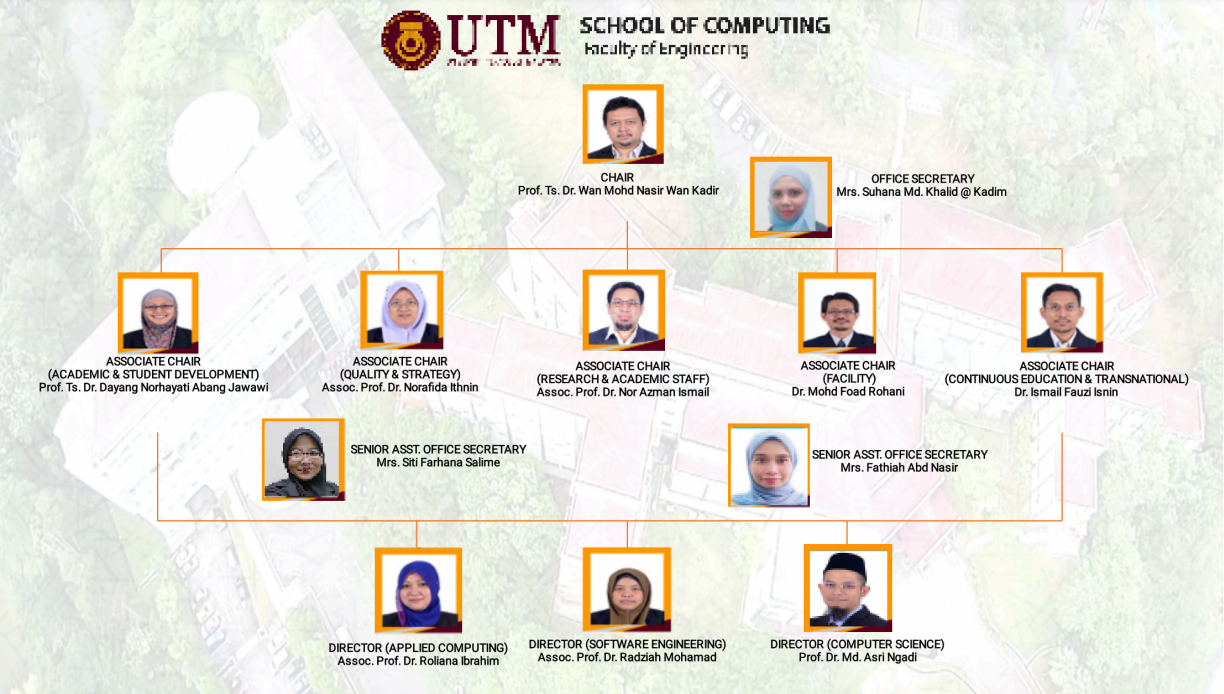
UNDERGRADUATE HANDBOOK

ACADEMIC SESSION 2021/2022

ADMINISTRATION TEAM



Position	Name
Chair	Professor Ts. Dr. Wan Mohd Nasir Wan Kadir wnasir@utm.my 07-5532000
Associate Chair (Academic and Student Development)	Professor Ts. Dr. Dayang Norhayati Abang Jawawi dayang@utm.my 07-5538768
Associate Chair (Research and Academic Staff)	Associate Professor Dr. Nor Azman Ismail azman@utm.my 07-5538772
Associate Chair (Quality and Strategy)	Associate Professor Dr. Norafida Ithnin afida@utm.my 07-5538767
Associate Chair (Continuous Education and TNE)	Dr. Ismail Fauzi Isnin ismailfauzi@utm.my 07-5538816
Associate Chair (Facility)	Dr. Mohd Fo'ad Rohani foad@utm.my 07-5538815
Director (Applied Computing)	Associate Professor Dr. Roliana Ibrahim roliana@utm.my 07-5538770
Director (Software Engineering)	Associate Professor Dr. Radziah Mohamad radziahm@utm.my 07-5538769
Director (Computer Science)	Professor Dr. Md Asri Ngadi dr.asri@utm.my 07-5538752

BACHELOR OF COMPUTER SCIENCE (BIOINFORMATICS) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Bioinformatics) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru. 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.

The programme is offered on full-time basis and is based on a 2-Semester per academic session. Generally, students are expected to undertake courses equivalent to between fourteen (14) to eighteen (18) credit hours per semester. Assessment is based on coursework and final examination 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 (Bioinformatics) with Honours	
4. Final Award			Bachelor of Computer Science (Bioinformatics) with Honours	
5. Programme Code			SECBH	
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 yrs (8 semesters) Maximum : 6 yrs (12 Semesters)	
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	20	8	14
Short	-	-	-	-

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses a. General b. Language c. Co-Curriculum d. IT Entrepreneurship	 10 8 3 2	17.6%
ii.	Core Courses	74	56.4%
iii.	Elective Courses	34	26.0%
	Total	**131**	**100%**
A	Engineering Courses (a) Lecture/Project/Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	Nil	Nil
	Total Credit Hours for Part A		
B	Related Courses (a) Applied Science/ Mathematic/ Computer (b) Management/Law/Humanities/ Ethics/Economy (c) Language (d) Co-Curriculum	Nil	Nil
	Total Credit Hours for Part B		
	Total Credit Hours for Part A and B	**Nil**	
	Total Credit Hours to Graduate	**131 credit hours**	

Award Requirements

To graduate, students must:

- Achieve a total of 131 credit hours with minimum CPA of 2.0.
- Pass industrial training (equivalent to 12 credit hours), which 4 credits will be graded and 8 credits as HW status.
- Complete Bioinformatics Project I and II.
- 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
PEO1	Obtain employment as computer scientist in local and global industries and organization, where they are competent in applying the fundamental knowledge, computational principles and skills in Bioinformatics to develop software of increasing size and complexity across different application areas.
PEO2	Demonstrate an ability to continue to learn throughout their career (i.e. professional, technical or postgraduate education) which can straighten their analytical and critical thinking skills to position them to advanced Computer Science and Bioinformatics and to contribute to the intellectual foundations of the Computer Science and Bioinformatics disciplines.
PEO3	Involve in Bioinformatics and related a number software project that they are proficient in applying theoretical computing and knowledge in analysing, modelling, designing, developing and evaluation computing and bioinformatics solutions.
PEO4	Becoming leaders or technopreneurs in computer science and bioinformatics disciplines with combination skills
PEO5	Demonstrate an awareness of professional ethics and social responsibility as computer scientists specialising in bioinformatics.

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 and Bioinformatics.
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 Bioinformatics.
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: SEMESTER 1			
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			
UHIS1022	Philosophy and Current Issues	2	
UHMS1182	Appreciation of Ethics and Civilizations	2	
INTERNATIONAL STUDENTS			
UHIS1022	Philosophy and Current Issues	2	
UHMS1182	Appreciation of Ethics and Civilizations		
UHLM1012	Malaysia Language for Communication 2	2	
	TOTAL CREDITS	**18**	
	CUMULATIVE CREDITS	**18**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECI1113	Computational Mathematics	3	
SECI1143	Probability & Statistical Data Analysis	3	
SECJ1023	Programming Technique II	3	SECJ1013
SECR1033	Computer Organization and Architecture	3	SECR1013
SExBxxx3	SECB Core Elective #1	3	
UHLB1112*	English Communication Skills	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**35**	
** 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: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECD2523	Database	3	
SECD2613	System Analysis and Design	3	
SECJ2013	Data Structure and Algorithm	3	SECJ1023
SECR2213	Network Communications	3	
SECV2113	Human Computer Interaction	3	
UKQFxxx2	Service-Learning Co-curriculum Elective	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**52**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECJ2203	Software Engineering	3	
SECV2223	Web Programming	3	
SECR2043	Operating Systems	3	SECR1033
SECJ2154	Object Oriented Programming	4	SECJ1023
UHLB2122	Academic Communication Skills	2	UHLB1112
SECBxxx3	SECB Core Elective #2	3	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**70**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
UHLB3132	Professional Communication Skill	2	UHLB2122
UHLx1112	Foreign Language Elective	2	
SECB3104	Applications Development	4	SECJ2203, SECD2523, SECV2223, SECJ2154
SECJ3553	Artificial Intelligence	3	SECJ2013
SECBxxx3	SECB elective 1	3	
SECBxxx3	SECB elective 2	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**87**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECB3032	Bioinformatics Project I	2	SECJ3104
SECJ3203	Theory of Computer Science	3	SECI1013, SECJ2013
UHIT2302	The Thought of Sciences and Technology	2	
UKQT3001	Extracurricular Experiential Learning (ExCEL)	1	
SExBxxx3	SECB elective 3	3	
SExBxxx3	SECB elective 4	3	
SExBxxx3	SECB elective 5	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**104**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECB4118	Industrial Training (HW)	8	92 credits CGPA >= 2.0
SECB4114	Industrial Training Report	4	
	TOTAL CREDIT	**12**	
	CUMULATIVE CREDITS	**116**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECB4134	Bioinformatics Project II	4	SECB3032
SECD3761	Technopreneurship Seminar	1	
UHAK1032	Introduction to Entrepreneurship	2	
Uxxx2xx2	General University Elective Course	2	
SExBxxx3	SECB elective 6	3	
SECx5xx3*	PRISM elective 1		
SExBxxx3	SECB elective 7	3	
SECx5xx3*	PRISM elective 2		
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**131**	
*PRISM elective courses are for PRISM students only. Information on PRISM can be found here: https://engineering.utm.my/prism/ For non-PRISM students, you can register any SECB elective course offered.			

SECB ELECTIVES (choose 7)			
Code	**Course**	**Credit**	**Pre-requisite**
SEBB4203	Protein Biomolecules	3	
SEBB4193	Gene and Protein Technology	3	
SECB3032	Bioinformatics II	3	
SECB3203	Programming for Bioinformatics	3	
SECB3213	Bioinformatics Database	3	
SECB3133	Computational Biology I	3	
SECB3223	Computational Biology II	3	
SECB4243	Special Topics in Bioinformatics	3	
SECB4213	Bioinformatics Visualization	3	
SECB4313	Bioinformatics Modeling and Simulation	3	

PRISMS ELECTIVE COURSES

For students who intend to enroll 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 SECJ5xx3 / SECP5xx3 / SECR5xx3.

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. 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 allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
COMPUTER SCIENCE COURSES					
CORE COURSES (74 CREDITS)					
1	SECI1013	Discrete Structure	3	3	
2	SECJ1013	Programming Technique I	3	3	
3	SECR1013	Digital Logic	3	3	
4	SCSP1513	Technology & Information System	3	3	
5	SECI1113	Computational Mathematics	3	3	
6	SCSI1143	Probability & Statistical Data Analysis	3	3	
7	SECJ1023	Programming Technique II	3	3	
8	SECR1033	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	SECR2213	Network Communications	3	3	
13	SECV2113	Human Computer Interaction	3	3	
14	SECJ2203	Software Engineering	3	3	
15	SECV2223	Web Programming	3	3	
16	SECR2043	Operating Systems	3	3	
17	SECJ2154	Object Oriented Programming	4	4	
18	SECB3032	Bioinformatic Project I	2	2	
19	SECJ3203	Theory of Computer Science	3	3	
20	SECB4118	Industrial Training	8	HL	
21	SECB4114	Industrial Training Report	4	4	
22	SECB4134	Bioinformatic Project II	4	4	
23	SECD3761	Technopreneurship Seminar	1	1	
ELECTIVES COURSES (34 CREDITS) *– Choose SECJ3104 and 10 other elective courses from the following list (which can include up to maximum of 4 PRISMS courses, for qualified students)*					
SECB ELECTIVES COURSES					
24	SECB3103	Bioinformatics I	3	3	
25	SECB3032	Bioinformatics II	3	3	
27	SECB3203	Programming for Bioinformatics	3	3	
28	SECB3213	Bioinformatic Database	3	3	
29	SECB3133	Computational Biology I	3	3	
30	SECB3223	Computational Biology II	3	3	
31	SECB4243	Special Topic in Bioinformatics	3	3	

