



BACHELOR OF COMPUTER SCIENCES (HONOURS)

SCHOOL OF COMPUTER SCIENCES

BACHELOR OF COMPUTER SCIENCE (HONOURS)

2023/2024



Transforming Higher Education
for a Sustainable Tomorrow

2023/2024
www.usm.my



Bachelor of
COMPUTER SCIENCE

Academic Session 2023/2024

USM Vision

Transforming Higher Education for a Sustainable Tomorrow

USM Mission

USM is a pioneering, transdisciplinary research-intensive university that empowers future talents and enables the bottom billions to transform their socio-economic well-being

STUDENT'S PERSONAL INFORMATION

Full Name	
Identity Card (IC)/Passport No.	
Current Address	
Permanent Address	
E-mail Address	
Telephone No. (Residence)	
Mobile Phone No. (if applicable)	
School	Computer Sciences
Programme of Study	

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IV.



ACADEMIC CALENDAR - ACADEMIC SESSION 2023/2024

FOR ALL SCHOOLS (EXCEPT FOR SCHOOL OF MEDICAL SCIENCES AND SCHOOL OF DENTAL SCIENCES)

Main Campus : Registration for New Student 07 - 08 October 2023 / **Orientation Week (09 - 13 October 2023)
 Engineering Campus : Registration for New Student (08 October 2023) / **Orientation Week (09 - 13 October 2023)
 Health Campus : Registration for New Student (08 October 2023)/**Orientation Week (09 - 13 October 2023)

SEM	WEEKS	ACTIVITY	DATE	REMARKS	
O N E	1	Teaching & Learning (T&L 7 weeks)	Monday, 16.10.2023 - Sunday, 22.10.2023		
	2		Monday, 23.10.2023 - Sunday, 29.10.2023		
	3		Monday, 30.10.2023 - Sunday, 05.11.2023		
	4		Monday, 06.11.2023 - Sunday, 12.11.2023	12.11.2023, Sunday - Deepavali*	
	5		Monday, 13.11.2023 - Sunday, 19.11.2023	13.11.2023, Monday - Deepavali (replacement leave)	
	6		Monday, 20.11.2023 - Sunday, 26.11.2023		
	7		Monday, 27.11.2023 - Sunday, 03.12.2023		
	8	Mid Semester Break (1 Week)	Monday, 04.12.2023 - Sunday, 10.12.2023		
	9	Teaching & Learning (T&L 7 weeks)	Monday, 11.12.2023 - Sunday, 17.12.2023		
	10		Monday, 18.12.2023 - Sunday, 24.12.2023		
	11		Monday, 25.12.2023 - Sunday, 31.12.2023	25.12.2023, Monday - Christmas	
	12		Monday, 01.01.2024 - Sunday, 07.01.2024	01.01.2024, Monday - New Year of 2024	
	13		Monday, 08.01.2024 - Sunday, 14.01.2024		
	14		Monday, 15.01.2024 - Sunday, 21.01.2024		
	15		Monday, 22.01.2024 - Sunday, 28.01.2024	23.01.2024, Thursday - Thaipusam	
	16	Revision Week (1 Week)	Monday, 29.01.2024 - Sunday, 04.02.2024		
	17		Monday, 05.02.2024 - Sunday, 11.02.2024	10 & 11.02.2024, Saturday & Sunday - Chinese New Year	
	18		Monday, 12.02.2024 - Sunday, 18.02.2024	12.02.2024, Monday - Chinese New Year (replacement leave)	
	19		Monday, 19.02.2024 - Sunday, 25.02.2024		
	20	Mid Semester Break / Industrial Training (4 Weeks)	Monday, 26.02.2024 - Sunday, 03.03.2024		
	21		Monday, 04.03.2024 - Sunday, 10.03.2024		
	22		Monday, 11.03.2024 - Sunday, 17.03.2024	12.03.2024, Tuesday - Ramadhan	
	23		Monday, 18.03.2024 - Sunday, 24.03.2024		
T W O	24/1	Teaching & Learning (T&L 7 weeks)	Monday, 25.03.2024 - Sunday, 31.03.2024	28.03.2024, Thursday - Nuzul Al-Quran	
	25/2		Monday, 01.04.2024 - Sunday, 07.04.2024		
	26/3		Monday, 08.04.2024 - Sunday, 14.04.2024	10 & 11.04.2024, Wednesday & Thursday - Eid al-Fitr**	
	27/4		Monday, 15.04.2024 - Sunday, 21.04.2024		
	28/5		Monday, 22.04.2024 - Sunday, 28.04.2024		
	29/6		Monday, 29.04.2024 - Sunday, 05.05.2024	01.05.2024, Wednesday - Labour Day	
	30/7		Monday, 06.05.2024 - Sunday, 12.05.2024		
	31/8	Mid Semester Break(1 Week)	Monday, 13.05.2024 - Sunday, 19.05.2024		
	32/9	Teaching & Learning (T&L 7 weeks)	Monday, 20.05.2024 - Sunday, 26.05.2024	22.05.2024, Wednesday - Wesak Day	
	33/10		Monday, 27.05.2024 - Sunday, 02.06.2024	30 & 31.05.2024, Thursday & Friday - Pesta Kaamatan	
	34/11		Monday, 03.06.2024 - Sunday, 09.06.2024	01 & 02.06.2024, Saturday & Sunday - Hari Gawai	
	35/12		Monday, 10.06.2024 - Sunday, 16.06.2024	03.06.2024, Monday - YDP Agong's Birthday	
	36/13		Monday, 17.06.2024 - Sunday, 23.06.2024	17.06.2024, Monday - Eid al-Adha** 18.06.2024, Tuesday - Eid al-Adha** (replacement leave) (Kelantan)	
	37/14		Monday, 24.06.2024 - Sunday, 30.06.2024		
	38/15		Monday, 01.07.2024 - Sunday, 07.07.2024	07.07.2024, Sunday - Georgetown World Heritage City Day	
	39/16	Revision Week (1 Week)	Monday, 08.07.2024 - Sunday, 14.07.2024	08.07.2024, Monday - Georgetown World Heritage City Day(replacement leave) & Awal Muharram 13.07.2024, Saturday - Penang Governor's Birthday	
	40/17	**Examination (2 Weeks)	Examination (3 Weeks)	Monday, 15.07.2024 - Sunday, 21.07.2024	
	41/18			Monday, 22.07.2024 - Sunday, 28.07.2024	
	42/19			Monday, 29.07.2024 - Sunday, 04.08.2024	
COURSE DURING LONG BREAK / SEMESTER BREAK	43/20	Long Semester Break/Industrial Training (10/11 Weeks)	Monday, 05.08.2024 - Sunday, 11.08.2024		
	44/21		Monday, 12.08.2024 - Sunday, 18.08.2024		
	45/22		Monday, 19.08.2024 - Sunday, 25.08.2024		
	46/23		Monday, 26.08.2024 - Sunday, 01.09.2024	31.08.2024, Saturday - National Day	
	47/24	*T&L	Monday, 02.09.2024 - Sunday, 08.09.2024		
	48/25		Monday, 09.09.2024 - Sunday, 15.09.2024		
	49/26	Examination	Monday, 16.09.2024 - Sunday, 22.09.2024	16.09.2024, Monday - Malaysia Day	
	50/27		Monday, 23.09.2024 - Sunday, 29.09.2024		
	51/28		Monday, 30.09.2024 - Sunday, 06.10.2024		
	52/29		Monday, 07.10.2024 - Sunday, 13.10.2024		

**This Academic Calendar is subject to changes

V. SCHOOL MAIN ADMINISTRATIVE STAFF

DEAN



Prof. Dato' Dr. Bahari Belaton

DEPUTY DEANS



Assoc. Prof. Dr. Nurul Hashimah
Ahamed Hassain Malim
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Assoc. Prof. Dr. Cheah Yu-N
(Research, Innovation and Industry-Community
Engagement)

PROGRAMME MANAGERS



Ts. Dr. Chew XinYing
(Computer Science)



Assoc. Prof. Dr. Ahmad Sufiril Azlan Mohamed
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Assoc. Prof. Dr. Wong Li Pei
(Postgraduate)



Assoc. Prof. Dr. Manmeet Kaur Mahinderjit
Singh
(Research Ecosystem, Development and
Innovation)

SENIOR ASSISTANT REGISTRAR



Puan Mahfuzah Othman

ASSISTANT REGISTRAR



Puan Zuhaida Ariffin

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Honorary Professor	Specialisation	E-mail Room Number Telephone Extension
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Executive Officer	
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1.0 INTRODUCTION

1.1 School of Computer Sciences

The School of Computer Sciences was established officially on the 1st of March 1995 after functioning for a period of 10 years as the Division of Computer Science, an independent and autonomous unit within the then School of Mathematical and Computer Sciences. The period had witnessed various advances, developments and achievements of Computer Science pertaining to academic programmes, research and development, consultancy, community engagements and others. The School of Computer Sciences will continue its efforts in strengthening its curricula and at the same time explore a variety of research areas that contribute significantly to the development of the nation.

1.2 Mission and Vision of the School of Computer Sciences

Vision:

Towards **holistic and sustainability-inspired computing** for a better tomorrow

Mission:

Providing **holistic and sustainability-inspired computing** in the quest for knowledge and **excellence in education and research** that **nurtures individuals** who can contribute effectively towards the transformation of the nation.

1.3 Bachelor of Computer Science (Honours) Programme

Computer Science at USM began with a course in programming in 1974. It has since developed into a specialisation in Computer Science under the Bachelor of Science (Mathematics) honours degree, and eventually the Bachelor of Science (Computer Science) (B.Sc. (Comp.Sc.)) degree with honours was offered. Beginning in the 1983/84 session, after a complete revamp of the curriculum, the Bachelor of Computer Science (B.Comp.Sc.) degree with honours was offered to replace the B.Sc. (Comp.Sc.) degree.

USM's B.Comp.Sc. (Hons.) has succeeded significantly in producing highly qualified graduates that have been widely accepted by both the public and the private sectors. An important contributing factor to this success is its strong curriculum, which always strives to achieve a balance between the teaching of the theory of computing and exposure to practical aspects. The curriculum has been continually updated in accordance with current technology. For instance, in the 1992/93 session a new curriculum which was more up-to-date was implemented, and in the 1994/95 session, it was further modified to conform to the University Academic System (SPU). Beginning with the 1996/97 session, the curriculum had been adjusted to reduce the minimum period for graduation from 4 years to 3 years under the Three Year Academic System (SPTT).

In 2000/01 session a new curriculum was introduced and adapted to conform with the recommendation made by the National Higher Education Council on SPTT (SPTT(M)).

In 2006/07 session, a new revised curriculum was introduced. The degree programme has been adjusted in 2009/10 to revert the minimum period for graduation to 4 years (Four Year Academic Systems) (*Sistem Pengajian Empat Tahun*) (SPET). In 2019/20 academic session, a revised curriculum was introduced which involved restructuring the degree programme into three programs that is offered as single entry multiple track entrance mechanism. This mechanism allows a unified intake for three programs and students will start to specialize at their fourth semester based on their choices. The programs are:

- Bachelor of Computer Science (Hons)(Intelligent Computing),
- Bachelor of Computer Science (Hons)(Computing Infrastructure)
- Bachelor of Computer Science (Hons)(Software Engineering)

1.4 Programme Profiles

All these programme encompasses various aspects of computing as a discipline. The programme covers theoretical and scientific foundations as well as various extensive applications in various domains. The curriculum of the programme emphasizes problem-based learning concepts in particular through practical/project/training-based courses that are integrated throughout the years as well as inculcates research orientation to the students.

