

## BACHELOR OF COMPUTER SCIENCE (COMPUTER NETWORKS & SECURITY) WITH HONOURS

### PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Computer Networks & Security) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru and is based on a 2-Semester per academic session.

The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years. Generally, students are expected to undertake courses equivalent to between twelve (12) to eighteen (18) credit hours per semester. Assessment is based on coursework and final examinations given throughout the semester.

#### General Information

1. Awarding Institution	Universiti Teknologi Malaysia			
2. Teaching Institution	Universiti Teknologi Malaysia			
3. Programme Name	Bachelor of Computer Science (Computer Network and Security) with Honours			
4. Final Award	Bachelor of Computer Science (Computer Network and Security) with Honours			
5. Programme Code	SECRH			
6. Professional or Statutory Body of Accreditation	Ministry of Higher Education			
7. Language(s) of Instruction	English			
8. Mode of Study (Conventional, distance learning, etc)	Conventional			
9. Mode of operation (Franchise, self-govern, etc)	Self-governing			
10. Study Scheme (Full Time/Part Time)	Full Time			
11. Study Duration	Minimum: 4 years (8 semesters) Maximum: 6 years (12 Semesters)			
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	20	14	14
Short	-	-	-	-

## Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses		
	a. General	10	
	b. Language	8	17.6%
	c. Co-Curriculum	3	
	d. IT Entrepreneurship	2	
ii.	Core Courses	74	56.5%
iii.	Elective Courses	34	25.9%
	<b>Total</b>	<b>131</b>	<b>100%</b>
<b>Total Credit Hours to Graduate</b>		<b>131 credit hours</b>	

## Award Requirements

To graduate, students must:

- i. Achieve a total of 131 credit hours with minimum CPA of 2.0
- ii. Pass industrial training (equivalent to 12 credit hours), which 4 credits will be graded and 8 credits as HW (Compulsory Attendance) status.
- iii. Complete Computer Networks & Security Final Year Project.
- iv. Pass 5 Professional Skills Certificate (PSC).

## Programme Educational Objectives (PEO)

After having exposed to 3 to 5 years working experience, our graduates should become professionals who demonstrate the following competencies:

Code	Intended Educational Objectives
PEO 1	Obtain employment in local and global industries and organization, where they are competent in applying the fundamental knowledge, computational principles and skills in computer network and security areas.
PEO 2	Demonstrate the ability to learn and grow throughout their career and further contribute to the advancement of the computer network and security discipline.
PEO 3	Develop software of increasing size and complexity, proficiently applying computer network and security theoretical knowledge across different application.
PEO 4	Become leaders or technopreneurs in computer science discipline.
PEO 5	Demonstrate an awareness of professional ethics and social responsibility as computer scientist.

## Programme Learning Outcomes (PLO)

After having completed the programme, graduates should be able to demonstrate the following competencies:

Code	Intended Learning Outcomes
PLO1 (KW)	Attain advanced knowledge to solve critical issues of a field in Computing.
PLO2 (CG)	Critically solve and manage complex problems using systematic approaches.
PLO3 (PS)	Adapt technical and scientific skills to solve problems in a field of Computer Network and Security.
PLO4 (IPS)	Demonstrate effective collaboration with stakeholders professionally.
PLO5 (CS)	Use a broad range of information, media and technology to support study.
PLO6 (DS)	Competently use digital technologies and software to support research works or studies.
PLO7 (NS)	Analyse numerical and graphical data using quantitative or qualitative tools in solving problems.
PLO8 (LAR)	Demonstrate leadership, autonomy and responsibility in conducting and managing research and resources.
PLO9 (PRS)	Self-advancement through continuous academic or professional development.
PLO10 (ENT)	Initiate entrepreneurial project with relevant knowledge and expertise.
PLO11 (ETS)	Demonstrate respectable ethical conducts and professionalism skills in an organization and society.

