BACHELOR OF COMPUTER SCIENCE (SOFTWARE ENGINEERING)

S C S J

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 (SCSJ)
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	-	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.

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 SystemRequirement (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
SCSI1013	Discrete Structure	3	
SCSJ1013	Programming Technique I	3	
SCSR1013	Digital Logic	3	
SCSP1513	Technology & Information System	3	
UHAK1012	Graduate Success Attributes	2	
UHAS1172	*Malaysia Dynamic	2	
UHAK1022	**Malaysian Studies 3		
UICI1012	*Islamic and Asian Civilization (TITAS)	2	
ULAM1012	**Malaysia Language for Communication		
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	18	

* For Malaysian students
** For International students

YEAR 1: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSI1113	Computational Mathematics	3	
SCSI1143	Probability & Statistical Data Analysis	3	
SCSJ1023	Programming Technique II	3	SCSJ1013
SCSR1033	Computer Organisation and Architecture	3	SCSR1013
UICL2302	The Thought of Sciences and Technology	2	
ULAB1122	Academic English Skills	2	
	TOTAL CREDIT	16	
	CUMULATIVE CREDITS	34	

YEAR 2: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SCSD2523	Database	3	
SCSD2613	System Analysis and Design	3	
SCSJ2013	Data Structure and Algorithm	3	SCSJ1013 SCSJ1023
SCSR2213	Network Communications	3	
SCSV2113	Human Computer Interaction	3	
UKQXxxx2	Co-curriculum	2	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	51	

YEAR 2: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSJ2203	Software Engineering	3	
SCSV2223	Web Programming	3	
SCSR2043	Operating Systems	3	SCSJ1033
SCSJ2154	Object Oriented Programming	4	SCSJ1023
ULAB2122	Advanced Academic English Skills	2	
Elective Courses - Choose 1 (3 Credits)			
SCSJ2253	Requirements Engineering & Software Modelling	3	SCSJ2203
SCSJ2363	Software Project Management	3	
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	69	

YEAR 3: SEMESTER 1			
Code	Course	Credit	Pre-requisite
ULAB3162	English for Professional Purpose	2	
ULAx 1122	* Foreign Language Elective	2	
UHAK 2xx2	**Generic Skills Elective		
UKQE 3001	Extracurricular Experiential Learning	1	
Elective Courses - Choose 4 (13 Credits)			
SCSJ3104	Applications Development	4	
SCSJ3553	Artificial Intelligence	3	SCSJ2013
SCSJ3303	Internet Programming	3	SCSJ2154 SCSV2223
SCSJ3323	Software Design & Architecture	3	SCSJ2203
SCSJ3603	Knowledge-Based & Expert Systems	3	SCSJ3533
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	87	

YEAR 3: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSJ3032	Software Engineering Project I	2	SCSJ3104
SCSJ3203	Theory of Computer Science	3	SCSI1013 SCSJ2013
Elective Courses - Choose 4 (12 Credits)			
SCSJ3343	Software Quality Assurance	3	
SCSJ3563	Computational Intelligence	3	SCSJ3553
SCSJ 3623	Mobile Application Programming	3	SCSJ2154
SCSJ3403	Special Topic in Software Engineering	3	
SCSJ3483	Web Technology	3	SCSJ2154 SCSV2223
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	104	

YEAR 4: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SCSJ4118	Industrial Training (HW)	8	92 credits CGPA >= 2.0
SCSJ4114	Industrial Training Report	4	
	TOTAL CREDIT	12	
	CUMULATIVE CREDITS	116	

