</td>
<td>172,800</td>
<td>15.0%</td>
</tr>
</tbody>
</table>

15% growth 2014 to 2015

Source: IDA's Annual Survey on Infocomm Manpower

**Employed Infocomm Manpower by Organisation Type, 2013 - 2015, Annual**

- **2013**:
  - Infocomm Organisations: 48%
  - End-user Organisations: 52%
  - Total: 146,700

- **2014**:
  - Infocomm Organisations: 49%
  - End-user Organisations: 51%
  - Total: 150,200

- **2015**:
  - Infocomm Organisations: 60%
  - End-user Organisations: 50%
  - Total: 172,800

Source: IDA's Annual Survey on Infocomm Manpower

Note: End-user organisations refer to organisations that are not classified under the infocomm industry.
Career Opportunities of EEE Graduates with Infocommunication Engineering

- Research Centres
- Consumer Electronics Industry
- Communications & Broadcasting
- Infocomm – Computers & Comms.
- Government & Statutory Boards
- Banking & Financial Institutions
- Private Communication Networks

- IME, I2R, DSTA, DSO, CSIT, DSI, MNC R&D
- Siemens, NEC, HP, Agilent, OKI, Sony, Creative, Philips, Infineon
- SingTel, StarHub, M1, Agilis, Ericsson
- IBM, HP, Lucent, Siemens, NEC, Fujitsu, Phillips
- iDA, PSA, HDB, MRTC, Singapore Power
- Banks, Stock Exchanges, Financial Institutions
- Petrochemical Companies, Private MNC Networks
Industries that requires Infocomm

- Siemens
- Philips
- Panasonic
- HP
- DSO National Laboratories
- SingTel
- StarHub
- Microsoft
- IBM
- KOEI Tecmo
- DSTA Defence Science & Technology Agency
- LUCASFILM Animation Singapore
- Ubisoft

Infocomm Engineering
Third Year Elective Talk
10 March 2017

Electrical and Systems Engineering (ECAL)

by
John Chan
For Electrical and Systems Engineering Option

Choose 2 pre-specialized Major Prescribed Electives courses in Third Year as follows:

EE3010  Electrical Devices and Machines ¹
EE3011  Modelling and Control ²
EE3015  Power Systems and Protection ³

1,3 - Pre-requisites for all final year power subjects: EE4503, EE4504, EE4530, EE4532, EE4534

2 - Pre-requisite for 2 final year control subjects: EE4265, EE4273

Final Year Technical Electives with Pre-requisites (PR)
EE4503 Power Engineering Design (PR: EE3010, EE3015)
EE4504 Design of Clean Energy Systems (PR: EE3010, EE3015)
EE4530 Power System Analysis and Control (PR: EE3010 EE3015)
EE4532 Power Electronics and Drives (PR: EE3010, EE3015)
EE4534 Modern Distribution Systems with Renewable Resources (PR: EE3010, EE3015)

EE4265 Process Control Systems (PR: EE3011)
EE4273 Digital Control Systems (PR: EE3011)
How to choose the 2 pre-specialized Major Prescribed Electives?

*If students do not intend to take any final year courses in power, then only EE3011 and EE3010\(^*\) are needed. (\(^*\) -recommended)

*If students intend to take at least 1 final year course in power and no final year courses in control (with PR), then only EE3010 and EE3015 are needed.

*If students intend to take final year courses in both power and control (with PR), then they must take EE3010, EE3011 and EE3015 (one of these must be registered as a UE).

=====================================================================

EE3010 Electrical Devices and Machines \(^1\)
EE3011 Modelling and Control \(^2\)
EE3015 Power Systems and Protection \(^3\)

1,3 - Pre-requisites for all power subjects: EE4503, EE4504, EE4530, EE4532, EE4534
2 - Pre-requisite for 2 control subjects: EE4265, EE4273
The courses to be taken in the final year

- 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.
For Electrical and Systems Engineering Option

**Design Elective Courses**

EE4207 Control Engineering Design (PR: Nil)
EE4208 Intelligent System Design (PR: Nil)
EE4503 Power Engineering Design (PR: EE3010, EE3015)
EE4504 Design of Clean Energy Systems (PR: EE3010, EE3015)
EE4901 Biomedical Control System Design (PR: Nil)
EE4902 Design of Medical Information Processing Systems (PR: Nil)
Technical Elective Courses

