Programme Educational Objectives (PEO)

Code	Intended Educational Objectives
PEO1	Obtain employment as computer scientist in local and global industries and organization, where they are competent in applying the fundamental knowledge, computational principles and skills in 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 (i.e. professional, technical or postgraduate education) which can strengthen their analytical and critical thinking skills to position them to advanced graphics and multimedia software practice and to contribute to the intellectual foundations of the graphics and multimedia software discipline
PEO3	Involve in 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 graphics and multimedia software

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 knowledge of computer science and graphics and multimedia software fundamentals
PLO2	Ability to demonstrate comprehensive problem analysis and creative design skill to solve and manage complex computing problems using systematic and current approaches
PLO3	Ability to demonstrate technical and scientific expertise in the field of computer graphics and multimedia software
PLO4	Ability to perform effective collaboration with stakeholders professionally
PLO5	Ability to communicate effectively both in written and spoken form with other professionals and community
PLO6	Ability to use digital technologies and software to support studies competently
PLO7	Ability to analyse numerical or graphical data using quantitative or qualitative tools in solving problems
PLO8	Ability to function individually or in teams, effectively, with a capability to be a leader
PLO9	Ability to self-advancement through continuous academic or professional development
PLO10	Ability to initiate entrepreneurial project with relevant knowledge and expertise
PLO11	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	
ULRS1032	Integrity and Anti - Corruption Course	2	
	TOTAL CREDITS	**14**	
	CUMULATIVE CREDITS	**14**	
Note: Students with IELTS Band less than 5.5 or TOEFL less than 525 or TOEFL IBT less than 60 or CEFR less than B2 or MUET (for Malaysian student) less than Band 4 must register for UHLB1112 course			

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
SECD2613	System Analysis and Design	3	
Malaysian Students			
UHMS1182	Appreciation of Ethics and Civilisations	2	
International Students			
UHLM1012	Malaysia Language for Communication	2	
	TOTAL CREDITS	**17**	
	CUMULATIVE CREDITS	**31**	

YEAR 2: SEMESTER 1			
Code	Course	Credit	Pre-requisite
SECD2523	Database	3	
SECJ2203	Software Engineering	3	
SECJ2013	Data Structure and Algorithm	3	SECJ1023
SECR2213	Network Communications	3	
SECV2113	Human Computer Interaction	3	
UKQF2xx2	Service-Learning and Community Engagement Courses	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**48**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECV2223	Web Programming	3	SECD2523
SECR2043	Operating Systems	3	
SECJ2154	Object Oriented Programming	4	SECJ1023
UHLB2122	Professional Communication Skills 1 *	2	
UHIS1022	Philosophy and Current Issues	2	
Elective Courses - Choose 1 (3 Credits)			
SECV2213	Fundamental of Computer Graphics	3	SECV1113 SECJ1023
SECJ2363	Software Project Management	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**65**	

* Note: Students with IELTS Band less than 5.5 or TOEFL less than 525 or TOEFL IBT less than 60 or CEFR less than B2 or MUET (for Malaysian student) less than Band 4 must register for UHLB1112 course

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
UHLB3132	Professional Communication Skills 2	2	
UHLx1112	Foreign Language Communication Elective	2	
Elective Courses - Choose 4 (13 Credits)			
SECV3104	Applications Development	4	SECJ2203, SECD2523, SECV2223, SECJ2154
SECJ3553	Artificial Intelligence	3	SECJ2013
SECV3313	Geometric Modelling	3	SECV2213
SECV3213	Fundamental of Image Processing	3	
SECJ3623	Mobile Application Programming	3	SECJ2154
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**82**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECV3032	Graphics and Multimedia Software Project I	2	80 credits SECV3104
Sxxxxxx3	University Free Electives **	3	
ULRS3032	Entrepreneurship and Innovation	2	
Elective Courses - Choose 4 (12 Credits)			
SECV3223	Multimedia Data Processing	3	SECJ1023
SECJ3563	Computational Intelligence	3	SECJ3553
SECV3263	Multimedia Web Programming	3	
SECV4233	Data Visualisation	3	
SECV3123	Real-time Computer Graphics	3	SECV2213
	TOTAL CREDIT	**19**	
	CUMULATIVE CREDITS	**101**	
** *Students must choose University Free Electives subjects offered by faculties other than Faculty of Computing.*			