YEAR 4: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSJ4134	Software Engineering Project II	4	SCSJ3032
SCSD3761	Technopreneurship Seminar	1	
UHAK1032	Introduction to Entrepreneurship	2	
UICL 2xx2	Enrichment of Knowledge Elective	2	
Elective Courses - Choose 2 (6 Credits)			
SCSJ4383	Software Construction	3	SCSJ2203
SCSJ4423	Real-Time Software Engineering	3	SCSJ2203
SCSJ4463	Agent-Oriented Software Engineering	3	SCSJ2203 SCSJ2154
	TOTAL CREDIT	15	
	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					
CORE COURSES (74 CREDITS)					
1	SCSI1013	Discrete Structure	3	3	
2	SCSJ1013	Programming Technique I	3	3	
3	SCSR1013	Digital Logic	3	3	
4	SCSP1513	Technology & Information System	3	3	
5	SCSI1113	Computational Mathematics	3	3	
6	SCSI1143	Probability & Statistical Data Analysis	3	3	
7	SCSJ1023	Programming Technique II	3	3	
8	SCSR1033	Computer Organisation and Architecture	3	3	
9	SCSD2523	Database	3	3	
10	SCSD2613	System Analysis and Design	3	3	
11	SCSJ2013	Data Structure and Algorithm	3	3	
12	SCSR2213	Network Communications	3	3	
13	SCSV2113	Human Computer Interaction	3	3	
14	SCSJ2203	Software Engineering	3	3	
15	SCSV2223	Web Programming	3	3	
16	SCSR2043	Operating Systems	3	3	
17	SCSJ2154	Object Oriented Programming	4	4	
18	SCSJ3032	Software Engineering Project I	2	2	
19	SCSJ3203	Theory of Computer Science	3	3	
20	SCSJ4118	Industrial Training	8	HL	
21	SCSJ4114	Industrial Training Report	4	4	
22	SCSJ4134	Software Engineering Project II	4	4	
23	SCSD3761	Technopreneurship Seminar	1	1	
ELECTIVES COURSES (34 CREDITS)					
24	SCSJ2253	Requirements Engineering & Software Modelling	3	3	
25	SCSJ2363	Software Project Management	3	3	
26	SCSJ3104	Applications Development	4	4	
27	SCSJ3553	Artificial Intelligence	3	3	
28	SCSJ3303	Internet Programming	3	3	
29	SCSJ3323	Software Design & Architecture	3	3	
30	SCSJ3603	Knowledge-Based & Expert Systems	3	3	
31	SCSJ3343	Software Quality Assurance	3	3	
32	SCSJ3563	Computational Intelligence	3	3	

33	SCSJ 3623	Mobile Application Programming	3	3	
34	SCSJ3403	Special Topic in Software Engineering	3	3	
35	SCSJ3483	Web Technology	3	3	
36	SCSJ4383	Software Construction	3	3	
37	SCSJ4423	Real-Time Software Engineering	3	3	
38	SCSJ4463	Agent-Oriented Software Engineering	3	3	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			**108**	**100**	

UNIVERSITY GENERAL COURSES

Cluster 1: Appreciation of Philosophy, Value & History
(Faculty of Social Sciences and Humanities)

1	UHAS 1172	Malaysia Dynamic (for Local Students Only)	2	2	
	UHAK 1022	Malaysian Studies 3 (for International Students only)			
2	UICI 1012	Islamic and Asian Civilisation (for Local Students only)	2	2	
	ULAM1012	**Malaysia Language for Communication for International Students only)			

Cluster 2: Generic Skills

1	UHAK 1012	Graduate Success Attributes	2	2	
2	UHAK 1032	Introduction to Entrepreneurship	2	2	

Cluster 3: Expansion of Knowledge

1	UICL 2302	The Thought of Science and Technology	2	2	
2	UICL 2xx2	Enrichment of Knowledge Elective	2	2	

Cluster 4: Co-Curriculum and Service Learning

1	UKQXxxx2	Co-curriculum	2	2	

Cluster 5: Language Skill
(Language Academy, Faculty of Social Sciences and Humanities)

1	ULAB 1122	Academic English Skills	2	2	
2	ULAB 2122	Advanced Academic English Skills	2	2	
3	ULAB 3162	English for Professional Purposes	2	2	
4	ULAX 1122	Elective Of Foreign Language	2	2	
5	UHAK 2xx2	Generic Skills Elective			

Cluster 6: Extracurricular Experiential Learning/ Pengalaman Pembelajaran Luar Kurikulum

1	UKQE 3001	Extracurricular Experiential Learning	1	1	
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

SCSI1013 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.

SCSJ1013 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.

SCSR1013 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.

SCSP1513 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.

SCSI1113 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.

SCSJ1023 Programming Technique II
Pre-requisite :   SCSJ1013 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.

SCSR1033 Computer Organisation and Architecture
Pre-requisite :   SCSR1013 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.

SCSD2523 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.

SCSD2613 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.

SCSJ2013 Data Structure and Algorithm
Pre-requisite : SCSJ1013 Programming Technique I
**   SCSJ1023 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.

SCSR2213 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.

SCSV2113 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.

