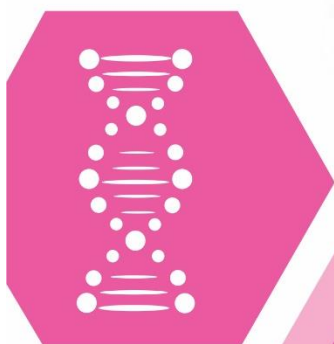


**BACHELOR OF COMPUTER SCIENCE
(BIOINFORMATICS)**



SCSB

BACHELOR OF COMPUTER SCIENCE (BIOINFORMATICS) PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Bioinformatics) is offered either 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 (Bioinformatics)
4. Final Award	Bachelor of Computer Science (Bioinformatics)
5. Programme Code	TC24 (SCSB)
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	-	8	-
Short	4	-	4	-

Course Classification

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

Award Requirements

To graduate, students must:

- Achieve a total of 131 credit hours with minimum CPA of 2.0.
- Pass industrial training (equivalent to 12 credit hours), which 4 credits will be graded and 8 credits as HW status.
- Complete Bioinformatics Project I and II.
- Pass 5 Professional Skills Certificate (PSC).

Entry Requirements

The minimum qualifications for candidates who intend to do a Bachelor of Computer Science (Bioinformatics) 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 computer scientists in local and global industries and organisations, where they are competent in applying the fundamental knowledge, computational principles and skills in Bioinformatics field to develop software of increasing size and complexity across different application areas.
PEO2	Demonstrate an ability to continue to learn throughout their career (professional, technical or postgraduate education) which can strengthen their analytical and critical thinking skills to position them to advanced Computer Science and Bioinformatics practices and to contribute to the intellectual foundations of the Computer Science and Bioinformatics disciplines.
PEO3	Involved in bioinformatics and related software projects that they are proficient in applying theoretical computing and knowledge in analysing, modelling, designing, developing and evaluating computing solutions.
PEO4	Become leaders or technopreneurs in interdisciplinary disciplines.
PEO5	Demonstrate an awareness of professional ethics and social responsibility as computer scientists specialising in bioinformatics.

Programme Learning Outcomes (PLO)

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

Code	Intended Learning Outcomes
PLO1	Ability to acquire and apply theory and principles of Computer Science and Bioinformatics, and equip with social science and personal development knowledge.
PLO2	Ability to design and construct computer programs using standard approaches.
PLO3	Ability to identify, formulate and solve real world bioinformatics problems through principles and methodologies.
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
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)		
ULAM1012	**Malaysia Language for Communication	2	
	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
SQBS1143	Cellular and Molecular Biology	3	
ULAB1122	Academic English Skills	2	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	35	

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	52	

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	
<i>Elective Courses - Choose 1 (3 Credits)</i>			
SCSB2103	Bioinformatics I	3	
SCSD2623	Database Programming	3	
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	70	

YEAR 3: SEMESTER 1			
Code	Course	Credit	Pre-requisite
ULAB3162	English for Professional Purpose	2	
ULAx 1122	* Foreign Language Elective	2	
UHAK 2x2	**Generic Skills Elective		
UKQE 3001	Extracurricular Experiential Learning	1	
<i>Elective Courses - Choose 4 (13 Credits)</i>			
SCSJ3104	Applications Development	4	
SCSJ3553	Artificial Intelligence	3	
SCSB3203	Programming for Bioinformatics	3	
SCSB3032	Bioinformatics II	3	
SQBS3683	Structure and Functions of Proteins	3	
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	88	

* For Malaysian students

** For International students

YEAR 3: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSB3032	Bioinformatics Project I	2	SCSJ3104
SCSJ3203	Theory of Computer Science	3	SCSI1013 SCSJ2013
UICL2302	The Thought of Sciences and Technology	2	
<i>Elective Courses - Choose 3 (9 Credits)</i>			
SCSB3213	Bioinformatics Database	3	
SCSB3133	Computational Biology I	3	
SQBS4713	Genomics and Proteomics	3	
SCSJ3303	Internet Programming	3	
	TOTAL CREDIT	16	
	CUMULATIVE CREDITS	104	

YEAR 4: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SCSB4118	Industrial Training (HW)	8	92 credits CGPA >= 2.0
SCSB4114	Industrial Training Report	4	
	TOTAL CREDIT	12	
	CUMULATIVE CREDITS	116	