32	SECB4213	Bioinformatics Visualization	3	3	
33	SECB4313	Bioinformatics Modeling and Simulation	3	3	
34	SECJ3104	Applications Development	4	4	
35	SECJ3553	Artificial Intelligence	3	3	
36	SECJ3303	Internet Programming	3	3	
37	SEBB4173	Cellular and Molecular Biology for Bioinformatics	3	3	
38	SEBB4203	Proteins Biomolecules	3	3	
39	SEBB4193	Gene and Protein Technology	3	3	
PRISMS ELECTIVES COURSES* *for PRISMS students only*					
40	SECR5013	Cryptographic Engineering	3	3	
41	SECR5023	Digital Forensics	3	3	
42	SECR5033	Information Security Governance and Risk Management	3	3	
43	SECR5043	Cloud Computing Security	3	3	
44	SECJ5013	Secure Software Engineering	3	3	
45	SECR5053	Penetration Testing	3	3	
46	SECJ5023	Advanced Theory of Computer Science	3	3	
47	SECJ5033	Advanced Data Structure and Algorithms	3	3	
48	SECJ5043	Advanced Artificial Intelligence	3	3	
49	SECP5013	Advanced Analytics for Data Science	3	3	
50	SECP5023	Big Data Management	3	3	
51	SECP5033	Business Intelligence and Analytics	3	3	
52	SECP5043	Data Science Governance	3	3	
53	SECP5053	Massive Mining and Streaming	3	3	
54	SECP5063	Statistics for Data Science	3	3	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			**108**	**100**	
UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
For Malaysian Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
For International Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
	UHMS1182	Penghayatan Etika dan Peradaban			
2	UHLM1012	Malaysia Language for Communication	2	2	
Cluster 2: Generic Skills					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
2	UHMT1012	Graduate Success Attributes	2	2	
Cluster 3: Knowledge Enhancement					
1	UHIT2302	The Thought of Science and Technology	2	2	

Cluster 4: Co-Curriculum and Service Learning					
1	UKQF2xx2	Service-Learning Co-curriculum Elective	2	2	
2	UKQT3001	Extracurricular Experiential Learning	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
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	
Other University Electives					
1	Uxxx2xx2	Any 1 course from Cluster 2 or Cluster 3	2	2	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	
TOTAL CREDIT TO GRADUATE (a + b + c)			131	123	

OTHER COMPULSORY COURSES		
No.	**PSC COURSE**	
COMPULSORY COURSES		
1	Design Thinking for Entrepreneur	
2	Talent and Competency Management	
3	English Communication Skills for Graduating Students (ECS)	
ELECTIVE COURSES		
4	Occupational Safety, Health & Environment (OSHE) (*Compulsory to all FE students*)	
5.	Choose ONE elective course from the following list: 1. Data Analytics for Organization 2. Construction Measurement (Mechanical & Electrical Works) 3. Professional Ethics and Integrity 4. 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, analyze 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.

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.

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.

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.

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.

SCSI1143 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.

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.

SECR1033 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.

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.

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.

SECR2213 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.

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 centered 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.

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 analyzing 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 artifacts, documentations, and deliverables.

SECV2223 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.

SECR2043 Operating Systems
Pre-requisite: SECR1033 Computer Organization and Architecture
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.

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.

SECB3032 Bioinformatics Project I
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.

SECJ3203 Theory of Computer Science
Pre-requisite: SECI1013 Discrete Structure
SECJ2013 Data Structure and Algorithm
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.

SECB4118 Industrial Training (HW)
Pre-requisite: 92 credits AND CGPA >= 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 organization 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.

SECB4114 Industrial Training Report
Pre-requisite: 92 credits AND CGPA >= 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%.

SECB4134 Bioinformatics Project II
Pre-requisite: SECB3032 Bioinformatics 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.

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.

ELECTIVE COURSES

SECB3103 Bioinformatics I

This course introduces the basic knowledge of Bioinformatics to students. It includes theories, applications, and tools. Introduction to Bioinformatics describes bioinformatics theories and tools that can help solve biological problems. It also shows how to efficiently apply bioinformatics applications to bioinformatics data and evaluate the resulting information.

SECB3023 Bioinformatics II

This subject familiarizes students with resources essential in examining how raw sequence data from genome sequencing projects can be used to generate information about gene sequence, protein structures, molecular evolution, biochemical, and genomics. It introduces existing DNA sequence and protein structure concepts and theories. Students will be exposed to bioinformatics methods and practices using appropriate bioinformatics tools. The focus will be on preparing the students with sufficient information, understanding and interpretation of biological data that may help them to learn of bioinformatics methodologies.

SECB3203 Programming for Bioinformatics

This course provides students with the fundamental skills for programming in bioinformatics. It starts with introducing students to the command line environment in the Unix/Linux operating system. This will include a broad coverage of Unix/Linux utilities as well as shell scripting. This course will then use the Python programming language to illustrate the fundamentals of bioinformatics programming. Python-based data science tools will be used including NumPy, SciPy, Pandas and Jupyter Notebook. This course will focus on solving real world biological problems using bioinformatics algorithms and approaches.

SECB3213 Bioinformatics Database

This subject introduces common types of biological data and major databases for bioinformatics applications. Students will learn how to search through the bioinformatics databases and the complete analytic process (data retrieval, pre-processing, data analysis and data visualization) for different types of biological data through different bioinformatics databases. Implementation of some of the process will be done in R programming.

SECB3133 Computational Biology I

This course will discuss the basic topics of computational biology and the application in bioinformatics. Based on DNA Sequence Analyze Algorithm, the course will apply Python programming. Starts with the usage of basic Python in solving the DNA Sequence challenge, student will learn how to build computational tools that are used to analyze biological data. At the end of this course, students will have an understanding and appreciation of how the computational biology solve the biological data challenge.

SECB3223 Computational Biology II

This course presents a comprehensive introduction to machine learning algorithms in bioinformatics. It provides a solid understanding of the entire machine learning algorithms and the needs for it in bioinformatics. Students apply knowledge learnt to solve some real-world problem.

SECB4243 Special Topics in Bioinformatics

A case-study approach to current topics in computational genomics. Completion of a series of projects emphasizing actual challenges facing by biologists and exposure to data science approach in life science. The projects are aimed in applying and developing current approaches that involve recent programming language such as Python and NodeJS with existing software packages.

SECB4213 Bioinformatics Visualization

This course presents a comprehensive introduction to data visualization and data mining in Bioinformatics. Students will be exposed to various techniques in visualizing / mining biological data using R programming language. R provides a vibrant of packages that able to produce interactive visualization of the data. This also provides a solid understanding of the importance of visualization in Bioinformatics and students will also able to apply these techniques in solving real-world case studies in Bioinformatics.

SECB4313 Bioinformatics Modeling and Simulation

This course introduces the concepts and applications of mathematical and computational modelling in Bioinformatics. Students are exposed to how to apply computational models and statistical methods on biological data to study and infer the underlying biological mechanisms and identify the common patterns.

SECB3104 Applications Development

Pre-requisite : SECJ2203 Software Engineering, SECD2523 Database, SECV2223 Web Programming, SECJ2154 Object Oriented Programming

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

SEBB4173 Cellular and Molecular Biology for Bioinformatics

This subject will facilitate students to understand and visualize processes in cell biology and those responsible for DNA transmission and expression hence mechanisms by which bacteria inherit genetic information as the blueprint of life. The lectures will explain relationship between structure and function in molecular biology and how this relationship operates to control biochemical processes. Topics include macromolecules like DNA, RNA and proteins and how

processes like replication, transcription and translation operate, eukaryotic genetics. Students will cover related aspects such as mutation and mutagenesis, effects of mutation and how cells overcome mutation. Students will also learn about basic techniques in molecular biology as the basis for genetic engineering. Microsoft PowerPoint presentation by each group will be done at the end of the semester on designated topics.

SEBB4203 Proteins Biomolecules

This course is a comprehensive introduction to the study of proteins and their importance to modern biochemistry. This course will start with a brief historical overview of the subject then move on to discuss the building blocks of proteins and their respective chemical and physical properties. This course will also explore experimental and computational methods of comparing proteins, methods of purification and protein folding and stability.

SEBB4193 Gene and Protein Technology

Students will learn the fundamental concepts of genomics and proteomics. Lectures will cover the structure, function and evolution of the human genome. Strategies for large-scale sequencing projects. Bioinformatics for the analysis of sequence data; approaches for determining gene expression patterns and functions. Protein/peptide separation techniques, protein mass spectrometry, bioinformatics tools, and biological applications which include quantitative proteomics, protein modification proteomics, interaction proteomics, structural genomics and structural proteomics.

BACHELOR OF COMPUTER SCIENCE (SOFTWARE ENGINEERING) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Software Engineering) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru. 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.

The programme is offered on full-time basis and is based on a 2-Semester per academic session. Generally, students are expected to undertake courses equivalent to between fourteen (14) 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 (Software Engineering) with Honours
4. Final Award	Bachelor of Computer Science (Software Engineering) with Honours
5. Programme Code	SECJH
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 yrs (8 semesters) Maximum : 6 yrs (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 b) Language c) Co-Curriculum d) IT Entrepreneurship	 10 8 3 2	17.6%
ii.	Core Courses	74	56.5%
iii.	Elective Courses	34	25.9%
	Total	**131**	**100%**
A	Engineering Courses a) Lecture/Project/Laboratory b) Workshop/Field/Design Studio c) Industrial Training d) Final Year Project	Nil	Nil
	Total Credit Hours for Part A		
B	Related Courses a) Applied Science/ Mathematic/ Computer b) Management/ Law/Humanities/ Ethics/ Economy c) Language d) Co-Curriculum	Nil	Nil
	Total Credit Hours for Part B		
	Total Credit Hours for Part A and B	**Nil**	
	Total Credit Hours to Graduate	**131 credit hours**	

Award Requirements

To graduate, students must:

- Achieve a total of 131 credit hours with minimum CPA of 2.0
- Pass industrial training (equivalent to 12 credit hours), which 4 credits will be graded and 8 credits as HW (Compulsory Attendance) status.
- Complete Software Engineering Final Year Projects.
- 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
PEO1	Obtain employment as software engineer in local and global industries and organization, where they are competent in applying the fundamental knowledge, computational principles and skills in Software Engineering to develop software of increasing size and complexity across different application areas.
PEO2	Demonstrate an ability to continue to learn throughout their career (i.e. professional, technical or postgraduate education) which can straighten their analytical and critical thinking skills to position them to advanced software engineering practice and to contribute to the intellectual foundations of the software engineering discipline.
PEO3	Involve with a number software project that they are proficient in applying appropriate methodologies, models and techniques that provide a basis for analysis, design, development, testing and implementation, evaluation, maintenance and documentation of a large-scale Software system.
PEO4	Becoming leaders or technopreneurs in software engineering discipline with combination skills.
PEO5	Demonstrate an awareness of professional ethics and social responsibility as software engineers.