In the first year, students are taught the basics of Computer Science such as algorithms and problem solving, programming techniques using a high-level language, data structures, computer organisation and a strong foundation in mathematics, statistics, logic, artificial intelligence and data analytics. Students from all programmes will be taking similar courses up to Year II Sem I.

Second year topics also include common core courses namely operating systems, computer networks and security, analysis of algorithms, database organisation, and foundations of software engineering. Practical and project-based courses namely integrated software development, and group innovation project and study for sustainability are also offered. In Year II Sem II, students will start taking courses related to the field they pursue i.e. Intelligent Computing / Computing Infrastructure / Software Engineering.

Year III offer an integrated and a wide range of specialise courses according to the field chosen. Students will be able to enrich their specialization with electives and additional knowledge via free modules or minor courses from discipline outside computer science. During the second semester and the long vacation of the third-year students will be assigned to various organisations for a full-time industrial training for a period of six months.

In the final year, students will be finishing specialization, elective courses and to undertake a course on professional and technopreneurship development. Students are also required to complete their Final Year project according to the field chosen under the supervision of at least one academic staff.

1.5 General Educational Goals and Objectives

The general educational goal of the Bachelor of Computer Science (Hons.) degree programme is to produce high-quality graduates with the necessary professional skills to practice as successful computing professionals and compete effectively in a world of rapid technological change. Therefore, the educational objectives of the programme are to train:

- PEO1: computing practitioners who are able to adopt appropriate methodologies and techniques to provide computing solutions based on relevant knowledge and technical skills in the fields of computing which are in line with the industry requirements.
- PEO2: computing practitioners who have leadership skills, autonomy and responsibility and communicate effectively with computing-related stakeholders.
- PEO3: computing practitioners who have positive attitudes, commitment for lifelong learning and entrepreneurial mind-set within industry for self and career progression.
- PEO4: computing practitioners who uphold ethical and professional practices in maintaining self and professional integrity.

1.6 Programme Learning Outcomes

At the end of the programme, graduates will be able to:

PLO1	Knowledge and Understanding	Analyse knowledge, facts, concepts, principles, and theories relating to Computer Science;
PLO2	Practical Skills	Adapt appropriate methodologies and techniques for modelling, designing, developing and evaluating computing solutions
PLO3	Cognitive Skills	Analyse algorithms and techniques to design and optimise computing solutions
PLO4	Communication Skills	Communicate effectively and confidently with diverse stakeholders in appropriate context in a well-structured manner to a diversity of audiences.
PLO5	Interpersonal Skills	Interact effectively with different people in diverse learning and working communities in computing practices as well as other groups.

PLO6	Ethics and Professionalism	Uphold professional and ethical practices in delivering services related to the field of computing and varied social environment.
PLO7	Personal Skills	Engage effectively in self-directed lifelong learning and professional pathways.
PL08	Entrepreneurial Skills	Apply entrepreneurial mind set in delivering solutions under changing industry landscape
PL09	Leadership, Autonomy and Responsibility,	Demonstrate leadership, teamwork, accountability and responsibility in delivering services related to field of computing.
PLO10	Digital Skills	Use a broad range of information and software tools to support study or professional work in computing.
PLO11	Numeracy Skills	Use numeracy skills for problem solving in the field of in computing practices.

1.7 Programme Requirements

Programme requirements together with course code classification for all Bachelor of Computer Science (Honours) programmes are given in the table below.

Programme Requirements	Course Type	Number of Units	
		Type of Programme	
		Computer Science	Computer Science plus Minor*
(a) Core (i) Computing (ii) Specialisation	T	60	
		20	
(b) Field Elective (i) Specialisation (ii) Other Field Elective	E	15	
		9	
(c) Free Module / Minor Courses	E	12	-
	M	-	20
University Requirements	U	17 - 22	
Minimum Total Unit Requirements		132 - 141	

*Minor will only appear on transcript if the whole 20 units are completed.

1.8 Type of Courses

Courses offered are categorised as follows:

(a) Core Courses (Course Code Classification – T)

Core courses are required courses for all disciplines related to computing. There are two categories of Core courses which are Computing and Specialisation.

Core Computing are foundation Computer Science courses that must be taken and passed by all Bachelor of Computer Science (Hons) (Intelligent Computing / Computing Infrastructure / Software Engineering) students.

Core courses also include:

- (i) Industrial Training
(Please refer to Section 4.4)
- (ii) Group Innovation Project and Study for Sustainability
(Please refer to Section 4.5)

Core Specialisation are the courses that represents core knowledge area of the specific area of computing. In this case areas such as Intelligent Computing, Computing Infrastructures and Software Engineering. This includes the Final Year Project

(b) Field-Elective Courses (Course Code Classification – E)

Field-elective courses are also divided into two types i.e. specialisation and elective.

Field Electives Specialisation are additional specialisation cores that are required for the area of computing undertaken by students.

Other Field Electives are courses that fall under any Computing discipline. Usually, these courses are related to the area of computing undertaken by students.

(c) Free Modules (Course Code Classification – E)

Free Modules are non-computing courses that are required to be taken by Computer Science students for knowledge enrichment.

(d) Minor Courses (Course Code Classification – M)

As an alternative to Free Modules, students can choose to take up Minor packages offered by other schools. However, students will be doing extra credit hours in order to complete the Minor package. Only once students completed Minor package will their transcript be recorded with Minor Programme details. The unit to be completed is usually 20 credit hours (Please refer to Section 5 or Minor Programme Handbook).

(e) University Courses/Option (Course Code Classification – U)

All Computer Science students must take a number of courses to fulfil the University requirements. Further information on the University Courses/Options is given in Section 3 and specific requirements for students of the School of Computer Sciences are given in Section 4.2.

(f) Special Courses (Course Code Type – Z)

Special Courses are pre-requisite courses that must be taken and passed with at least 'C' grade before a less qualified student is allowed to take a higher-level course. LMT100/2 – Preparatory English is one of such courses in this category.

(g) Audit Courses (Course Code Type – Y)

In principle, the university allows students to register for any courses on an audit basis for the purpose of enhancing the students' knowledge in specific fields during the duration of their study. However, the units of any such audit courses will not be taken into consideration for graduation purposes.

The registration procedures for courses on an audit basis are as follows:

- (i) Students may register for courses on an audit basis for the purpose of augmenting his/her knowledge in specific fields. Registration for the said course must be done within the course registration period.
- (ii) Only students of active status are allowed to register for courses on an audit basis.
- (iii) Courses registered for on an audit basis are designated as code 'Y' courses. This designation will be indicated on the relevant academic transcript. A space at the bottom of the academic transcript will be reserved for listing the courses registered for on an audit basis.
- (iv) Courses registered for on an audit basis will not be taken into consideration in determining the minimum and maximum units of courses registered for.

- (v) Students must fulfil all course requirements. Students, who register for courses on an audit basis, are not obligated to sit for any examinations pertaining to that course. 'R' grade will be awarded irrespective as to whether the student had or had not sat for the examination.

1.9 Graduation Requirements

Students must fulfil the following requirements to graduate:

- (a) Fulfil the minimum required (8 semesters) of the residential requirement for the programme of study and has not exceeded the maximum period of study (14 semesters).
- (b) Fulfil all credit requirements of the courses for the programme of study such as the requirements for each component (Core, Field Elective, Free Modules/Minor and University Courses/Option).
- (c) Obtain a CGPA of 2.00 and above for the Core components (CGPA (AT)).
- (d) Obtain a CGPA of 2.00 and above for the programme.
- (e) Achieve a minimum of 'C' grade or a grade point of 2.00 for all University courses/options especially Bahasa Malaysia, English Language (4 units), HFE224/2 (Local students only), HFF225/2, Core Entrepreneurship (Local students only) and SEA205E - Malaysian Studies (for international students only).

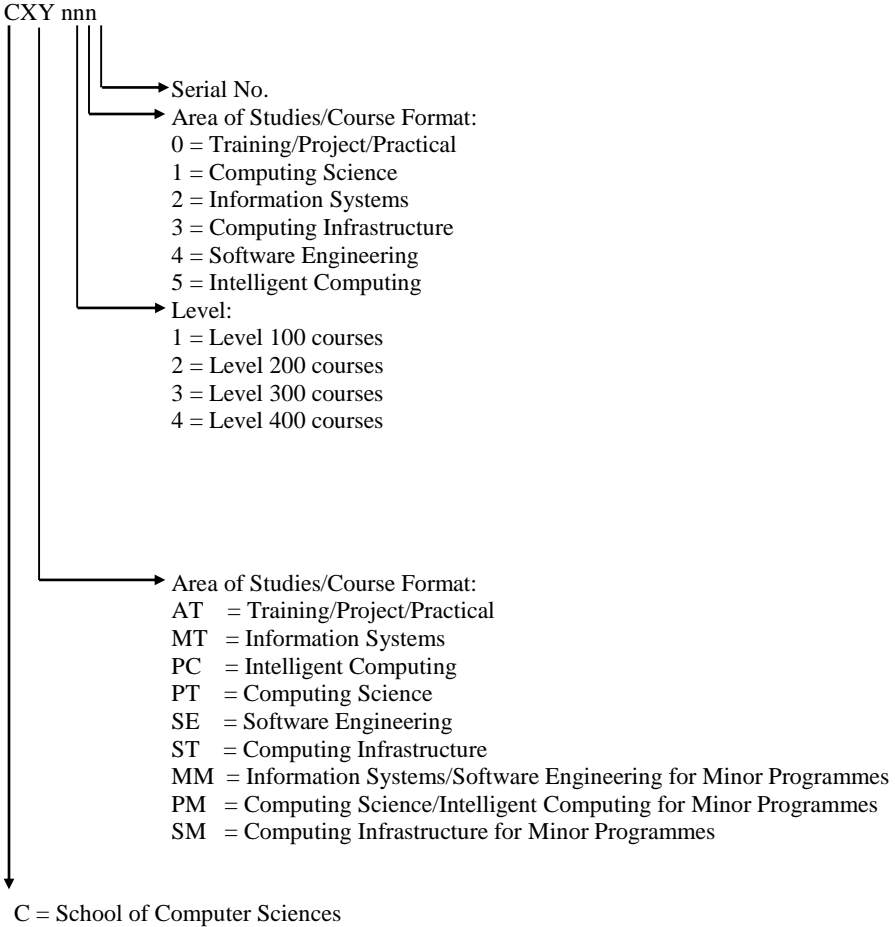
1.10 Academic Year Status

Based on the unit system, the student's academic status is not defined by the number of years that the student has spent in the university. Instead, students are classified as First Year student, Second Year and so on based on the total number of credits accumulated. The academic year status for Bachelor of Computer Science programme is as follows:

Year Status	Total Credits Accumulated
First	0 – 32
Second	33 – 65
Third	66 – 98
Fourth	99 – Graduation Credits

1.11 Course Coding

Each course has a course code, which is made up of three letters and three digits. The explanation for each of the codes used by the School of Computer Sciences for the undergraduate programmes is as follows:



2.0 ACADEMIC SYSTEM AND GENERAL INFORMATION

2.1 Course Registration Activity

Registration of courses is an important activity during the period of study at the university. It is the first step for the students to sit for the examination at the end of each semester. Signing up for the right courses each semester will help to facilitate the graduation process based on the stipulated duration of study.