## COURSE MENU

YEAR 1 (SEPTEMBER)			
Code	Course	Credit	Pre-requisite
SECI1013	Discrete Structure	3	
SECJ1013	Programming Technique I	3	
SECP1513	Technology & Information System	3	
SECR1013	Digital Logic	3	
UHMT1012	Graduate Success Attributes	2	
MALAYSIAN STUDENTS			
UHS1012	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban	2	
INTERNATIONAL STUDENTS			
UHS1022	Philosophy and Current Issues	2	
UHMS1182	Appreciation of Ethics and Civilisation		
UHLM1012	Malaysia Language for Communication 2	2	
<b>TOTAL CREDITS</b>		<b>18</b>	
<b>CUMULATIVE CREDITS</b>		<b>18</b>	

YEAR 1 (FEBRUARY)			
Code	Course	Credit	Pre-requisite
SECI1113	Computational Mathematics	3	
SECJ1023	Programming Technique II	3	SECJ1013
SECI2143	Probability & Statistical Data Analysis	3	
SECR2033	Computer Organisation and Architecture	3	SECR1013
SECV2113	Human Computer Interaction	3	
UHLB1112	English Communication Skills*	2	
<b>TOTAL CREDITS</b>		<b>17</b>	
<b>CUMULATIVE CREDITS</b>		<b>35</b>	

Notes: Students with minimum score of IELTS Band 5.5, TOEFL 525, TOEFL iBT 60, CEFR B2 and MUET Band 4 can apply for credit exemption for UHLB1112.

YEAR 2 (SEPTEMBER)			
Code	Course	Credit	Pre-requisite
SECR1213	Network Communications (CCNA1)	3	SECR1013
SECD2523	Database	3	
SECD2613	System Analysis and Design	3	
SECJ2013	Data Structure and Algorithm	3	SECJ1023
SECR2043	Operating Systems	3	
UKQF2xx2	Service Learning Co-curriculum Elective	2	
<b>TOTAL CREDITS</b>		<b>17</b>	
<b>CUMULATIVE CREDITS</b>		<b>52</b>	

YEAR 2 (FEBRUARY)			
Code	Course	Credit	Pre-requisite
SECV1223	Web Programming	3	SECD2523
SECJ2154	Object Oriented Programming	4	SECJ1023
SECJ2203	Software Engineering	3	
SECR2242	Computer Networks (CCNA2)	2	SECR1213
SECR2941	Computer Networks Lab	1	SECR1213
SECR3413	Computer Security	3	SECR2043
UHLB2122	Academic Communication Skills	2	UHLB1112
<b>TOTAL CREDITS</b>		<b>18</b>	
<b>CUMULATIVE CREDITS</b>		<b>70</b>	

YEAR 3 (SEPTEMBER)			
Code	Course	Credit	Pre-requisite
SECJ3553	Artificial Intelligence	3	SECJ2013
SECR3104	Applications Development	4	SE, DB, Web, CS
SECR3242	Internetworking Technology (CCNA3 & 4)	2	SECR2242
SECR3941	Internetworking Technology Lab	1	SECR2941
SECR3443	Introduction to Cryptography	3	SECR3413
UHLB3132	Professional Communication Skills	2	UHLB2122
UHLx1112	Foreign Language Elective	2	
UKQT3001	Extracurricular Experiential Learning	1	
<b>TOTAL CREDITS</b>		<b>18</b>	
<b>CUMULATIVE CREDITS</b>		<b>88</b>	

YEAR 3 (FEBUARY)			
Code	Course	Credit	Pre-requisite
SECR3032	Computer Network & Security Project I	2	SECR3104
SECJ3203	Theory of Computer Science	3	SECI1013
SECD3761	Technopreneurship Seminar	1	
UBSS1032	Introduction to Entrepreneurship	2	
SECRxxx3	SECR Elective 1	3	
UHIT2302	Science and Technology Thinking	2	
Uxxx2xx2	General University Elective Course	2	
<b>TOTAL CREDITS</b>		<b>15</b>	
<b>CUMULATIVE CREDITS</b>		<b>106</b>	

YEAR 4 (SEPTEMBER)			
Code	Course	Credit	Pre-requisite
SECR4114	Industrial Training Report	4	92 credits CGPA >= 2.0
SECR4118	Industrial Training (HW)	8	
<b>TOTAL CREDITS</b>		<b>12</b>	
<b>CUMULATIVE CREDITS</b>		<b>118</b>	

YEAR 4 (FEBRUARY)			
Code	Course	Credit	Pre-requisite
SECR4134	Computer Network & Security Project II	4	SECR3032
SECRxxx3	SECR Elective 2	3	
SECx5xx3	PRISMS Elective 1		
SECRxxx3	SECR Elective 3	3	
SECx5xx3	PRISMS Elective 2		
SECRxxx3	SECR Elective 4	3	
SECx5xx3	PRISMS Elective 3		
SECRxxx3	SECR Elective 5	3	
SECx5xx3	PRISMS Elective 4		
<b>TOTAL CREDITS</b>		<b>16</b>	
<b>CUMULATIVE CREDITS</b>		<b>131</b>	

