

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

PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Graphics and Multimedia Software) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru. The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years.

The programme is offered on full-time basis and is based on a 2-Semester per academic session. Generally, students are expected to undertake courses equivalent to between fourteen (14) to eighteen (18) credit hours per semester. Assessment is based on 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 (Graphics and Multimedia Software) with Honours			
4. Final Award	Bachelor of Computer Science (Graphics and Multimedia Software) with Honours			
5. Programme Code	SECVH			
6. Professional or Statutory Body of Accreditation	Ministry of Higher Education			
7. Language(s) of Instruction	English			
8. Mode of Study (Conventional, distance learning, etc)	Conventional			
9. Mode of operation (Franchise, self-govern, etc)	Self-governing			
10. Study Scheme (Full Time/Part Time)	Full Time			
11. Study Duration	Minimum : 4 yrs (8 semesters) Maximum : 6 yrs (12 Semesters)			
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	20	14	14
Short	-	-	-	-

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses a) General b) Language c) Co-Curriculum d) IT Entrepreneurship	10 8 3 2	17.6%
ii.	Core Courses	74	56.5%
iii.	Elective Courses	34	25.9%
	Total	131	100%
A	Engineering Courses a) Lecture/Project/Laboratory b) Workshop/ Field/ Design Studio c) Industrial Training d) Final Year Project	Nil	Nil
	Total Credit Hours for Part A		
B	Related Courses a) Applied Science/ Mathematic /Computer b) Management/Law/Humanities/ Ethics/Economy c) Language d) Co-Curriculum	Nil	Nil
	Total Credit Hours for Part B		
	Total Credit Hours for Part A and B	Nil	
	Total Credit Hours to Graduate	131 credit hours	

Award Requirements

To graduate, students must:

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

Programme Educational Objectives (PEO)

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

Code	Intended Educational Objectives
PEO1	Obtain employment as computer scientists in local and global industries and organisations, where they are competent in applying the relevant knowledge, computational principles and skills in Computer Graphics and Multimedia fields to develop software of increasing size and complexity across different application areas
PEO2	Demonstrate an ability to continue to learn throughout their career (professional, technical or postgraduate education) which can strengthen their analytical and critical thinking skills to position them to advanced computer graphic and multimedia practices and to contribute to the intellectual foundations of the Computer Graphics and Multimedia disciplines.
PEO3	Involve in computer graphics and multimedia software projects that they are proficient in applying theoretical computing and knowledge in analysing, modelling, designing, developing and evaluating computing solutions.
PEO4	Becoming leaders or technopreneurs in graphics and multimedia software discipline with combination skills
PEO5	Demonstrate an awareness of professional ethics and social responsibility as computer scientists specialising in computer graphics and multimedia.

Programme Learning Outcomes (PLO)

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

Code	Intended Learning Outcomes
PLO 1 (KW)	Ability to acquire and apply knowledge of Computer Sciences and Graphics and Multimedia Software fundamentals.
PLO 2 (CG)	Ability to demonstrate comprehensive problem analysis and creative design skill to solve and manage complex computing problems using systematic and current approaches
PLO 3 (PS)	Ability to demonstrate technical and scientific expertise in a field of graphics and multimedia software
PLO 4 (IPS)	Ability to perform effective collaboration with stakeholders professionally
PLO 5 (CS)	Ability to communicate effectively both in written and spoken form with other professionals and community
PLO 6 (DS)	Ability to use digital technologies and software to support studies competently
PLO 7 (NS)	Ability to analyse numerical or graphical data using quantitative or qualitative tools in solving problems
PLO 8 (LAR)	Ability to function individually or in teams, effectively, with a capability to be a leader.
PLO 9 (PRS)	Ability to self-advancement through continuous academic or professional development
PLO 10 (ENT)	Ability to initiate entrepreneurial project with relevant knowledge and expertise
PLO 11 (ETS)	Ability to conduct respectable, ethical and professional practices in organization and society

COURSE MENU

YEAR 1: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SECI1013	Discrete Structure	3	
SECJ1013	Programming Technique I	3	
SECR1013	Digital Logic	3	
SECP1513	Technology & Information System	3	
UHMT1012	Graduate Success Attributes	2	
Malaysian Students			
UHS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban	2	
International Students			
UHLB2122	Academic Communication Skills	2	
UHIT2302	The Thought of Sciences and Technology	2	
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	18	