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	**113**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECV4134	Graphics and Multimedia Software Project II	4	SECV3032
SECD3761	Technopreneurship Seminar	1	
SECJ3203	Theory of Computer Science	3	SECI1013 SECJ2013
Elective Courses - Choose 2 (6 Credits)			
SECV4213	Computer Games Development	3	SECV3123
SECV4543	Advanced Computer Graphics	3	SECV2213
SECV4273	Introduction to Speech Recognition	3	SECJ1023
SECP5xx3/ SECJ5xx3/ SECR5xx3	PRISMS Elective 1	3	
SECP5xx3/ SECJ5xx3/ SECR5xx3	PRISMS Elective 2	3	
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**127**	

PRISMS ELECTIVE COURSES

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

GRADUATION CHECKLIST

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

NO	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
COMPUTER SCIENCE COURSES					
CORE COURSES (74 CREDITS)					
1	SECI1013	Discrete Structure	3	3	
2	SECJ1013	Programming Technique I	3	3	
3	SECR1013	Digital Logic	3	3	
4	SECP1513	Technology & Information System	3	3	
5	SECV1113	Mathematics for Computer Graphics	3	3	
6	SECI1143	Probability & Statistical Data Analysis	3	3	
7	SECJ1023	Programming Technique II	3	3	
8	SECR1033	Computer Organisation and Architecture	3	3	
9	SECD2523	Database	3	3	
10	SECD2613	System Analysis and Design	3	3	
11	SECJ2013	Data Structure and Algorithm	3	3	
12	SECR2213	Network Communications	3	3	
13	SECV2113	Human Computer Interaction	3	3	
14	SECJ2203	Software Engineering	3	3	
15	SECV2223	Web Programming	3	3	
16	SECR2043	Operating Systems	3	3	
17	SECJ2154	Object Oriented Programming	4	4	
18	SECV3032	Graphics and Multimedia Software Project I	2	2	
19	SECJ3203	Theory of Computer Science	3	3	
20	SECV4118	Industrial Training	8	HL	
21	SECV4114	Industrial Training Report	4	4	
22	SECJ4134	Graphics and Multimedia Software Project II	4	4	
23	SECD3761	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	SECR5033	Information Security Governance and Risk Management	3	3	
40	SECR5043	Cloud Computing Security	3	3	
41	SECJ5013	Secure Software Engineering	3	3	
42	SECR5053	Penetration Testing	3	3	
43	SECJ5023	Advanced Theory of Computer Science	3	3	
44	SECJ5033	Advanced Data Structure and Algorithms	3	3	
45	SECJ5043	Advanced Artificial Intelligence	3	3	
46	SECP5013	Advanced Analytics for Data Science	3	3	
47	SECP5023	Big Data Management	3	3	
48	SECP5033	Business Intelligence and Analytics	3	3	
49	SECP5043	Data Science Governance	3	3	
50	SECP5053	Massive Mining and Streaming	3	3	
51	SECP5063	Statistics for Data Science	3	3	
		TOTAL CREDIT OF COMPUTER SCIENCE COURSES (a)	108	100	
		UNIVERSITY GENERAL COURSES			
		Cluster 1:Malaysia Core Value			
		For Malaysian and International Students			
1	UHIS1022	Philosophy and Current Issues	2	2	
		For Malaysian Students			
1	UHMS1182	Appreciation of Ethics and Civilizations	2	2	
		For International Students			
1	UHLM1012	Malaysia Language for Communication	2	2	