Programme Learning Outcomes (PLO)

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

Code	Intended Learning Outcomes
PLO1 (KW)	Ability to acquire and apply knowledge of Computer Sciences and Software Engineering fundamentals.
PLO2 (CG)	Ability to demonstrate comprehensive problem analysis and creative design skill to solve and manage complex computing problems using systematic and current approaches
PLO3 (PS)	Ability to demonstrate technical and scientific expertise in a field of software engineering
PLO4 (IPS)	Ability to perform effective collaboration with stakeholders professionally
PLO5 (CS)	Ability to communicate effectively both in written and spoken form with other professionals and community
PLO6 (DS)	Ability to use digital technologies and software to support studies competently
PLO7 (NS)	Ability to analyse numerical or graphical data using quantitative or qualitative tools in solving problems
PLO8 (LAR)	Ability to function individually or in teams, effectively, with a capability to be a leader.
PLO9 (PRS)	Ability to self-advancement through continuous academic or professional

Code	Intended Learning Outcomes
	development
PLO10 (ENT)	Ability to initiate entrepreneurial project with relevant knowledge and expertise
PLO11 (ETS)	Ability to conduct respectable, ethical and professional practices in organization and society

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECI1013	Discrete Structure	3	
SECJ1013	Programming Technique I	3	
SECR1013	Digital Logic	3	
SECP1513	Technology & Information System	3	
UHMT1012	Graduate Success Attributes	2	
Malaysian Students			
UHIS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban	2	
International Students			
UHLB2122	Academic Communication Skills	2	
UHIT2302	The Thought of Sciences and Technology	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**18**	
** Students must apply for UHLB1122 credit exemption from semester 1 (if you are qualified). Only students with the following previous qualification can apply for credit exemption: Minimum score of IELTS Band 5.5 or TOEFL 525 or TOEFL iBT 60 or CEFR B2 or MUET Band 4 {Malaysian student)*			

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECI1113	Computational Mathematics	3	
SECI1143	Probability & Statistical Data Analysis	3	
SECJ1023	Programming Technique II	3	SECJ1013
SECR1033	Computer Organisation and Architecture	3	SECR1013
UHLB1122*	English Communication Skills	2	
Malaysian Students			
UHIT2302	The Thought of Sciences and Technology		
International Students			
UHLM1012	Malaysia Language for Communication	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**34**	
**For students who have applied your UHLB1122 exemption in SEMESTER 1 and if your application has been approved you do not have to register for UHLB1122 this semester. Your 2 credits exemption will be shown in your transfer credit slip. Students who have received UHLB1122 credit exemption also can register for another 2 credits course determined by the academic office.*			

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECD2523	Database	3	
SECD2613	System Analysis and Design	3	
SECJ2013	Data Structure and Algorithm	3	SECJ1023
SECR2213	Network Communications	3	
SECV2113	Human Computer Interaction	3	
UKQF2xx2	Service-Learning Co-curriculum Elective	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**51**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECJ2203	Software Engineering	3	
SECV2223	Web Programming	3	
SECR2043	Operating Systems	3	
SECJ2154	Object Oriented Programming	4	SECJ1023
Elective Courses - Choose 1 (3 Credits)			
SECJ2253	Requirements Engineering & Software Modelling	3	SECJ2203
SECJ2363	Software Project Management	3	
Malaysian Students			
UHLB2122	Academic Communication Skills	2	
International Students			
UHIS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban		
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**69**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
UHLB3132	Professional Communication Skills	2	
UHLx1122	Foreign Language Elective	2	
UKQE3001	Extracurricular Experiential Learning	1	
Elective Courses - Choose 4 (13 Credits)			
SECJ3104	Applications Development	4	SECJ2203, SECD2523, SECV2223, SECJ2154
SECJ3553	Artificial Intelligence	3	SECJ2013
SECJ3303	Internet Programming	3	SECJ2154, SECV2223
SECJ3323	Software Design & Architecture	3	SECJ2203
SECJ3603	Knowledge-Based & Expert Systems	3	SECJ3533
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**87**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECJ3032	Software Engineering Project I	2	80 credits SECJ3104
SECJ3203	Theory of Computer Science	3	SECI1013 SECJ2013
Elective Courses - Choose 4 (12 Credits)			
SECJ3343	Software Quality Assurance	3	SECJ2203
SECJ3563	Computational Intelligence	3	SECJ3553
SECJ 3623	Mobile Application Programming	3	SECJ2154
SECJ3403	Special Topic in Software Engineering	3	
SECJ3483	Web Technology	3	SECJ2154 SECV2223
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**104**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECJ4118	Industrial Training (HW)	8	92 credits CGPA >= 2.0
SECJ4114	Industrial Training Report	4	
	TOTAL CREDIT	**12**	
	CUMULATIVE CREDITS	**116**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECJ4134	Software Engineering Project II	4	SECJ3032
SECD3761	Technopreneurship Seminar	1	
UBSS1032	Introduction to Entrepreneurship	2	
UXXX 2xx2	Enrichment of Knowledge Elective	2	
UXXX2XX2	Generic Skill Elective		
Elective Courses - Choose 2 (6 Credits)			
SECJ4383	Software Construction	3	SECJ2203
SECJ4423	Real-Time Software Engineering	3	SECJ2203
SECJ4463	Agent-Oriented Software Engineering	3	SECJ2203 SECJ2154
SECP5xx3/ SECJ5xx3/ SECR5xx3	PRISMS Elective 1	3	
SECP5xx3/ SECJ5xx3/ SECR5xx3	PRISMS Elective 2	3	
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**131**	

PRISMS ELECTIVE COURSES

For students who intended 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 this checklist. 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 allowed to graduate.

NO	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
COMPUTER SCIENCE COURSES					
CORE COURSES (74 CREDITS)					
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	SECI1143	Probability & Statistical Data Analysis	3	3	
7	SECJ1023	Programming Technique II	3	3	
8	SECR1033	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	SECR2213	Network Communications	3	3	
13	SECV2113	Human Computer Interaction	3	3	
14	SECJ2203	Software Engineering	3	3	
15	SECV2223	Web Programming	3	3	
16	SECR2043	Operating Systems	3	3	
17	SECJ2154	Object Oriented Programming	4	4	
18	SECJ3032	Software Engineering Project I	2	2	
19	SECJ3203	Theory of Computer Science	3	3	
20	SECJ4118	Industrial Training	8	HL	
21	SECJ4114	Industrial Training Report	4	4	
22	SECJ4134	Software Engineering Project II	4	4	
23	SECD3761	Technopreneurship Seminar	1	1	

ELECTIVES COURSES (34 CREDITS) – Choose SECJ3104 and 10 other elective courses from the following list (which can include up to maximum of 4 PRISMS courses, for qualified students)					
SECJ ELECTIVES COURSES					
24	SECJ2253	Requirements Engineering & Software Modelling	3	3	
25	SECJ2363	Software Project Management	3	3	
26	SECJ3104	Applications Development	4	4	
27	SECJ3553	Artificial Intelligence	3	3	
28	SECJ3303	Internet Programming	3	3	
29	SECJ3323	Software Design & Architecture	3	3	
30	SECJ3603	Knowledge-Based & Expert Systems	3	3	
31	SECJ3343	Software Quality Assurance	3	3	
32	SECJ3563	Computational Intelligence	3	3	
33	SECJ3623	Mobile Application Programming	3	3	
34	SECJ3403	Special Topic in Software Engineering	3	3	
35	SECJ3483	Web Technology	3	3	
36	SECJ4383	Software Construction	3	3	
37	SECJ4423	Real-Time Software Engineering	3	3	
38	SECJ4463	Agent-Oriented Software Engineering	3	3	
PRISMS ELECTIVES COURSES					
39	SECR5033	Information Security Governance and Risk Management	3	3	
40	SECR5043	Cloud Computing Security	3	3	
41	SECJ5013	Secure Software Engineering	3	3	
42	SECR5053	Penetration Testing	3	3	
43	SECJ5023	Advanced Theory of Computer Science	3	3	
44	SECJ5033	Advanced Data Structure and Algorithms	3	3	
45	SECJ5043	Advanced Artificial Intelligence	3	3	
46	SECP5013	Advanced Analytics for Data Science	3	3	
47	SECP5023	Big Data Management	3	3	
48	SECP5033	Business Intelligence and Analytics	3	3	
49	SECP5043	Data Science Governance	3	3	
50	SECP5053	Massive Mining and Streaming	3	3	
51	SECP5063	Statistics for Data Science	3	3	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			**108**	**100**	
UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
For Malaysian Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
For International Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
	UHMS1182	Penghayatan Etika dan Peradaban			

2	UHLM1012	Malaysia Language for Communication	2	2	
Cluster 2: Generic Skills					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
2	UHMT1012	Graduate Success Attributes	2	2	
Cluster 3: Knowledge Enhancement					
1	UHIT2302	The Thought of Science and Technology	2	2	
Cluster 4: Co-Curriculum and Service Learning					
1	UKQF2xx2	Service-Learning Co-curriculum Elective	2	2	
2	UKQT3001	Extracurricular Experiential Learning	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
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	
Other University Electives					
1	Uxxx2xx2	Any 1 course from Cluster 2 or Cluster 3	2	2	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	
TOTAL CREDIT TO GRADUATE (a + b + c)			131	123	

OTHER COMPULSORY COURSES

No.	**PSC COURSE**	
COMPULSORY COURSES		
1.	Design Thinking for Entrepreneur	
2.	Talent and Competency Management	
3.	English Communication Skills for Graduating Students (ECS)	
ELECTIVE COURSES		
4.	Occupational Safety, Health & Environment (OSHE) (*Compulsory to all FE students*)	
5.	Choose ONE elective course from the following list: 1. Data Analytics for Organization 2. Construction Measurement (Mechanical & Electrical Works) 3. Professional Ethics and Integrity 4. 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, analyze 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.

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.

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.

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.

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.

SECI1143 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.

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.

SECR1033 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.

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.

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.

SECR2213 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.

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-centered 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.

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 analyzing 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 artifacts, documentations, and deliverables.

SECV2223 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.

SECR2043 Operating Systems

Pre-requisite : SECR1033 Computer Organization and Architecture

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.

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.

SECJ3032 Software Engineering Project I

Pre-requisite : 80 credits AND SECJ3104 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.

SECJ3203 Theory of Computer Science

Pre-requisite: SECI1013 Discrete Structure
SECJ2013 Data Structure and Algorithm

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.

SECJ4118 Industrial Training (HW)
Pre-requisite: 92 credits AND CGPA >= 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 intend 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 students personality. The assessment by faculty supervisor more focusing on students' generic skills.

SECJ4114 Industrial Training Report
Pre-requisite : 92 credits AND CGPA >= 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) log book 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 log book 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%.

SECJ4134 Software Engineering Project II
Pre-requisite : SECJ3032 Software Engineering 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.

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.

ELECTIVE COURSES

SECJ2253 Requirements Engineering & Software Modelling
Pre-requisite : SECJ2203 Software Engineering
This course provides an introduction to requirement engineering and a thorough look at the software modeling. It will include requirements engineering topics include types of requirements, requirements elicitation techniques, requirements specification: text-based and model-based, requirements validation and negotiation, as well as requirements management. At the end of this course, the students shall have the skills necessary to conduct requirements engineering process with appropriate principles and methods.

SECJ2363 Software Project Management
This course is designed to provide students with in-depth knowledge on software project planning, cost estimation and scheduling, project management tools, factors influencing productivity and success, productivity metrics, analysis of options and risks, software process improvement, software contracts and intelectual property and approaches to maintenance and long term software development. At the end of this course, students should be able to know how to manage a software development lifecycle.

SECJ3104 Applications Development
Pre-requisite : SECJ2203 Software Engineering, SECD2523 Database, SECV2223 Web Programming, SECJ2154 Object Oriented Programming
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.

SECJ3303 Internet Programming
Pre-requisite : SECJ2154 Object Oriented Programming
SECV2223 Web Programming
This course covers the development of web component with Servlets and Java Server Pages (JSP) Technologies. This course will enable students to obtain the knowledge and skills necessary to quickly build web applications based on Servlet and JSP technologies using the NetBeans IDE and Glassfish/Tomcat web container. Students are exposed to the current methods for analyzing, designing, developing, and deploying web applications with Java

technologies. At the end of this course, student should be able to develop a web-based application using Servlet, JSP and JavaBeans technologies.

SECJ3323 Software Design & Architecture
Pre-requisite : SECJ2203 Software Engineering
This course provides the students with an in-depth look at the theory and practice of software architecture and design. It introduces the important concepts related to software architecture and design. It emphasizes on the design and (faithful) implementation of a large scale software using the widely accepted architecture styles and design patterns. It will also expose students to the use of the industrial strength design notations (e.g. UML) and CASE tools (e.g. Ent Arch, Visual Studio). In addition, it provides other aspects of a large and complex software design such as user interface design, management, leadership, and ethics. At the end of this course, the students should be able to use the techniques, architectural styles, and design patterns in software design.

SECJ3603 Knowledge-Based & Expert Systems
Pre-requisite : SECJ3533 Artificial Intelligence
This course is designed to expose the students to knowledge-based system that requires expert knowledge in the system development. It emphasizes the theory, concepts and important components in expert system. The students will be introduced the difference between expert system and conventional systems. Students will be experience developing an application using any expert system tools with appropriate methodologies. Having some skill in AI programming, but not essential, is an advantage in the development of the system prototype. The students are expected to be able to work in a team and adhere to professional ethics.

