# COURSE COUNSELING (FORYEARS 2, 3 & 4 IN 2023-24)

**Department of Information Engineering** 

August 4<sup>th</sup>, 2023



# OUTLINE

IERG & MIEG Curricula Major required & IE elective courses New IE courses IE courses offered in 2023-24 IE Streams of Specialization Discussion on some courses O&A

## ENGGYEAR I MAJOR CORE

Semester 1 (7/6)

## ▶ <u>MATHI510</u> (MATH1010)

Calculus

## ► ENGGIII0

Problem Solving by Programming

FOUNDATION

#### ► IERG1000

FACULTY

Introduction to Information Engineering

## Semester 2 (13/9)

- ENGGII20 (MATHI030) Linear Algebra for Engineers
- ENGGII30 (MATHI050) Multivariable Calculus for
  - Engineers
- ► IERG2080
  - Introduction to System Programming
- ► IERG2060

IERG

- Analog and Digital Circuits
- ► IERG1810 (1 unit)
  - Electronic Circuit Laboratory
- At least 3 units from
  - ENGG1310, PHYS1001/1002/1111, STAT1011

MIEG

IERG/MIEG YEAR 2 MAJOR REQUIRED

### Semester 3 (11/12)

### ▶ <u>ENGG2440</u>

**Discrete Mathematics for Engineers** 

### ENGG2720 (2 units)

Complex Number for Engineers

► IERG2051 (MIEG2051)

Signals and Systems

► CSCI2100

Data Structures

► MATH2010

Advanced Calculus I

MATH2040

Linear Algebra II

At least 3 units from
 AIST1110, CSCI1120, CSCI1130, IERG1080





- Semester 4 (10/13)
- IERG2470 (MIEG2440)

Probability Models and Applications

▶ IERG2310

Principles of Communication Systems

► IERG3310

**Computer Networks** 

- IERG3820 (1 unit)
  - **Communication Laboratory**
- D MATH2020
  - Advanced Calculus II
- ► IERG2080

Introduction to System Programming IERG2060

Analog and Digital Circuits

IERG 810 (1 unit) Electronic Circuit Laboratory

IERG

MIEG

IERG3800 (I unit)
IERG3800 (I unit)
IERG3800 (I unit)

Information Infrastructure Design Lab

► IERG3080

Software Engineering and Practices

▶ IERG3060

Microcontrollers and Embedded Systems

### ▶ IERG3810 (1 unit)

Microcontrollers and Embedded System Laboratory

 At least 3 units from CSCI1120, CSCI1130, ENGG1310, ENGG2740, ENGG2780, FTEC2101, SEEM2460
 CSCI2100

Data Structures

MATH2050

Mathematical Analysis I

**Complex Variables with Applications** 

► MATH2070

**Algebraic Structures** 

Semester 6 (1/10)

- IERG3840 or IERG3842 (1 unit)
   Web/Mobile Applications Development
- **> |ERG2810**

Principles of Communication Systems

- **Computer Networks**
- ► IERG3820 (I unit)

Communication Laboratory

▶ MATH2060

Mathematical Analysis II

## **IERG/MIEG YEAR 4 MAJOR CORE**

### Semester 7 (3/10)

 IERG4998 Final Year Project I
 CSCI3160 Design & Analysis of Algorithms
 IERG3800 (1 unit) Information Infrastructure Design Lab
 IERG3080 Software Engineering and Practices Semester 8 (3/3)

IERG4999
 Final Year Project II

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

## **CHANGES TO IERG2602**

IERG2602 will NO LONGER be offered.