<b>SECR Elective Courses (CHOOSE 5)</b>			
<b>Code</b>	<b>Course</b>	<b>Credit</b>	<b>Pre-requisite</b>
SECR3223	High Performance & Parallel Computing	3	SECJ1023
SECR3253	Network Programming	3	SECJ1013
SECR3263	Wireless Sensor Network	3	SECR2242
SECR4453	Network Security	3	SECR2242
SECR4483	Secure Programming	3	SECR3443
SECR4973	Special Topics on Computer Network & Security	3	

### **PRISMS ELECTIVE COURSES**

For students who intend to enrol in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme. The PRISMS elective begins with code SECP/J/R5XX3.

### **GRADUATION CHECKLIST**

To graduate, students must pass all the stated courses in the course menu including the 5 compulsory Professional Skills Certificate Courses. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the course are not eligible to graduate.

<b>NO.</b>	<b>CODE</b>	<b>COURSE</b>	<b>CREDIT EARNED (JKD)</b>	<b>CREDIT COUNT-ED (JKK)</b>	<b>TICK (✓) IF PASSED</b>
<b>COMPUTER SCIENCE COURSES</b>					
<b>CORE COURSES (74 CREDITS)</b>					
1	SECI1013	Discrete Structure	3	3	
2	SECJ1013	Programming Technique I	3	3	
3	SECR1013	Digital Logic	3	3	
4	SECP1513	Technology & Information System	3	3	
5	SECI1113	Computational Mathematics	3	3	
6	SECI2143	Probability & Statistical Data Analysis	3	3	
7	SECJ1023	Programming Technique II	3	3	
8	SECR2033	Computer Organisation and Architecture	3	3	
9	SECD2523	Database	3	3	

10	SECD2613	System Analysis and Design	3	3	
11	SECJ2013	Data Structure and Algorithm	3	3	
12	SECR1213	Network Communications	3	3	
13	SECV2113	Human Computer Interaction	3	3	
14	SECJ2203	Software Engineering	3	3	
15	SECV1223	Web Programming	3	3	
16	SECR2043	Operating Systems	3	3	
17	SECJ2154	Object Oriented Programming	4	4	
18	SECR3032	Computer Networks and Security Project I	2	2	
19	SECJ3203	Theory of Computer Science	3	3	
20	SECR4118	Industrial Training	8	HW	
21	SECR4114	Industrial Training Report	4	4	
22	SECR4134	Computer Networks and Security Project II	4	4	
23	SCSD3761	Technopreneurship Seminar	1	1	
<b>ELECTIVES COURSES (34 CREDITS)</b> – Choose SECR3104 and 10 other elective courses from the following list (which can include up to maximum of 4 PRISMS courses, for qualified students)					
<b>SECR ELECTIVES COURSES</b>					
24	SECR3104	Applications Development	4	4	
25	SECJ3553	Artificial Intelligence	3	3	
26	SECR2242	Computer Networks	2	3	
27	SECR2941	Computer Networks Lab	1	3	
28	SECR3241	Internetworking Technology	2	4	
29	SECR3941	Internetworking Technology Lab	1	3	
30	SECR3413	Computer Security	3	3	
31	SECR3443	Cryptography	3	3	
32	SECR3223	High Performance & Parallel Computing	3	3	
33	SECR3253	Network Programming	3	3	
34	SECR3263	Wireless Sensor Network	3	3	
35	SECR4453	Network Security	3	3	
36	SECR4483	Secure Programming	3	3	
37	SECR4973	Special Topics on Computer Network & Security	3	3	
<b>PRISMS ELECTIVES COURSES</b>					
38	SECR5013	Cryptographic Engineering	3	3	
39	SECR5023	Digital Forensics	3	3	
40	SECR5033	Information Security Governance and Risk Management	3	3	
41	SECR5043	Cloud Computing Security	3	3	
42	SECR5053	Penetration Testing	3	3	
43	SECJ5013	Secure Software Engineering	3	3	
44	SECJ5023	Advanced Theory of Computer Science	3	3	