EE4001 Software Engineering (PR: Nil)
EE4265 Process Control Systems (PR: EE3011)
EE4266 Computer Vision (PR: Nil)
EE4268 Robotics and Automation (PR: Nil)
EE4273 Digital Control Systems (PR: EE3011)
EE4285 Computational Intelligence (PR: Nil)
EE4530 Power Systems Analysis and Control (PR: EE3010, EE3015)
EE4532 Power Electronics and Drives (PR: EE3010, EE3015)
EE4534 Modern Distribution Systems with Renewable Resources (PR: EE3010, EE3015)
EE4903 Physiological Systems Analysis (PR: Nil)
EE4904 Biomedical Instrumentation (PR: Nil)
EE4840 Biophotonics (PR: Nil)
Final Year Specialization

- Biomedical Electronics
- Power and Clean Energy
- Intelligent Systems and Control Engineering
Biomedical Electronics [1]

What is Biomedical Engineering?

- Biomedical Engineering is a multiple disciplines and high technology area
- It is to provide solutions for health care industries and services
- Electrical engineers play a key role in health care industries and services (circuits and electronics, measurement and instrumentation, information and signal processing, medical imaging and image processing, modelling and control, telemedicine)
- Biomedical Engineering is exciting
- It is important: Health caring and life saving
- It is profound and challenging (Nobel prizes in medicine in 1979, for the development of computed tomography (CT) and in 2003 for the development of magnetic resonance Imaging (MRI))
- It is high tech
- Health care industry is robust and resilient in the economic crisis
Where do biomedical engineers work?

- Research institutions
- Hospitals
- Academic institutions/government boards
- Companies
- Sale and marketing of medical instruments and products
Biomedical Electronics

Design courses
EE4901 Biomedical Control System Design (PR: Nil)
EE4902 Design of Medical Information Processing Systems (PR: Nil)

Technical Elective Courses
EE4903 Physiological Systems Analysis (PR: Nil)
EE4904 Biomedical Instrumentation (PR: Nil)
EE4840 Biophotonics (PR: Nil)
EE4265 Process Control Systems (PR: EE3011)
EE4266 Computer Vision (PR: NIL)
Power and Clean Energy [2]

- Power is a basic necessity....Can you think of anything in life without ELECTRICITY (POWER) ?
- Importance of power engineers
- What do they do?
- Power system control, building services & electrical consulting, energy traders/brokers, power electronics, energy alternatives & renewable energy, intelligent energy system, oil refineries and related companies
- Registered as a professional engineer (PEng) with PEB
Career Opportunities

- Oil refineries
- Building services
- Electrical consulting companies
- Power equipment sales
- Engineering firms
- Hospitals
- Shipyards
- Singapore Power, MINDEF, SMRT, PSA, JTC, CAAS, LTA
Power and Clean Energy

Design courses
EE4503 Power Engineering Design (PR: EE3010, EE3015)
EE4504 Design of Clean Energy Systems (PR: EE3010, EE3015)

Technical Elective Courses
EE4530 Power Systems Analysis and Control (PR: EE3010, EE3015)
EE4532 Power Electronics and Drives (PR: EE3010, EE3015)
EE4534 Modern Distribution Systems with Renewable Resources (PR: EE3010, EE3015)
EE4265 Process Control Systems (PR: EE3011)
EE4273 Digital Control Systems (PR: EE3011)
Intelligent Systems and Control Engineering [3]

- CONTROL is the heart of many engineering systems and it synergistically integrates the plants (electro-mechanical, chemical, etc), with sensors, actuators, computers, communication, and software to yield optimal responses.

- Control systems enables integrations of mechanics, electronics, and computer hardware and software to revolutionize technology in the new economy.
Control engineers have multi-disciplinary engineering system perspectives to take advantage of exciting career opportunities in

- Robotics and automated manufacturing
- Aerospace and automotive industries
- Precision engineering and manufacturing
- Process industries (petrochemical processes, pharmaceuticals and biotechnology processes, energy (including alternative energy) systems, environment and water treatment processes, food production processes)
- Building automation
Intelligent Systems and Control Engineering

Design courses
EE4207 Control Engineering Design (PR: Nil)
EE4208 Intelligent System Design (PR: Nil)

Technical Elective Courses
EE4265 Process Control Systems (PR: EE3011)
EE4266 Computer Vision (PR: Nil)
EE4268 Robotics and Automation (PR: Nil)
EE4273 Digital Control Systems (PR: EE3011)
EE4285 Computational Intelligence (PR: Nil)
Thank You!