 Course substitution:
 Either
 IERG3840 Web Application Development Project (I unit)
 (It cannot be used to substitute CSCI2720 Building Web Applications which is required for CS Minor)
 OR
 IERG3842 Mobile Application Development Project (I unit)

#### IERG 3840 Web Application Development Project

This hands-on project-oriented lab introduces the fundamental concepts, architectures, tools, languages, and frameworks in web applications development and deployment. After a series of lectures that cover the fundamentals, students will self-learn via online resources a set of language/tool/framework to design and implement a web application in multiple phases. This lab emphasizes on educating our students the fundamentals and empowers them to acquire skills/knowledge of specific language/tool/framework via self-learning so that they can adapt and tackle the future technological advances through life-long learning.

#### IERG3842 Mobile Application Development Project

This hands-on project-oriented lab introduces the fundamental concepts, development tools, application frameworks, application components, multithreading and basic network programming in mobile network applications development and deployment. After a series of lectures that cover the fundamentals, students will self-learn via online resources a set of language/tool/framework to design and implement a mobile network application in multiple phases. This lab emphasizes on educating our students the fundamentals and empowers them to acquire skills/knowledge of specific language/tool/framework via self-learning so that they can adapt and tackle the future technological advances through life-long learning.

## MAJOR ELECTIVES

- IERG: at least 16 units
  - At least 13 units from IE Major Elective List
- The rest (3 units) can be either from IE Major Elective List or from 3000-coded or above courses from all other programmes under Engineering Faculty
- MIEG: at least 12 units
  - At least 6 units from IE Major Elective List
    - At least 3 units from MATH Major Elective List
      - At most 3 units from 3000-coded courses or above from AIST/CSCI/FTEC/SEEM/STAT and ENGG5xxx.

# **IE MAJOR ELECTIVES**

- **CSCI 3150** Introduction to Operating Systems
- **CSCI 3160** Design and Analysis of Algorithms
- **ENGG 1820** Engineering Internship
- IERG 3010 Digital Communications
- **IERG 3050** Simulation and Statistical Analysis
- **IERG 3280** Networks: Technology, Economics, and Social Interactions
- **IERG 3300** Introduction to Stochastic Processes
- **IERG 3320** Social Media and Human Information Interaction
- IERG 3830 Product Design Project
- **IERG 4004** E-payment Systems and Cryptocurrency Technologies
- **IERG 4030** Optical Communications
- IERG 4060 Real-time Embedded Systems
- IERG 4080 Building Scalable Internet-based Services
- **IERG 4090** Network Protocols and Systems
- **IERG 4100** Wireless Communication Systems

# **IE MAJOR ELECTIVES**

**IERG 4110** Hands-on Wireless Communications IERG 4120 Functional Programming **IERG 4130** Introduction to Cyber Security **IERG 4150** Introduction to Cryptography **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 4300** Web and Information Analytics IERG 4320 Data Science in Practice **IERG 4330** Programming Big Data Systems IERG 4340 Emerging Technologies in IE **IERG 4350** Cloud Computing Security **IERG 4360** Blockchain and Applications IERG 4831 Networking Laboratory I IERG 4841 Networking Laboratory II IERG 4851 Cyber Security Laboratory

- **IERG 5020** Telecommunication Switching and Network Systems
- **IERG 5090** Advanced Networking Protocols and Systems
- **IERG 5100** Advanced Wireless Communications
- IERG 5110 Signal Processing in Wireless Communications and Sensing
- **IERG 5130** Probabilistic Models and Inference Algorithms for Machine Learning
- **IERG 5154** Information Theory
- **IERG 5200** Channel Coding and Modulation
- **IERG 5230** Algorithms and Realization of Internet of Things Systems
- **IERG 5240** Applied Cryptography
- IERG 5254 Network Information Theory
- **IERG 5280** Mobile Networking
- **IERG 5290** Network Coding Theory
- **IERG 5300** Random Processes for Engineers
- **IERG 5310** Security & Privacy in Cyber Systems
- **IERG 5320** Digital Forensics
- **IERG 5340** IT Innovation and Entrepreneurship
- IERG 5350 Reinforcement Learning
- IERG 5360 Program Represent, Modeling and Understanding for Software Security
- IERG 5380 Quantum Information Processing
- IERG 5400 Theory of Probability
- **IERG 5590** Advances in Blockchains