2.1.1 Course Registration Secretariat for the Bachelor's Degree and Diploma Programmes

Student Data and Records Unit
Academic Management Division
Registry
Level 1, Chancellory Building

Tel. No.	:	04-653 2925/2924/2923
Fax No.	:	04-657 4641
E-Mail	:	sdrp@usm.my
Website	:	http://bpa.usm.my/index.php/ms/

2.1.2 Course Registration Platform

1. E-Registration

E-Registration is a platform for online course registration. The registration is done directly through the Campus Online portal. Course registration exercise for both semesters begins after the release of Official examination results of every semester

The online registration for Long Vacation Semester (KSCP) begins officially after the release of the 2nd semester examination result.

The date of the E-Registration will be announced to the students via email during the revision week of every semester and details of the activity will be displayed in the USM's official website.

All courses are allowed to be registered through E-Registration, except for co-curriculum courses. The registration of co-curriculum courses is managed by the Director of the Centre for Co-Curriculum Programme at the Main Campus or the Coordinator of the Co-Curriculum Programme at the Engineering Campus and the Coordinator of the Co-Curriculum Programme at the Health Campus.

Students are required to preregister their co-curriculum courses before the actual E-Registration activity. They are allowed to follow the respective course once the preregistration is approved. The list of the co-curriculum courses taken will be included in their course registration data.

Access to *E-Daftar* System

- a. *E-Daftar* System can be accessed through the Campus Online portal (<https://campusonline.usm.my>).
- b. Students need to use their USM E-mail ID and password to access their profile page, which includes the *E-Daftar* menu.
- c. Students need to print the course registration confirmation slip upon completion of the registration process or after updating the course registration list (add/ drop) within the *E-Daftar* period.

2. Course Registration Activity at the School

Registration activities conducted at the Schools/Centres are applicable to students who are academically active and under Probation (P1/P2) status. Students who encounter difficulties in registering their courses during the E-Registration period are allowed to register the courses at their respective school/centre during the official period of course registration.

The official period for registration begins on the first day of the new semester until 3rd week. Registration during 4th - 6th week of the official academic calendar is considered as late registration. Hence, a penalty of RM50.00 per registration will be imposed unless justifications for the late registration are provided by the students. The Examination and Graduation Unit, Academic Management Section (Registrar Department) will manage students' late registration.

2.1.3 Course Registration General Information

1. Several information that can be referred by the students pertaining to the registration activity:
 - a. The website of the respective School, for the updated information of the courses offered or course registration procedure.

- b. List the courses to be registered and number of units (unit value) for each course (refer to Students Handbook for Study Programme).

Academic Status	PNG	Minimum Units	Maximum Units
Active	2.00 & Above	9	25
P1	1.99 & Below	9	12
P2		9	10

- c. Students with arrears are not allowed to register any courses. You may only register courses after paying off your arrears.

2. Type of course codes during registration:

T = Core courses
E = Elective courses
M = Minor courses
U = University courses

} Grade and number of units obtained from these courses are considered for graduation

Two (2) other course codes are:

Y = audit courses
Z = prerequisite courses

} Grade and number of units obtained are not considered for graduation

- Academic Advisor's advice and approval are necessary.
- Students are not allowed to register or resit any course with grade 'C' and above.
- Medical, Dentistry and Pharmacy students are not allowed to register or resit any course with grade 'B-' and above.

2.1.4 Information/Document Given to All Students through Campus Online Portal (<https://campusonline.usm.my>)

- The information of the Academic Advisor.
- Academic information such as academic status, GPA value, CGPA value and year of study.
- Cangred and Course Registration Form.
- List of courses offered by all Schools/Centres.
- Teaching and Learning Timetable for all Schools/Centres/Units from the three campuses.

6. List of pre-registered courses which have been added into the students' course registration record (if any).
7. Reminders about the University course registration policies/general requisites.

2.1.5 Registration of Language and Co-Curricular Courses

1. Registration of Language courses through *E-Daftar* is allowed.
 - a. However, if any problem arises, registration for language courses can still be carried out/updated during the official period of OCR at the office of the School of Languages, Literacies and Translation.
 - b. All approval/registration/dropping/adding of language courses is under the responsibility and administration of the School of Languages, Literacies and Translation.
 - c. Any problems related to the registration of language courses can be referred to the School of Languages, Literacies and Translation. The contact details are as follows:

General Office	: 04-653 4542	}	for Main Campus students
Malay Language Programme Chairperson	: 04-653 3974		
English Language Programme Chairperson	: 04-653 3406		
Foreign Language Programme Chairperson	: 04-653 3396		
Engineering Campus Programme Chairperson	: 04-599 5400/5430 : 04-599 5402/5407		
Health Campus Programme Chairperson	: 09-767 1262		

2. Registration of **co-curricular courses through *E-Daftar*** is not allowed.
 - a. Registration for co-curricular courses is either done through pre-registration before the semester begins or during the first/second week of the semester. Co-curricular courses will be included in the students' course registration account prior to the *E-Daftar* activity if their pre-registration application is successful.
 - b. All approval/registration/dropping/adding of co-curricular courses is under the responsibility and administration of:

Director of the Centre for Co-Curricular Programme, Main Campus (04-653 5242/5248)

Deputy Director of the Centre for Co-Curricular Programme,
Engineering Campus (04-599 5097/6308)

Deputy Director of the Centre for Co-Curricular Programme,
Health Campus (09-767 2371/6625)

3. **Dropping of Language and Co-Curricular courses, if necessary, must be made within the first week.** After the first week, a fine of RM50.00 will be imposed for each course.

2.1.6 Registration of ‘Audit’ Courses (Y code)

Registration for the ‘Audit’ course (Y code) **is not allowed on the *E-Daftar***. It can be done during the official period of OCR at the School or Centre involved.

Students who are interested must complete the course registration form which can be printed from the Campus Online Portal or obtained directly from the School. Approval from the lecturers of the courses and the Dean/ Deputy Dean (Academic) of the respective school is required.

Registration of ‘Audit’ courses (Y code) is not included in the calculation of the total registered workload units. Grades obtained from ‘Audit’ courses are not considered in the calculation of CGPA and total units for graduation.

2.1.7 Registration of Prerequisite Courses (Z code)

Registration of Prerequisite courses (Z code) is included in the total registered workload (units). Grades obtained from the Prerequisite courses are not considered in the calculation of CGPA and units for graduation.

2.1.8 Late Course Registration and Late Course Addition

Late course registration and addition are only allowed during the first and up to the third week with approval from the Dean. Application to add a course after the third week will not be considered, except for special cases approved by the University. A RM50.00 fine will be imposed on students if reasons given for late registration are not accepted by the University or School.

2.1.9 Dropping of Courses

Dropping of courses is allowed until the **end of the sixth week**.

For this purpose, students must meet the requirements set by the University as follows:

1. Students who intend to drop any course are required to fill in the dropping of course form. The form needs to be signed by the lecturer of the course involved and the Dean/Deputy Dean (Academic, Career International Affairs) of the School. The form has to be submitted to the general office of the School/Centre which offers that particular course.
2. Students who wish to drop language courses must obtain the signature and stamp of the Dean/Deputy Dean (Academic, Career and International Affairs) of the School of Languages, Literacies and Translation.
3. Students who wish to drop the Co-Curricular courses must obtain the approval of the Director/Coordinator of the Co-Curricular Programme.
4. The option for dropping courses cannot be misused. Lecturers have the right not to approve the course that the student wishes to drop if the student is not serious, such as poor attendance record at lectures, tutorials and practical, as well as poor performance in coursework. The student will be barred from sitting for the examination and will be given grade 'X' and is not allowed to repeat the course during the *Courses during the Long Vacation* (KSCP) period.

2.1.10 Course Registration Confirmation Slip

The course registration confirmation slip that has been printed/obtained after registering the course should be checked carefully to ensure there are no errors, especially the code type of the registered courses.

Any data errors for course registration must be corrected immediately whether during the period of *E-Daftar* (for students with active status only) or during the registration period at the Schools.

2.1.11 Revising and Updating Data/Information/ of Students' Personal and Academic Records

Students may check their personal and academic information through the Campus Online portal.

Students are advised to regularly check the information displayed on this website.

1. Student may update their correspondence address, telephone number and personal email through the Campus Online portal.
2. The office of the Student Data and Records Unit must be notified of any application for updating the personal data such as the spelling of names, identification card number, passport number and address (permanent address and correspondence address).
3. The office of the Student Data and Records Unit must be notified of any application for correction of academic data such as information on major, minor, MUET result and the course code (besides data on the examination results).

2.1.12 Academic Advisor

Each School will appoint an Academic Advisor for every student. Academic Advisors will advise their students under their responsibility on academic matters.

2.2 Interpretation of Unit/Credit/Course

2.2.1 Unit

Each course is given a value, which is called a **UNIT**. The unit is determined by the scope of its syllabus and the workload for the students. In general, a unit is defined as follows:

Type of Course	Definition of Unit
Theory	1 unit is equivalent to 1 contact hour per week for 13 – 14 weeks in one semester
Practical/Laboratory/ Language Proficiency	1 unit is equivalent to 1.5 contact hours per week for 13 – 14 hours in one semester
Industrial Training/ Teaching Practice	1 unit is equivalent to 2 weeks of training

Based on the requirements of Malaysian Qualifications Framework (MQF):

One unit is equivalent to 40 hours of student learning time

[1 unit = 40 hours of Student Learning Time (SLT)]

2.2.2 Accumulated Credit Unit

Units registered and passed are known as credits. To graduate, students must accumulate the total number of credits stipulated for the programme concerned.

2.3 Examination System

Examinations are held at the end of every semester. Students have to sit for the examination of the courses they have registered for except for courses with 100% coursework. Students are required to settle all due fees and fulfil the standing requirements for lectures/tutorials/practical and other requirements before being allowed to sit for the examination of the courses they have registered for. Course evaluation will be based on the two components of coursework and final examinations. Coursework evaluation includes tests, essays, projects, assignments and participation in tutorials. The examination can be held face to face or online.

2.3.1 Duration of Examination

Evaluated Courses	Examination Duration
2 units	1 hour for coursework of more than 40%
2 units	2 hours for coursework of 40% and below
3 units or more	2 hours for coursework of more than 40%
3 units or more	3 hours for coursework of 40% and below

2.3.2 Barring from Examination

Students will be barred from sitting for the final examination if they do not fulfil at least 70% of the course requirements, such as absence from lectures and tutorials, and have not completed/fulfilled the required components of coursework. A grade 'X' would be awarded for a course for which a student is barred. Students will not be allowed to repeat the course during the *Courses During the Long Vacation (KSCP)* period.

2.3.3 Examination Special Needs

Students with Disabilities (OKU) who require special needs while sitting for exams can inform the School to get special permission to sit for exams in the Quarantine Room at the Examination Operations Office.

If a student falls ill during the exam, the student is only allowed to continue the exam in the exam hall or quarantine room or Pusat Sejahtera (subject to the approval of the Pusat Sejahtera Director).

Students who fall ill on the day of the exam and do not attend the exam must submit a medical certificate (from a government hospital/clinic or panel clinic/USM clinic) to the exam secretariat via email exam@usm.my within 48 hours after the end of the examination.