SECJ3343 Software Quality Assurance
The content of the course discusses the Software Quality issues much beyond the classic boundaries of custom-made software development by large established software houses. It dedicates significant attention to the other software development and maintenance environment that reflect the current state of industry. This course is designed to provide students with in depth knowledge on software testing and its test process. The course covers the basic principles of software testing and test activities that include the test plan, test design, monitoring, implementation and test closure. The students will also learn various categories of test design techniques and methods used in both black-box and white-box testing. At the end of this course, students should be able to recognize various types and levels of testing as well as categorizing and applying software testing process and techniques.

SECJ3563 Computational Intelligence
Pre-requisite : SECJ3553 Artificial Intelligence
The aim of this course is to expose the students to current methods and algorithms utilized in area of computational intelligence. The methods include knowledge representation of vague data and inferences using fuzzy logic, learning using neural network and searching using evolutionary algorithms. Students will be equipped with the theories and the necessary skills to model the domain problems suited to the associated techniques or algorithms. This course will cover the topics on fuzzy logic, neural network and evolutionary algorithms. Hands-on class on how to apply the techniques in solving non-linear problems is also introduced. Conducting a paper review of related journals will expose the students to appreciate the contributions of CI-

related techniques in solving real-world problems besides developing academic research writing skill.

SECJ3623 Mobile Application Programming
Pre-requisite : SECJ2154 Object-Oriented Programming
This course is concerned with the development of application for mobile and wireless handheld devices such as personal digital assistants (PDA) and mobile phones. These mobile applications are either native/installation-based, or web applications delivered over HTTP. In this course, the emphasis is placed on the processes, tools and frameworks required to develop applications for current and emerging mobile computing devices. A current and dominant technology will be selected as a basis for teaching programming techniques and design patterns related to the development of these standalone applications and mobile portals to enterprise and m-commerce systems. Students will work at all stages of the software development life-cycle from inception through to implementation and testing. In doing so, students will be required to consider the impact of user characteristics, device capabilities, networking infrastructure and deployment environment, in order to develop software for the targeted mobile environment.

SECJ3403 Special Topic in Software Engineering
This course provides students with current issues related to software engineering in general and specifically in software development life cycle that includes planning, analysis, design, implementation, and maintenance. The key objective of this course is to equip the students with the knowledge in current issues mainly the research done to solve related problems. Based on the given topic in current research, the students should argue and think critically what could be other alternatives besides the current solutions.

SECJ3483 Web Technology
Pre-requisite : SECJ2154 Object Oriented Programming
SECV2223 Web Programming
The content of the course is divided into 2 main parts. The first is on the state of the art of web technology (Web2.0 and Web3.0). The student will be introduced to various topics such as web services, frontend web application, world wide web data (JSON), mobile technologies, social network, collaborative content management and semantic web. The second part is on the technologies/API and actual development on the next evolution of web application - the frontend web application. The students will be introduced to various related APIs and technologies for the development of frontend web and hybrid mobile application. Javascript as the main development language. jQuery as the library for managing frontend view. Bootstrap and framework7 for responsive CSS. AJAX and JSON for communicating and data transfer to the backend. PHP Slim framework for the RESTFul backend API development. Finally, Phonegap/Cordova as compiler for compiling Javascript frontend web application into hybrid mobile app.

SECJ4383 Software Construction
Pre-requisite : SECJ2203 Software Engineering
This course provides students with two main phases in software development life cycle that are software construction and evolution. The knowledge subareas for software construction include software construction fundamentals, managing construction, practical considerations. In addition, the knowledge subareas for software evolution or maintenance include software maintenance fundamentals, key issues in software maintenance, maintenance process, and

techniques for software maintenance. The key objective of this course is to equip the students with the skills to manage software construction towards maintainable software that is easy to maintain in future.

SECJ4423 Real-Time Software Engineering
Pre-requisite : SECJ2203 Software Engineering
This course equips the students with knowledge in embedded real-time systems and real-time software development particularly on how software engineering approaches assist real-time software development. The knowledge unit for this course area emphasize the following topics; real-time concepts, embedded real-time development methodologies, real-time operating systems, embedded real-time hardware fundamental and real-time analysis. The objective of this course is to introduce students with key software engineering practices in real-time software development and give practical experience to the students in developing embedded real-time software using appropriate software methods and tools.

SECJ4463 Agent-Oriented Software Engineering
Pre-requisite : SECJ 2203 Software Engineering
SECJ2154 Object Oriented Programming
The course begins with an overview of the software agent multiagent system (MAS). Then we focus on agent system architecture and infrastructure from a software engineering viewpoint, including requirements for agent-based systems, modeling and design of agent-based systems, development process for agent-based systems. Topics such as agent architecture, agent communication language and knowledge sharing, agent coordination and belief desire intention for agent modelling are discussed. Java Agent Development Framework (JADE) is used for development and will be in line with the material presented. GAIA will be used as framework for the design of the MAS requirement specification. For managing knowledge for the agent, Java rule agent (JSR94) will be introduced.

BACHELOR OF COMPUTER SCIENCE (DATA ENGINEERING) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Data Engineering) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru. 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.

The programme is offered on full-time basis and is based on a 2-Semester per academic session. Generally, students are expected to undertake courses equivalent to between fourteen (14) to eighteen (18) credit hours per semester. Assessment is based on courseworks and final examinations given throughout the semester.

General Information

<table>
<tr><td colspan="2">1. Awarding Institution</td><td colspan="2">Universiti Teknologi Malaysia</td></tr>
<tr><td colspan="2">2. Teaching Institution</td><td colspan="2">Universiti Teknologi Malaysia</td></tr>
<tr><td colspan="2">3. Programme Name</td><td colspan="2">Bachelor of Computer Science (Data Engineering) with Honours</td></tr>
<tr><td colspan="2">4. Final Award</td><td colspan="2">Bachelor of Computer Science (Data Engineering) with Honours</td></tr>
<tr><td colspan="2">5. Programme Code</td><td colspan="2">SECPH</td></tr>
<tr><td colspan="2">6. Professional or Statutory Body of Accreditation</td><td colspan="2">Ministry of Higher Education</td></tr>
<tr><td colspan="2">7. Language(s) of Instruction</td><td colspan="2">English</td></tr>
<tr><td colspan="2">8. Mode of Study (Conventional, distance learning, etc)</td><td colspan="2">2u2i</td></tr>
<tr><td colspan="2">9. Mode of operation (Franchise, self-govern, etc)</td><td colspan="2">Self-governing</td></tr>
<tr><td colspan="2">10. Study Scheme (Full Time/Part Time)</td><td colspan="2">Full Time</td></tr>
<tr><td colspan="2">11. Study Duration</td><td colspan="2">Minimum : 4 yrs (8 semesters)
Maximum : 6 yrs (12 Semesters)</td></tr>
<tr><td rowspan="2">Type of Semester</td><td colspan="2">No. of Semesters</td><td colspan="2">No of Weeks/Semester</td></tr>
<tr><td>Full Time</td><td>Part Time</td><td>Full Time</td><td>Part Time</td></tr>
<tr><td>Normal</td><td>8</td><td>20</td><td>14</td><td>14</td></tr>
<tr><td>Short</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses a) General b) Language c) Co-Curriculum d) IT Entrepreneurship	 10 8 3 2	17.6%
ii.	Core Courses	77	58.7%
iii.	Elective Courses	31	23.7%
	Total	**131**	**100%**
A	Engineering Courses a) Lecture/Project/Laboratory b) Workshop/Field/Design Studio c) Industrial Training d) Final Year Project	Nil	Nil
	Total Credit Hours for Part A	**Nil**	
B	Related Courses a) Applied Science/Mathematic/ Computer b) Management/Law/Humanities/ Ethics/Economy c) Language d) Co-Curriculum	Nil	Nil
	Total Credit Hours for Part B	**Nil**	
	Total Credit Hours for Part A and B	**Nil**	
	Total Credit Hours to Graduate	**131 credit hours**	

Award Requirements

To graduate students MUST:

- Achieve a total of 131 credit hours with minimum CPA of 2.0;
- Pass both industrial training component and final year project component at the industry (equivalent to 26 credit hours in two consecutive semesters in Year 4), where:
  - 14 credits will be graded at the first semester under the Professional Development and Practice course codes SECP4114, SECP4124, SECP4134 and SECP4112; and
  - 12 credits will be graded at the second semester under the Industrial Integrated Project course codes SECP4223, SECP4235 and SECP4234.
- 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
PEO1	To produce graduates who are able to obtain employment as computer scientist in local and global industries and organization, where they are competent in applying the fundamental knowledge, computational principles and skills in data engineering and computer science to develop software of increasing size and complexity across different application areas
PEO2	To produce graduates who are able to demonstrate an ability to continue to learn throughout their career (i.e., professional, technical or postgraduate education) which can strengthen their analytical and critical thinking skills to position them to advanced computer science practice and data engineering to contribute to the intellectual foundations of the computer science discipline
PEO3	To produce graduates who are capable to involve with a number of software and data engineering projects that they are proficient in applying theoretical computing and knowledge in analyzing, modelling, designing, developing and evaluating computing solutions.
PEO4	To produce graduates who are able to becoming leaders or technopreneurs in computer science discipline
PEO5	To produce graduates who are able to 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)	Ability to acquire the theory and principles of Computer Science and Data Engineering and be equipped with social science and personal development knowledge.
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 Data Engineering
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.

Code	Intended Learning Outcomes
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: SEMESTER 1				
	CODE	**COURSE NAME**	**CREDIT**	**PRE-REQUSITE**
	SECP1513	Technology and Information Systems (WBL)	3	
	SECJ1013	Programming Technique I	3	
	SECR1013	Digital Logic	3	
	SECI1013	Discrete Structure	3	
	UHMT1012	Graduate Success Attribute	2	
	Local Students			
	UHIS1022	Philosophy and Current Issues	2	
	UHMS1182	Appreciation of Ethics and Civilizations	2	
	International Students			
	UHMS1182	Appreciation of Ethics and Civilizations	2	
	UHLM1012	Malaysia Language for Communication 2	2	
TOTAL CREDIT			**18**	
CUMULATIVE CREDIT			**18**	

YEAR1: SEMESTER 2				
	CODE	**COURSE NAME**	**CREDIT**	**PRE-REQUSITE**
	SECJ1023	Programming Technique II	3	SECJ1013
	SECV2113	Human Computer Interaction	3	
	SECI1143	Probability & Statistical Data Analysis	3	
	SECR1033	Computer Organization and Architecture	3	SECR1013
	UHIT2302	Science and Technology Thinking	2	
	UHLB1112	English Communication Skills	2	
	UKQF2*xx*2	*Co-Curriculum Service Learning*	2	
TOTAL CREDIT			**18**	
CUMULATIVE CREDIT			**36**	

YEAR 2: SEMESTER 1				
	CODE	**COURSE NAME**	**CREDIT**	**PRE-REQUSITE**
	SECP2523	Database *(WBL)	3	
	SECP2613	System Analysis and Design *(WBL)	3	
	SECJ2013	Data Structure and Algorithm	3	SECJ1023
	SECR2213	Network Communication	3	

	UHLB2122	Academic Communication Skills	2	
	Elective Courses – Choose 1 (3 credits)			
	SECP3723	System Development Technology (WBL)	3	
	SECP2733	Multimedia Data Modeling (WBL)	3	
TOTAL CREDIT			**17**	
CUMULATIVE CREDIT			**53**	

YEAR 2: SEMESTER 2				
	CODE	**COURSE NAME**	**CREDIT**	**PRE-REQUSITE**
	SECJ2154	Object-Oriented Programming	4	SECJ1023
	SECR2043	Operating System	3	SECR1033
	SECD3761	Technopreneurship Seminar	1	
	UBSS1032	Introduction to Entrepreneurship	2	
	UHLB3132	Professional Communication Skills	2	
	UXXX2xx2	*Generic Skills Elective* OR *Knowledge Enhancement Elective*	2	
	Elective Courses – Choose 1 (3 credits)			
	SECP2633	Information Retrieval	3	
	SECP2753	Data Mining	3	
TOTAL CREDIT			**17**	
CUMULATIVE CREDIT			**70**	

