OUTLINE

- IERG & MIEG Curricula
  - Major required & IE elective courses
- New IE courses
- IE courses offered in 2015-16
- IE Streams of Specialization
- Q&A
ENGG YEAR 1 MAJOR CORE

Semester 1

- MATH1510
  Calculus
- PHYS1110/1003
  Engineering Physics I
- ENGG1100
  Engineering Design Lab

Semester 2

- ENGG1410
  Engineering Mathematics I
- ENGG1110
  Problem Solving by Programming

One more Faculty Science Course:

Chemistry Courses: CHEM1070, 1280, 1380
Life Science Courses: LSCI1001, 1003
Physics Courses: ENGG2520, PHYS1110
Other Courses: CSCI1120, CSCI1130, SEEM2460
IERG/MIEG YEAR 2 MAJOR REQUIRED (13/14)

**Semester 3**
- **ENGG2420**
  Engineering Mathematics II
- **CSCI2100**
  Data Structures
- **IERG2051**
  Signals and Systems
- **IERG2060 (elective)**
  Basic Analog and Digital Circuits
- **MATH2010**
  Advanced Calculus I
- **MATH1050**
  Foundations of Modern Mathematics

**Semester 4**
- **ENGG2430**
  Engineering Mathematics III
- **ENGG2600**
  Technology, Society and Engineering
- **ENGG2310**
  Principles of Communication Systems
- **IERG3820**
  Communication Laboratory
- **MATH2020**
  Advanced Calculus II
  (MATH2040 Linear Algebra II)

FACULTY  IERG  MIEG (additional)
<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
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</thead>
<tbody>
<tr>
<td>IERG3310 Computer Networks</td>
<td>IERG3060 Microcontroller and Embedded Systems</td>
</tr>
<tr>
<td>IERG3921 Information Engineering Lab</td>
<td>IERG3810 Microcontroller and Embedded Systems Laboratory</td>
</tr>
<tr>
<td>IERG3080 Software Engineering and Practices</td>
<td></td>
</tr>
<tr>
<td>MATH2050 Algebraic Structures</td>
<td>MATH2040 Linear Algebra II</td>
</tr>
<tr>
<td>MATH2230 Complex Variables with Applications</td>
<td>MATH2070 Mathematical Analysis I</td>
</tr>
</tbody>
</table>

(ELEG3230 & IERG3810 are elective courses for MIEG)
IERG/MIEG YEAR 2 MAJOR REQUIRED (14/15)

Semester 3

- ENGG2460
  Complex Numbers, Differential Equations & Discrete Mathematics
- CSCI1140 (1 unit)
  Programming Laboratory
- IERG2060
  Basic Analog and Digital Circuits
- MATH2010
  Advanced Calculus I
- MATH1050
  Foundations of Modern Mathematics

Semester 4

- ENGG2430
  Probability & Statistics
- ENGG2601 (2 units)
  Technology, Society and Engineering
- ENGG2602 (1 unit)
  Engineering Practicum
- CSCI2100
  Data Structure
- IERG2051
  Signals and Systems
- MATH2020
  Advanced Calculus II

FACULTY IERG MIEG (additional)
<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>➤ ENGG2310 Principles of Communication Systems</td>
<td>➤ IERG3060 Microcontrollers and Embedded Systems</td>
</tr>
<tr>
<td>➤ IERG3820 Communication Laboratory</td>
<td>➤ IERG3810 Microcontrollers and Embedded Systems Laboratory</td>
</tr>
<tr>
<td>➤ IERG3310 Computer Networks</td>
<td>➤ MATH2040 Linear Algebra II</td>
</tr>
<tr>
<td>➤ IERG3800 (1 unit) Information Infrastructure Design Lab</td>
<td>➤ MATH2070 Mathematical Analysis I</td>
</tr>
<tr>
<td>➤ IERG3080 Software Engineering and Practices</td>
<td>(IERG3060 &amp; IERG3810 are elective courses for MIEG)</td>
</tr>
<tr>
<td>➤ MATH2050 Algebraic Structures</td>
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</tr>
<tr>
<td>➤ MATH2230 Complex Variables with Applications</td>
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</tr>
</tbody>
</table>

(IERG3060 & IERG3810 are elective courses for MIEG)
IERG/MIEG YEAR 4 MAJOR CORE

Semester 7

- ENGG4998
  Final Year Project I

Semester 8

- ENGG4999
  Final Year Project II

- Two-semester Final Year Project (FYP)
- Project selection in April for next academic year
- Professor suggested topics
- Student proposed topics
- Poster presentations in December and May
MAJOR ELECTIVES

