



**BACHELOR OF COMPUTER SCIENCE
(SOFTWARE ENGINEERING)**



BACHELOR OF COMPUTER SCIENCE (SOFTWARE ENGINEERING) PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Software Engineering) 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

1. Awarding Institution	Universiti Teknologi Malaysia			
2. Teaching Institution	Universiti Teknologi Malaysia			
3. Programme Name	Bachelor of Computer Science (Software Engineering)			
4. Final Award	Bachelor of Computer Science (Software Engineering)			
5. Programme Code	TC10 (SECJ)			
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 status.
- Complete Software Engineering Projects.
- Pass 5 Professional Skills Certificate (PSC).

Entry Requirements

The minimum qualifications for candidates who intend to do a Bachelor of Computer Science (Software Engineering) are as follows:

- 1) Minimum results based on **the Malaysian High School Certificate (STPM)** (results would be based on the general requirements as well as other conditions as the pre-requisites for the programme set by the university).

University General Requirements:

- i. Passed and obtained good results in the Malaysian Certificate Examination (SPM) or its equivalent.
- ii. Passed Bahasa Melayu/Bahasa Malaysia with credit in the SPM/equivalent.
- iii. Passed the Malaysian High School Certificate (STPM) or its equivalent and obtained the following:
 - a) Grade C (NGMP 2.00) General paper, and
 - b) Grade C (NGMP 2.00) in TWO (2) other subjects
- iv. Passed the Malaysian University English Test (MUET) with minimum result of Band 1.

Special Requirements for the Programme

- i. Passed with a minimum Grade B- (NGMP 2.67) in TWO (2) of the following subjects:
 - a) Mathematics T / Further Mathematics / Computing AND
 - b) Physics/ Chemistry/ Biology
- ii. Passed Mathematics with credits in the SPM / equivalent examination.

- 2) Minimum requirements for **Matriculation Certificates (KPM) / Asasi Sains UM** (fulfil the general requirements set by the university as well as other conditions of the programme).

General University Requirements

- i. Passed the Malaysian Certificate Examination (SPM) with good results.
- ii. Obtained passes in Bahasa Melayu/Bahasa Malaysia with credits in the SPM/equivalent examination.
- iii. Passed the Matriculation Certificate Examination KPM/Asasi Sains UM with a minimum CGPA of 2.80 and passed all the core subjects.
- iv. Passed the Malaysian University English Test (MUET) with minimum result of Band 1.

Special Requirements of the Programme:

- i. Passed with a Grade B- (2.67) in two of the following subjects:
 - a) Mathematics AND
 - b) Physics/ Engineering Physics / Biology/ Chemistry / Engineering Chemistry / Computer Science / Computer Engineering
- ii. Passed with credits in Mathematics in the SPM/ equivalent examination.

- 3) Minimum qualifications for students with **Certificates/Diplomas**

(fulfill the general requirements set by the university as well as specific requirements of the programme).

General University Requirements

- i. Obtained a Diploma in Computer Science from UTM/equivalent with a minimum CPA of 3.00; or for candidates with a CPA below 3.00 but have a minimum of two or more years of working experience in the related area of study will be eligible to apply for a place to study at the university.
- ii. Obtained a credit pass in Mathematics in their SPM/equivalent examination or a minimum grade B- in any of the Mathematics Courses taken at the diploma level.

- iii. Candidates are required to submit the results transcript of all their examinations taken during their Diploma study (semester one until the final semester) to UTM. A copy of the diploma or a letter of completion of study will also have to be submitted together with their applications.
- iv. Passed the Malaysian University English Test (MUET) with minimum result of Band 1.

Note :-

Year of entry and duration of study will be based on the credit exemptions and credit transfer awarded by the university.

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.
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Programme Learning Outcomes (PLO)

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

Code	Intended Learning Outcomes
PLO1	Ability to acquire theory and principles of Computer Science and Software Engineering and equip with social science and personal development knowledge.
PLO2	Ability to apply theoretical principles of Computer Science and Software Engineering for analyzing, designing and developing computer systems.
PLO3	Ability to integrate and demonstrate knowledge to solve real world problems through software engineering principles and methodologies, and to creatively produce software artifacts using current tools and technique.
PLO4	Ability to present technical solutions to a range of audience.
PLO5	Ability to think critically and creatively in order to solve problems.
PLO6	Ability to continuously integrate computer science knowledge and skills through lifelong learning process.
PLO7	Ability to lead and work effectively in a team to achieve common goals.
PLO8	Ability to adapt and work effectively in varying cultures of communities, professional fields and environments.
PLO9	Ability to behave ethically, responsibly, and professionally with integrity in carrying out responsibilities and making decisions.
PLO10	Ability to identify business opportunities and develop entrepreneurship mind-set and skills.