Cluster 2: Value and Identity					
1	ULRS1032	Integrity and Anti - Corruption Course	2	2	
Cluster 3: Global Citizen					
1	UKQF2xx2	Service Learning & Community Engagement Courses	2	2	
Cluster 4: Communication and Skills					
1	UHLB2122	Professional Communication Skills 1	2	2	
2	UHLB3132	Professional Communication Skills 2	2	2	
3	UHLx 1112	Foreign Language Communication Elective	2	2	
Cluster 5: Enterprising Skill					
1	ULRS3032	Entrepreneurship and Innovation	2	2	
University Free Electives					
1	Sxxxxxx3	Any 1 course University Free Electives offered by other faculties	3	3	
TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)			19	19	
TOTAL CREDIT TO GRADUATE (a + b + c)			127	119	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATE (PSC)			
Students are required to enrol and pass FIVE (5) PSC courses, to be eligible to graduate. Enrol the PSC courses as follows:			
COMPULSORY PSC COURSES (Enrol All 3 Courses)			
1	GLRB0010	Design Thinking for Entrepreneur	
2	GLRM0010	Talent and Competency Management	
3	GLRL0010	English Communication Skills for Graduating Students (ECS)	
ELECTIVE PSC COURSES (Choose Any 2 Courses only)			
1	GLRT0010	Data Analytics for Organization	
2	GLRM0020	Professional Ethics and Integrity	
3	GLRT0020	Construction Measurement (Mechanical & Electrical)	
4	GLRT0030	OSHE for Engineering Industry and Laboratory	
5	GLRT0040	OSHE for Construction Industry and Laboratory Works	
6	GLRT0050	Quality Management for Build Environment and Engineering Professionals	
7	GLRT0060	Safety and Health Officer Introductory Course	
8	GLRT0070	Industrial Machinery and Lubrication	
Or any other elective PSC courses offered by UTM iLeague. Information on PSC Courses: https://ileague.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

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) and the emerging trends of 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, systems applications, 4IR, cloud computing and data analytics will be introduced. Students will be equipped with basic skills in setting up and handling cloud server via practical work in the virtual guided lab, which shall comprise a major part of the study. At the end of the course, student should be able to distinguish basic IS/IT component and applications.

SECV1113 - Mathematics for Computer Graphics
The aim of this course is to introduce and develop mathematical skills that underpin the technical aspects of computer graphics application. It will emphasize on matrix, vector, geometry and parametric representation, trigonometry, linear algebra and general concept of Vector Calculus. For further understanding about this subject, a lot of exercises will be

given. At the end of the course, students should be able to grasp key concept and uses each of the mathematical concept in computer graphics application.

SECI1143 - Probability & Statistical Data Analysis

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

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

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

SECR1033 - Computer Organisation and Architecture
Pre-requisite: SECR1013 Digital Logic

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

SECD2523 - Database

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

SECD2613 - System Analysis and Design

The main focus of this course is to provide a practical approach of systems analysis and designing skills for the students using structured methodology. Hence the course enables

students to study information system requirements for any system application within an organizational context. The contents are sequentially organized directly from planning, analysis, designing and implementation phases. From the resulting output of the planning and analysis phase shall enable students to form input, output and interface design. Hence a prototype design can be demonstrated.

SECJ2013 - Data Structure and Algorithm
Pre-requisite: SECJ1023 Programming Technique II
This course emphasis on data structure concepts theoretically and practically with detail algorithms for each of data structure. Students will learn abstract data type concepts using class and apply the concept in the implementation of data structures. Apart from it, student will learn recursive concept as a programming style and algorithm efficiency analysis with Big O notation. Various sorting and searching techniques will be discussed as data structure operations. Analysis of each algorithm will also be explained. Further, students will be exposed to linear data structures such as linked lists, stack and queue. Non-linear data structures such as tree and binary search tree will be discussed. Along the course, students should be able to implement and apply the theory and concepts of data structure in the assignments and mini project which are conducted in group.

SECR2213 - Network Communications
This course will discuss the basic topics of computer network and data communications. Based on TCP/IP Internet protocol stack, the course will apply top down approach. Starts with the important and usage of computer network in commonly applications, the approach will go further detail in the technical aspect in data communication. At the end of this course, students will have an understanding and appreciation of how the network works.