## MAJOR ELECTIVES FOR MIEG

At least 12 units, at least 6 units from List A, at least 3 units from List B and at most 3 units from List C

A. CSCI3130, CSCI3150/ESTR3102, CSCI3230/ESTR3108, CSCI3320, 5320 (or MATH3260), ENGG1820, IERG3010/ESTR3300, IERG3050, 3060, IERG3280/ESTR3302, IERG3300/ESTR3304 (or MATH4240), IERG3320/ESTR3306, IERG3810, 3830, IERG4004/FTEC4004, IERG4030/ESTR4320, IERG4080/ESTR4312, IERG4090/ESTR4302, IERG4100/ESTR4304, IERG4110/ESTR4314, IERG4130/CSCI4130/ESTR4306, IERG4150/ESTR4322, IERG4160, IERG4180/ESTR4308, IERG4190, 4210, 4220, 4230, IERG4300/ESTR4300, IERG4320/ESTR4324, IERG4330/ESTR4316, IERG4340, 4350, IERG4360/ESTR4326, IERG4831, 4841, 5020, IERG5040/ENGG5392, IERG5090, IERG5100/ENGG5303, IERG5110, 5130, 5140, IERG5154/ENGG5301, IERG5200 (or MATH4260), IERG5230, IERG5240/ENGG5383, IERG5254, 5280, 5290, IERG5300/ENGG5302, IERG5310, 5320, 5330, 5340, 5350, 5360, 5380, 5400, 5590

- MATH3010, 3030, 3040, 3070, 3080, 3093, 3215, 3230, 3270, 3290, 3310, 3320, 3330, 3360, 4010, 4020, 4030, 4230, 4280
- C. AIST course(s) at 3000 and 4000 level, CSCI course(s) at 3000 and above level, ENGG course(s) at 5000 level, FTEC course(s) at 3000 and above level, SEEM course(s) at 3000 and above level, STAT course(s) at 3000 and above level

#### IERG 1080 Introduction to Python for Engineering Applications

Nowadays, many applications are written with the help of the Python programming language. This course aims to provide some hands-on experience with Python. Topics include the basic Python programming language syntax, Python data types and objects, Python functions, Python modules, basic Python data science tools (including the NumPy, the Pandas and the SciPy packages), basic Python visualization tools (including the Matplotlib and the Seaborn packages), multi-threaded programming and Python database tools. As part of this course, students will complete a project on a topic relevant to Engineering applications, such as web applications, data analysis, security and cryptography.

#### IERG 4060 Real-time Embedded Systems

Real-time embedded systems are special embedded systems that must meet certain realtime requirements. Typical examples of real-time embedded systems include autonomous driving systems, smart manufacturing systems, transportation control systems, etc. Due to the real-time constraints, special hardware architecture and software structure should be used during the development of a real-time embedded system, including the use of direct memory access (DMA), memory management policy, task scheduling, inter-task communication, etc. This course will introduce the important concepts and development techniques of real-time embedded systems, including the following major topics:

1. Important concepts of real-time embedded systems, such as: hard real-time vs. software real-time constraints, periodic vs. aperiodic vs. sporadic events, event-driven vs. time-driven state transitions, preemptive vs. non-preemptive scheduling, etc.

2. Introduction to unique features of real-time operating systems (RTOS) compared with general-purpose operating systems (GPOS), in terms of task scheduling, resource allocation, etc.

3. Using the  $\mu$ C/OS-II and FreeRTOS to introduce the programming model of real-time embedded systems, including software structure, task assignment, inter-task synchronization and communication (e.g., semaphores, message queue), memory usage and management, and so on.