SCSJ2203 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.

SCSV2223 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.

SCSR2043 Operating Systems
Pre-requisite : SCSJ1033 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.

SCSJ2154 Object Oriented Programming
Pre-requisite : SCSJ1023 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.

SCSJ3032 Software Engineering Project I
Pre-requisite : SCSJ3104 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.

SCSJ3203 Theory of Computer Science
Pre-requisite : SCSI1013 Discrete Structure
**   SCSJ2013 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.

SCSJ4118 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

SCSJ4114 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%.

SCSJ4134 Software Engineering Project II
Pre-requisite :   SCSJ3032 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.

SCSD3761 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

SCSJ2253 Requirements Engineering & Software Modelling
Pre-requisite :   SCSJ2203 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.

SCSJ2363 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.

SCSJ3104 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.

SCSJ3553 Artificial Intelligence
Pre-requisite :   SCSJ2013 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

SCSJ3303 Internet Programming
Pre-requisite : **SCSJ2154 Object Oriented Programming**
SCSV2223 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.

SCSJ3323 Software Design & Architecture
Pre-requisite : **SCSJ 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.

SCSJ3603 Knowledge-Based & Expert Systems
Pre-requisite : **SCSJ 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.

SCSJ3343 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.

SCSJ3563 Computational Intelligence
Pre-requisite :   SCSJ3553 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.

SCSJ 3623 Mobile Application Programming
Pre-requisite :   SCSJ2154 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.

SCSJ3403 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.

SCSJ3483 Web Technology
Pre-requisite :   SCSJ2154 Object Oriented Programming
SCSV2223 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.

SCSJ4383 Software Construction
Pre-requisite :   SCSJ 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.

SCSJ4423 Real-Time Software Engineering
Pre-requisite :   SCSJ 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.

SCSJ4463 Agent-Oriented Software Engineering
Pre-requisite :   SCSJ 2203 Software Engineering
                              SCSJ2154 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)

S C S P

BACHELOR OF COMPUTER SCIENCE (DATA ENGINEERING) PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Data 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 (Data Engineering)
4.	Final Award	Bachelor of Computer Science (Data Engineering)
5.	Programme Code	TC16 (SCSP)
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)	2u2i
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	-	14	-
Short	4	-	8	-

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 SCSP4114, SCSP4124, SCSP4134 and SCSP4112; and
  - 12 credits will be graded at the second semester under the Industrial Integrated Project course codes SCSP4223, SCSP4235 and SCSP4234.
- Pass 5 Professional Skills Certificate (PSC).

Entry Requirements

The minimum qualifications for candidates who intend to do a Bachelor of Computer Science (Data 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 SPM with credit in Bahasa Melayu/Bahasa Malaysia OR credit in Bahasa Melayu/Bahasa Malaysia in July Paper;
   ii.   Passed STPM with Grade C (GPA 2.00) in Pengajian Am, AND Grade C (GPA 2.00) in TWO (2) other subjects;
   iii. Achieved Malaysian University English Test (MUET) with at least Band 1.

   Special Requirements for the Programme
   i.   Passed with at least Grade B- (2.67) in 2 (TWO) of the following subjects:
         a. Mathematics T / Further Mathematics / Computing
         b. Physics/ Chemistry/ Biology
   ii.   Passed with credit in Mathematics at SPM level or equivalent

2) Minimum requirements for **Matriculation Certificates (KPM) / Universiti Malaya (UM) Foundation Science / Universiti Teknologi MARA (UiTM) Foundation / Ministry of Education (MOE) Foundation of Law** (fulfil the general requirements set by the university as well as other conditions of the programme).

General University Requirements
   i.   Passed SPM OR equivalent with credit in Bahasa Melayu / Bahasa Malaysia OR credit in Bahasa Melayu / Bahasa Malaysia in July Paper.
   ii. Passed MOE Matriculation / UM Foundation Science / UiTM Foundation / MOHE Foundation of Law with at least CPA 2.80.
   iii. 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:
        c) Mathematics; AND
        d) 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.   Passed SPM or equivalent with credit in Bahasa Melayu/Bahasa Malaysia OR credit in Bahasa Melayu/Bahasa Malaysia in July Paper.
   ii. Obtained Diploma or other certifications from institutions recognized by the Malaysian Government and approved by the University Senate.
   iii. Achieved Malaysian University English Test (MUET) with at least Band 1.