2.3.4 Grade Point Average System

Students' academic achievement for registered courses will be graded as follows:

Alphabetic Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Grade Points	4.00	3.67	3.33	3.00	2.67	2.33	2.00	1.67	1.33	1.00	0.67	0

Students who obtained a grade 'C-' and below for particular course would be given a chance to improve their grades by repeating the course during the KSCP (see below) or normal semester. Students who obtained a grade 'C' and above for a particular course are not allowed to repeat the course whether during KSCP or normal semester.

The achievement of students in any semester is based on Grade Point Average (GPA) achieved from all the registered courses in a particular semester. GPA is the indicator to determine the academic performance of students in any semester.

CGPA is the Cumulative Grade Point Average accumulated by a student from one semester to another during the years of study.

The formula to compute GPA and CGPA is as follows:

$$\text{Grade Point Average} = \frac{\sum_{i=1}^n U_i M_i}{\sum_{i=1}^n U_i}$$

where:

n = Number of courses taken
 U_i = Course units for course i
 M_i = Grade point for course i

Example of calculation for GPA and CGPA:

	Course	Unit	Grade Point (GP)	Grade (G)	Total GP
Semester I	ABC XX1	4	3.00	B	12.00
	ABC XX2	4	2.33	C+	9.32
	BCD XX3	3	1.67	C-	5.01
	CDE XX4	4	2.00	C	8.00
	EFG XX5	3	1.33	D+	3.99
	EFG XX6	2	2.67	B-	5.34
		20			43.66

$$\text{GPA} = \frac{43.66}{20} = 2.18$$

	Course	Unit	Grade Point (GP)	Grade (G)	Total GP
Semester II	ABC XX7	3	1.00	D	3.00
	ABB XX8	4	2.33	C+	9.32
	BBC XX9	4	2.00	C	8.00
	BCB X10	4	2.67	B-	10.68
	XYZ XX1	3	3.33	B+	9.99
		18			40.99

$$\text{GPA} = \frac{40.99}{18} = 2.28$$

$$\text{CGPA} = \frac{\text{Total Accumulated GP}}{\text{Total Accumulated Unit}} = \frac{43.66 + 40.99}{20 + 18} = \frac{84.65}{38} = 2.23$$

From the above examples, the CGPA is calculated as the total grade point accumulated for all the registered courses and divided by the total number of the registered units.

2.3.5 Courses During the Long Vacation (*Kursus Semasa Cuti Panjang*) (KSCP)

KSCP is offered to students who have taken a course earlier and obtained a grade of 'C-', 'D+', 'D', 'D-', 'F' and 'DK' only. Students who obtained a grade 'X' or 'F*' are not allowed to take the course during KSCP.

The purpose of KSCP is to:

1. Give an opportunity to students who are facing time constraints for graduation.
2. Assist students who need to accumulate a few more credits for graduation.
3. Assist probationary students to enhance their academic status.
4. Assist students who need to repeat a prerequisite course, which is not offered in the following semester.

However, this opportunity is only given to students who are taking courses that they have attempted before and achieved a grade as stipulated above, provided that the course is being offered. Priority is given to final year students. Usually, formal lectures are not held, and teaching is via tutorials.

The duration of KSCP is 3 weeks, i.e. 2 weeks of tutorial and 1 week of examination, all held during the long vacation. The KSCP schedule is available on the University's Academic Calendar.

The Implementation of KSCP

1. Students are allowed to register for a maximum of 3 courses and the total number of units registered must not exceed 10.
2. Marks/grades for coursework are taken from the highest marks/the best grades obtained in a particular course in the normal semester before KSCP. The final overall grade is determined as follows:

**Final Grade = The best coursework marks or grade +
Marks or grade for KSCP examination**

3. GPA calculation involves the **LATEST** grades (obtained in KSCP) and also involves courses taken in the second semester and those repeated in KSCP. If the GPA during KSCP as calculated above is 2.00 or better, the academic status will be active, even though the academic status for the second semester was probation status. However, if the GPA for KSCP (as calculated above) is 1.99 or below, the academic status will remain as probation status for the second semester.
4. Graduating students (those who have fulfilled the graduation requirements) in the second semester are not allowed to register for KSCP.

2.3.6 Academic Status

Active Status: Any student who achieves a GPA of 2.00 and above for any examination in a semester will be recognised as ACTIVE and be allowed to pursue his/her studies for the following semester.

Probation Status: A probation status is given to any student who achieves a GPA of 1.99 and below. A student who is under probation status for three consecutive semesters (P1, P2, FO) will not be allowed to pursue his/her studies at the university. On the other hand, if the CGPA is 2.00 and above, the student concerned will be allowed to pursue his/her studies and will remain at P2 status.

2.3.7 Penalty for not attending the examination

Students who do not attend the examination for any of the courses they have registered for must provide their reasons in writing to the Principal Assistant Registrar, Examination and Graduation Unit, Academic Management Division within 48 hours (for full-time students) and 48 hours (for Distance Learning Education programme students) after the examination being held. The reasons provided will be considered by the Examination Board of the School/Centre and endorsed by the University Examination Board as below:

1. For reasons accepted by the University Examination Board, students will be granted a DK grade (with permission). DK grade will be granted to the students if they submit Medical Certificates (from hospital/government clinic or panel clinic/USM clinic) or submit any reason that can be accepted by the University Examination Board. DK grade will be exempted from the GPA/CGPA calculations of the student.
2. Candidates who fail to sit for the examination without any reason will be granted an F* grade.

2.3.8 Termination of Candidature

Without any prejudice to the above regulations, **the University Examination Council has the absolute right to terminate any student's studies if he/she does not fulfil the accumulated minimum credits.**

The University Examination Council has the right to terminate any student's studies due to certain reasons (a student who has not registered for the courses, has not attended the examination without valid reasons), as well as medical reasons can be disqualified from pursuing his/her studies.

2.3.9 Examination Results

Full results (with grade) will be announced by the University through the Campus Online portal (campusonline.usm.my) after the School Examination Council meeting which is approximately one month after the final examination.

Students can print their official semester results document namely 'SEMGRED' through the Campus Online portal (campusonline.usm.my) on the same day/date of the results announcement.

Examination results for students with outstanding debts will be withheld until the student clears the outstanding debts.

2.3.10 Re-checking of Examination Result

Students can apply for the rechecking of their examination result for the course/s taken during the semester. The application form can be obtained from USM official website or at the Academic Management Division, Registry Department of each campus. The appeal form must be submitted along with a copy of the official receipt / e-payment statement amounting to RM25.00 for each examination paper. The appeal period is two (2) weeks after the official result is announced.

The rechecking process is only to ensure that all answers in the scripts have been marked and consistently graded and the calculation of marks awarded are correct. The answer script of the course will not be reevaluated.

The school will confirm any changes in the students' examination results. If there are any changes in the grades or marks, students may request a refund of RM25.00. The Examination and Graduation Unit will make amendments to the results of the course and students can check their updated status in the respective Campus Online portals.

2.4 Unit Exemption

2.4.1 Unit Exemption

Unit exemption is defined as the total number of units given to students who are pursuing their studies in USM that are exempted from the graduation requirements. Students only need to accumulate the remaining units for graduation purposes. Only passes or course grades accumulated or acquired in USM will be included in the calculation of the Cumulative Grade Point Average (CGPA) for graduation purposes.

2.4.2 Regulations and Implementation of Unit Exemption

1. Diploma holders from recognised Public and Private Institutions of Higher Learning:

- a. Unit exemption may only be granted for courses taken at diploma level including courses under the General Studies Component (MPU) such as Philosophy and Current Issues and Appreciation of Ethics and Civilisations.

However, unit exemptions are not permitted for Language courses under the U1 Group of the General Studies Component (MPU).

- b. Courses for unit exemption may be combined (in two or more combinations) in order to obtain exemption of one course at degree level. However, if the School would like to approve only one course at the diploma level for unit exemption of one course at degree level, the course at diploma level must be equivalent to the degree course and have the same number of or more units.
- c. Courses taken during employment (in-service) for diploma holders cannot be considered for unit exemption.
- d. The minimum achievement at the diploma level that can be considered for unit exemption is a minimum grade 'C' or 2.0 or equivalent.

- e. The total number of semesters exempted should not exceed two semesters.
 - f. **In order to obtain unit exemption for industrial training**, a student must have continuous work experience for at least two years in the area. If a student has undergone industrial training during the period of diploma-level study, the student must have work experience for at least one year. The students are also required to produce a report on the level and type of work performed. Industrial training unit exemption cannot be considered for semester exemption as the industrial training is carried out during the long vacation in USM.
2. USM Supervised IPTS (Private Institutions of Higher Learning) /External Diploma Graduates:
- a. Students from USM supervised IPTS/External Diploma graduates are given unit exemption as stipulated by the specific programme of study. **Normally, unit exemption in this category is given as a block according to the agreement** between USM (through the School that offers the programme) with the IPTS.
 - b. **Students from recognised local or foreign IPTA** (Public Institutions of Higher Learning)/IPTS who are studying at the Bachelor's Degree level may apply to study in this university and if successful, may be considered for unit exemption, subject to the following conditions:
 - [1] Courses taken in the previous IPT are equivalent (at least 80% of the course must be the same) to the courses offered in USM.
 - [2] Students taking courses at the Advanced Diploma level in IPT that are recognised to be equivalent to the Bachelor's Degree course in USM may be considered for unit exemption as in Section 2.5.
 - [3] The total maximum unit exemption allowed should not exceed 30% of the total unit requirement for graduation.

2.4.3 Total Number of Exempted Semesters

Semester exemption is based on the total units exempted as below:

Total Units Exempted	Total Semesters Exempted
8 and below	None
9 – 32	1
33 to 1/3 of the total units for graduation	2

2.4.4 Application Procedure for Unit Exemption

Any student who would like to apply for unit exemption is required to complete the Unit Exemption Application Form which can be obtained from the Examination and Graduation Section or the respective Schools.

The form must be approved by the Dean of the School prior to submission to the Examination and Graduation Section for consideration and approval.

2.5 Credit Transfer

Credit transfer is defined as the recognition of the total number of credits obtained by USM students taking courses in other IPTAs (Public Institution of Higher Learning) within the period of study at USM and is combined with credits obtained at USM to fulfil the unit requirements for his/her programme of study. The transferred examination results or grades obtained in courses taken at other IPTAs will be taken into consideration in the Cumulative Grade Point Average (CGPA) calculation.

1. Category of Students Who Can Be Considered for Credit Transfer

USM full-time Bachelor Degree level students who would like to attend specific Bachelor Degree level courses at other IPTAs.

USM full-time diploma level students who would like to attend specific diploma level courses at other IPTAs.

2. Specific Conditions

a. Basic and Core Courses

Credit transfer can only be considered for credits obtained from other courses in other IPTAs that are equivalent (at least 80% of the content is the same) with the courses offered by the programme.

Courses that can be transferred are only courses that have the same number of units or more. For equivalent courses but with less number of units, credit transfers can be approved by combining a few courses. Credits transferred are the same as the course units offered in USM. The average grade of the combined courses will be taken into account in the CGPA calculation.

b. Elective or Option Courses

Students may take any appropriate courses in other IPTAs subject to permission from the School as well as the approval of the IPTAs.