SECV2113 - Human Computer Interaction
This course will introduce students to human-computer interaction theories and design processes. The emphasis will be on applied user experience (UX) design. The course will present an iterative evaluation-centered UX lifecycle and will introduce a broader notion of user experience, including usability, usefulness, and emotional impact. The lifecycle should be viewed as template intended to be instantiated in many different ways to match the constraints of a particular development project. The UX lifecycle activities we will cover include contextual inquiry and analysis, requirements extraction, design-informing models, design thinking, ideation, sketching, conceptual design, and formative evaluation.

SECJ2203 - Software Engineering
This course is designed to give students an introduction to an engineering approach in the development of high quality software systems. It will discuss the important software engineering concepts in the various types of the common software process models. The students will also learn the concepts and techniques used in each software development phase including requirements engineering, software design and software testing. This course will also expose the students to utilizing object-oriented method (e.g. UML) and tools in analyzing and designing the software. At the end of this course, students are expected to be able to appreciate most of the common software engineering concepts and techniques as well as producing various software artifacts, documentations, and deliverables.

SECV2223 - Web Programming

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

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

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

SECJ2154 - Object Oriented Programming
Pre-requisite: SECJ1023 Programming Technique II

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

SECV3032 - Graphics and Multimedia Software Project I
Pre-requisite: SECJ3104 Application Development

This is the initial part of a 2-part Final Year Project that every student must fulfil successfully. Students are introduced to the methodologies of research and application development through a series of lectures. Students are guided through a step-by-step practice to complete the initial stages of proposal, planning and design of a project. Students must also meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their initial work.

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

The goal of this course is to provide students with an understanding of basic concepts in the theory of computation. This course introduces students to formal languages and automata theory. It will emphasize on languages, grammars and abstract machines i.e. Regular Language, Context Free Language, Regular Grammar, Context Free Grammar, Finite Automata, Push Down Automata and Turing Machine. The course will also provide practice

on the acceptability of input string by these machines. At the end of the course, students should be able to apply the theory in constructing these abstract machines and testing them with the right input strings.

SECV4118 - Industrial Training (HW)
Pre-requisite: 92 credits AND CGPA >= 2.0
Industrial Training refers to the placement of a student at an organization for a minimum of 20 weeks to elevate students' knowledge and skills in a specific database profession and at the same time produce graduates who are credible, creative and proficient. This course aims to provide a platform for the students apply their knowledge learned in the university and boost their skills which needed by a profession. It is also intended for the students to gain exposure in every aspect of real career life. The students will be evaluated based on two components; 1) student performance evaluation by organisation supervisor and 2) student performance evaluation by faculty supervisor. The organization supervisor is expected to assess the student performance based on work performance and students' personality. The assessment by faculty supervisor more focusing on students' generic skills

SECV4114 - Industrial Training Report
Pre-requisite: 92 credits AND CGPA >= 2.0
Industrial Training Report refers to the placement of a student at an organization for a minimum of 20 weeks to experience and apply their theoretical knowledge in the industrial training. The students will be evaluated based on four components; 1) technical report, 2) oral presentation, 3) log book and 4) ethics. The aim of the technical report is to educate the students in producing related technical report and able to explain a specific detail on the tasks that have been done during the training. Students need to follow specified format in writing the technical report and submit it within the predetermined date. The students are required to present their training achievement to Industrial Training supervisors (organization and supervisor). Students need to fill in the online log book daily for the purpose of close monitoring between the students and supervisors. Student also needs to practice the good ethical values and work conduct throughout the training. The passing mark is 60%.

SECV4134 - Graphics and Multimedia Software Project II
Pre-requisite: SECV3032 Graphics and Multimedia Software Project I
This is the second part of a 2-part Final Year Project that every student must fulfil successfully. In this installation, students are required to execute the next phases of their development plan from Part1. Students are now required to code and integrate the different modules that make up the proposed project. Students will test the developed modules and the final fully-integrated project following software development and research testing practices. Students must meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their final work.

SECD3761 - Technopreneurship Seminar
This 1-credit course will provide module and training for students on how to generate digital income through crowdsourcing platforms and methods. Crowdsourcing is a method to generate online income which the work is offered and implemented digitally in global platforms.