YEAR 1: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SECV1113	Mathematics for Computer Graphics	3	
SECI1143	Probability & Statistical Data Analysis	3	
SECJ1023	Programming Technique II	3	SECJ1013
SECR1033	Computer Organisation and Architecture	3	SECR1013
UHLB1122	English Communication Skills	2	
Malaysian Students			
UHIT2302	The Thought of Sciences and Technology		
International Students			
UHLM1012	Malaysia Language for Communication	2	
	TOTAL CREDIT	16	
	CUMULATIVE CREDITS	34	

YEAR 2: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SECD2523	Database	3	
SECD2613	System Analysis and Design	3	
SECJ2013	Data Structure and Algorithm	3	SECJ1013 SECJ1023
SECR2213	Network Communications	3	
SECV2113	Human Computer Interaction	3	
UKQF2xx2	Service Learning Co-curriculum Elective	2	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	51	

YEAR 2: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SECJ2203	Software Engineering	3	
SECV2223	Web Programming	3	
SECR2043	Operating Systems	3	SECJ1033
SECJ2154	Object Oriented Programming	4	SECJ1023
<i>Elective Courses - Choose 1 (3 Credits)</i>			
SECV2213	Fundamental of Computer Graphics	3	SECV1113 SECJ1023
SECJ2363	Software Project Management	3	
Malaysian Students			
UHLB2122	Academic Communication Skills	2	
International Students			
UHS1022	Falsafah dan Isu Semasa	2	
UHMS1182	Penghayatan Etika dan Peradaban		
	TOTAL CREDIT	18	
	CUMULATIVE CREDITS	69	

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

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

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

YEAR 4: SEMESTER 2			
Code	Course	Credit	Pre-requisite
SECV4134	Graphics and Multimedia Software Project II	4	SECV3032
SECD3761	Technopreneurship Seminar	1	
UBSS1032	Introduction to Entrepreneurship	2	
UXXX 2xx2	Enrichment of Knowledge Elective	2	
UXXX2XX2	Generic Skill Elective	4	
<i>Elective Courses - Choose 2 (6 Credits)</i>			
SECV4213	Computer Games Development	3	SECJ1013
SECV4233	Advanced Computer Graphics	3	SECV2213
SECV4273	Introduction to Speech Recognition	3	SECJ1023
SECH5xx3/ SECD5xx3/ SECS5xx3	PRISMS Elective 1	3	
SECH5xx3/ SECD5xx3/ SECS5xx3	PRISMS Elective 2	3	
	TOTAL CREDIT	15	
	CUMULATIVE CREDITS	131	

PRISMS ELECTIVE COURSES

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

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the course are not allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNT-ED (JKK)	TICK (✓) IF PASSED
COMPUTER SCIENCE COURSES					
CORE COURSES (74 CREDITS)					
1	SECI1013	Discrete Structure	3	3	
2	SECJ1013	Programming Technique I	3	3	
3	SECR1013	Digital Logic	3	3	
4	SECP1513	Technology & Information System	3	3	
5	SECI1113	Computational Mathematics	3	3	
6	SECI1143	Probability & Statistical Data Analysis	3	3	
7	SECJ1023	Programming Technique II	3	3	
8	SECR1033	Computer Organisation and Architecture	3	3	
9	SECD2523	Database	3	3	
10	SECD2613	System Analysis and Design	3	3	
11	SECJ2013	Data Structure and Algorithm	3	3	
12	SECR2213	Network Communications	3	3	
13	SECV2113	Human Computer Interaction	3	3	
14	SECJ2203	Software Engineering	3	3	
15	SECV2223	Web Programming	3	3	
16	SECR2043	Operating Systems	3	3	
17	SECJ2154	Object Oriented Programming	4	4	
18	SECV3032	Graphics and Multimedia Software Project I	2	2	
19	SECJ3203	Theory of Computer Science	3	3	
20	SECV4118	Industrial Training	8	HL	
21	SECV4114	Industrial Training Report	4	4	
22	SECV4134	Graphics and Multimedia Software Project II	4	4	
23	SCSD3761	Technopreneurship Seminar	1	1	
ELECTIVES COURSES (34 CREDITS) – Choose SECV3104 and 10 other elective courses from the following list (which can include up to maximum of 4 PRISMS courses, for qualified students)					