YEAR 3: SEMESTER 1				
	CODE	**COURSE NAME**	**CREDIT**	**PRE-REQUSITE**
	SECJ3553	Artificial Intelligence	3	
	UHL*X*1112	*Elective Foreign Language*	2	
	UKQT3001	Extra-Curricular Experiential Learning	1	
	Elective Courses – Choose 4 (12 credits)			
	SECP3133	High Performance Data Processing	3	
	SECP3213	Business Intelligence	3	
	SECP3623	Database Programming	3	
	SECP3713	Database Administration	3	
	SECP3223	Data Analytic Programming	3	
TOTAL CREDIT			**18**	
CUMULATIVE CREDIT			**88**	

YEAR 3: SEMESTER 2

	CODE	COURSE NAME	CREDIT	PRE-REQUSITE
	SECP3204	Software Engineering *(WBL)	4	
		Elective Courses – Choose 3 (13 credits)		
	SECP3744	Enterprise Systems Design and Modeling*(WBL)	4	
	SECP3843	Special Topic in Data Engineering *(WBL)	3	
	SECP3823	Knowledge Management Systems *(WBL)		
	SECP3106	Application Development *(WBL)	6	
	SECP3416	Management Information Systems *(WBL)		
TOTAL CREDIT			**17**	
CUMULATIVE CREDIT			**105**	

YEAR 4: SEMESTER 1 (Conducted during internship at selected industry)				
	CODE	**COURSE NAME**	**CREDIT**	**PRE-REQUSITE**
	SECP4114	Professional Development	4	
	SECP4124	Professional Practice	4	
	SECP4134	Professional Development and Practice Report	4	
	SECP4112	Initial Industry Project Proposal	2	
TOTAL CREDIT			**14**	
CUMULATIVE CREDIT			**119**	

YEAR 4: SEMESTER 2 (Conducted during internship at selected industry)				
	CODE	**COURSE NAME**	**CREDIT**	**PRE-REQUSITE**
	SECP4223	Industrial Integrated Project Proposal	3	
	SECP4235	Industrial Integrated Project Development	5	
	SECP4234	Industrial Integrated Project Report	4	
TOTAL CREDIT			**12**	
CUMULATIVE CREDIT			**131**	

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. 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 allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
COMPUTER SCIENCE COURSES					
CORE COURSES (77 CREDITS)					
1	SECP1513	Technology and Information Systems (WBL)	3	3	
2	SECJ1013	Programming Technique I	3	3	
3	SECR1013	Digital Logic	3	3	
4	SECI1013	Discrete Structure	3	3	
5	SECJ1023	Programming Technique II	3	3	
6	SECV2113	Human Computer Interaction	3	3	
7	SECI1143	Probability & Statistical Data Analysis	3	3	
8	SECR1033	Computer Organization and Architecture	3	3	
9	SECP2523	Database *(WBL)	3	3	
10	SECP2613	System Analysis and Design *(WBL)	3	3	
11	SECJ2013	Data Structure and Algorithm	3	3	
12	SECR2213	Network Communication	3	3	
13	SECJ2154	Object Oriented Programming	4	3	
14	SECR2043	Operating Systems	3	3	
15	SECD3761	Technopreneurship Seminar	1	3	
16	SECJ3553	Artificial Intelligence	3	3	
17	SECP3204	Software Engineering *(WBL)	4	4	
18	SECP4114	Professional Development	4	4	
19	SECP4124	Professional Practice	4	4	
20	SECP4134	Professional Development and Practice Report	4	4	
21	SECP4112	Initial Industry Project Proposal	2	2	
22	SECP4223	Industrial Integrated Project Proposal	3	3	
23	SECP4235	Industrial Integrated Project Development	5	5	
24	SECP4234	Industrial Integrated Project Report	4	4	
ELECTIVES COURSES (31 CREDITS) *– Choose SECP3106 and 8 other elective courses from the following list.*					
25	SECP3723	System Development Technology (WBL)	3	3	
26	SECP2733	Multimedia Data Modeling *(WBL)	3	3	
27	SECP2633	Information Retrieval	3	3	
28	SECP2753	Data Mining	3	3	
29	SECP3133	High Performance Data Processing	3	3	

30	SECP3213	Business Intelligence	3	3	
31	SECP3623	Database Programming	3	3	
32	SECP3713	Database Administration	3	3	
33	SECP3223	Data Analytics Programming	3	3	
34	SECP3744	Enterprise System Design and Modeling (WBL)	4	4	
35	SECP3843	Special Topic in Data Engineering *(WBL)	3	3	
36	SECP3823	Knowledge Management Systems *(WBL)	3	3	
37	SECP3106	Application Development *(WBL)	6	6	
38	SECP3416	Management Information System *(WBL)	6	6	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			**108**	**108**	
UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
For Malaysian Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
For International Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
	UHMS1182	Penghayatan Etika dan Peradaban			
2	UHLM1012	Malaysia Language for Communication	2	2	
Cluster 2: Generic Skills					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
2	UHMT1012	Graduate Success Attributes	2	2	
Cluster 3: Knowledge Enhancement					
1	UHIT2302	The Thought of Science and Technology	2	2	
Cluster 4: Co-Curriculum and Service Learning					
1	UKQF2xx2	Service-Learning Co-curriculum Elective	2	2	
2	UKQT3001	Extracurricular Experiential Learning	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
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	
Other University Electives					
1	Uxxx2xx2	Any 1 course from Cluster 2 or Cluster 3	2	2	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	

TOTAL CREDIT TO GRADUATE (a + b + c)	131	131	

OTHER COMPULSORY COURSES

No.	PSC COURSE
COMPULSORY COURSES	
1	Design Thinking for Entrepreneur
2	Talent and Competency Management
3	English Communication Skills for Graduating Students (ECS)
ELECTIVE COURSES	
4	Occupational Safety, Health & Environment (OSHE) (*Compulsory to all FE students*)
5.	Choose ONE elective course from the following list: 1. Data Analytics for Organization 2. Construction Measurement (Mechanical & Electrical Works) 3. Professional Ethics and Integrity 4. 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, analyze 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.

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.

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.

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.

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 analyzing data using available software.

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.

SECR1033 Computer Organization 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.

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-centered 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.

SECP2523 Database *(WBL)

This course introduces students to the concept of database system and how it can be used in daily human life and profession. The focus of the course is to equip students with 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 are taught to use a database management system (DBMS). Students are required to work on a project, i.e., to develop a database application system, for a selected organization. In this project, students are required to work closely with an organization during the process of analysis, designing and implementing the system and to use the learned techniques, DBMS and development tools in the development process. At the end of the course, students shall be able to apply the knowledge of designing and developing a good database system for a real-world problem.

SECP2613 System Analysis and Design *(WBL)

The main focus of this course is to provide a practical approach of systems analysis and designing skills for the students using a structured methodology. Hence, the course enables students to study information system requirements for any system application within an organizational context. The contents are organized in sequence, which are 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. Students are required to work on a project, i.e., to develop a database application system, for a selected organization. In this project, students are required to work closely with the organization during the process of analysis, designing and implementing the system by using the learned techniques. At the end of the course, students shall be able to apply the knowledge of designing and developing a good information system for a real-world problem.

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.

SECR2213 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.

SECR2043 Operating Systems
Pre-requisite: SECR1033 Computer Organization and Architecture
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.

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.

SECP3204 Software Engineering *(WBL)
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 analyzing 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 artifacts, documentations, and deliverables. This course requires students to collaborate with a selected industry by building a high-quality software system required by the industry. Students are required to apply the most suitable software approach and techniques learned in the course. The industry involved will also contribute to a portion of assessment for the system build.

SECD3761 Technopreneurship Seminar
This 1-credit course will involve, among others, with a series of lectures and/or reviewing entrepreneurship/technopreneurship case studies. Lectures may come from invited guest speakers who are successful entrepreneurs/technopreneurs to share their experiences in setting and building their companies.

SECP4114 Professional Development

Professional Development refers to the placement of a student at an organization for a minimum of TWENTY (20) weeks. This course aims to provide a platform for the students to adapt with the working environment and gain their knowledge and working experience as well as developing their generic skills in a real career life when performing the tasks given by the organization. The students are jointly evaluated by supervisors from the school and the industry coach from the organization. The evaluation is focusing on students' generic skills.

SECP4124 Professional Practice

Professional Practice refers to the placement of a student at an organization for a minimum of TWENTY (20) weeks. This course aims to provide a platform for the students to apply their knowledge learned in the university and at the workplace in solving organization's problem with the supervision from organization supervisor. It is also intended for the students to experience handling real project in order to produce graduates who are credible, creative and proficient. The students will be evaluated based on their performance by the organization and faculty's supervisor. The focus of the evaluation is based on work performance.

SECP4134 Professional Development & Practice Report

In Professional Development & Practice Report, students will be evaluated based on four components; 1) technical report, 2) oral presentation, 3) log book and 4) ethics. The aim of the technical report is to educate the students in producing 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 Professional Development & Practice supervisors (organization and supervisor). Students need to fill in the log book 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.

SECP 4112 Initial Industry Project Proposal

This course is conducted at the industry where students perform their first semester internship. In this course, students are required to propose an initial idea on an industry project that deem to be suitable to be considered as a final year project which will be fully implemented in the second semester of their fourth year. The content of the proposal shall contain the project title, problem background, project objectives, project scopes, project methodology, and proposed solution. Students will present their initial proposal in a presentation session to a panel of examiners, which consists of a member from the industry and lecturers, to validate the proposed topic.

SECP 4223 Industry Integrated Project Proposal

This course is also conducted at the industry where students perform their second semester internship. This course is an in-depth work based on the initial idea project proposal from SECP4112. Students are required to identify relevant information pertaining to the project needs and requirements, including identifying the objectives, producing project plan, conducting relevant literature reviews, producing the detail requirements of the project, and producing initial output or relevant designs for the project. These works are reported in a written report for the course. Students are also required to discuss their work with their supervisors (from faculty and industry) and report the progress by filling-up a log book throughout the semester. Students will

present their proposal in a presentation session to a panel of examiners. Through this course students should acquire the knowledge and skills in project development methodology and the skill of writing an academic report which will be the basis of a final year industry integrated project report.

SECP4235 Industrial Integrated Project Development

This course is also conducted at the industry where students perform their second semester internship. The objective for the students is to apply the knowledge learned in the university and boost their skills in implementing and completing the project. This course requires student to fully implement the project according to the specified project requirements as proposed in SECP4223. Based on the user and organization requirements, the students need to implement the full project development lifecycle, including coding, executing and/or integrate modules and testing the developed project. Students are required to present the fully develop system to the user, organization and faculty, where their implemented project will be assessed by a panel of examiners.

SECP4234 Industry Integrated Project Report

This course is also conducted at the industry where students perform their second semester internship. This course requires student to provide a complete report (i.e., a thesis) based on the project completed in SECP4235. The report shall contain the project requirements in full, with the objectives, problems and scopes are clearly written, the literature review on relevant topics related to projects, including the project methodology, the project designs, the project implementation and development (coding). It shall reflect the project development in full. and fulfil a project successfully at an organization or industry. The full report is considered as the thesis for the student's final year project. The students are also required to consult their supervisors (industry and faculty) in the process of preparing the report, to ensure it fulfill the project developed and adhere to a written undergraduate thesis standard. The report will be assessed by a panel of examiners.

ELECTIVE COURSES

SECP3723 System Development Technology *(WBL)

This course provides fundamental theories and practices of using basic technologies and components for web application developments. It focuses on standard XHTML/HTML for content creation, CSS for content presentation, JavaScript for client-side logics, PHP a server-side languages for business logics and data processing with MySQL database. Furthermore, the course will enable the student to build more powerful web solutions and advance to dynamic, database-enabled, website/intranet programming and applications using the open- source PHP scripting language and MySQL database. The course broadly comprises the fundamentals of programming with PHP, relational database design and operations with MySQL, and web solutions using PHP and MySQL. This course prepares students for the real web development process. This course will also expose students to industry's experiences for two months in web application development through sharing knowledge sessions and work-based learning activities with selected organization.