The transferred credits are credits obtained from courses at other IPTAs. No course equivalence condition is required.

c. Minor Courses

For credit transfer of minor courses, the School should adhere to either condition (i) or (ii), and take into account the programme requirement.

3. General Conditions

- a. The total maximum units transferred should not exceed one-third of the total number of units for the programme.
- b. Credit transfer from other IPTAs can be considered only once for each IPTA.
- c. The examination results obtained by a student who has taken courses at other IPTAs will be taken into account for graduation purposes. Grades obtained for each course will be combined with the grades obtained at USM for CGPA calculation.
- d. Students who have applied and are approved for credit transfer are not allowed to cancel the approval after the examination result is obtained.
- e. Students are required to register for courses at other IPTAs with not less than the total minimum units as well as not exceeding the

maximum units as stipulated in their programme of study. However, for specific cases (e.g. students on an extended semester and only require a few units for graduation), the Dean may allow such students to register less than the minimum units and the semester will not be considered for the residential requirement. In this case, the CGPA calculation will be similar to that requirement of the KSCP.

- f. USM students attending courses at other IPTAs who have failed in any courses will be allowed to re-sit the examinations of the courses if there is such a provision in that IPTA.
- g. If the method of calculation of examination marks in the other IPTAs is not the same as in USM, grade conversions will be carried out according to the existing scales.
- h. USM students who have registered for courses at other IPTAs but have decided to return to study in USM must adhere to the existing course registration conditions of USM.

2.5.1 Application Procedure for Attending Courses/Credit Transfer

USM students who would like to apply to attend courses/credit transfer at other IPTAs should apply using the Credit Transfer Application Form.

The application form should be submitted for the Dean's approval for the programme of study at least three months before the application is submitted to other IPTAs for consideration.

2.6 Academic Integrity

“Integrity without knowledge is weak and useless. Knowledge without integrity is dangerous and dreadful.” - Samuel Johnson

Academic honesty in academic is important because it is the main pillar in ensuring that manners and ethics with regards to higher education integrity are preserved.

Universiti Sains Malaysia encourages its students to respect and ensure that any matter relating to academic integrity are well-preserved. Universiti Sains Malaysia always encourages its students to ensure that manners, ethics and integrity would be essential in academics while focusing on their studies in Universiti Sains Malaysia.

The following are practices or acts that are considered as conducts of lack of integrity in academics:

1. Cheating

Cheating in the context of academic include copying during examination, usage of information without authorization or in a dishonest manner. There are numerous ways and methods of cheating which include among others:

- a. Copying answers from others during tests or exams.
- b. Any suspicious action that can be described as cheating or an attempt to cheat in an exam.
- c. Using unauthorized materials or devices without authorization such as hand-written notes or any smart electronic device during test or exam.
- d. Asking or allowing another student to take a test or exam on behalf and vice-versa.
- e. Sharing answers in assignments or projects.
- f. Purposely tampering with the marks/grade given in any course work, and then re-submit it for remarking/regrading.
- g. Give the command, to force, persuade, deceive or threaten others to conduct research, writing, programming or any task for a student's personal gain.
- h. Submitting any identical or similar work in more than one course without consulting or prior permission from the lecturers concerned.

2. Plagiarism

The reputation of an academic institution depends on the ability to achieve and sustain academic excellence through the exercise of academic integrity. Academic integrity is based on honesty, trust, fairness, respect, and responsibility, which form the basis of academic work.

One aspect of the loss of academic integrity is due to plagiarism, which is the act of presenting published and unpublished ideas, writings, works or inventions of others in written or other medium, as one's own original intellectual endeavours without any clear acknowledgement of or reference to the author of the source.

POLICY ON PLAGIARISM OF UNIVERSITI SAINS MALAYSIA

University Sains Malaysia Policy on Plagiarism describes the University's strong commitment to uphold academic integrity in relation to plagiarism. It will come into effect when there is an infringement of academic conduct relating to plagiarism.

This policy acts as a guideline to educate and prevent plagiarism and can be used as the guideline if the University's staff and students violate any rules and regulations of the University.

The policy applies to all students, former students, staff and former staff which include fellows, post-doctorates, visiting scholars, as well as academic, non-academic, research, contract and temporary staff who study, serve or have served, or have graduated from the University.

Plagiarism is defined as the act of presenting, quoting, copying, paraphrasing or passing off of ideas, images, processes, works, data, own words or those of other people or sources without proper acknowledgement, reference or quotation of the original source(s). The acts of plagiarism include, but are not limited to, the following:

- a. Quoting verbatim (word-for-word replication of) works of other people.
- b. Paraphrasing another person's work by changing some of the words, or the order of the words, without due acknowledgement of the source(s).
- c. Submitting another person's work in whole or part as one's own.
- d. Auto-plagiarising or self-plagiarising (one's own work or previous work) that has already been submitted for assessment or for any other academic award and pass it as a new creation without citing the original content.
- e. Insufficient or misleading referencing of the source(s) that would enable the reader to check whether any particular work has indeed been cited accurately and/or fairly and thus to identify the original writer's particular contribution in the work submitted.

The University will take action on every report and offence relating to plagiarism and if the student is found guilty, the student can be charged by the university according to the Students Disciplinary Rules.

3. Fabrication

Fabrication refers to a process of invention, adaptation or copying with the intention of cheating. This is an act of deceiving other people. Fabrication is somewhat related to matters which have been 'created' or altered.

Invention or task outcome or academic work without acknowledgement, alteration, falsification or misleading use of data, information or citation in any academic work constitutes fabrication. Fabricated information neither represents the student's own effort nor the truth concerning a particular investigation or study and thus violates the principle of truth in knowledge. Some examples are:

- a. Creating or exchanging data or results, or using someone else's results, in an experiment, assignment or research.
- b. Citing sources that are not actually used or referred to.
- c. Listing with intent, incorrect or fictitious references.
- d. Forging signatures of authorization in any academic record or other university documents.
- e. Developing a set of false data.

4. Collusion

Collusion refers to the cooperation in committing or to commit or to do work with negative intentions. Some examples of collusion include:

- a. Paying, bribing or allowing someone else to do an assignment, test/exam, project or research for you.
- b. Doing or assisting others in an assignment, test/exam, project or research for something in return.
- c. Permitting your work to be submitted as the work of others.
- d. Providing material, information or sources to others knowing that such aids could be used in any dishonest act.

5. Other violations relating to academic integrity

- a. Late to lecture, tutorial, class or other forms of teaching modes relating to their courses.
- b. Sending or submitting late any assignment relating to their courses.

- c. Hire someone else to do the assignment or thesis.
- d. Carrying out business by providing service to write assignment or thesis of the students.
- e. Any other violations that USM deemed as violating academic integrity.

2.6.1 Consequences of Violating Academic Integrity

Students are responsible in protecting and upholding academic integrity in USM.

If in any specific event a student or students would encounter any incident that denotes academic dishonesty, the student(s) need to submit a report to the relevant lecturer. The lecturer is then responsible to investigate and substantiate the violation and report the matter to the Dean of the School.

1. If any violation of academic integrity is considered as not of a serious nature, the Dean of the School may take administrative action on the students.
2. However, if the violation is deemed serious by the School, this matter shall be brought to the attention of the Secretariat of University Student Disciplinary Committee (Academic Cases) at Legal Office, Level 2, Building E42, Chancellory II, Universiti Sains Malaysia for further disciplinary action as specified in the disciplinary procedures
3. If a student is caught copying or cheating during examination, the Investigation Committee of *Copying/Cheating in Examination* will pursue the matter according to the University's procedures. If the investigation found that there is a case, the student(s) will be brought to the Student's Disciplinary Committee of the University. In this matter, the rule on conduct during the examination shall be applied.
4. Any student who has been found guilty in the Student's Disciplinary Committee (Academic Cases) may be graded as fail or grade "F" in the said subject tried.

5. Rule 48 in the Kaedah-Kaedah Universiti Sains Malaysia (Discipline of Students) 1999 provides that a student who commits a disciplinary offence and is found guilty of the offence shall be liable to any one or any appropriate combination of two or more of the following punishments as follows:
 - a. a warning;
 - b. a fine not exceeding Ringgit Malaysia Two Hundred (RM200.00);
 - c. exclusion from any specific part or parts of the University for a specified period;
 - d. suspension from being a student of the University for a specified period;
 - e. expulsion from the University.

2.7 USM Mentor Programme

The Mentor Programme acts as a support aid that involves staff undergoing special training as consultants and guides to the USM community who would like to share their feelings and any psychosocial issues that could affect their social activities. This programme helps individuals to manage psychosocial issues in a more effective manner, which will eventually improve their well-being in order to achieve a better quality of life.

Objectives

1. To serve as a co-operation and mutual assistance mechanism for dealing with stress, psychosocial problems and many more in order to ensure the well-being of the USM community.
2. To inculcate the spirit of unity and the concept of helping one another by appointing a well-trained mentor as a social agent who promotes a caring society for USM.
3. To produce more volunteers to assist those who need help.
4. To prevent damage in any psychosocial aspect before they reach a critical stage.

2.8 Student Exchange Programme

2.8.1 Study Abroad Scheme

The student exchange programme is an opportunity for USM students to study for one or two semesters abroad at any USM partner institutions. Ideally, students are encouraged to participate in the exchange programme within their third to fifth semester (3 year degree programme) and within the third to seventh semester (4 year degree programme).

USM students who wish to follow the SBLN programme must discuss their academic plans with the Dean or Deputy Dean of their respective Schools and also with the International Mobility & Collaboration Centre (IMCC) (to ensure that credits obtained from the external higher education institution can be transferred as part of the credit accumulation for graduation).

Any student who follows the SBLN programme and violates any disciplinary act in the external higher education institution, can be penalised in accordance with the University (Discipline of Students) Rules if the matter is referred to USM.

For further information, please visit www.imcc.usm.my or contact the International Mobility and Collaboration Centre (IMCC) at +604 – 653 2777/2774.

2.8.2 Student Exchange Programme in Local Higher Education Institutions (RPPIPT)

This is a programme that allows students of Higher Learning Institutions to do an exchange programme for a semester among the higher institutions themselves. Students can choose any relevant courses and apply for credit transfers.

USM students who want to participate in RPPIPT have to discuss their academic plans with the Dean or Deputy Dean of their respective Schools and the Division of Academic and International (to ensure that credits obtained from the higher education institution in Malaysia can be transferred as part of the credit accumulation for graduation).

Any student who participates in RPPIPT and violates any of the institution's disciplinary rules can be penalised according to the University (Discipline of Students) Rules if the matter is referred to USM.

For further information, please contact the Academic & International Division at +604 – 653 3126.