45	SECJ5033	Advanced Data Structure and Algorithms	3	3	
46	SECJ5043	Advanced Artificial Intelligence	3	3	
47	SECP5013	Advanced Analytics for Data Science	3	3	
48	SECP5023	Big Data Management	3	3	
49	SECP5033	Business Intelligence and Analytics	3	3	
50	SECP5043	Data Science Governance	3	3	
51	SECP5053	Massive Mining and Streaming	3	3	
52	SECP5063	Statistics for Data Science	3	3	
<b>TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)</b>			<b>108</b>	<b>100</b>	
<b>UNIVERSITY GENERAL COURSES</b>					
<b>Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)</b>					
For Malaysian Students					
1	UHS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
For International Students					
1	UHS1022	Falsafah dan Isu Semasa	2	2	
	UHMS1182	Penghayatan Etika dan Peradaban			
2	UHLM1012	Malaysia Language for Communication	2	2	
<b>Cluster 2: Generic Skills</b>					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
2	UHMT1012	Graduate Success Attributes	2	2	
<b>Cluster 3: Knowledge Enhancement</b>					
1	UHIT2302	The Thought of Science and Technology	2	2	
<b>Cluster 4: Co-Curriculum and Service Learning</b>					
1	UKQF2xx2	Service Learning Co-curriculum Elective	2	2	
2	UKQT3001	Extracurricular Experiential Learning	1	1	
<b>Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)</b>					
1	UHLB1122	English Communication Skills	2	2	
2	UHLB2122	Academic Communication Skills	2	2	
3	UHLB3132	Professional Communication Skills	2	2	
4	UHLx1112	Foreign Language Elective	2	2	
<b>Other University Electives</b>					
1	Uxxx2xx2	Any 1 course from Cluster 2 or Cluster 3	2	2	

<b>TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)</b>	23	23	
<b>TOTAL CREDIT TO GRADUATE (a + b + c)</b>	131	123	

#### OTHER COMPULSORY COURSES

No.	PSC COURSE	
<b>COMPULSORY COURSES</b>		
1	Design Thinking for Entrepreneur	
2	Talent and Competency Management	
3	English Communication Skills for Graduating Students (ECS)	
<b>ELECTIVE COURSES</b>		
4	Occupational Safety, Health & Environment (OSHE) ( <i>Compulsory to all FE students</i> )	
5.	Choose ONE elective course from the following list: 13. Data Analytics for Organization 14. Construction Measurement (Mechanical & Electrical Works) 15. Professional Ethics and Integrity 16. Other electives courses offered in future	

## **COURSE SYNOPSIS**

### **CORE COURSES**

#### **SECI1013 Discrete Structure**

This course introduces students to the principles and applications of discrete structure in the field of computer science. The topics that are covered in this course are set theory, proof techniques, relations, functions, recurrence relations, counting methods, graph theory, trees and finite automata. At the end of the course, the students should be able to use set theory, relations and functions to solve computer science problems, analyse and solve problems using recurrence relations and counting methods, apply graph theory and trees in real world problems and use deterministic finite automata finite state machines to model electronic devices and problems.

#### **SECI1113 Computational Mathematics**

This course is a combination of linear algebra and numerical methods as preparation for computer science student to apply mathematics knowledge in core knowledge of computer science. The first part of this course is an introduction to linear algebra. The topics that are covered in linear algebra are linear equations, linear combinations, linear independence, linear transformation, and vector spaces. The second part of this course covers numerical methods that can be used to solve non-linear equation, linear systems, eigenvalue problems, interpolation, differentiation and integration. At the end of the course, students should be able to apply mathematics knowledge to solve mathematical problems. Implementation of engineering tools such as MATLAB, would enhance student to use simple programming technique for solving mathematical problems.

#### **SECJ1013 Programming Technique I**

As a fundamental subject, this course equips the students with theory and practice on problem solving techniques by using the structured approach. Students are required to develop programs using C++ programming language, in order to solve simple to moderate problems. The course covers the following: pre-processor directives, constants and variables, data types, input and output statements, control structures: sequential, selection and loop, built-in and user-defined functions, single and two-dimensional arrays, file operations, pointers, and structured data types.