SECP2753 Data Mining
This subject presents a comprehensive introduction to the understanding of knowledge discovery process in databases. Such methodological understanding is important to tackle projects of all sizes. A number of data mining techniques with its algorithms are explained. Students explore into the application of these techniques in both lab and industry. Students could apply the knowledge learnt to solve real world problems.

SECP2733 Multimedia Data Modeling
With the explosion of digital multimedia information, large amounts of non-traditional forms of data such as text, image, video and audio are available in digital forms. Retrieval and storage of multimedia data is different from retrieval and storage of structured data. This subject presents a comprehensive introduction to multimedia databases that stores these types of data. The schematic description of a multimedia information retrieval system will be discussed and how its data are stored and retrieved. Storage structure, indexing, retrieval and analysis of text, image, video and audio will be covered. Various methods of pattern recognition to derive high-level description of the data automatic approaches tom derive semantic annotation of the data will be discussed.

SECP3133 High Performance Data Processing
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 either C/C++ or Java programming languages. Student will experience hands-on programming practices on cluster computer.

SECP3213 Business Intelligence
This course focuses on business intelligence to support a wide variety of management tasks in industry. Students learn to create business intelligence solutions, utilizing data mining methods, and applying artificial intelligence techniques for industrial decision support. Students will involve with industrial partners to apply the knowledge learnt to solve real world problems.

SECP3223 Data Analytic Programming
This course introduces the use of Python specifically for Data Science. Students will learn about powerful ways to store and manipulate data to do data analysis. The course is divided into two parts. In Part 1, students will learn general programming practices and tools. Part 2 will focus more on data analysis, studying statistical techniques, machine learning and presentation of findings.

SECP3713 Database Administration
This course prepares students with a firm foundation in basic database administration. It focuses on database administration (DBA) skills in general and specific skills needed to manage an enterprise level, large scale, relational database management system such as Oracle. The course looks at concepts underlying a database administration, among which are the database architecture, installation, configuration and operation. Students will also learn how to create an operational database and properly manage the various structures in an effective and efficient manner including performance monitoring, database security, user management, DBMS tuning

and backup/recovery techniques. The lesson topics are reinforced with structured hands-on practices. This course prepares students for the corresponding certification examination (such as Oracle Certified Associate exam). This course will also expose students to industry's experiences in administrating databases through sharing knowledge sessions and work-based learning activities with selected organization.

SECP3744 Enterprise Systems Design and Modeling *(WBL)

This subject presents a data management perspective to the Enterprise Information Systems in a contemporary organization. The course will introduce the importance of enterprise information system management, strategic role of information systems in an organization, enterprise system integration, enterprise value system and value chain modelling, view integration and implementation compromises, and inter versus intra enterprise systems. Students will creatively explore real-world industry case study, identify problems and propose enterprise system solutions. This course will expose students to industry's experiences in Enterprise Systems through sharing knowledge sessions and/or work-based learning activities with selected organization. At the end of the semester, student shall be able to plan and manage the development of enterprise data and information systems.

SECP3843 Special Topic in Data Engineering (WBL)

This course presents research and industrial issues pertaining to data engineering, database systems and technologies. Various topics of interests that are directly or indirectly relevant the data engineering tasks, database systems and technologies are explored and discussed. Participation in forums as well as face to face interaction, with researchers and practitioners on these topics are encouraged. Students should then be able to conduct their own investigation and deductions. This course will also expose students to industry's experiences through sharing knowledge sessions and/or work-based learning activities with selected organization.

SECP3823 Knowledge Management System

This subject covers the basic concept of Knowledge Management including the definition and the importance of knowledge management, types of knowledge management systems (KMS), such as document management systems, decision support systems and group support systems. It focuses on the development and deployment of KMS. Several knowledge managements tools and technologies are introduced and real case studies are discussed. At the end of the course, students shall be able to develop basic KMS.

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 b. Language c. Co-Curriculum d. IT Entrepreneurship	 10 8 3 2	17.6%
ii.	Core Courses	74	56.5%
iii.	Elective Courses	34	25.9%
	Total	**131**	**100%**
Total Credit Hours to Graduate		**131 credit hours**	

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			
UHIS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban	2	
INTERNATIONAL STUDENTS			
UHIS1022	Philosophy and Current Issues	2	
UHMS1182	Appreciation of Ethics and Civilisation		
UHLM1012	Malaysia Language for Communication 2	2	
TOTAL CREDITS		**18**	
CUMULATIVE CREDITS		**18**	

YEAR 1 (FEBRUARY)			
Code	**Course**	**Credit**	**Pre-requisite**
SECI1113	Computational Mathematics	3	
SECJ1023	Programming Technique II	3	SECJ1013
SECI2143	Probability & Statistical Data Analysis	3	
SECR1033	Computer Organisation and Architecture	3	SECR1013
SECV2113	Human Computer Interaction	3	
UHLB1112	English Communication Skills*	2	
TOTAL CREDITS		**17**	
CUMULATIVE CREDITS		**35**	
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	
	TOTAL CREDITS	**17**	
	CUMULATIVE CREDITS	**52**	

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
TOTAL CREDITS		**18**	
CUMULATIVE CREDITS		**70**	

YEAR 3 (SEPTEMBER)			
Code	**Course**	**Credit**	**Pre-requisite**
SECJ3553	Artificial Intelligence	3	SECJ2013
SECR3104	Applications Development	4	SECJ2203, SECD2523, SECV2223, SECR3413
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	
TOTAL CREDITS		**18**	
CUMULATIVE CREDITS		**88**	

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	
	TOTAL CREDITS	**15**	
	CUMULATIVE CREDITS	**106**	

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

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		
	TOTAL CREDITS	**16**	
	CUMULATIVE CREDITS	**131**	

SECR Elective Courses (CHOOSE 5)			
Code	**Course**	**Credit**	**Pre-requisite**
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.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
COMPUTER SCIENCE COURSES					
CORE COURSES (74 CREDITS)					
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	SECR1033	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	

ELECTIVES COURSES (34 CREDITS) *– Choose SECR3104 and 10 other elective courses from the following list (which can include up to maximum of 4 PRISMS courses, for qualified students)*					
SECR ELECTIVES COURSES					
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	
PRISMS *ELECTIVES COURSES*					
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	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			**108**	**100**	
UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
For Malaysian Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
For International Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
	UHMS1182	Penghayatan Etika dan Peradaban			

2	UHLM1012	Malaysia Language for Communication	2	2	
Cluster 2: Generic Skills					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
2	UHMT1012	Graduate Success Attributes	2	2	
Cluster 3: Knowledge Enhancement					
1	UHIT2302	The Thought of Science and Technology	2	2	
Cluster 4: Co-Curriculum and Service Learning					
1	UKQF2xx2	Service Learning Co-curriculum Elective	2	2	
2	UKQT3001	Extracurricular Experiential Learning	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
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	
Other University Electives					
1	Uxxx2xx2	Any 1 course from Cluster 2 or Cluster 3	2	2	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	
TOTAL CREDIT TO GRADUATE (a + b + c)			131	123	

OTHER COMPULSORY COURSES

No.	PSC COURSE	
COMPULSORY COURSES		
1	Design Thinking for Entrepreneur	
2	Talent and Competency Management	
3	English Communication Skills for Graduating Students (ECS)	
ELECTIVE COURSES		
4	Occupational Safety, Health & Environment (OSHE) (*Compulsory to all FE students*)	
5.	Choose ONE elective course from the following list: 5. Data Analytics for Organization 6. Construction Measurement (Mechanical & Electrical Works) 7. Professional Ethics and Integrity 8. 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, studentsshould 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.

SECR1033 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 >= 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 >= 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 expose 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.

BACHELOR OF COMPUTER SCIENCE
(GRAPHICS AND MULTIMEDIA SOFTWARE) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Graphics and Multimedia Software) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru. 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.

The programme is offered on full-time basis and is based on a 2-Semester per academic session. Generally, students are expected to undertake courses equivalent to between fourteen (14) 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 (Graphics and Multimedia Software) with Honours	
4. Final Award			Bachelor of Computer Science (Graphics and Multimedia Software) with Honours	
5. Programme Code			SECVH	
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 b) Language c) Co-Curriculum d) IT Entrepreneurship	 10 8 3 2	17.6%
ii.	Core Courses	74	56.5%
iii.	Elective Courses	34	25.9%
	Total	**131**	**100%**
A	Engineering Courses a) Lecture/Project/Laboratory b) Workshop/ Field/ Design Studio c) Industrial Training d) Final Year Project	Nil	Nil
	Total Credit Hours for Part A		
B	Related Courses a) Applied Science/ Mathematic /Computer b) Management/Law/Humanities/ Ethics/Economy c) Language d) Co-Curriculum	Nil	Nil
	Total Credit Hours for Part B		
	Total Credit Hours for Part A and B	**Nil**	
	Total Credit Hours to Graduate	**131 credit hours**	

Award Requirements

To graduate, students must:

- Achieve a total of 131 credit hours with minimum CPA of 2.0
- Pass industrial training (equivalent to 12 credit hours), which 4 credits will be graded and 8 credits as HW (Compulsory Attendance) status.
- Complete Graphics and Multimedia Software Final Year Project.
- 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
PEO1	Obtain employment as computer scientists in local and global industries and organisations, where they are competent in applying the relevant knowledge, computational principles and skills in Computer Graphics and Multimedia fields to develop software of increasing size and complexity across different application areas
PEO2	Demonstrate an ability to continue to learn throughout their career (professional, technical or postgraduate education) which can strengthen their analytical and critical thinking skills to position them to advanced computer graphic and multimedia practices and to contribute to the intellectual foundations of the Computer Graphics and Multimedia disciplines.
PEO3	Involve in computer graphics and multimedia software projects that they are proficient in applying theoretical computing and knowledge in analysing, modelling, designing, developing and evaluating computing solutions.
PEO4	Becoming leaders or technopreneurs in graphics and multimedia software discipline with combination skills
PEO5	Demonstrate an awareness of professional ethics and social responsibility as computer scientists specialising in computer graphics and multimedia.

Programme Learning Outcomes (PLO)

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

Code	Intended Learning Outcomes
PLO 1 (KW)	Ability to acquire and apply knowledge of Computer Sciences and Graphics and Multimedia Software fundamentals.
PLO 2 (CG)	Ability to demonstrate comprehensive problem analysis and creative design skill to solve and manage complex computing problems using systematic and current approaches
PLO 3 (PS)	Ability to demonstrate technical and scientific expertise in a field of graphics and multimedia software
PLO 4 (IPS)	Ability to perform effective collaboration with stakeholders professionally
PLO 5 (CS)	Ability to communicate effectively both in written and spoken form with other professionals and community
PLO 6 (DS)	Ability to use digital technologies and software to support studies competently
PLO 7 (NS)	Ability to analyse numerical or graphical data using quantitative or qualitative tools in solving problems
PLO 8 (LAR)	Ability to function individually or in teams, effectively, with a capability to be a leader.
PLO 9 (PRS)	Ability to self-advancement through continuous academic or professional development

PLO 10 (ENT)	Ability to initiate entrepreneurial project with relevant knowledge and expertise
PLO 11 (ETS)	Ability to conduct respectable, ethical and professional practices in organization and society