Special Requirements of the Programme:

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- (2.67) 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.

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 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.
PEO2	Demonstrate the ability to learn and grow throughout their career and further contribute to the advancement of the computer network and security discipline.
PEO3	Develop software of increasing size and complexity, proficiently applying computer network and security theoretical

	knowledge across different application.
PEO4	Become leaders or technopreneurs in computer science discipline.
PEO5	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	Ability to acquire the theory and principles of Computer Science and Data Engineering and be equipped with social science and personal development knowledge.
PLO2	Ability to apply theoretical principles of Computer Science and Data Engineering for analyzing, designing and developing computer system and adapt it in practice.
PLO3	Ability to integrate and demonstrate knowledge to solve real world industry problems through data engineering principles and methodologies, and propose IT related business solutions innovatively using current tools and techniques.
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 work effectively and adapt to the new 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 enroll and pass all certificate programmes offered by the Centers 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
SCSP1513	Technology & Information System (WBL)	3	
SCSJ1013	Programming Technique I	3	
SCSR1013	Digital Logic	3	
SCSI1013	Discrete Structure	3	
UHAS1162	Arts, Customs & Belief of Malaysian *(International Students)*	2	
UHAS1172	Malaysia Dynamic		
UICI1012	Islamic and Asian Civilization (TITAS)	2	
ULAM1012	Malaysia Language for Communication *(International Students)*	2	
ULAx1112	Elective Foreign Language		
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	18	

YEAR 1: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSJ1023	Programming Technique II	3	SCSJ1013
SCSV2113	Human Computer Interaction	3	
SCSI1143	Probability & Statistical Data Analysis	3	
SCSR1033	Computer Organization and Architecture	3	SCSR1013
UHAK1012	Graduate Students Attributes	2	
ULAB1122	Academic English Skills	2	
UKQXxxx2	Co-Curriculum	2	
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	36	

YEAR 2: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SCSP2523	Database (WBL)	3	
SCSP2613	System Analysis and Design (WBL)	3	
SCSJ2013	Data Structure and Algorithm	3	SCSJ1013 SCSJ1023
SCSR2213	Network Communications	3	
ULAB2122	Advance Academic English	2	
Elective Courses – Choose 1 (3 credits)			
SCSP2723	System Development Technology (WBL)	3	
SCSP2733	Multimedia Data Modeling (WBL)	3	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	53	

YEAR 2: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSJ2154	Object Oriented Programming	4	SCSJ1023
SCSR2043	Operating Systems	3	SCSJ1033
ULAB3162	English for Professional Purpose	2	
UHAK1032	Introduction to Entrepreneurship	2	
SCSD3761	Technopreneurship Seminar (WBL)	1	
UICL2302	The Thought of Science & Technology	2	
Elective Courses - Choose 1 (3 Credits)			
SCSP2633	Information Retrieval	3	
SCSP2753	Data Mining	3	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	70	

YEAR 3: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SCSJ3553	Artificial Intelligence	3	
UICL2xx2	Elektif Perluasan Ilmu	2	
UKQE3001	Extracurricular Experiential Learning	1	
Elective Courses - Choose 4 (12 Credits)			
SCSP3133	High Performance Data Processing	3	
SCSP3213	Business Intelligence	3	
SCSP3623	Database Programming	3	
SCSP3713	Database Administration	3	
SCSP3223	Data Analytics Programming	3	
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	88	

YEAR 3: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSP3204	Software Engineering (WBL) – Modular	4	
Elective Courses - Choose 4 (12 Credits)			
SCSP3744	Enterprise Systems Design and Modeling (WBL) - Modular	4	
SCSP3843	Special Topic in Data Engineering (WBL) - Modular	3	
SCSP3823	Knowledge Management Systems (WBL) - Modular		
*SCSP3106	Application Development (WBL)	6	
*SCSP3416	Management Information Systems (WBL)		
* 3 months short internship			
NOTE:			
• The three courses in this semester will be conducted in modular mode.			
• Students are required to go for a 3 months short internship after week 6 to conduct a case study at the industry.			
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	105	

YEAR 4: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SCSP4114	Professional Development	4	105 credits CGPA >= 2.0
SCSP4124	Professional Practice	4	
SCSP4134	Professional Development and Practice Report	4	
SCSP4112	Initial Industry Project Proposal	2	
	TOTAL CREDIT	14	
	CUMULATIVE CREDITS	119	