#### **SECJ1023 Programming Technique II**

**Pre-requisite:** SECJ1013 Programming Technique I

This course presents the concept of object orientation and object-oriented programming (OOP) techniques using the C++ programming language. It equips the students with the theory and practice on problem solving techniques using the object-oriented approach. It emphasizes on the implementation of the OOP concepts including encapsulations, associations and inheritance. At the end of this course, students should be able to apply the OOP techniques to solve problems.

### **SECP1513 Technology & Information System**

As a primer subject, this course will introduce students to information systems and technology (IS/IT), as well as its uses in daily life both at home and at work. Various aspects of IS/IT encompassing hardware, software, network, communications, internet, multimedia, graphics and systems applications will be introduced. Students will be equipped with basic skills in handling PC installation and productivity tools via practical work in the labs, which shall comprise a major part of the study. At the end of the course, student should be able to distinguish basic IS/IT component and applications.

### **SECR1013 Digital Logic**

Digital electronics is the foundation of all microprocessor-based systems found in computers, robots, automobiles, and industrial control systems. This course introduces the students to digital electronics and provides a broad overview of many important concepts, components, and tools. Students will get up-to-date coverage of digital fundamentals-from basic concepts to programmable logic devices. Laboratory experiments provide hands-on experience with the simulator software, actual devices and circuits studied in the classroom.

### **SECR1213 Network Communications**

This course will discuss the basic topics of computer network and data communications. Based on TCP/IP Internet protocol stack, the course will apply top down approach. Starts with the important and usage of computer network in commonly applications, the approach will go further detail in the technical aspect in data communication. At the end of this course, students will have an understanding and appreciation of how the network works.

### **SECV1223 Web Programming**

This course is designed to introduce students the fundamental of knowledge, technologies and components for web application developments. The basic topics includes the standard HTML for content creation, CSS for content presentation, JavaScript for client-side logics, PHP for server-side logics and MySQL for database processing. At the end of the course, the students should be able to apply the web base technologies and then implement it all in the creating functional data-centric online system project.

### **SECD2523 Database**

This course introduces students to the concept of database system and how it is used in daily human life and profession. The focus of the course is to equip students with the knowledge and skills on important steps and techniques used in developing a database, especially in the conceptual and logical database design phase. Among topics covered are database environment, database design, entity relationship diagram, normalization, and structured query language (SQL). Students will be taught to use a database management system (DBMS). Students are required to design and develop the database component of an information system using the learned techniques, DBMS and a development tool. At the end of the course, students should be able to apply the knowledge of designing and developing a good database system.

### **SECD2613 System Analysis and Design**

The main focus of this course is to provide a practical approach of systems analysis and designing skills for the students using structured methodology. Hence the course enables students to study information system requirements for any system application within an organizational context. The contents are sequentially organized directly from planning, analysis, designing and implementation phases. From the resulting output of the planning and analysis phase shall enable students to form input, output and interface design. Hence a prototype design can be demonstrated.

### **SECI2143 Probability & Statistical Data Analysis**

This course is designed to introduce some statistical techniques as tools to analyse the data. In the beginning the students will be exposed with various forms of data. The data represented by the different types of variables are derived from different sources; daily and industrial activities. The analysis begins with the data representation visually. The course will also explore some methods of parameter estimation from different distributions. Further data analysis is conducted by introducing the hypothesis testing. Some models are employed to fit groups of data. At the end of course the students should be able to apply some statistical models in analysing data using available software.

### **SECJ2013 Data Structure and Algorithm**

**Pre-requisite:**            **SECJ1023 Programming Technique II**

This course emphasis on data structure concepts theoretically and practically with detail algorithms for each of data structure. Students will learn abstract data type concepts using class and apply the concept in the implementation of data structures. Apart from it, student will learn recursive concept as a programming style and algorithm efficiency analysis with Big O notation. Various sorting and searching techniques will be discussed as data structure operations. Analysis of each algorithm will also be explained. Further, students will be exposed to linear data structures such as linked lists, stack and queue. Non-linear data structures such as tree and binary search tree will be discussed. Along the course, students should be able to implement and apply the theory and concepts of data structure in the assignments and mini project which are conducted in group.

### **SECJ2203 Software Engineering**

This course is designed to give students an introduction to an engineering approach in the development of high-quality software systems. It will discuss the important software engineering concepts in the various types of the common software process models. The students will also learn the concepts and techniques used in each software development phase including requirements engineering, software design and software testing. This course will also expose the students to utilizing object-oriented method (e.g. UML) and tools in analysing and designing the software. At the end of this course, students are expected to be able to appreciate most of the common software engineering concepts and techniques as well as producing various software artefacts, documentations, and deliverables.