2.9 Ownership of Students' Dissertation/Research Project/Thesis and University's Intellectual Property

The copyright of a dissertation/research project/thesis belongs to the student. However, as a condition for the conferment of a degree, the student gives this right unconditionally, directly but not exclusively, and free of royalties to the university to use the contents of the work/thesis for teaching, research and promotion purposes. In addition, the student gives non-exclusive rights to the University to keep, use, reproduce, display and distribute copies of the original thesis with the rights to publish for future research and the arch

3.0 UNIVERSITY COURSE REQUIREMENTS

3.1 Summary of University Course Requirements

Students are required to take 15-22 credits for the following University courses/options for University needs:

UNIVERSITY COURSE REQUIREMENTS		CREDIT TOTAL	
		Local Students	International Students
General Studies (MPU)			
U1	<u>Local Students</u> <ul style="list-style-type: none"> ▪ HFF225 (Philosophy and Current Issues) (2 credits) ▪ HFE224 (Appreciation of Ethics and Civilisations) (2 credits) ▪ LKM400 (Bahasa Malaysia IV) (2 credits) 	6	
	<u>International Students of Science and Technology</u> <ul style="list-style-type: none"> ▪ HFF225 (Philosophy and Current Issues) (2 credits) ▪ Malay Language course (2 credits) 		
	<u>International Students of Arts</u> <i>(program with Malay Language as the medium of instruction)</i> <ul style="list-style-type: none"> ▪ HFF225 (Philosophy and Current Issues) (2 credits) ▪ LKM100 (Malay Language I) (Z) ▪ LKM200 (Malay Language 2) (U) (2 credits) 		4
	<u>International Students of Arts / Science</u> <i>(program with English Language as the medium of instruction)</i> <ul style="list-style-type: none"> ▪ HFF225 (Philosophy and Current Issues) (2 credits) ▪ LKM100 (Malay Language I) (U) (2 credits) 		
U2 (Local students) AND U3 (International students)	<u>Local Students</u> <ul style="list-style-type: none"> ▪ WUS101 (Core Entrepreneurship) (2 credits) ▪ English Language Courses (4 credits) <u>International Students</u> <ul style="list-style-type: none"> ▪ SEA205E (Malaysian Studies) (4 credits) ▪ English Language Courses (4 credits) 	6	8
U4	<u>Local Students</u> <ul style="list-style-type: none"> ▪ WAR122 (Integrity and Anti-Corruption) (2 credits) <u>International Students</u> <ul style="list-style-type: none"> ▪ Co-curricular courses 	2	2
Options	Skill courses/Foreign Language Courses/ Other courses offered by other schools. Students have to choose any of the following: <ul style="list-style-type: none"> ▪ Co-curricular courses ▪ Skill courses/Foreign Language Courses/ Other courses offered by other schools 	1-8	1-8
CREDIT TOTAL		15-22	15-22

3.2 General Studies Components (MPU) (14 credits)

General studies is one of the strategies and initiatives planned for the purpose of Shift 1, which is Holistic, Entrepreneurial and Balanced Graduates. Malaysia Education Blueprint 2015-2025 (Higher Education) or PPPM (PT) outlines 10 shifts to achieve the aspirations of the nation's higher education system and student aspirations.

General studies are divided into four groups as follows:

1. U1: appreciation of philosophy, values and history;
2. U2: the mastery of soft skills;
3. U3: expansion of the knowledge of Malaysia and its history; and
4. U4: practical community management skills such as community service and co-curriculum.

A. U1 Group

Local Students

All Malaysian students are required to take and pass the following courses. In order to graduate, the minimum passing grade required is Grade C.

(i) **HFF225 (Philosophy and Current Issues) (2 credits)**

The course synopsis is as follows:

This course covers the relation between philosophy and the National Education Philosophy and Rukun Negara. Philosophy is used as a tool to refine the culture of thought in life through the art and methods of thinking as well as through our understanding of the concept of the human person. Key topics in philosophy, namely epistemology, metaphysics, and ethics, are discussed in the context of current issues. Emphasis is given to philosophy as the basis for intercultural dialogue and fostering common values. At the end of this course, students will be able to see the disciplines of knowledge as a comprehensive and integrated body of knowledge.

(ii) **HFE224 (Appreciation of Ethics and Civilisations) (2 credits)**

The course synopsis is as follows:

This course prepares students to appreciate the ethics and civilisation that existed in the multiple ethnic society in Malaysia to strengthen their critical and analytical thinking in handling a more challenging life. The content of this course focuses on appreciating ethics and civilisation according to the Malaysian mould. Students will be exposed to the dynamics of the concept of ethics and civilisation that gave strength to the formation of a Malaysian nation based on the timeline of its historical evolution from the

precolonial to the postcolonial era. Understanding the formation of the ethical and civilisation is discussed to increase their civil ethical appreciation towards strengthening the concept of national and Malaysian nation. Civilisation in the Malaysian mould needs to be analysed and debated in academic activity with reference to the Federal Constitution as the base for integration and a vehicle for ethics and civilisation. The development of national unity is too much influenced by globalisation and the development of information technology and complex communication. Therefore, the appreciation of ethics and civilisation has given rise to socially responsible behaviour and moved at the level of individual, community, society and nation. Therefore, the change that is happening in the society and direct economic development has brought new challenges to the strengthening of ethics and civilisation in Malaysia. Finally, High Impact Educational Practices is carried out during teaching and learning to learn the course in-depth.

(iii) LKM400/2 (Bahasa Malaysia IV)

In order to graduate, the minimum passing grade required is Grade C. Entry requirements for Bahasa Malaysia are as follows:

No	Qualification	Grade	Entry Level	Type	Credit	Status
1	(a) SPM/MCE/SC (or equivalent qualification)	1 - 6	LKM400	U	2	Graduation Requirement
	(b) STPM/HSC (or equivalent qualification)	P/S				

Note:

To obtain credits for Bahasa Malaysia courses, a minimum of grade C is required. Students may seek advice from the School of Languages, Literacies and Translation if they have a different Bahasa Malaysia qualification from the above.

International Students

All international students are required to take and pass the following courses. In order to graduate, the minimum passing grade required is Grade C.

(i) HFF225 (Philosophy and Current Issues) (2 credits)

The course synopsis is as follows:

This course covers the relation between philosophy and the National Education Philosophy and Rukun Negara. Philosophy is used as a

tool to refine the culture of thought in life through the art and methods of thinking as well as through our understanding of the concept of the human person. Key topics in philosophy, namely epistemology, metaphysics, and ethics, are discussed in the context of current issues. Emphasis is given to philosophy as the basis for intercultural dialogue and fostering common values. At the end of this course, students will be able to see the disciplines of knowledge as a comprehensive and integrated body of knowledge.

(ii) Malay Language Course (2 credits)

All international students are required to take and pass the Malay Language course. In order to graduate, the minimum passing grade required is Grade C. Malay Language course requirements by academic programme are as follows:

- (i) International students pursuing a Bachelor’s Degree in Arts (*program with Malay Language as the medium of instruction*) are required to take the following courses:

Code	Type	Credit
LKM100	Z	2
LKM200	U	2

- (ii) International students pursuing a Bachelor’s Degree in Arts (*program with English Language as the medium of instruction*) are required to take the following course:

Code	Type	Credit
LKM100	U	2

- (iii) International students pursuing Bachelor’s Degrees in Science and Technology are required to take the following course:

Code	Type	Credit
LKM100	U	2

B. U2 or U3 Group

Local Students

WUS101 (Core Entrepreneurship) (2 credits)

All students are required to take and pass the WUS101/2 (Core Entrepreneurship) course. In order to graduate, the minimum passing grade required is Grade C. The following is the synopsis of the course:

This course provides basic exposure to students on entrepreneurship and business fields, with emphasis on the implementation of the learning aspects while experiencing the process of executing business projects on

campus. The main learning outcome is the assimilation of culture and entrepreneurship work ethics in their everyday life. This initiative is made to open the minds and arouse the spirit of entrepreneurship among target groups that possess the potential to become successful entrepreneurs.

For more information, please refer to the Centre for Co-Curricular Programme website.

International Students

SEA205E (Malaysian Studies) (4 credits)

All international students are required to take and pass the SEA205E/4 (Malaysian Studies) course. In order to graduate, the minimum passing grade required is Grade C. The following is the synopsis of the course:

This course discusses Malaysia from the perspectives of history, politics, social, culture and economics. It looks at the relations between the country's history and its politics, the formation of a plural society that has since become its important characteristics, as well as issues related to development in Malaysia. Students will also be exposed to contemporary issues in Malaysia such as the marginalized groups, popular culture, issues related to health and wellbeing, as well as looking at Malaysia from the global context.

Local and International Students

All Bachelor's degree students must take four (4) units from the English Language courses to fulfil the University requirement for graduation.

(a) **Entry Requirements for English Language Courses (for students with MUET)**

The following table shows the entry requirements for the English language courses offered by the School of Languages, Literacies and Translation.

No.	MUET qualification/ Pre-requisite course	Band / Grade	English Language Course	Course Type
1.	MUET or;	2.0 / 2.5 / 3.0 / 3.5	LSP101 (2 credits)	Pre-requisite/ Type Z
	Discretion of the Dean of SoLLaT			
2.	MUET or;	4.0 / 4.5	LSP201 (2 credits)	Compulsory/ Type U
	LSP101 / LMT100 or;	A - C		
	Discretion of the Dean of SoLLaT			
3.	MUET or;	5.0	LSP301 (2 credits)	Compulsory/ Type U
	LSP201 / LSP300 or;	A - C		

	Discretion of the Dean of SoLLaT			
4.	MUET or;	5+	LHP410/411/412/458/459 (2 credits)	Compulsory/Option / Type U
	LSP301/401/402/403/404 or;	A - C		
	Discretion of the Dean of SoLLaT			

(b) Entry Requirements for English Language Courses (for students with TOEFL or IELTS)

The following table shows the entry requirements for the English language courses offered by the School of Languages, Literacies and Translation.

No.	TOEFL (Internet Based Test)	IELTS	English Language Course	Course Type
1.	35 – 45	5.0	LSP101 (2 credits)	Pre-requisite / Type Z
2.	46 – 79	5.5 – 6.5	LSP201 (2 credits)	Compulsory/ Type U
3.	80 - 109	7.0 – 7.5	LSP301 (2 credits)	Compulsory/ Type U
4.	110 - 120	8.0 – 9.0	LHP Series	Compulsory/ Option/ Type U

Note:

- Students are required to refer to the list of English language courses required by their respective schools.
- Students may seek advice from the School of Languages, Literacies and Translation if they have a different English language qualification from the above.
- In order to obtain units in English Language courses, students have to pass with a minimum grade ‘C’.
- Students with Bands 5+ in MUET must accumulate the 4 credits of English from the courses in the advanced level (LHP410/411/412/458/459).
- Students with Bands 2.0/2.5/3.0/3.5 in MUET may re-sit MUET to improve their score to Band 4.0 OR take the LSP101 course and pass with a minimum grade C before they can register for the LSP201 course.

(c) English Language Course

English courses offered as university courses are as follows:

No.	Code/Unit	Course Title
1.	LSP101/2	Progressive English
2.	LSP201/2	General English I
3.	LSP301/2	General English II
4.	LHP410/2	Effective Reading
5.	LHP411/2	Effective Writing
6.	LHP412/2	Effective Oral Presentation
7.	LHP458/2	English for Translation (offered in Semester 2 only)
8.	LHP459/2	English for Interpretation (offered in Semester 1 only)

C. U4 Group

All students are required to register for a co-curricular course in order to complete the minimum requirement of two (2) credit hours in the MPU structure. Students who choose to take packaged co-curricular courses are required to complete all levels of the package. Students can choose the courses offered by the Core group as follows:

(i) **Core of Volunteerism (6 - 10 credits)**

All courses offered under this core are the uniformed courses offered in the following packages:

PALAPES Army	PALAPES Navy	PALAPES Air Force	SUKSIS (Students' Police Volunteers)
WTD103/3	WTL103/3	WTU103/3	WPD101/2
WTD203/3	WTL203/3	WTU203/3	WPD201/2
WTD304/4	WTL304/4	WTU304/4	WPD301/2

SISPA (Siswa Siswi Pertahanan Awam Malaysia)	St John Ambulance	Red Crescent Emergency Aid Team
WPA103/2	WJA102/2	WBM102/2

WPA203/2	WJA202/2	WBM202/2
WPA303/2	WJA302/2	WBM302/2

For more information, please refer to the Centre for Co-Curricular Programme website.