- IERG: at least 17 units
  - At least 12 units from IE Major Elective List
  - The rest (5 units) can be either from IE Major Elective List or from 3000-coded courses from all other programmes under Engineering Faculty

- MIEG: at least 9 units from the given MIEG major elective list
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 3150</td>
<td>Introduction to Operating Systems</td>
</tr>
<tr>
<td>ENGG 1820</td>
<td>Engineering Internship</td>
</tr>
<tr>
<td>ENGG 4030</td>
<td>Web and Information Analytics</td>
</tr>
<tr>
<td>IERG 3010</td>
<td>Digital Communications</td>
</tr>
<tr>
<td>IERG 3050</td>
<td>Simulation and Statistical Analysis</td>
</tr>
<tr>
<td>IERG 3280</td>
<td>Networks: Technology, Economics, and Social Interactions</td>
</tr>
<tr>
<td>IERG 3300</td>
<td>Introduction to Stochastic Processes</td>
</tr>
<tr>
<td>IERG 3320</td>
<td>Social Media and Human Information Interaction</td>
</tr>
<tr>
<td>IERG 3830</td>
<td>Product Design Project</td>
</tr>
<tr>
<td>IERG 4020</td>
<td>Telecommunication Switching and Network Systems</td>
</tr>
<tr>
<td>IERG 4030</td>
<td>Optical Communications</td>
</tr>
<tr>
<td>IERG 4080</td>
<td>Building Scalable Internet-based Services</td>
</tr>
<tr>
<td>IERG 4090</td>
<td>Network Protocols and Systems</td>
</tr>
<tr>
<td>IERG 4100</td>
<td>Wireless Communication Systems</td>
</tr>
</tbody>
</table>
MAJOR ELECTIVES

IERG 4110  Hands-on Wireless Communications
IERG 4130  Introduction to Cyber Security
IERG 4160  Image and Video Processing
IERG 4180  Network Software Design and Programming
IERG 4190  Multimedia Coding and Processing
IERG 4210  Web Programming and Security
IERG 4220  Secure Software Engineering
IERG 4230  Introduction to Internet of Things
IERG 4320  Programming Big Data Systems
IERG 4831  Networking Laboratory I
IERG 4841  Networking Laboratory II
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>IERG 5040</td>
<td>Lightwave System Technologies</td>
</tr>
<tr>
<td>IERG 5090</td>
<td>Advanced Networking Protocols and Systems</td>
</tr>
<tr>
<td>IERG 5100</td>
<td>Advanced Wireless Communications</td>
</tr>
<tr>
<td>IERG 5124</td>
<td>Signal Analysis and Application</td>
</tr>
<tr>
<td>IERG 5140</td>
<td>Lightwave Networks</td>
</tr>
<tr>
<td>IERG 5154</td>
<td>Information Theory</td>
</tr>
<tr>
<td>IERG 5200</td>
<td>Channel Coding and Modulation</td>
</tr>
<tr>
<td>IERG 5240</td>
<td>Applied Cryptography</td>
</tr>
<tr>
<td>IERG 5270</td>
<td>Advanced Topics in P2P Networks and Systems</td>
</tr>
<tr>
<td>IERG 5280</td>
<td>Mobile Networking</td>
</tr>
<tr>
<td>IERG 5290</td>
<td>Network Coding Theory</td>
</tr>
<tr>
<td>IERG 5300</td>
<td>Random Processes for Engineers</td>
</tr>
<tr>
<td>IERG 5310</td>
<td>Security &amp; Privacy in Cyber Systems</td>
</tr>
<tr>
<td>IERG 5320</td>
<td>Digital Forensics</td>
</tr>
<tr>
<td>IERG 5330</td>
<td>Network Economics</td>
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IERG3320 Social Media and Human Information Interaction

- Social media is one of the main sources of big data. This course aims to enable students to understand about social media and the interaction between human and information.

- It  
  1) examines the social and human dimensions of social media;  
  2) introduces the theories, models, and analysis techniques related to social media and human information interaction; and  
  3) discusses how to integrate theories and concepts into social media and human information interaction into the analytics and visualization of big data.