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECI1013	Discrete Structure	3	
SECJ1013	Programming Technique I	3	
SECR1013	Digital Logic	3	
SECP1513	Technology & Information System	3	
UHMT1012	Graduate Success Attributes	2	
Malaysian Students			
UHIS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban	2	
International Students			
UHLB1122*	English Communication Skills	2	
UHIT2302	The Thought of Sciences and Technology	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**18**	
** 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 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECV1113	Mathematics for Computer Graphics	3	
SECI1143	Probability & Statistical Data Analysis	3	
SECJ1023	Programming Technique II	3	SECJ1013
SECR1033	Computer Organisation and Architecture	3	SECR1013
Malaysian Students			
UHIT2302	The Thought of Sciences and Technology	2	
UHLB1122*	English Communication Skills	2	
International Students			
UHLM1012	Malaysia Language for Communication	2	
UHLB2122	Academic Communication Skills	2	
UHLB1122	English Communication Skills	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**34**	
** 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: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECD2523	Database	3	
SECD2613	System Analysis and Design	3	
SECJ2013	Data Structure and Algorithm	3	SECJ1023
SECR2213	Network Communications	3	
SECV2113	Human Computer Interaction	3	
UKQF2xx2	Service-Learning Co-curriculum Elective	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**51**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECJ2203	Software Engineering	3	
SECV2223	Web Programming	3	
SECR2043	Operating Systems	3	SECR1033
SECJ2154	Object Oriented Programming	4	SECJ1023
Elective Courses - Choose 1 (3 Credits)			
SECV2213	Fundamental of Computer Graphics	3	SECV1113 SECJ1023
SECJ2363	Software Project Management	3	
Malaysian Students			
UHLB2122	Academic Communication Skills	2	
International Students			
UHIS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban		
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**69**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
UHLB3132	Professional Communication Skills	2	
UHLx 1122	Foreign Language Elective	2	
UKQE 3001	Extracurricular Experiential Learning	1	
Elective Courses - Choose 4 (13 Credits)			
SECV3104	Applications Development	4	SECJ2203, SECD2523, SECV2223, SECJ2154
SECJ3553	Artificial Intelligence	3	SECJ2013
SECV3113	Geometric Modelling	3	SECV2213
SECV3213	Fundamental of Image Processing	3	
SECJ3263	Mobile Application Programming	3	SECJ2154
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**87**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECV3032	Graphics and Multimedia Software Project I	2	SECV3104
SECJ3203	Theory of Computer Science	3	SECI1013, SECJ2013
Elective Courses - Choose 4 (12 Credits)			
SECV3223	Multimedia Data Processing	3	SECJ1023
SECJ3563	Computational Intelligence	3	SECJ3553
SECV3263	Multimedia Web Programming	3	
SECV3233	Data Visualisation	3	
SECV3123	Real-time Computer Graphics	3	SECV2213
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**104**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECV4118	Industrial Training (HW)	8	92 credits & CGPA >= 2.0
SECV4114	Industrial Training Report	4	
	TOTAL CREDIT	**12**	
	CUMULATIVE CREDITS	**116**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECV4134	Graphics and Multimedia Software Project II	4	SECV3032
SECD3761	Technopreneurship Seminar	1	
UBSS1032	Introduction to Entrepreneurship	2	
UXXX 2xx2	Enrichment of Knowledge Elective	2	
UXXX2XX2	Generic Skill Elective		
Elective Courses - Choose 2 (6 Credits)			
SECV4213	Computer Games Development	3	SECV3123
SECV4233	Advanced Computer Graphics	3	SECV2213
SECV4273	Introduction to Speech Recognition	3	SECJ1023
SECP5xx3/ SECJ5xx3/ SECR5xx3	PRISMS Elective 1	3	
SECP5xx3/ SECJ5xx3/ SECR5xx3	PRISMS Elective 2	3	
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**131**	

PRISMS ELECTIVE COURSES

For students who intend to enroll 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 this checklist. 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 allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
COMPUTER SCIENCE COURSES					
CORE COURSES (74 CREDITS)					
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	SECV1113	Mathematics for Computer Graphics	3	3	
6	SECI1143	Probability & Statistical Data Analysis	3	3	
7	SECJ1023	Programming Technique II	3	3	
8	SECR1033	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	SECR2213	Network Communications	3	3	
13	SECV2113	Human Computer Interaction	3	3	
14	SECJ2203	Software Engineering	3	3	
15	SECV2223	Web Programming	3	3	
16	SECR2043	Operating Systems	3	3	
17	SECJ2154	Object Oriented Programming	4	4	
18	SECV3032	Graphics and Multimedia Software Project I	2	2	
19	SECJ3203	Theory of Computer Science	3	3	
20	SECV4118	Industrial Training	8	HL	
21	SECV4114	Industrial Training Report	4	4	
22	SECV4134	Graphics and Multimedia Software Project II	4	4	
23	SCSD3761	Technopreneurship Seminar	1	1	
ELECTIVES COURSES (34 CREDITS) *– Choose SECV3104 and 10 other elective courses from the following list (which can include up to maximum of 4 PRISMS courses, for qualified students)*					
SECV ELECTIVES COURSES					
24	SECV2213	Fundamental of Computer Graphics	3	3	

25	SECJ2363	Software Project Management	3	3	
26	SECV3104	Applications Development	4	4	
27	SECJ3553	Artificial Intelligence	3	3	
28	SECV3113	Geometric Modelling	3	3	
29	SECV3213	Fundamental of Image Processing	3	3	
30	SECJ3263	Mobile Application Programming	3	3	
31	SECV3223	Multimedia Data Processing	3	3	
32	SECJ3563	Computational Intelligence	3	3	
33	SECV3263	Multimedia Web Programming	3	3	
34	SECV3233	Data Visualisation	3	3	
35	SECV3123	Real-time Computer Graphics	3	3	
36	SECV4213	Computer Games Development	3	3	
37	SECV4233	Advanced Computer Graphics	3	3	
38	SECV4273	Introduction to Speech Recognition	3	3	
PRISMS ELECTIVES COURSES					
39	SECR 5033	Information Security Governance and Risk Management	3	3	
40	SECR5043	Cloud Computing Security	3	3	
41	SECJ5013	Secure Software Engineering	3	3	
42	SECR5053	Penetration Testing	3	3	
43	SECJ5023	Advanced Theory of Computer Science	3	3	
44	SECJ5033	Advanced Data Structure and Algorithms	3	3	
45	SECJ5043	Advanced Artificial Intelligence	3	3	
46	SECP5013	Advanced Analytics for Data Science	3	3	
47	SECP5023	Big Data Management	3	3	
48	SECP5033	Business Intelligence and Analytics	3	3	
49	SECP5043	Data Science Governance	3	3	
50	SECP5053	Massive Mining and Streaming	3	3	
51	SECP5063	Statistics for Data Science	3	3	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			**108**	**100**	
UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
For Malaysian Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
For International Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
	UHMS1182	Penghayatan Etika dan Peradaban			
2	UHLM1012	Malaysia Language for Communication	2	2	
Cluster 2: Generic Skills					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
2	UHMT1012	Graduate Success Attributes	2	2	
Cluster 3: Knowledge Enhancement					
1	UHIT2302	The Thought of Science and Technology	2	2	

Cluster 4: Co-Curriculum and Service Learning					
1	UKQF2xx2	Service-Learning Co-curriculum Elective	2	2	
2	UKQT3001	Extracurricular Experiential Learning	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
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	
Other University Electives					
1	Uxxx2xx2	Any 1 course from Cluster 2 or Cluster 3	2	2	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	
TOTAL CREDIT TO GRADUATE (a + b + c)			131	123	

OTHER COMPULSORY COURSES

No.	**PSC COURSE**	
COMPULSORY COURSES		
1	Design Thinking for Entrepreneur	
2	Talent and Competency Management	
3	English Communication Skills for Graduating Students (ECS)	
ELECTIVE COURSES		
4	Occupational Safety, Health & Environment (OSHE) (*Compulsory to all FE students*)	
5.	Choose ONE elective course from the following list: 1. Data Analytics for Organization 2. Construction Measurement (Mechanical & Electrical Works) 3. Professional Ethics and Integrity 4. 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, analyze 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.

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.

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.

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.

SECV1113 Mathematics for Computer Graphics

The aim of this course is to introduce and develop mathematical skills that underpin the technical aspects of computer graphics application. It will emphasize on matrix, vector, geometry and parametric representation, trigonometry, linear algebra and general concept of Vector Calculus. For further understanding about this subject, a lot of exercises will be given. At the end of the course, students should be able to grasp key concept and uses each of the mathematical concept in computer graphics application.

SECI1143 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.

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.

SECR1033 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.

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.

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.

SECR2213 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.

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-centered 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.

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 analyzing 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 artifacts, documentations, and deliverables.

SECV2223 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.

SECR2043 Operating Systems

Pre-requisite : SECR1033 Computer Organization and Architecture

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.

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.

SECV3032 Graphics and Multimedia Software Project I

Pre-requisite : SECJ3104 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.

SECJ3203 Theory of Computer Science

Pre-requisite : SECI1013 Discrete Structure
SECJ2013 Data Structure and Algorithm

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.

SECV4118 Industrial Training (HW)
Pre-requisite : 92 credits AND CGPA >= 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 intend 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 students personality. The assessment by faculty supervisor more focusing on students' generic skills

SECV4114 Industrial Training Report
Pre-requisite : 92 credits AND CGPA >= 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) log book 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 log book 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%.

SECV4134 Graphics and Multimedia Software Project II
Pre-requisite : SECV3032 Graphics and Multimedia Software 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.
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.

ELECTIVE COURSES

SECV2213 Fundamental of Computer Graphics
Pre-requisite : SECV1113 Mathematics for Computer Graphics
SECJ1023 Programming Technique II

The course introduces students to the fundamental of computer graphics and its applications. It will emphasize on raster graphics hardware, generation of 2D primitives, 2D and 3D transformations, specification of windows and viewports. Students are required to write 2D/3D application in order to reinforce their understanding. At the end of the course, the student should be able to understand how a computer graphics system works and develop simple graphics application using standard graphics libraries.

SECJ2363 Software Project Management

This course is designed to provide students with in depth knowledge on software project planning, cost estimation and scheduling, project management tools, factors influencing productivity and success, productivity metrics, analysis of options and risks, software process improvement, software contracts and intellectual property and approaches to maintenance and long term software development. At the end of this course, students should be able to know how to manage a software development lifecycle.

SECV3104 Applications Development
Pre-requisite : SECJ2203 Software Engineering, SECD2523 Database, SECV2223 Web Programming, SECJ2154 Object Oriented Programming

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.

SECV 3113 Geometric Modelling
Pre-requisite : SECV2213 Fundamental of Computer Graphics

This course is designed for students to understand how geometric objects are modeled. This subject emphasizes on the theory of representations, algorithms, and the underlying theoretical framework, essential to solving geometric problems encountered in modeling a 2D/3D object. Selected advanced research issues, such as mesh generation, shape reconstruction; feature-based modeling, non-manifold geometry, and variation surface modeling are also covered. At

the end of the course, the student should be able to apply the knowledge of 3D geometric modeling and write program to produce simple 3D models using standard 3D graphics libraries.

SECV3213 Fundamental of Image Processing

This course discusses some of the digital image processing techniques and their applications particularly in real life applications. It begins with an understanding of specification and structure of a graphic file format with a special attention to image data extractions procedures. Using the extracted data, the image will be manipulated utilizing some of the most popular image processing techniques, among others: point processing operations; (halftoning and histogram equalization), neighbourhood operations; (convolution, low pass filters, high pass filters, high boost filters, median filter), edge detections, and geometric operations.

SECJ3563 Computational Intelligence

Pre-requisite : SECJ3553 Artificial Intelligence

The aim of this course is to expose the students to current methods and algorithms utilized in area of computational intelligence. The methods include knowledge representation of vague data and inferences using fuzzy logic, learning using neural network and searching using evolutionary algorithms. Students will be equipped with the theories and the necessary skills to model the domain problems suited to the associated techniques or algorithms. This course will cover the topics on fuzzy logic, neural network and evolutionary algorithms. Hands-on class on how to apply the techniques in solving non-linear problems is also introduced. Conducting a paper review of related journals will expose the students to appreciate the contributions of CI-related techniques in solving real-world problems besides developing academic research writing skill.

SECJ 3623 Mobile Application Programming

Pre-requisite : SECJ2154 Object-Oriented Programming

This course is designed to give students a foundation on the development of applications for mobile devices. It will cover the workflows, tools and frameworks required to develop applications for current and emerging mobile computing devices. The course will adopt a current technology as a basis for teaching the process of mobile application development. This course will also expose the students to composing user interfaces for mobile, dealing with device resources, integrating with backends and deploying the applications. At the end of the course, students should be able to work collaboratively in developing working data-centric mobile applications.