YEAR 4: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SCSB4134	Bioinformatics Project II	4	SCSB3032
SCSD3761	Technopreneurship Seminar	1	
UHAK1032	Introduction to Entrepreneurship	2	
UICL 2xx2	Enrichment of Knowledge Elective	2	
<i>Elective Courses - Choose 2 (6 Credits)</i>			
SCSB3223	Computational Biology II	3	
SCSB4243	Special Topics in Bioinformatics	3	
SCSB4213	Bioinformatics Visualization	3	
SCSB4313	Bioinformatics Modeling and Simulation	3	
	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	SCSB3032	Bioinformatic Project I	2	2	
19	SCSJ3203	Theory of Computer Science	3	3	
20	SCSB4118	Industrial Training	8	HL	
21	SCSB4114	Industrial Training Report	4	4	
22	SCSB4134	Bioinformatic Project II	4	4	
23	SCSD3761	Technopreneurship Seminar	1	1	
ELECTIVES COURSES (34 CREDITS)					
24	SCSB3103	Bioinformatics I	3	3	
25	SCSB3032	Bioinformatics II	3	3	
26	SCSB3203	Programming for Bioinformatics	3	3	
27	SCSB3213	Bioinformatic Database	3	3	
28	SCSB3133	Computational Biology I	3	3	
29	SCSB3223	Computational Biology II	3	3	
30	SCSB4243	Special Topic in Bioinformatics	3	3	
31	SCSB4213	Bioinformatics Visualization	3	3	
32	SCSB4313	Bioinformatics Modeling and Simulation	3	3	

33	SCSD2623	Database Programming	3	3	
34	SCSJ3104	Applications Development	4	4	
35	SCSJ3553	Artificial Intelligence	3	3	
36	SCSJ3303	Internet Programming	3	3	
37	SQBS1143	Cellular and Molecular Biology	3	3	
38	SQBS3683	Structure and Functions of Proteins	3	3	
39	SQBS4713	Genomics and Proteomics	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.

SCSB3032 Bioinformatics 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 : SCSJ1013 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.

SCSB4118 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.

SCSB4114 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%.

SCSB4134 Bioinformatics Project II

Pre-requisite : SCSB3032 Bioinformatics Project I

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

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

SCSB3103 Bioinformatics I

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

SCSB3023 Bioinformatics II

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

SCSB3203 Programming for Bioinformatics

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

SCSB3213 Bioinformatics Database

This subject allows students to learn the major bioinformatics databases for data ranking, indexing, searching, visualizing and searching. It also covers information retrieval techniques (e.g. classic, networks, extended Boolean, generalized vector, latent semantic indexing, fuzzy), query operations, text operations searching, the main interface paradigms for query formation and visualization of results, models, indexing (R-trees, Gemini) and searching.

SCSB3133 Computational Biology I

This course will discuss the basic topics of computational biology and the application in bioinformatics. Based on DNA Sequence Analyse Algorithm, the course will apply Python programming. Starts with the usage of basic

Python in solving the DNA Sequence challenge, student will learn how to build computational tools that are used to analyse biological data. At the end of this course, students will have an understanding and appreciation of how the computational biology solve the biological data challenge.

SCSB3223 Computational Biology II

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

SCSB4243 Special Topics in Bioinformatics

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

SCSB4213 Bioinformatics Visualization

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

SCSB4313 Bioinformatics Modeling and Simulation

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

SCSD2623 Database Programming

This course is designed to teach students how to create programmed solutions using SQL and SQL*Plus script as well PUSQL procedural language. As each student is required to have a working knowledge of the programming process and understanding of the functional constructs in programming, the focus of this course is on database problems and potential solutions. Topics that will be covered include storing, retrieving, updating and displaying data using Structured Query Language (SQL)

integrated into Stored Procedures, Functions, Packages and Triggers (PUSQL Programming).

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.

SQBS1143 Cellular and Molecular Biology

This subject will facilitate students to understand and visualize processes in cell biology and those responsible for DNA transmission and expression hence mechanisms by which bacteria inherit genetic information as the blue print of life. The lectures will explain relationship between structure

and function in molecular biology and how this relationship operates to control biochemical processes. Topics include macromolecules like DNA, RNA and proteins and how processes like replication, transcription and translation operate, eukaryotic genetics. Students will cover related aspects such as mutation and mutagenesis and basic techniques for recombinant DNA construction via genetic engineering.

SQBS3683 Structure and Functions of Proteins

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

SQBS4714 Genomics and Proteomics

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