4. Testing, debugging and performance bench-marking of real-time embedded systems.

### IERG 4120 Functional Programming

Functional Programming is an important programming paradigm based on lambdacalculus. It has been widely used by many finance and trading companies (e.g., Jane Street) as well as big IT companies (e.g., Google, Facebook). Different from the imperative programming paradigm based on Turing Machines to specify the exact operation in each step, functional programming performs computation through evaluation and composition of expressions. These differences of the underlying computation model lead to many unique features, including algebraic data types, pattern matching, high-order functions, etc., and such features may help developers solve certain computation problems more efficiently. This course will introduce the following core topics about the functional programming paradigm:

- 1. Lambda Calculus
- 2. Data types, such as tuples, lists, records, variants, and algebraic data types
- 3. Pattern matching
- 4. Function as the first-class citizen and high-order functions
- 5. Recursive Function and Tail Recursion
- 6. Modular programming
- 7. Imperative programming inside functional programming
- 8. Advanced functional data types, e.g., hash tables, trees, sequences, monads
- 9. Typical algorithms in functional programming
- 10. Real-world applications of functional programming

#### IERG 4320 Data Science in Practice

Data science is a cross-disciplinary study involving informatics, machine learning, and statistics. This course adopts a problem driven approach to discuss various components in the pipeline of a data science project and the applications in various real-life examples. Topics include, but not limited to, Python programming, data pre-processing, feature selection, common machine learning algorithms and data visualization.

#### **IERG 4360** Blockchain and Applications

The course introduces the basic underlying cryptographic concepts of blockchain as a powerful tool to support distributed ledgers in all digital transactions. The significances of trust, anonymity, and consensus mechanisms are discussed. The course further explores the applications of blockchain and smart contracts in various practical applications, including financial services, distributed systems, and specific domains such as smart city, healthcare, logistics and supply chains, etc.

### IERG 4851 Cyber Security Laboratory

Learning cyber security is more than the grasp of security concepts, principles, theories and methodologies. An excellent cyber security professional needs lots of hands-on training before being able to solve real world problems independently. This is a companion laboratory course that extends the scope of IERG4130 (Introduction to Cyber Security) and aims to teach students how to use existing tools to solve cyber security problems. This course will also serve as the introductory training course for the Capture-the-Flag (CTF) competition so that our students can achieve better results in local, regional and international CTF competitions. The whole lab course will be organized around six topics:

- 1. Cryptography
- 2. Reverse Engineering
- 3. Web Exploitation
- 4. Binary Exploitation
- 5. Forensics
- 6. Miscellaneous problems

For each of the topics above, the students will learn the typical vulnerability types and attacking methods, as well as the commonly used tools for vulnerability discovery and exploitation, followed by solving given problems with those tools and techniques.

# MAJOR GPA

#### **IERG:**

AIST/BMEG/CENG/CSCI/EEEN/ELEG/ENGG/ESTR/FTEC/IERG/MAEG/SEEM required and major elective courses at 2000 and above level will be included in the calculation of Major GPA for honours classification excluding courses in Faculty Package and Foundation courses.

#### **MIEG:**

AIST/BMEG/CENG/CSCI/EEEN/ELEG/ENER/ENGG/ESTR/IERG/MAEG/MATH/ MIEG/SEEM/STAT required and major elective courses at 2000 and above level as well as MATH1030/1038 and 1050/1058 will be included in the calculation of Major GPA for honours classification, excluding courses in Faculty Package and Foundation courses.

### **Courses on Telecommunications and Information Processing**

#### ENGG1410 IERG2470

Engineering Math/ Probability Models

#### IERG2051

**Signals and Systems** 

#### **IERG2060**

Basic Analog and Digital Circuits

**IERG3830** 

**Product Development** 

**Project** 

#### IERG2310

Principles of Communication

IERG3820

Communication Laboratory

Digital Communications

IERG3050

Simulation and Statistical Analysis

#### IERG3060

Microcontrollers & Embedded Systems

#### **IERG3810**

Microcontrollers & Embedded Systems Lab

**IERG3300** 

**Stochastic Process** 

#### **IERG3280**

Networks: Technology, Economics & Social Interactions

#### **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

### IERG5200

Channel Coding and Modulation

**IERG5154** 

Information Theory

IERG5290

**Network Coding Theory** 

**IERG5040** 

Lightwave System Technologies

**IERG5140** 

**Lightwave Networks** 

**IERG5280** 

**Mobile Networking** 

**IERG5240** 

Algorithms & Realization in IoT

**IERG5300** 

Random Processes for Engineers **Courses on Software, Computer Networking, Cyber Security, Big Data** 