SECV3223 Multimedia Data Processing

Pre-requisite : SECJ1023 Programming Technique II

This course will concentrates on using existing frameworks (Java Media Framework, DirectX or MatLab) for processing multimedia data with the main purpose to train the students to produce multimedia data related software & tools. As multimedia comes with many types of data (text, audio, video, and animation) and varieties of formats for presentation and storage, students will be first exposed with the basic ideas and concept behind multimedia data technology. Students are required to understand the theory and techniques for data acquisition, sampling, storage, and presentation. Next, students are exposed with more advance task which involving multimedia data manipulation. At the end of the course students are required to produce their own software/application for multimedia data presentation & manipulation.

SECV3263 Multimedia Web Programming
Web environment provide a wide selection of technologies and components for online application development. Current available technologies and components are consisting of standard view elements (HTML and CSS), server-side logic (CGI, Servlet. Server Pages Technologies), client-script logic (JavaScript), data communication and interoperability (AJAX, JSON, XML), 2D/3D graphic system (X3DOM, SVG) and various components provided by other proprietary software vendors. This course will expose the students to the concepts and hands-on experiences on how to fully integrate and exploit all of these components into single application to provide full-featured "Rich Internet Application" (RIA) to the clients.

SECV3233 Data Visualisation
This course presents the theoretical and technical aspects of data visualization in various applications. It emphasises on the process of visualization, which include various data sources, reconstruction of data, data models and data model representation techniques. Real applications of data visualization such as used in medical, scientific, engineering, biotechnology and environment applications are also discussed.

SECV3123 Real-time Computer Graphics
Pre-requisite : SECV2213 Fundamental of Computer Graphics
This course is to expose students in developing real-time and interactive computer graphics applications. This is an intensive programming subject and students are expected to equip themselves with adequate programming skills. Interactive development such as fast polygon rendering algorithm with level-of detail, scene management, dynamic camera manipulation, real-time shading and rendering and physical simulation will be covered and integrated in the application. Throughout the course, students will design and develop a real-time computer graphics application. At the end of this course, student should be able to acquire the theory and practice of real-time computer graphics.

SECV4213 Computer Games Development
Pre-requisite : SECV3123 Real Time Computer Graphics
This course introduces and equips student to the process of developing Computer Games including fundamental theory such as Game Design and Game Programming. The game design provides students with basic skills to design games such as genre-specific, storytelling, level design and project lifecycle and documents. The game programming emphasizes on the development of games using game engine such as Unity3D, or any other latest game engine technology employed in developing games.

SECV4543 Advanced Computer Graphics
Pre-requisite : SECV2213 Fundamental of Computer Graphics Student is expected to have basic knowledge about 3D modelling and rendering techniques. Topics covered include 3D transformation, viewing, projection, 3D Clipping, viewport transformation. Lighting, shading, visible surface detection, adding realism through textures, ray casting, ray tracing and radiosity are also covered. At the end of the course, the students should be able to apply the rendering and lighting algorithms and then implement the algorithms in the creation of a 3D graphics project.

SECV4273 Introduction to Speech Recognition
Pre-requisite : SECJ1023 Programming Technique II

This course aims to provide theoretical foundations and practical experience in computer speech processing and recognition. Many of the techniques and algorithms covered under the course are applicable to a variety of areas concerned with recognizing sequences. On completion of the course, students should be able to understand the basic principles of pattern recognition, gain knowledge of automatic speech recognition (ASR) system design, and the various trade-offs involved. It should also enable students to read and discuss technical papers in ASR, speech processing and pattern recognition.

INTEGRATED BACHELOR-MASTER PROGRAMME (PRISMS) ELECTIVE COURSES

LIST of PRISMS ELECTIVE COURSES

1. **Master of Science (Information Security)/ Master of Cyber Security**

- SSCR/SECR 5013 Cryptographic Engineering
- SSCR SECR5023 Digital Forensics
- SSCR/SECR 5033 Information Security Governance and Risk Management
- SSCR/SECR 5043 Cloud Computing Security
- SCSJ/SECJ 5013 Secure Software Engineering
- SECR 5053 Penetration Testing

2. **Master of Computer Science,** by mixed mode

- SCSJ/ SECJ 5023 Advanced Theory of Computer Science
- SCSJ/ SECJ 5033 Advanced Data Structure and Algorithms
- SCSJ/ SECJ 5043 Advanced Artificial Intelligence

3. **Master of Science (Data Science)**

- SCSP/SECP 5013 Advanced Analytics for Data Science
- SCSP/SECP 5023 Big Data Management
- SCSP/SECP 5033 Business Intelligence and Analytics
- SCSP/SECP 5043 Data Science Governance
- SCSP/SECP 5053 Massive Mining and Streaming
- SCSP/SECP 5063 Statistics for Data Science

PRISMS ELECTIVE COURSE SYNOPSIS

1. Master of Cyber Security

SECR5013 Cryptographic Engineering
Pre-requisite: SECR3443 Introduction to Cryptography
This subject is a continuation from the introductory cryptography. All networked computers and devices must have cryptographic layers implemented and must be able to access to cryptographic functions in order to provide security features. In this context, efficient (in terms of time, area, and power consumption) hardware and software structures will have to be designed, implemented, and deployed. Discussion and analysis on how to resist cryptanalytic attacks by protecting access to primary (communication) and secondary (power, electromagnetic, acoustic) channels. Learn the algorithms, methods, and techniques in order to create latest cryptographic embedded software and hardware using common platforms and technologies. In addition to that, Ethical issues in Cryptography is discuss.

SECR5023 Digital Forensics
Pre-requisite: SECR3413 Computer Security
This course takes a detailed approach to the use of computers and computer technology in the investigation of incidents, both criminal and civil, in which computer technology play a significant or interesting role. Students completing this course will be familiar with the core computer science theory and practical skills necessary to perform elementary computer/digital forensic investigations, understand the role of technology in investigating computer based crime, and be prepared to deal with investigative bodies at an elementary level.

SECR5033 Information Security Governance and Risk 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 information system. This course covers issues related to administration, management and governance of security of information systems. Topics include auditing and data management, risk management (risk identification, risk analysis, risk control), contingency planning, incident handling and risk governance. 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.

SECR5043 Cloud Computing Security
Pre-requisite: SECR1213 Network Communications
SECR3413 Computer Security
In this course, we are going to learn about common cloud misconfigurations, how to perform a risk assessment and verify compliance for various Cloud Services. Further, we will delve deeper into identifying security risks in these cloud services and to implement best practices to mitigate the common cloud misconfigurations. Other topics include topics of data ownership, privacy protections, data mobility, quality of service and service levels, bandwidth costs, data protection, and support.

SECR5053 Penetration Testing
Pre-requisite: SECR2043 Operating System
SECR3413 Computer Security
This course will discuss issues pertaining to penetration testing which covers areas like finding vulnerabilities in various computer systems, 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 pentesting, wireless pentesting, network pentesting, and current issues in pentesting.

SECJ5013 Secure Software Engineering
This course provides the principles of Secure Software Engineering and practical methods to secure requirements, design, implementation, testing, deployment and maintenance in software development. Students will also review policy specific requirements necessary to implement a secure development program within enterprise organizations. The students will also be able to understand software vulnerability, and how to evaluate, and address security risks to software.

2. Master of Computer Science, by mixed mode

SECJ5023 Advanced Theory of Computer Science
The course presents the most fundamental theories and concepts that provide a mathematical sense to answer some of the basic question as can the given problems be solved by computation and how efficiently can a given problem be solved by computation. The course provides an in-depth study to the main models and concepts of the mathematical theory of computation, including automata and languages, computability and complexity. The emphasis of the course will be on the ability to move from a concrete problem to a mathematical model, and after proving things about the mathematical model to correctly interpret what we have

learned about the concrete problem.

SECJ5033 Advanced Data Structure and Algorithms
This course provides a solid or advanced understanding to theory and practice of data structure and the study of algorithms analysis. Students will learn the most common data structures and the advanced concepts of the data structure such as B-trees, heaps and priority queues. Further, students will be exposed to the techniques used in the development and analysis of data structures and its algorithms. The analytical abilities of the students in this course are to analyze the performance of data structures and algorithms. At the end of the course, students should be able to implement and apply the theory and concepts of the advanced data structure in assignments.

SECJ5043 Advanced Artificial Intelligence
Increasing practical implementation of several Soft Computing approaches in real world problems has grounded this course to explore the intensity of SC techniques. As such, Neural Computing, Nature Inspired Computing and Granular Computing provide foundations for the conception, design and development of the intelligent systems. By hybridizing such paradigms, it has been possible to create a number of successful and sophisticated solutions to complex real-world problems. The aim of this course is to provide the student with knowledge of the principles, mechanisms and theory behind SC and their applications. The theory of each SC techniques is given in a conceptual and in a mathematical way; the practice is discussed with stress on the outcomes of successful applications and on the intricacies of the actual implementations.

3. Master of Science (Data Science)

SECP5013 Advanced Analytics for Data Science
This course provides a solid or advanced understanding on the use of analytics approach in the examination of data or content to discover deeper insights, make predictions or generate recommendations using sophisticated techniques and tools on real world problems. Students will learn descriptive analytics using advance tools to gain insight into the past. Students will also acquire understanding of predictive analytics using statistical and machine learning techniques to understand future outcome. The prescriptive analytics provides knowledge in simulation and optimization to quantify the effect of future decision to advise possible outcomes before decision is made. The analytical abilities to be acquired by students in this course are to reliably select analytic techniques or method and specify steps involve in the analysis process and to interpret analytically the results obtained from data analytics techniques or tools. At the end of the course, students should be able to implement and apply the knowledge on analytical techniques or tools in real world problems and able to make an informed decisions or recommendation through analytical interpretations of results.

SECP5023 Big Data Management
This course provides a basic fundamental of big data architecture and management. Students will learn the big data processes and the current big data technologies that are available. Further, students will be exposed to the big data platform ecosystem for big data manipulation. The big data management will be explored for the best practice in managing and manipulating large amount of data. At the end of the course, students should be able to understand the

architecture and management of big data and also can develop simple application of big data handling using particular platform in assignment.

SECP5033 Business Intelligence and Analytics

Business analytics refers to the ways in which enterprises such as businesses, non-profits and governments can use data to gain insights and make better decisions. Business analytics is applied in operations, marketing, finance and strategic planning among other functions. The ability to use data effectively to drive rapid, precise and profitable decision has been critical strategic advantages for companies. With the increasing availability of broad and deep sources of information-so called “Big data”- business analytics are becoming an even more critical capability for enterprises of all types and all sizes. It combines statistical analysis and predictive modeling to identify trends and understand the information that can drive business change and support sustained successful business practices.

SECP5043 Data Science Governance

Data governance is a mandatory requirement for a successful organization which aims to achieve master data management, build business intelligence, improve data quality or manage documents. This course provides an overview of the data governance lifecycle. Students will learn why data governance is needed, how to design, initiate, and execute a program and how to keep the program sustainable. The big data management will be explored for the best practice in managing and manipulating large amount of data. At the end of the course, students should be able to understand the management and governance of big data.

SECP5053 Massive Mining and Streaming

This course aims to introduce students to basic principles and methods of machine learning algorithms that are typically used for mining large data sets. This course also will provide students with the skill and knowledge to build system and capable of analyzing huge amount of data. It explains the principle of distributed file systems and shows map reduce as a tool for creating parallel algorithms. Typically, it covers the algorithms that used for analyzing networks, fundamental principles of techniques such as decision trees and support vector machines and finally neural network architecture. The students will gain practical understanding through a coding exercise where they will implement and apply one machine learning algorithm on a particular large dataset.

SECP5063 Statistics for Data Science

This course provides a fundamental concept in statistics for data science. Students will learn statistical inference including estimation, hypothesis testing and nonparametric tests. Further, students will be introduced to Bayesian inference, linear regression and classification. R will be used to apply these statistical methods. At the end of the course, students should be able to apply the statistical methods to real large data sets.