SECV ELECTIVES COURSES					
24	SECV2213	Fundamental of Computer Graphics	3	3	
25	SECJ2363	Software Project Management	3	3	
26	SECV3104	Applications Development	4	4	
27	SECJ3553	Artificial Intelligence	3	3	
28	SECV3113	Geometric Modelling	3	3	
29	SECV3213	Fundamental of Image Processing	3	3	
30	SECJ3263	Mobile Application Programming	3	3	
31	SECV3223	Multimedia Data Processing	3	3	
32	SECJ3563	Computational Intelligence	3	3	
33	SECV3263	Multimedia Web Programming	3	3	
34	SECV3233	Data Visualisation	3	3	
35	SECV3123	Real-time Computer Graphics	3	3	
36	SECV4213	Computer Games Development	3	3	
37	SECV4233	Advanced Computer Graphics	3	3	
38	SECV4273	Introduction to Speech Recognition	3	3	
PRISMS ELECTIVES COURSES					
39	SECR 5033	Information Security Governance and Risk Management	3	3	
40	SECR 5043	Cloud Computing Security	3	3	
41	SECJ 5013	Secure Software Engineering	3	3	
42	SECR 5053	Penetration Testing	3	3	
43	SECJ 5023	Advanced Theory of Computer Science	3	3	
44	SECJ 5033	Advanced Data Structure and Algorithms	3	3	
45	SECJ 5043	Advanced Artificial Intelligence	3	3	
46	SECP 5013	Advanced Analytics for Data Science	3	3	
47	SECP 5023	Big Data Management	3	3	
48	SECP 5033	Business Intelligence and Analytics	3	3	
49	SECP 5043	Data Science Governance	3	3	
50	SECP 5053	Massive Mining and Streaming	3	3	
51	SECP 5063	Statistics for Data Science	3	3	
TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)			108	100	
UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
For Malaysian Students					
1	UHIS1022	Falsafah dan Isu Semasa	2	2	
2	UHMS1182	Penghayatan Etika dan Peradaban	2	2	
For International Students					

1	UHS1022	Falsafah dan Isu Semasa	2	2	
	UHMS1182	Penghayatan Etika dan Peradaban			
2	UHLM1012	Malaysia Language for Communication	2	2	
Cluster 2: Generic Skills					
1	UBSS1032	Introduction to Entrepreneurship	2	2	
2	UHMT1012	Graduate Success Attributes	2	2	
Cluster 3: Knowledge Enhancement					
1	UHIT2302	The Thought of Science and Technology	2	2	
Cluster 4: Co-Curriculum and Service Learning					
1	UKQF2xx2	Service Learning Co-curriculum Elective	2	2	
2	UKQT3001	Extracurricular Experiential Learning	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
1	UHLB1122	English Communication Skills	2	2	
2	UHLB2122	Academic Communication Skills	2	2	
3	UHLB3132	Professional Communication Skills	2	2	
4	UHLx1112	Foreign Language Elective	2	2	
Other University Electives					
1	Uxxx2xx2	Any 1 course from Cluster 2 or Cluster 3	2	2	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			23	23	
TOTAL CREDIT TO GRADUATE (a + b + c)			131	123	

OTHER COMPULSORY COURSES

No.	PSC COURSE	
COMPULSORY COURSES		
1	Design Thinking for Entrepreneur	
2	Talent and Competency Management	
3	English Communication Skills for Graduating Students (ECS)	
ELECTIVE COURSES		
4	Occupational Safety, Health & Environment (OSHE) (<i>Compulsory to all FE students</i>)	
5.	Choose ONE elective course from the following list: 17. Data Analytics for Organization 18. Construction Measurement (Mechanical & Electrical Works) 19. Professional Ethics and Integrity 20. Other electives courses offered in future	

COURSE SYNOPSIS

CORE COURSES

SECI1013 Discrete Structure

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

SECJ1013 Programming Technique I

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

SECR1013 Digital Logic

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

SECP1513 Technology & Information System

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

SECV1113 Mathematics for Computer Graphics

The aim of this course is to introduce and develop mathematical skills that underpin the technical aspects of computer graphics application. It will emphasize on matrix, vector, geometry and

parametric representation, trigonometry, linear algebra and general concept of Vector Calculus. For further understanding about this subject, a lot of exercises will be given. At the end of the course, students should be able to grasp key concept and uses each of the mathematical concept in computer graphics application.