#### **IERG3320**

Social Media and Human Information Interaction

Problem Solving by Programming

**ENGG1110** 

**CSCI2100** 

**Data Structures** 

#### **IERG2080**

Introduction to System Programming

#### **IERG4300**

Web-scale Information Analytics

#### **IERG3280**

Networks: Technology, Economics & Social Interactions

**IERG3080** 

Software Engineering and Practices

### IERG3310

**Computer Networks** 

#### **CSCI3150**

Introduction to Operating Systems

#### IERG4330

Programming Big Data Systems

#### **IERG4090**

Network Protocols and Systems IERG4180

Network Software Design and Programming

**IERG3800** 

Information Infrastructure Lab IERG4831/4841

**Networking Laboratories I/II** 

**IERG4080** 

Building Scalable Internet-based Services

IERG4130

IERG4210

Web Programming and Security

**IERG4220** 

Secure Software Engineering

#### **IERG4230**

Introduction to Internet of Things

#### **IERG5090**

Advanced Networking Protocols and Systems

**IERG5270** 

Advanced Topics in P2P Networks and Systems

**IERG5280** 

**Mobile Networking** 

**IERG5240** 

Applied Cryptography

**IERG5310** 

Security & Privacy in Cyber Systems

**IERG5320** 

**Digital Forensics** 

**IERG5330** 

**Networks Economics** 

**IERG5130** 

Probabilistic Models and Inference Algorithms for Machine Learning

# IE MAJOR REQUIRED & ELECTIVES TO BE OFFERED IN 2023-24

### **First Semester**

- > IERG3050
- ≻ IERG3300
- ≻ IERG3320
- > IERG4100
- ➢ IERG4120
- ➢ IERG4130
- > IERG4150
- > IERG4180
- > IERG4190
- > IERG4230
- ➢ IERG4300
- > IERG4320
- ➢ IERG4360

- >IERG1000
- >ENGG1110
- >ENG2440
- >ENGG2720
- >CSC12100
- >IE**F**C2051
- **2 MIEC2051**
- >1ERC30160
- >IERG3080
- ≻IERG3310
- ≻IERG3800

### **Second Semester**

- > IERG1080
- > IERG3010
- > IERG3280
- ➢ IERG3830
- > IERG4004
- > IERG4030
- ≻ IERG4080
- > IERG4090
- ≻ IERG4160
- > IERG4210
- > IERG4220
- ≻ IERG4330
- ➢ IERG4350
- > IERG4831
- ➢ IERG4841

- ≻ ENGG1120
- > ENGG1130
- > IERG2080/ESTR2306
- > IERG2060
- > IERG1810
- > IERG2310
- **> IERG3820**
- > IER(6)247/0
- > MIEG2440
- ➤ IERG3310
- ≻ IERG3840
- > IERG3842

## **IE STREAMS OF SPECIALIZATION**

- Communications
- Internet Engineering
- Cyber Security

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- Information Science
  - **Big Data: Systems and Applications**
- On voluntary basis.
- 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**

#### **Big Data: Systems and Applications**

CSCI3320, CSCI4180/ESTR4106, CSCI4190, ELEG5491, IERG3320/ESTR3306, IERG4080/ESTR4312, IERG4120/ESTR4328, IERG4160, 4230, IERG4300/ESTR4300 (required), IERG4320/ESTR4324, IERG4330/ESTR4316, IERG5130, 5350