- Topics include: foundations of social media, human cognition and information behavior, online communities, and social interactions, as well as infographic and big data visualization.
IERG4080 Building Scalable Internet-Based Services

- Mobile devices have greatly increased the demand of Internet-based services. Large-scale online services such as Pinterest and Instagram must be designed in a way such that they can be scaled up and scaled out in a rapid and seamless manner.

- This course will teach students how to build scalable online services and applications. In particular, the design principles and engineering considerations for different core components, including the front-end system, the load-balancer, performance monitoring, content-delivery networking, fault-tolerant mega data store, distributed messaging services, backend big data processing/analytics will be discussed.

- As a course project, the students will prototype a scalable Internet service by leveraging industrial-strength component offerings from leading infrastructure and platform service providers.

- Advisory note: Students are expected to have background in object-oriented programming.
IERG4110 Hands-on Wireless Communications

- The focus of this course will be on the design, implementation, and evaluation of a digital wireless communication link.
- Software-defined wireless communication platforms, e.g., USRP (universal software radio peripheral), will be used as a teaching tool. A two-hour laboratory period will complement the usual two-hour lecture period each week.
- The students will learn how to transmit, receive, analyze, and process RF wireless signals. The main topics may include: Introduction to SDR, USRP, and common programming software (GNU Radio and NI LabVIEW); Baseband QAM Modulation and Demodulation; Channel Estimation; Synchronization; Frequency Offset Estimation and Correction; OFDM Modulator and Demodulator; OFDM Synchronization, Frequency Offset Compensation, Channel Tracking, and etc.
- Advisory note: It is advisable for students to have had digital communications background or take digital communications course (IERG3010) at the same time as this course.
IERG4230 Introduction to Internet of Things

- The course introduces the principles, architectures and applications of Internet of Things (IoT) systems, which enable the networking and interaction of smart objects via various communication technologies.

- The design issues to be discussed include: smart object identification/positioning/tracking, smart sensors, data communication technologies for IoT, machine-to-machine communications and protocols, methodologies for large-scale sensing-data collection and analysis, system optimization and the related socio-economic impact.

- Emerging applications of IoT in various fields such as healthcare, energy management, transportation/urban dynamics, inventory control, building/home automation, environmental monitoring/control, will also be studied.

Videos:
1. In A Grocery Store
2. A day in the life of the Internet of Things
3. Smart Home
“The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure” (From Wiki).

Naming ➔ name
Sensing ➔ 5 sense organs
Processing ➔ brain
Communication ➔ language

IOT is more like a Human Society
THE NEXT STEP IN INTERNET EVOLUTION

Pre-internet + Internet of CONTENT + Internet of SERVICES + Internet of PEOPLE + Internet of THINGS

H2H + WWW + WEB 2.0 + SOCIAL WEB + M2M

Unit-wise, the potential is significant
Computing Growth Drivers over Time, 1960-2030e

SMART GRID

Source: Company Data, Morgan Stanley Research
CYBER PHYSICAL SYSTEM

- Computation
- Information
- Communication
- Control

- Machine Learning
- Information Security
- Human-computer interaction
- Robotics
- Wireless Sensor Networks
- Control Systems
- Embedded Systems
- Real time Systems
- Cognitive Sciences
- Sensor Technology

- Sociology
- Behaviour
- Philosophy
- Psychology
IERG4330 Programming Big Data Systems

- The course aims to provide students with the hands-on experience needed for a successful career in Big Data in the information technology industry.

- Many of the assignments will be completed on massive publicly available data sets giving them appropriate experience with the algorithm, mainstream platforms and software tools needed to master programming for Big Data.

- The students will develop a solid background in provisioning, programming and applying Big Data systems and software.
Courses on Telecommunications and Information Processing

- **ENGG1410/2460/2430**
  - Engineering Math
- **IERG2051**
  - Signals and Systems
- **IERG2060**
  - Basic Analog and Digital Circuits
- **IERG3830**
  - Product Development Project
- **IERG3820**
  - Communication Laboratory
- **IERG3010**
  - Digital Communications
- **IERG3050**
  - Simulation and Statistical Analysis
- **IERG3060**
  - Microcontrollers and Embedded Systems
- **IERG3810**
  - Microcontrollers and Embedded Systems Lab
- **IERG3300**
  - Stochastic Process
- **IERG4020**
  - Telecommunication Switching and Network Systems
- **IERG4030**
  - Optical Communications
- **IERG4100**
  - Wireless Communication Systems
- **IERG4110**
  - Hands-on Wireless Communications
- **IERG4160**
  - Image and Video Processing
- **IERG4190**
  - Multimedia Coding and Processing
- **IERG4230**
  - Introduction to Internet of Things
- **IERG5040**
  - Lightwave System Technologies
- **IERG5124**
  - Signal Analysis and Applications
- **IERG5140**
  - Lightwave Networks
- **IERG5154**
  - Mobile Networking
- **IERG5154**
  - Information Theory
- **IERG5200**
  - Channel Coding and Modulation
- **IERG5280**
  - Network Coding Theory
- **IERG5290**
  - Network Coding Theory
- **IERG5300**
  - Random Processes for Engineers
IE MAJOR ELECTIVES TO BE OFFERED IN 2015-16