(ii) Core of Sports (1 - 3 credits)

The courses offered are as follows:

Packaged Courses (3 Credits, 3 Semesters) (Students are required to complete all levels)	
Karate	Taekwondo
WSC108/1	WSC115/1
WSC208/1	WSC215/1
WSC308/1	WSC315/1
Non Packaged Courses (1 Credit)	
WSC105/1 –Volley Ball	WSC124/1 - Sepak Takraw
WSC106/1 - Golf	WSC 125/1- Futsal
WSC110/1 - Archery	WSC 126/1 - Netball
WSC111/1 - Table Tennis	WSC127/1 - Event Management 1
WSC112/1 - Swimming	WSC227/1 - Event Management 2
WSC113/1 - Aerobics	WSC128/1 - Petanque
WSC114/1 - Squash	WSC130/1 - Orienteering
WSC116/1 - Tennis	WSC131/1 - Woodball
WSC119/1 - Badminton	

For more information, please refer to the Centre for Co-Curricular Programme website.

(iii) Core of Culture (1 – 6 credits)

The courses offered are as follows:

Packaged Courses (6 Credits, 3 Academic Sessions) (Students are required to complete all levels)	
Jazz Band	Seni Silat Cekak Malaysia
WCC108/2	WCC123/2
WCC208/2	WCC223/2
WCC308/2	WCC323/2

Non-Packaged Courses (1 Credit)	
WCC105/1 - Gamelan	WCC117/1 - Modern Theatre
WCC107/1 - Guitar	WCC118/1 - Malay Shadow Play
WCC109/1 - Choir	WCC119/1 - Qigong Exercises
WCC115/1 - Modern Dance	WCC124/1 - Musical Kompong
WCC116/1 - Traditional Dance	WCC129/1 - Latin Dance

For more information, please refer to the Centre for Co-Curricular Programme website.

(iv) Core of Innovation and Initiative (1 - 2 credits)

The courses offered are as follows:

Non-Packaged Courses (1 Credit)	
WCC103/1 - Painting	WCC128/1 - Embroidery and Beads Sequin Art
WCC110/1 - Handcrafting	WCC130/1 - Digital SLR Photography Art
WCC120/1 - Canting Batik	WCC 131/1 - Editing Digital Photography Art
WCC121/1 - Calligraphic Art	WCC132/1 - The Art of Ceramic
WCC122/1 - Cullinary Arts	WCC133/1 - Decoupage Arts
WCC125/1 - Traditional of Kite Art	
Non-Packaged Courses (2 Credits)	
WMU102/2 - Makers@USM Level 1	WMU112/2 – Artificial Intelligence Literacy
WMU122/2 - Data Science Literacy	

For more information, please refer to the Centre for Co-Curricular Programme website.

(v) Core of Community Service (4 credits)

The courses offered are as follows:

Packaged Courses (4 Credits) (Students are required to complete all levels)	
WKM102/2 - Community Service 1	WKM202/2 - Community Service 2
Non-Packaged Courses (2 Credits)	
WSK102/2 - Volunteerism Science	

For more information, please refer to the Centre for Co-Curricular Programme website.

(vi) Core of Public Speaking (2 credits)

The courses offered are as follows:

Non-Packaged Courses (2 Credits)
WEC102/2 - Public Speaking in Malay Language
WEC103E/2 - Public Speaking in English Language

For more information, please refer to the Centre for Co-Curricular Programme website.

(vii) Core of Sustainability (2 credits)

The courses offered are as follows:

Non-Packaged Courses (2 Credits)
WSU101/2 - Sustainability of Issues, Challenges and Prospects

For more information, please refer to the Centre for Co-Curricular Programme website.

3.3 Options (1 – 8 Credits)

A. Co-curricular course

Students who have enrolled in co-curricular courses in excess of two (2) credits under the U4 General Subjects requirement are not required to attend the co-curriculum course under the Option courses. Students only need to register for skill courses or Foreign Language courses subject to the graduation requirements of their respective program of study.

The details of the list of co-curricular courses offered are in the U4 General Subjects section as stated above.

B. Skill / Foreign Language Courses / Courses offered by other schools

Students can choose the following courses as an option:

(i) WSU 101 (Sustainability: Issues, Challenges & Prospects) (2 credits)

The following is the synopsis of the course:

This course introduces and exposes the concept of sustainable development to students. The course aims to ensure future generation capabilities to meet their needs in the future are not affected, especially in the era of challenging globalization and the rapid development of information technology at present. Sustainable development models and case studies are also discussed.

For more information, please refer to the Centre for Co-Curricular Programme website.

(ii) HTV201 (Thinking Techniques) (2 credits)

The following is the synopsis of the course:

This course introduces students to various creative thinking such as styles and thinking tools that can broaden their understanding of creativity and improve problem-solving skills. Students are trained to select and apply the best techniques to solve specific problems. So this course helps students to learn to think effectively in order to make the most effective decisions in both their studies and daily life.

(iii) SHE101 (Ethnic Relations) (2 credits)

The following is the synopsis of the course:

This course is an introduction to ethnic relations in Malaysia. This course is designed with 3 main objectives: (1) to introduce students to the basic concepts and the practices of social accord in Malaysia, (2) to reinforce basic understanding of challenges and problems in a multi-ethnic society, and (3) to provide an understanding and awareness in managing the complexity of ethnic relations in Malaysia. At the end of this course, it is hoped that students will be able to identify and apply the skills to issues associated with ethnic relations in Malaysia.

(iv) Other options/skill courses as recommended or required by the respective schools (if any)

(v) **English language course**

The following courses may be taken as a university course to fulfil the compulsory English language requirements (or for students with MUET Band 5+) or as a skill/option course:

No	Code/Kredit	Course Title
1.	LHP410/2	Effective Reading
2.	LHP411/2	Effective Writing
3.	LHP412/2	Effective Oral Presentation
4.	LHP458/2	English for Translation (offered in Semester 2 only)
5.	LHP459/2	English for Interpretation (offered in Semester 1 only)

(vi) **Foreign Language Courses**

The foreign language courses offered by the School of Languages, Literacies and Translation can be taken by students as option or compulsory courses to fulfil the number of units required for graduation. Students are not allowed to register for more than one foreign language course per semester. They must complete at least two levels of a foreign language course before they are allowed to register for another foreign language course. However, students are not required to complete all four levels of one particular foreign language course. The foreign language courses offered are as follows:

Arabic	Chinese	Japanese	German	Spanish
LAA100/2	LAC100/2	LAJ100/2	LAG100/2	LAE100/2
LAA200/2	LAC200/2	LAJ200/2	LAG200/2	LAE200/2
LAA300/2	LAC300/2	LAJ300/2	LAG300/2	LAE300/2
LAA400/2	LAC400/2	LAJ400/2	LAG400/2	LAE400/2

French	Thai	Tamil	Korean
LAP100/2	LAS100/2	LAT100/2	LAK100/2
LAP200/2	LAS200/2	LAT200/2	LAK200/2
LAP300/2	LAS300/2	LAT300/2	LAK300/2
LAP400/2	LAS400/2		

4.0 SCHOOL REQUIREMENTS

4.1 Summary of School Requirements

Details and summary of credits and courses for the degree programmes are given separately in the subsequent sections.

4.1.1 Bachelor of Computer Sciences (Intelligent Computing)

A. Programme Learning Outcome Matrix

	Course Code/Unit	Course Title	Programme Learning Outcomes										
			Knowledge & Understanding	Practical Skills	Cognitive Skills	Communication Skills	Interpersonal Skills	Ethics and Professionalism	Personal Skills	Entrepreneurship Skills	Leadership, Autonomy and Responsibility	Digital Skills	Numeracy Skills
			PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
CORE COMPUTING COURSES													
1.	CPT111/3	Principles of Programming	C2	P3	C3								
2.	CPT112/4	Discrete Structures	C3		C3							C3	
3.	CST131/4	Computer Organisations	C3					A3				C3	
4.	CPT113/3	Programming Methodology and Data Structures	C3	P4	C4								
5.	CPC151/4	Fundamentals of Logic and Artificial Intelligence	C3		C4								
6.	CPC152/4	Foundations and Programming for Data Analytics		P4	C2	A4						C3	
7.	CAT201/2	Integrated Software Development Workshop	C3	P4	C3						P4		
8.	CMT221/4	Database Organisations and Design	C4	P4			A3						
9.	CST232/3	Operating Systems	C2	P2	C4		A3						
10.	CSE241/4	Foundations of Software Engineering	C4		C4					A3	P2		
11.	CPT212/4	Design and Analysis of Algorithms	C3	P4								C4	
12.	CST235/4	Principles of Computer Networks and Information Security	C3		C5			A3					
13.	CAT302/12	Industrial Training		P4	C3	A3	A5	A2	A5		A4	P4	

	Course Code/Unit	Course Title	Programme Learning Outcomes											
			Knowledge & Understanding	Practical Skills	Cognitive Skills	Communication Skills	Interpersonal Skills	Ethics and Professionalism	Personal Skills	Entrepreneurship Skills	Leadership, Autonomy and Responsibility	Digital Skills	Numeracy Skills	
			PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	
14.	CAT304/3	Group Innovation Project and Study for Sustainability		P4		A3	A3		A3		A3			
15.	CAT402/2	Professional & Technopreneurship Development				A2		A3		A1	A4			
CORE SPECIALISATION COURSES														
1.	CPC251/3	Machine Learning and Computational Intelligence	C2	P4	C4									
2.	CPT316/3	Programming Language Implementation and Paradigms	C3	P4	C4				A3					
3.	CPT411/3	Automata Theory and Formal Languages	C3	P4	C6									
4.	CST435/3	Parallel and Cloud Computing	C4	P4	C5									
5.	CAT405/8	Final Year Project		P4	C3	A2		A3	A4	A3				
FIELD ELECTIVE SPECIALISATION COURSES														
1.	CPC351/3	Principles of Data Analytics	C2	P4	C4	A2								
2.	CPC353/3	Natural Language Processing	C3	P4	C6									
3.	CPC357/3	IOT Architecture and Smart Applications	C2	P4	C4									
4.	CPC451/3	Big Data Technologies and Management	C3	P4	C4									
5.	CMT426/3	Business Intelligence and Analytics	C2	P4	C4									
OTHER FIELD ELECTIVE COURSES														
1.	CMT322/3	Web Engineering and Technologies	C4	P4			A3				A3			
2.	CPC354/3	Computer Graphics and Visualisation	C2	P4	C3									
3.	CPC452/3	Animation and Virtual Reality	C4	P4	C4									