### **SECJ2154 Object Oriented Programming**

**Pre-requisite:**       **SECJ1023 Programming Technique II**

This course presents the concepts of object orientation and object-oriented programming techniques using Java programming language. It provides students with a thorough look at the basic constructs of the Java programming language such as its basic data types and operations. It also emphasizes on the use of standard Java APIs that allow students to develop text-based and GUI applications. It will also provide the programming techniques on exception handling and input/output files. At the end of this course, students should be able to use the basic constructs in object-oriented programming and utilize the selected Java APIs.

### **SECR2033 Computer Organisation and Architecture**

**Pre-requisite:**       **SECR1013 Digital Logic**

This course was designed to give the understanding of basic concept of computer organization and architecture. Topics covered in this subject will be on computer performance, types of data and the representative, arithmetic manipulation, instruction execution, micro programmable control memory, pipelining, memory, input/output and instruction format. At the end of this course, the student should be able to understand the concept of overall computer component and realize the current technology in computer hardware.

### **SECR2043 Operating Systems**

This course covers introduction to operating systems, which serve as an interface between computer hardware and the user. The operating system is responsible for the management and coordination of processes, sharing of limited resources of the computer. Students will be exposed to the techniques and algorithms that may be applied in designing an operating system. Topics covered include process management, concurrency and synchronization, deadlock, memory management, file management, secondary storage management and I/O management. At the end of the course, the student shall have a clear understanding on the general concepts that underlie of an operating system.

### **SECV2113 Human Computer Interaction**

This course will introduce students to human-computer interaction theories and design processes. The emphasis will be on applied user experience (UX) design. The course will present an iterative evaluation centred UX lifecycle and will introduce a broader notion of user experience, including usability, usefulness, and emotional impact. The lifecycle should be viewed as template intended to be instantiated in many different ways to match the constraints of a particular development project. The UX lifecycle activities we will cover include contextual inquiry and analysis, requirements extraction, design-informing models, design thinking, ideation, sketching, conceptual design, and formative evaluation.

### **SECD3761 Technopreneurship Seminar**

This 1-credit course will provide module and training for students on how to generate digital income through crowdsourcing platforms and methods. Crowdsourcing is a method to generate online income which the work is offered and implemented digitally in global platforms.

### **SECJ3203 Theory of Computer Science**

**Pre-requisite:**        **SECI1013     Discrete Structure**

The goal of this course is to provide students with an understanding of basic concepts in the theory of computation. This course introduces students to formal languages and automata theory. It will emphasize on languages, grammars and abstract machines i.e. Regular Language, Context Free Language, Regular Grammar, Context Free Grammar, Finite Automata, Push Down Automata and Turing Machine. The course will also provide practice on the acceptability of input string by these machines. At the end of the course, students should be able to apply the theory in constructing these abstract machines and testing them with the right input strings.

### **SECR3032 Computer Networks & Security Project I**

**Pre-requisite:**        **SECR3104 Application Development**

This is the initial part of a 2-part Final Year Project that every student must fulfil successfully. Students are introduced to the methodologies of research and application development through a series of lectures. Students are guided through a step-by-step practice to complete the initial stages of proposal, planning and design of a project. Students must also meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their initial work.

### **SECR4118 Industrial Training (HW)**

**Pre-requisite:**        **92 credits AND CGPA  $\geq$  2.0**

Industrial Training refers to the placement of a student at an organization for a minimum of 20 weeks to elevate students' knowledge and skills in a specific database profession and at the same time produce graduates who are credible, creative and proficient. This course aims to provide a platform for the students apply their knowledge learned in the university and boost their skills which needed by a profession. It is also intended for the students to gain exposure in every aspect of real career life. The students will be evaluated based on two components; 1) student performance evaluation by organisation supervisor and 2) student performance evaluation by faculty supervisor. The organization supervisor is expected to assess the student performance based on work performance and student's personality. The assessment by faculty supervisor more focusing on students' generic skills.