SECI1143 Probability & Statistical Data Analysis

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

SECJ1023 Programming Technique II

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

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

SECR1033 Computer Organisation and Architecture

Pre-requisite : **SECR1013 Digital Logic**

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

SECD2523 Database

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

developing a good database system.

SECD2613 System Analysis and Design

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

SECJ2013 Data Structure and Algorithm

Pre-requisite : **SECJ1013 Programming Technique I**
 SECJ1023 Programming Technique II

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

SECR2213 Network Communications

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

SECV2113 Human Computer Interaction

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

SECJ2203 Software Engineering

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

SECV2223 Web Programming

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

SECR2043 Operating Systems

Pre-requisite : **SECJ1033 Computer Organization and Architecture**

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

SECJ2154 Object Oriented Programming

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

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

SECV3032 Graphics and Multimedia Software Project I

Pre-requisite : **SECJ3104 Application Development**

This is the initial part of a 2-part Final Year Project that every student must fulfil successfully. Students are introduced to the methodologies of research and application development through

a series of lectures. Students are guided through a step-by-step practice to complete the initial stages of proposal, planning and design of a project. Students must also meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their initial work.

SECJ3203 Theory of Computer Science

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

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

SECV4118 Industrial Training (HW)

Pre-requisite : **92 credits AND CGPA \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

SECV4114 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%.

SECV4134 Graphics and Multimedia Software Project II

Pre-requisite : **SECV3032 Graphics and Multimedia Software Project I**

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

SECD3761 Technopreneurship Seminar

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

ELECTIVE COURSES

SECV2213 Fundamental of Computer Graphics

Pre-requisite : **SECV1113 Mathematics for Computer Graphics**
 SECJ1023 Programming Technique II

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

SECJ2363 Software Project Management

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

SECV3104 Applications Development

Application Development is a comprehensive service learning course which requires student to solve a real community problem by developing an application. Students will learn how to practice design thinking, adopting Agile development methodology. This involves an iterative process starting from community engagement, requirement elicitation and analysis, design solution, application construction and iterative verification process. Students are required to do reflection

on the outcome of the project. In this course students should be able to develop their soft skills such as leadership, team collaboration, documentation process and communication skill.

SECJ3553 Artificial Intelligence

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

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

SECV 3113 Geometric Modelling

Pre-requisite : **SECV2213 Fundamental of Computer Graphics**

This course is designed for students to understand how geometric objects are modeled. This subject emphasizes on the theory of representations, algorithms, and the underlying theoretical framework, essential to solving geometric problems encountered in modeling a 2D/3D object. Selected advanced research issues, such as mesh generation, shape reconstruction; feature-based modeling, non-manifold geometry, and variation surface modeling are also covered. At the end of the course, the student should be able to apply the knowledge of 3D geometric modeling and write program to produce simple 3D models using standard 3D graphics libraries.

SECV3213 Fundamental Of Image Processing

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

SECJ3563 Computational Intelligence

Pre-requisite : **SECJ3553 Artificial Intelligence**

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

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

SECJ 3623 Mobile Application Programming

Pre-requisite : **SECJ2154 Object-Oriented Programming**

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

SECV3223 Multimedia Data Processing

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

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

SECV3263 Multimedia Web Programming

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

SECV3233 Data Visualisation

This course 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.