#### Communications

IERG3010/ESTR3300, IERG3280/ESTR3302, IERG3300/ESTR3304, IERG4030/ESTR4320, IERG4060, IERG4100/ESTR4304, IERG4110/ESTR4314, IERG4130/CSCI4130/ESTR4306, IERG4230, 4340, 4851, 5020, IERG5040/ENGG5392, IERG5100/ENGG5303, IERG5110, 5200, 5230, 5280, 5330

#### Cyber Security

CSCI3150/ESTR3102, IERG4004/FTEC4004, IERG4120/ESTR4328, IERG4130/CSCI4130/ESTR4306 (required), IERG4150/ESTR4322, IERG4210, 4220, 4350, IERG4360/ESTR4326, IERG4851, IERG5240/ENGG5383, IERG5310, 5320, 5360, 5590

#### Internet Engineering

CSCI3150/ESTR3102 (required), IERG3050, IERG3280/ESTR3302, IERG3300/ESTR3304, IERG4080/ESTR4312, IERG4090/ESTR4302, IERG4130/CSCI4130/ESTR4306, IERG4180/ESTR4308, IERG4190, 4210, 4831, 4841, 4851, 5090, 5280

#### Information Science

CSCI3160/ESTR3104, IERG3010/ESTR3300, IERG3050, IERG3280/ESTR3302, IERG3300/ESTR3304, IERG4100/ESTR4304, IERG4190, IERG4300/ESTR4300, IERG4320/ESTR4324, IERG5154/ENGG5301, IERG5200, 5254, 5290, 5380, 5400

## ELITE (ENGINEERING LEADERSHIP, INNOVATION, TECHNOLOGY AND ENTREPRENEURSHIP) STREAM

#### Elective Courses:

- I5 units of courses:
  - (i) 12 units of ESTR courses of which at most 6 units of courses at 1000 or 2000 level and at least 6 units of courses at 3000 or 4000 level
  - (ii) 3 units of BMEG/CENG/CSCI/ELEG/ENGG/IERG/MAEG/SEEM courses at 5000 level

# **CS MINOR**

Students are required to complete a minimum of 18 units of courses, with at least 6 units at 3000 or above level, as follows:

Units

12

3

3

18

- 1. Required Courses: CSCI2510, 2520, 2720, 3100
- 2. Elective Courses:
- (a) CSCI1510, 1520, 1530, 1540
- (b) CENG3150, CENG3430/ESTR3100, CSCI1020, 1030, 1040, 1050, CSCI2110/ENGG2440/ESTR2004, CSCI2120, 2800, 3120, 3130, CSCI3150/ESTR3102, CSCI3160/ESTR3104, CSCI3170, CSCI3180/ ESTR3106, CSCI3190, 3220, CSCI3230/ESTR3108, CSCI3250, 3260, 3280, 3310, 3320, 3420, 4120, 4140, CSCI4180/ESTR4106, CSCI4190, 4210, 4220

Explanatory Notes:

 Course(s) in Column A are equivalent to course(s) in Column B and can be used to fulfill the requirements of this Minor Programme.

Column A	Column B
CSCI1110/1120/1130/ESTR1100/1102	CSCI1510/1520/1530/1540
ENGG1110/ESTR1002	CSCI1510/1520/1530/1540
CENG2400/ELEG2401/3230/	CSCI2510
ESTR2100	
CSCI2100/ESTR2102	CSCI2520
MATH2210 and 2220	CSCI1530
PHYS2061	CSCI1530

 Other than CSCI2520, 2720 and one of the courses from CSCI1510, 1520, 1530 and 1540, students cannot use the same course to fulfill requirements of both Minor in Computer Science and Minor in Web and Cloud Computing.

\*\*IE students must at least take 3 units CS course to fulfill CS minor. (Required by CSE Dept)

IERG3080	CSCI3100
IERG3060	CSCI2510