ELECTIVE COURSES

SECV2213 - Fundamental of Computer Graphics
Pre-requisite: SECV1113 Mathematics for Computer Graphics
                 SECJ1023 Programming Technique II
The course introduces students to the fundamental of computer graphics and its applications. It will emphasize on raster graphics hardware, generation of 2D primitives, 2D and 3D transformations, specification of windows and viewports. Students are required to write 2D/3D application in order to reinforce their understanding. At the end of the course, the student should be able to understand how a computer graphics system works and develop simple graphics application using standard graphics libraries.

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

SECV3104 - Applications Development
Pre-requisite: SECJ2203 Software Engineering, SECD2523 Database, SECV2223 Web
                 Programming, SECJ2154 Object Oriented Programming
Application Development is a comprehensive service learning course which requires student to solve a real community problem by developing an application. Students will learn how to practice design thinking, adopting Agile development methodology. This involves an iterative process starting from community engagement, requirement elicitation and analysis, design solution, application construction and iterative verification process. Students are required to do reflection on the outcome of the project. In this course students should be able to develop their soft skills such as leadership, team collaboration, documentation process and communication skill.

SECJ3553 - Artificial Intelligence
Pre-requisite: SECJ2013 Data Structure and Algorithm
This course offers students a new perspective on the study of Artificial Intelligence (AI) concepts. The essential topics and theory of AI are presented, but it also includes practical information on data input and reduction as well as data output (i.e. algorithm usage). In particular, this course emphasizes on theoretical and practical aspects of various search algorithms, knowledge representations, and machine learning methods. The course features practical implementations through assignments undertaken both individually and in groups.

SECV 3113 - Geometric Modelling
Pre-requisite: SECV2213 Fundamental of Computer Graphics
This course is designed for students to understand how geometric objects are modelled. This subject emphasizes on the theory of representations, algorithms, and the underlying theoretical framework, essential to solving geometric problems encountered in modelling a 2D/3D object. Selected advanced research issues, such as mesh generation, shape reconstruction; feature-based modelling, non-manifold geometry, and variation surface modelling are also covered. At the end of the course, the student should be able to apply the knowledge of 3D geometric modelling 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; (half toning and histogram equalization), neighbourhood operations; (convolution, low pass filters, high pass filters, high boost filters, median filter), edge detections, and geometric operations.

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

SECJ 3623 - Mobile Application Programming
Pre-requisite: SECJ2154 Object-Oriented Programming
This course is designed to give students a foundation on the development of applications for mobile devices. It will cover the workflows, tools and frameworks required to develop applications for current and emerging mobile computing devices. The course will adopt a current technology as a basis for teaching the process of mobile application development. This course will also expose the students to composing user interfaces for mobile, dealing with device resources, integrating with backend and deploying the applications. At the end of the course, students should be able to work collaboratively in developing working data- centric mobile applications.

SECV3223 - Multimedia Data Processing
Pre-requisite: SECJ1023 Programming Technique II
This course will 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 presents the theoretical and technical aspects of data visualization in various applications. It emphasises on the process of visualization, which include various data sources, reconstruction of data, data models and data model representation techniques. Real applications of data visualization such as used in medical, scientific, engineering, biotechnology and environment applications are also discussed.

SECV3123 - Real-time Computer Graphics
Pre-requisite: SECV2213 Fundamental of Computer Graphics

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

SECV4213 - Computer Games Development
Pre-requisite: SECV3123 Real Time Computer Graphics

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

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

SECV4273 - Introduction to Speech Recognition
Pre-requisite: SECJ1023 Programming Technique II
This course aims to provide theoretical foundations and practical experience in computer speech processing and recognition. Many of the techniques and algorithms covered under the course are applicable to a variety of areas concerned with recognizing sequences. On completion of the course, students should be able to understand the basic principles of pattern recognition, gain knowledge of automatic speech recognition (ASR) system design, and the various trade-offs involved. It should also enable students to read and discuss technical papers in ASR, speech processing and pattern recognition.