SECV3123 Real-time Computer Graphics

Pre-requisite : **SECV2213 Fundamental of Computer Graphics**

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

SECV4213 Computer Games Development

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

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

SECV4543 Advanced Computer Graphics

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

SECV4273 Introduction to Speech Recognition

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

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

INTEGRATED BACHELOR-MASTER PROGRAMME (PRISMS) ELECTIVE COURSES

LIST of PRISMS ELECTIVE COURSES

1. **Master of Science (Information Security)/ Master of Cyber Security**
 - SSCR/SECR 5013 Cryptographic Engineering
 - SSCR SECR5023 Digital Forensics
 - SSCR/SECR 5033 Information Security Governance and Risk Management
 - SSCR/SECR 5043 Cloud Computing Security
 - SCSJ/SECJ 5013 Secure Software Engineering
 - SECR 5053 Penetration Testing

2. **Master of Computer Science, by mixed mode**
 - SCSJ/ SECJ 5023 Advanced Theory of Computer Science
 - SCSJ/ SECJ 5033 Advanced Data Structure and Algorithms
 - SCSJ/ SECJ 5043 Advanced Artificial Intelligence

3. **Master of Science (Data Science)**
 - SCSP/SECP 5013 Advanced Analytics for Data Science
 - SCSP/SECP 5023 Big Data Management
 - SCSP/SECP 5033 Business Intelligence and Analytics
 - SCSP/SECP 5043 Data Science Governance
 - SCSP/SECP 5053 Massive Mining and Streaming
 - SCSP/SECP 5063 Statistics for Data Science

PRISMS ELECTIVE COURSE SYNOPSIS

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

SECR 5013 Cryptographic Engineering

Pre-requisite: **SECR3443 Introduction to Cryptography**

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

SECR 5023 Digital Forensics

Pre-requisite: **SECR3413 Computer Security**

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

SECR 5033 Information Security Governance and Risk Management

Pre-requisite: **SECR3413 Computer Security**

The course is aimed at imparting knowledge and skill sets required to assume the overall responsibilities of administration and management of security of an information system. This course covers issues related to administration, management and governance of security of information systems. Topics include auditing and data management, risk management (risk identification, risk analysis, risk control), contingency planning, incident handling and risk governance. The course will study in detail principles and tools related to these topics. The course will also cover security standards, evaluation and certification process, security planning, ethical and legal issues in information and privacy.

SECR 5043 Cloud Computing Security

Pre-requisite: **SECR1213 Network Communications**
 SECR3413 Computer Security

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

SECR 5053 Penetration Testing

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

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

SECJ 5013 Secure Software Engineering

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

2. Master of Computer Science, by mixed mode

SECJ 5023 Advanced Theory of Computer Science

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

SECJ 5033 Advanced Data Structure and Algorithms

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

SECJ 5043 Advanced Artificial Intelligence

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

3. Master of Science (Data Science)

SECP 5013 Advanced Analytics for Data Science

This course provides a solid or advanced understanding on the use of analytics approach in the examination of data or content to discover deeper insights, make predictions or generate recommendations using sophisticated techniques and tools on real world problems. Students will learn descriptive analytics using advance tools to gain insight into the past. Students will also acquire understanding of predictive analytics using statistical and machine learning techniques to understand future outcome. The prescriptive analytics provides knowledge in

simulation and optimization to quantify the effect of future decision to advise possible outcomes before decision is made. The analytical abilities to be acquired by students in this course are to reliably select analytic techniques or method and specify steps involve in the analysis process and to interpret analytically the results obtained from data analytics techniques or tools. At the end of the course, students should be able to implement and apply the knowledge on analytical techniques or tools in real world problems and able to make an informed decisions or recommendation through analytical interpretations of results.

SECP 5023 Big Data Management

This course provides a basic fundamental of big data architecture and management. Students will learn the big data processes and the current big data technologies that are available. Further, students will be exposed to the big data platform ecosystem for big data manipulation. The big data management will be explored for the best practice in managing and manipulating large amount of data. At the end of the course, students should be able to understand the architecture and management of big data and also can develop simple application of big data handling using particular platform in assignment.

SECP 5033 Business Intelligence and Analytics

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

SECP 5043 Data Science Governance

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

SECP 5053 Massive Mining and Streaming

This course aims to introduce students to basic principles and methods of machine learning algorithms that are typically used for mining large data sets. This course also will provide students with the skill and knowledge to build system and capable of analyzing huge amount of data. It explains the principle of distributed file systems and shows map reduce as a tool for creating parallel algorithms. Typically, it covers the algorithms that used for analyzing networks,

fundamental principles of techniques such as decision trees and support vector machines and finally neural network architecture. The students will gain practical understanding through a coding exercise where they will implement and apply one machine learning algorithm on a particular large dataset.

SECP 5063 Statistics for Data Science

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