### **SECR4114 Industrial Training Report**

**Pre-requisite:**        **92 credits AND CGPA  $\geq$  2.0**

Industrial Training Report refers to the placement of a student at an organization for a minimum of 20 weeks to experience and apply their theoretical knowledge in the industrial training. The students will be evaluated based on four components; 1) technical report, 2) oral presentation, 3) logbook and 4) ethics. The aim of the technical report is to educate the students in producing related technical report and able to explain a specific detail on the tasks that have been done during the training. Students need to follow specified format in writing the technical report and submit it within the predetermined date. The students are required to present their training achievement to Industrial Training supervisors (organization and supervisor). Students need to fill in the online logbook daily for the purpose of close monitoring between the students and

supervisors. Student also needs to practice the good ethical values and work conduct throughout the training. The passing mark is 60%.

### **SECR4134 Computer Networks & Security Project II**

#### **Pre-requisite: SECR3032 Computer Networks & Security Project I**

This is the second part of a 2-part Final Year Project that every student must fulfil successfully. In this installation, students are required to execute the next phases of their development plan from Part1. Students are now required to code and integrate the different modules that make up the proposed project. Students will test the developed modules and the final fully integrated project following software development and research testing practices. Students must meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their final work.

## **COMPULSORY PROGRAMME COURSES**

### **SECR2242 Computer Networks & SECR2941 Computer Networks Lab**

#### **Pre-requisite: SECR1213 Network Communications**

This course will discuss the routing and switching concepts in computer networking specifically in local area network (LAN). The course starts with the architecture, components and operation of routers and switches and furthermore discusses the operation of Virtual LAN (VLAN), Access control list (ACL) and Network Address Translation (NAT).

### **SECR3104 Applications Development**

#### **Pre-requisite: SECD2523 Database, SECV1213 Web Programming, SECJ2203 Software Engineering, SECR3413 Computer Security**

Application Development is a comprehensive service-learning course which requires student to solve a real community problem by developing an application. Students will learn how to practice design thinking, adopting Agile development methodology. This involves an iterative process starting from community engagement, requirement elicitation and analysis, design solution, application construction and iterative verification process. Students are required to do reflection on the outcome of the project. In this course students should be able to develop their soft skills such as leadership, team collaboration, documentation process and communication skill.

### **SECJ3553 Artificial Intelligence**

#### **Pre-requisite: SECJ2013 Data Structure and Algorithm**

This course offers students a new perspective on the study of Artificial Intelligence (AI) concepts. The essential topics and theory of AI are presented, but it also includes practical information on data input and reduction as well as data output (i.e. algorithm usage). In particular, this course emphasizes on theoretical and practical aspects of various search algorithms, knowledge representations, and machine learning methods. The course features practical implementations through assignments undertaken both individually and in groups



### **SECR3242 Inter-Network Technology & SECR3941 Inter-Network Technology Lab**

**Pre-requisite:**       **SECR2242 Computer Networks & SECR2941 Computer Networks Lab**

This course will discuss related to scaling and connecting networks in a wide area network (WAN). The course starts with enhancing LAN and discusses two most popular routing protocols i.e. EIGRP and OSPF. Furthermore, the course will cover on WAN interconnection, security issues and Quality of Service). At the end of this course, students will be able to design and configure enhanced VLAN, WAN connection and network troubleshooting

### **SECR3413 Computer Security**

**Pre-requisite:**       **SECR2043 Operating Systems**

This course helps to equip students with basic principles in computer security including its issues and requirements. It covers the topics of the threats to computer as well as other general security areas such as program and network, evaluating the relative risks of these threats and developing cost-effective and user-friendly countermeasures. At the end of this course, the student should gain some knowledge and experience with respect to the risks of secure computing.

### **SECR3443 Cryptography**

**Pre-requisite:**       **SECR3413 Computer Security**

This course will introduce the concepts of fundamental cryptography and its applications. The topics that will be covered are evolution of cryptography, number theory, information theory, symmetric and asymmetric cryptography and message authentication. Several cryptographic structures and the characteristics of the algorithms that provide the strength to the algorithms will also be discussed. At the end of the course, the student should be able to apply the knowledge in developing application with security features.

## **PROGRAMME ELECTIVE COURSES**

### **SECR3223 High Performance & Parallel Programming**

**Pre-requisite:**       **SECJ1023 Programming Technique II**

High performance computing/parallel computing is widely used, nowadays, to execute complex systems and computations of complex problems that need to be solved with minimal time as possible. This course introduces the students to architectures of parallel computers, parallel algorithm design and parallel application programming using MPI and OpenMP packages in C/C++ programming language. Student will experience hands-on programming practices on cluster computer.