YEAR 4: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSP4223	Industrial Integrated Project Proposal	3	
SCSP4235	Industrial Integrated Project Development	5	
SCSP4234	Industrial Integrated Project Development	4	
	TOTAL CREDIT	15	
	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					
CORE COURSES (74 CREDITS)					
1	SCSI1013	Discrete Structure	3	3	
2	SCSJ1013	Programming Technique I	3	3	
3	SCSR1013	Digital Logic	3	3	
4	SCSP1513	Technology & Information System	3	3	
5	SCSJ1023	Programming Technique II	3	3	
6	SCSV2113	Human Computer Interaction	3	3	
7	SCSI1143	Probability & Statistical Data Analysis	3	3	
8	SCSR1033	Computer Organization and Architecture	3	3	
9	SCSP2523	Database (WBL)	3	3	
10	SCSP2613	System Analysis and Design (WBL)	3	3	
11	SCSJ2013	Data Structure and Algorithm	3	3	
12	SCSR2213	Network Communications	3	3	
13	SCSJ2154	Object Oriented Programming	3	3	
14	SCSR2043	Operating Systems	3	3	
15	SCSD3761	Technopreneurship Seminar	3	3	
16	SCSJ3553	Artificial Intelligence	3	3	
17	SCSP3204	Software Engineering (WBL)	4	4	
18	SCSP4114	Professional Development	4	4	
19	SCSP4124	Professional Practice	4	4	
20	SCSP4134	Professional Development and Practice Report	4	4	
21	SCSP4112	Initial Industry Proj2633ect Proposal	2	3	

22	SCSP4223	Industrial Integrated Project Proposal	3	3	
23	SCSP4235	Industrial Integrated Project Development	5	5	
24	SCSP4234	Industrial Integrated Project Report	4	4	
ELECTIVES COURSES (31 CREDITS)					
25	SCSP2723	System Development Technology (WBL)	3	3	
26	SCSP2733	Multimedia Data Modeling (WBL)	3	3	
27	SCSP2633	Information Retrieval	3	3	
28	SCSP2753	Data Mining	3	3	
29	SCSP3133	High Performance Data Processing	3	3	
30	SCSP3213	Business Intelligence	3	3	
31	SCSP3623	Database Programming	3	3	
32	SCSP3713	Database Administration	3	3	
33	SCSP3223	Data Analytics Programming	3	3	
34	SCSP3744	Enterprise System Design and Modeling (WBL) – Modular	4	4	
35	SCSP3843	Special Topic in Data Engineering (WBL) – Modular	3	3	
36	SCSP3823	Knowledge Management Systems	3	3	
37	SCSP3106	Application Development (WBL)	6	6	
38	SCSP3416	Management Information System (WBL)	6	6	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			109	109	

UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value & History **(Faculty of Social Sciences and Humanities)**					
1	UHAS1172	Malaysia Dynamic (for Local Students Only)	2	2	
	UHAS1162	Arts, Customs & Belief of Malaysians (for International Students only)			
2	UICI 1012	Islamic and Asian Civilisation (for Local Students only)	2	2	
Cluster 2: Generic Skills					
1	UHAK 1012	Graduate Success Attributes	2	2	
2	UHAK 1032	Introduction to Entrepreneurship	2	2	
Cluster 3: Expansion of Knowledge					
1	UICL 2302	The Thought of Science and Technology	2	2	
2	UICL 2xx2	Enrichment of Knowledge Elective	2	2	
Cluster 4: Co-Curriculum and Service Learning					
1	UKQXxxx2	Co-curriculum	2	2	
Cluster 5: Language Skill **(Language Academy, Faculty of Social Sciences and Humanities)**					
1	ULAB 1122	Academic English Skills	2	2	
2	ULAB 2122	Advanced Academic English Skills	2	2	

3	ULAB 3162	English for Professional Purposes	2	2	
4	ULAx 1122	Elective Foreign Language	2	2	
5	ULAM1112	Bahasa Melayu untuk Komunikasi (International Students)			
Cluster 6: Extracurricular Experiential Learning/ Pengalaman Pembelajaran Luar Kurikulum					
1	UKQE 3001	Extracurricular Experiential Learning	1	1	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	
TOTAL CREDIT TO GRADUATE (a + b + c)			131	131	
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

SCSI1013 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.