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>IERG3010</td>
<td>IERG4831</td>
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<tr>
<td>IERG3050</td>
<td>IERG4841</td>
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<td>IERG4030</td>
<td>IERG5240</td>
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<td>IERG4080</td>
<td>IERG3010</td>
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<td>IERG4090</td>
<td>IERG3280</td>
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<td>IERG4110</td>
<td>IERG4090</td>
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<td>IERG4130</td>
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<td>IERG4180</td>
<td>IERG4160</td>
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<td>IERG4190</td>
<td>IERG4210</td>
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<tr>
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<td>IERG4831</td>
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<td>ENGG4030</td>
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<td>IERG5040</td>
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<td>IERG5100</td>
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<td>IERG5200</td>
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IE STREAMS OF SPECIALIZATION

- Big Data: Systems and Applications
- Communications
- Cyber Security
- Internet Engineering
- Enrichment

To qualify for a stream of specialization, the student must complete at least 12 units from the electives listed under the stream.

A student who satisfies all the requirements of a stream of specialization may obtain a letter of certification from the department.
IE STREAMS OF SPECIALIZATION

Communications
IERG3010, 3280, 3300, 4020, 4030, 4100, 4110, 4130, 4230, 5040, 5100, 5200, 5280, 5330

Cyber Security
CSCI3150, IERG4130 (required), 4210, 4220, 5240, 5310, 5320

Internet Engineering
CSCI3150 (required), IERG3050, 3280, 3300, 4080, 4090, 4130, 4180, 4190, 4210, 4831, 4841, 5090, 5270, 5280

Enrichment
ENGG4030, IERG3010, 3050, 3280, 3300, 4100, 4190, 5154, 5200, 5270, 5290, 5300
### IE STREAMS OF SPECIALIZATION

**Big Data: Systems and Applications**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Notes</th>
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<tbody>
<tr>
<td>ENGG 4030</td>
<td>Web-scale Information Analytics</td>
<td>(Required)</td>
</tr>
<tr>
<td>IERG 3320</td>
<td>Social Media and Human Information Interaction</td>
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<td>IERG 4230</td>
<td>Introduction to Internet of Things</td>
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<tr>
<td>IERG 4330</td>
<td>Programming Big Data Systems</td>
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<tr>
<td>CSCI 3320</td>
<td>Fundamental of Machine Learning</td>
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<tr>
<td>CSCI 4180</td>
<td>Introduction to Cloud Computing and Storage</td>
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<td>CSCI 4190</td>
<td>Introduction to Social Networks</td>
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<tr>
<td>ELEG 5491</td>
<td>Introduction to Deep Learning</td>
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WHAT IS BIG DATA?

- **Big Data**, as a collective term, refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyze.

- Big Data is believed to give tremendous insights and predictive power to work and to lives if processed *intelligently*.
BIG DATA AND ANALYTICS

Data Management
- Knowledge
- Structured Data
- Unstructured Data

Advanced Analytics
- Traditional
  - Warehouse
  - Data Mart
  - Files
- Big Data
  - Hadoop
  - Hbase
  - Cassandra
  - Sqoop
- Analytic Methods
  - Data Mining
  - Text Analytics
  - Statistical Analysis
  - Forecasting
  - Simulation
  - Predictive Modeling
  - Optimization
  - Link Analysis
- Big Data
  - Mahout
  - MapReduce

Insight Consumption
- Human Intervention
  - Business Intelligence
    - Visual Analytics
    - Reporting
    - Traditional Analysis
    - Dashboard
  - Big Data Analysis
    - Pig
    - Hive
    - MapReduce

Intelligent Processes
BIG DATA APPLICATIONS IN TELECOM
Have a Happy Summer Vacation!!