### **SECR3253 Network Programming**

**Pre-requisite:**       **SECR1213 Network Communications**

This course covers various techniques and technologies to develop network applications. Topics cover from networking fundamentals, to remote procedure call, including TCP and UDP sockets, multicasting, multimedia network application, and peer-to-peer computing.

### **SECR3263 Wireless Sensor Network**

**Pre-requisite:**           **SECR1213 Network Communications**

This course will discuss on the topics of Wireless Sensor Networks (WSNs) technology, which collect information and pass the information via wireless networks to achieve a high level of desired monitoring and control in coordinated manners. In this course, the student will be exposed to various protocols proposed for WSNs based on top-down approach at each layer of OSI model. Furthermore, the analyses of advantages and disadvantages of those protocols and their applicability and performance in different application will be carried out. In this way the students will be exposed to the creation of technology as the evolution of different technologies before. At the end of this course the student will have an understanding in the area of Wireless Sensor Networks.

### **SECR4283 Network Analysis & Design Simulation**

**Pre-requisite:**           **SECR2242 Computer Networks**

This course presents the main ideas on how to study a LAN performance, to design a new computer network using latest technologies with basic security features, and how to forecast computer network performance using simulation technique with NS3 simulator.

### **SECR4433 Penetration Testing**

**Pre-requisite:**           **SECR2043 Operating System & SECR3413 Computer Security**

This course will discuss issues pertaining to penetration testing, finding vulnerabilities in various computer systems and exploiting them in an ethical manner. Emphasis is given on the fundamental theory and as well as hands on practice. Topics covered include information reconnaissance, web application pen testing, wireless pen testing, network pen testing, and mobile application pen testing.

### **SECR4453 Network Security**

**Pre-requisite:**           **SECR2941 Computer Networks Lab & SECR3413 Computer Security**

This course educates students about the overall security process based on a security policy design, implementation and management. Emphasis is placed on security technologies, products and solutions; and on firewall and secure router design, installation, configuration, and maintenance. The course covers authentication, authorization, and accounting (AAA) implementation using routers and firewalls and security the network at both Layer 2 and 3 of the OSI model, intrusion prevention system (IPS) and virtual private network (VPN) implementations using routers and firewalls. Finally, managing a secure network is also discussed during the lecture.

### **SECR4473 Security Management**

**Pre-requisite:**           **SECR3413 Computer Security**

The course is aimed at imparting knowledge and skill sets required to assume the overall responsibilities of administration and management of security of an enterprise information

system. This course covers issues related to administration and management of security of enterprise information systems. Topics include auditing and data management, risk management, contingency planning, incident handling and responses. The course will study in detail principles and tools related to these topics. The course will also cover security standards, evaluation and certification process; security planning, ethical and legal issues in information and privacy.

### **SECR4483 Secure Programming**

**Pre-requisite:**       **SECJ1023 Programming Technique II, SECR2043 Operating System  
SECR3413 Computer Security**

This course covers various techniques and technologies to develop secure applications using Java Programming Language. Topics cover from Basic Security Concepts to Authentication and Authorization, including Cryptography Fundamental, Keys & Certificates, Key Management, Message Digests, Digital Signatures, Cipher-based Encryption and SSL & HTTPS. At the end of this course student should be able to design and develop secure application based on current security technologies.

### **SECR4493 Computer Forensic**

**Pre-requisite:**       **SECR3413 Computer Security**

This course educates students on the overall computer forensic principles and practices. Emphasis is given on the fundamental knowledge of digital forensics investigations, such as types of crimes and evidences, basic computer investigation, evidence acquisition and legal and ethical issues. Hands on practice on selected tools are also added to give a more holistic view of an investigation process. Real case examples are studied and discussed to enhance critical and investigative thinking.

### **SECR4973 Special Topics on Network & Security**

**Pre-requisite:**       **Depends on the topic**

This course is aimed to expose students to specific topics in Computer networks and Security. Topics such as optical networks, wireless sensor networks and cloud computing will be discussed. Students will learn the concepts, application domain, trends and security challenges of these topics. Students will be given self-reading assignments to further enhance their understanding of the course. Student will learn how to write.