SCSJ1013 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.

SCSR1013 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.

SCSP1513 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.

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.

SCSJ1023 Programming Technique II
Pre-requisite: SCSJ1013 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.

SCSR1033 Computer Organisation and Architecture
Pre-requisite: SCSR1013 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.

SCSV2113 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.

SCSP2523 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 will be 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 the 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 should be able to apply the knowledge of designing and developing a good database system for a real world problem.

SCSP2613 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 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 system can be developed..

SCSJ2013 Data Structure and Algorithm
Pre-requisite: SCSJ1013 Programming Technique I
SCSJ1023 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.

SCSR2213 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.

SCSR2043 Operating Systems
Pre-requisit : SCSJ1033 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.

SCSJ2154 Object Oriented Programming
Pre-requisite: SCSJ1023 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.

SCSP3204 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. Thi! 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 will also expose students to industry's experiences for a montt in administrating high quality software systems through sharing knowledge sessions and work based learnin1 activities with selected organization.

SCSD3761 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.

SCSP4114 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 develop their generic skills in a real career life when performing the tasks given by the organisation. The students are jointly evaluated by supervisors from the faculty and the organisation. The evaluation is focusing on students' generic skills.

SCSP4124 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 intend 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.

SCSP4134 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.

SCSP 4112 Initial Industry Project Proposal

This course required students to write a report for initial industry project. The objectives are for the students to produce an initial industry project report. This will require students to identify relevant information pertaining to the project needs and write a step-by-step report to complete the initial stages of proposal. In the proposal students need to identify project title, problem background, proper solutions, project objectives, project scopes and technical project requirements. Students will undergo interview sessions by lecturers to validate the proposed topic.

SCSP 4223 Industry Integrated Project Proposal

This course requires student to report their individual project given at the organisation or industry. The objective is for the students to apply the knowledge learned in the university and in the industry, and to produce a complete report of their lesson learnt in the project involvement experiences. This will require students to identify relevant information pertaining to the project needs and write a step-by-step report to complete the initial stages of proposal, planning, designing, developing and presenting the project. Students also need to report their progress by filling-up log book and closely communicate with the supervisors (faculty and industry) throughout the semester. Through this course students should acquire knowledge and skills in systems development methodology and be able to prepare a final year industry integrated project report.

SCSP4234 Industry Integrated Project Report

This course requires student to fulfil task/project successfully at an organisation or industry. The objective for the students is to apply the knowledge learned in the university and boost their skills which needed by a profession. This will require students to identify relevant information pertaining to project needs and propose a project according to the user requirements. Based on the user and organization requirement, the students need to code, execute and/or integrate modules to fully implement the project development lifecycle. Students also need to test the system the fully develop system to the user, organization and faculty. Students need to report their progress by filling-up log book and closely communicate with the supervisors (faculty and industry) throughout the semester. Through this course students should acquire knowledge and skills in systems development methodology and be able to prepare a final year project proposal.

SCSP4235 Industrial Integrated project Development

This course requires student to fulfil task/project successfully at an organization or industry. The objective for the students is to apply the knowledge learned in the university and boost their skills which needed by a profession. This will require students to identify relevant information pertaining to project needs and propose a project according to the user requirements. Based on the user and organization requirement, the students need to code, execute and/or integrate modules to implement the full project development lifecycle. Students also need to test the system and present the fully develop system to the user, organization and faculty.

ELECTIVE COURSES

SCSP2723 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.

SCSP2753 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.

SCSP2733 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.

SCSP3133 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.

SCSP3213 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.

SCSP3223 Data Analytic Programming

This course introduces the use of Phython specifically for Data Science. Students will learn about powerful ways to store and manipulate data to do da ta 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.

SCSP3713 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.

SCSP3744 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 organisation, 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 work based learning activities with selected organization. At the end of the semester, student should be able to plan and manage the development of enterprise data and information systems.

SCSP3843 Special Topic In Data Engineering (WBL)

This course presents to the students recent research and industrial issues pertaining to data engineering, database systems and technologies. Various topics of interests that are directly or indirectly affecting or are being influenced by data engineering, 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 for a month in managing database systems and technologies through sharing knowledge sessions and work based learning activities with selected organization.

SCSP3823 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 management tools and technology are introduced and real case studies are discussed. At the end of the course, students should be able to develop basic KMS.