UTM PROFESSIONAL SKILLS CERTIFICATE (PSC)

Students are required to enrol and pass all certificate programmes offered by the Centres of Excellence in the University and the School of Professional and Continuing Education (SPACE) during semester breaks

1. How to Get Yourself Employed (HTGYE)
2. ISO 9001: 2008 Quality Management System Requirement (ISO)
3. Occupational Safety and Health Awareness (OSHA)
4. How to Manage Your Personal Finance (HTMYPF)
5. Test of English Communication Skills for Graduating Students (TECS):
 - (i) TECS 1001 (Paper I – Oral Interaction)
 - (ii) TECS 1002 (Paper II - Writing)

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			
UHIT2302	The Thought of Sciences and Technology	2	
UHMS1172	Malaysia Dynamic	2	
International Students			
UHLM1012	Malaysia Language for Communication	2	
UHMS1022	Malaysian Studies 3	2	
	TOTAL CREDIT	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	SCSJ1013
SECR1033	Computer Organisation and Architecture	3	SCSR1013
UHLB1122	English Communication Skills	2	
Malaysian Students			
UHS1022	Falsafah dan Isu Semasa	2	
International Students			
UHIT2302	The Thought of Sciences and Technology	2	
UHS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban		
	TOTAL CREDIT	16/18	
	CUMULATIVE CREDITS	34/36	

YEAR 2: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SECD2523	Database	3	
SECD2613	System Analysis and Design	3	
SECJ2013	Data Structure and Algorithm	3	SECJ1013 SECJ1023
SECR2213	Network Communications	3	
SECV2113	Human Computer Interaction	3	
UKQF2x2	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	SECJ1033
SECJ2154	Object Oriented Programming	4	SECJ1023
UHLB2122	Academic Communication Skills	2	
<i>Elective Courses - Choose 1 (3 Credits)</i>			
SECJ2253	Requirements Engineering & Software Modelling	3	SECJ2203
SECJ2363	Software Project Management	3	
	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	
<i>Elective Courses - Choose 4 (13 Credits)</i>			
SECJ3104	Applications Development	4	
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	SECJ3104
SECJ3203	Theory of Computer Science	3	SECJ1013 SECJ2013
<i>Elective Courses - Choose 4 (12 Credits)</i>			
SECJ3343	Software Quality Assurance	3	
SECJ3563	Computational Intelligence	3	SECJ3553
SECJ3623	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
SECJ4114	Industrial Training Report	4	CGPA >= 2.0
	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	
<i>Elective Courses - Choose 2 (6 Credits)</i>			
SECJ4383	Software Construction	3	SECJ2203
SECJ4423	Real-Time Software Engineering	3	SECJ2203
SECJ4463	Agent-Oriented Software Engineering	3	SECJ2203 SECJ2154
Malaysian Students			
UHMS1182	Penghayatan Etika dan Peradaban	2	
	TOTAL CREDIT	15/13	
	CUMULATIVE CREDITS	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 COUNT-ED (JKK)	TICK (✓) IF PASSED
COMPUTER SCIENCE COURSES					
<i>CORE COURSES (74 CREDITS)</i>					
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	
<i>ELECTIVES COURSES (34 CREDITS)</i>					
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	SECJ 3623	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	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			108	100	
UNIVERSITY GENERAL COURSES					
Kluster 1: Penghayatan Falsafah, Nilai & Sejarah (Faculty of Social Sciences and Humanities)					
1	UHS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
3	UHLM1012	Malaysia Language for Communication (for International Students only)	2	2	
Kluster 2: Kemahiran Insaniah (Soft Skills)					
1	UHMT1012	Graduate Success Attributes	2	2	
Kluster 3: Perluasan Ilmu					
1	UHIT2302	The Thought of Science and Technology	2	2	
2	UHMS1172	Malaysia Dynamic (for Malaysian Students only)	2	2	
	UHMS1022	Malaysian Studies 3 (for International Students only)	2	2	
Kluster 4: Kokurikulum Pembelajaran Servis					
1	UKQF2xx2	Service Learning Co-curriculum Elective	2	2	
2	UKQE 3001	Extracurricular Experiential Learning	1	1	
Kluster 5: Kemahiran Bahasa (Language Skill) (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	UHLx 1122	Foreign Language Elective	2	2	
Kluster 6: Keusahawanan					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	
TOTAL CREDIT TO GRADUATE (a + b + c)			131	123	
OTHER COMPULSORY COURSES					
Professional Skills Certificate (PSC) (UTMSPACE/ School)					
1	GLL 1001	How to Get Your Self Employed			
2	GLL 1029	ISO 9001:2008 Quality Management System Requirement			
3	GLL 1040	Occupational Safety, Health and Environment			
4	GLL 1041	How to Manage Your Personal Finance			
Test of English Communication Skill (TECS) (Language Academy, Faculty of Social Sciences and Humanities)					
1	TECS 1001	Oral Interaction			
2	TECS 1002	Writing			

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 : SECJ1013 Programming Technique I
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 : **SECJ1033 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 : 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 \geq 2.0

Industrial Training refers to the placement of a student at an organization for a minimum of 20 weeks to elevate students' knowledge and skills in a specific database profession and at the same time produce graduates who are credible, creative and proficient. This course aims to provide a platform

for the students apply their knowledge learned in the university and boost their skills which needed by a profession. It is also 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 \geq 2.0

Industrial Training Report refers to the placement of a student at an organization for a minimum of 20 weeks to experience and apply their theoretical knowledge in the industrial training. The students will be evaluated based on four components; 1) technical report, 2) oral presentation, 3) 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 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.

SECJ3104 Applications Development

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 : SECJ 2203 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 : SECJ 3533 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.

SECJ 3623 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 : SECJ 2203 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 : SECJ 2203 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.