B. Study Scheme

TYPE OF COURSE (CODE)	YEAR I		YEAR II	
	SEMESTER I	SEMESTER II	SEMESTER I	SEMESTER II
Core (T) (80 Units) <i>Core Computing = 60 units</i>	CPT111/3 - Principles of Programming CPT112/4 – Discrete Structures CST131/4 - Computer Organisation	CPT113/3 - Programming Methodology & Data Structures CPC151/4 - Fundamentals of Logic and Artificial Intelligence CPC152/4 – Foundations and Programming for Data Analytics	CAT201/2 - Integrated Software Development Workshop CMT221/4 - Database Organisations & Design CST232/3 - Operating Systems CSE241/4 - Foundations of Software Engineering	CPT212/4 - Design & Analysis of Algorithms CST235/4 - Principles of Computer Networks & Information Security
<i>Core Specialisation = 20 units</i>				CPC251/3 – Machine Learning & Computational Intelligence
Field Elective (E) (24 Units) <i>Specialisation Field Elective = 15 unit</i>				
<i>Other Field Elective = 9 unit</i>				
Free Modules (E) <i>(12 units taken from other schools)</i> OR Minor (M) (20 Units)		Free Module 1 (4 units) OR 4 Units (AKW104)	Free Module 2 (4 units) OR 4 Units (AKW103)	Free Module 3 (4 units) OR 4 Units (AKP202)
University (U) (17 Units) <i>Compulsory U1 – U3 = 12 Units</i>	LKM400/2 (Local) LKM100/2 (International) HFF225/2	ENGLISH I [LSP201/2- MUET Band 4.5 & below & International, LSP301/2 - MUET Band 5, LHP4xx-MUET Band 6] HFE224/2 (Local)	ENGLISH II [LSP301/2 -MUET Band 4.5 & below & International, LHP4xx/2 -MUET Band 5/6]	WUS101/2 (Local)
<i>Compulsory U4</i>		WAR122/2 (Local)		Any Co-Curriculum (2 credits) (International)
<i>Option</i> Choose (A) or (B) (A) Packaged Co-Curriculum (6- 10 Units)	Packaged Co-Curriculum/(2-3)		Packaged Co-Curriculum/(2-3)	
(B) Co-Curriculum + Skill /Foreign Language/Option (1-4 Units)			Co-Curriculum / Option / Skill / Foreign Language (1-2 Units)	
Prerequisite (Z)	LSP101/2 (MUET Band 3.5 & below only)			
#Units (#Courses)	15 - 17 (5 - 7)	17 - 21 (5 - 7)	21 (6)	17 (5)

TYPE OF COURSE (CODE)	YEAR III		YEAR IV	
	SEMESTER I	SEMESTER II	SEMESTER I	SEMESTER II
Core (T) (80 Units) <i>Core Computing = 60 units</i>	CAT304/3 - Group Innovation Project and Study for Sustainability	CAT302/12 - Industrial Training	CAT402/2 - Professional and Technopreneurship Development	
<i>Core Specialisation = 20 units</i>	CPT316/3 – Programming Language Implementation & Paradigms		CAT405/8(4) – Intelligent Computing Major Project CST435/3 –Parallel and Cloud Computing	CAT405/8(4) – Final Year Project CPT411/3 – Automata Theory & Formal Languages
Field Elective (E) (24 Units) <i>Specialisation Field Elective = 15 unit</i>	CPC351/3 – Principles of Data Analytics CPC353/3 – Natural Language Processing		CPC357/3 – IOT Architecture and Smart Applications	CMT426/3 – Business Intelligence and Analytics CPC451/3 – Big Data Technologies and Management
<i>Other Field Elective = 9 unit</i>	CPC354/3 – Computer Graphic and Visualization		CMT322/3 – Web Engineering and Technologies	CPC452/3 – Animation and Virtual Reality
Minor (M) <i>20 units</i>	4 Units (AKP201)		4 Units (AKP302)	
University (U) (17 Units) <i>Compulsory U1 –U3= 12 Units</i>	SEA205E/4 (International)			
<i>Option</i> Choose (A) or (B) (A) Packaged Co-Curriculum (6- 10 Units)	Packaged Co-Curriculum/(2-3)		Packaged Co-Curriculum/(2-3)	
(B) Co-Curriculum + Skill /Foreign Language/Option (1-4 Units)	Co-Curriculum / Option / Skill / Foreign Language (1-2 Units)			Co-Curriculum / Option / Skill / Foreign Language (0-2 Units)
#Unit (#Courses)	17 - 25 (6 - 8)	12 (1)	15 - 19 (5 - 6)	16 (5 - 6)

4.1.2 Bachelor of Computer Sciences (Computing Infrastructure)

A. Programme Learning Outcome Matrix

	Course Code /Unit	Course Title	Programme Learning Outcomes										
			Knowledge & Understanding	Practical Skills	Cognitive Skills	Communication Skills	Interpersonal Skills	Ethics and Professionalism	Personal Skills	Entrepreneurship Skills	Leadership, Autonomy and Responsibility	Digital Skills	Numeracy Skills
			PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
CORE COMPUTING COURSES													
1.	CPT111/3	Principles of Programming	C2	P3	C3								
2.	CPT112/4	Discrete Structures	C3		C3							C3	
3.	CST131/4	Computer Organisations	C3						A3			C3	
4.	CPT113/3	Programming Methodology and Data Structures	C3	P4	C4								
5.	CPC151/4	Fundamentals of Logic and Artificial Intelligence	C3		C4								
6.	CPC152/4	Foundations and Programming for Data Analytics		P4	C2	A4						C3	
7.	CAT201/2	Integrated Software Development Workshop	C3	P4	C3							P4	
8.	CMT221/4	Database Organisations and Design	C4	P4			A3						
9.	CST232/3	Operating Systems	C2	P2	C4		A3						
10.	CSE241/4	Foundations of Software Engineering	C4		C4					A3	P2		
11.	CPT212/4	Design and Analysis of Algorithms	C3	P4								C4	
12.	CST235/4	Principles of Computer Networks and Information Security	C3		C5			A3					
13.	CAT302/12	Industrial Training		P4	C3	A3	A5	A2	A5		A4	P4	
14.	CAT304/3	Group Innovation Project and Study for Sustainability		P4		A3	A3		A3		A3		
15.	CAT402/2	Professional & Technopreneurship Development				A2		A3		A1	A4		
CORE SPECIALISATION COURSES													
1.	CST236/3	Digital Systems Design	C4	P4	C3								

	Course Code /Unit	Course Title	Programme Learning Outcomes												
			Knowledge & Understanding	Practical Skills	Cognitive Skills	Communication Skills	Interpersonal Skills	Ethics and Professionalism	Personal Skills	Entrepreneurship Skills	Leadership, Autonomy and Responsibility	Digital Skills	Numeracy Skills		
			PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11		
2.	CPT316/3	Programming Language Implementation and Paradigms	C3	P4	C4					A3					
3.	CST431/3	Systems Security and Protection	C5	P4	C4										
4.	CST435/3	Parallel and Cloud Computing	C4	P4	C5										
5.	CAT403/8	Final Year Project		P4	C3	A2		A3	A4	A3					
FIELD ELECTIVE SPECIALISATION COURSES															
1.	CST337/3	Network Configuration and Protocols	C2	P4	C6									P5	
2.	CST338/3	Network and Communication Security	C3	P4	C5				A3						
3.	CST339/3	Information Security Management and Assurance	C2		C4			A3							
4.	CST434/3	Wireless Networks and Mobile Computing	C6		C4										C4
5.	CST436/3	Digital Forensics and Investigations	C4	P4	C5			A3							
OTHER FIELD ELECTIVE COURSES															
1.	CPC357/3	IOT Architecture and Smart Applications	C2	P4	C4										
2.	CST432/3	Microprocessors and Embedded Systems	C3	P4	C4										
3.	CSE443/3	Real-Time Software Engineering	C4	P5	C5										

B. Study Scheme

TYPE OF COURSE (CODE)	YEAR I		YEAR II	
	SEMESTER I	SEMESTER II	SEMESTER I	SEMESTER II
Core (T) (80 Units) <i>Core Computing = 60 units</i>	CPT111/3 - Principles of Programming CPT112/4 – Discrete Structures CST113/4 - Computer Organisation	CPT113/3 - Programming Methodology & Data Structures CPC151/4 - Fundamentals of Logic and Artificial Intelligence CPC152/4 – Foundations and Programming for Data Analytics	CAT201/2 - Integrated Software Development Workshop CMT221/4 - Database Organisations & Design CST232/3 - Operating Systems CSE241/4 - Foundations of Software Engineering	CPT212/4 - Design & Analysis of Algorithms CST235/4 - Principles of Computer Networks & Information Security
<i>Core Specialisation = 20 units</i>				CST236/3 – Digital System Design
Field Elective (E) (24 Units) <i>Specialisation Field Elective = 15 unit</i>				
<i>Other Field Elective = 9 unit</i>				
Free Modules (E) <i>(12 units taken from other schools)</i> OR Minor (M) (20 Units)		Free Module 1 (4 units) OR 4 Units (AKW104)	Free Module 2 (4 units) OR 4 Units (AKW103)	Free Module 3 (4 units) OR 4 Units (AKP202)
University (U) (17 Units) <i>Compulsory U1 – U3 = 12 Units</i>	LKM400/2 (Local) LKM100/2 (International) HFF225/2	ENGLISH I [LSP201/2- MUET Band 4.5 & below & International, LSP301/2 - MUET Band 5, LHP4xx-MUET Band 6] HFE224/2 (Local)	ENGLISH II [LSP301/2 -MUET Band 4.5 & below & International, LHP4xx/2 - MUET Band 5/6]	WUS101/2 (Local)
<i>Compulsory U4</i>		WAR122/2 (Local)		Any Co-Curriculum (2 credits) (International)
<i>Option</i> Choose (A) or (B)	Packaged Co-Curriculum/(2-3)		Packaged Co-Curriculum/(2-3)	
(A) Packaged Co-Curriculum (6- 10 Units)				
(B) Co-Curriculum + Skill /Foreign Language/Option (1-4 Units)			Co-Curriculum / Option / Skill / Foreign Language (1-2 Units)	
Prerequisite (Z)	LSP101/2 (MUET Band 3.5 & below only)			
#Units (#Courses)	15 - 17 (5 - 7)	17 - 21 (5 - 7)	21 (6)	17 (5)

TYPE OF COURSE (CODE)	YEAR III		YEAR IV	
	SEMESTER I	SEMESTER II	SEMESTER I	SEMESTER II
Core (T) (80 Units) <i>Core Computing = 60 units</i>	CAT304/3 - Group Innovation Project and Study for Sustainability	CAT302/12 - Industrial Training	CAT402/2 - Professional and Technopreneurship Development	
<i>Core Specialisation = 20 units</i>	CPT316/3 – Programming Language Implementation & Paradigms		CAT405/8(4) – Intelligent Computing Major Project CST435/3 –Parallel and Cloud Computing	CAT403/8(4) – Final Year Project CST431/3 – Systems Security and Protection
Field Elective (E) (24 Units) <i>Specialisation Field Elective = 15 unit</i>	CST338/3 – Network and Communication Security CST339/3 – Information Security Management and Assurance		CST337/3 – Network Configuration and Protocol	CST434/3 – Wireless Network and Mobile Computing CST436/3 – Digital Forensics and Investigations
<i>Other Field Elective = 9 unit</i>	CST432/3 – Microprocessors and Embedded Systems		CPC357/3 – IOT Architecture and Smart Applications	CSE443/3 – Real-time Software Engineering
Minor (M) <i>20 units</i>	4 Units (AKP201)		4 Units (AKP302)	
University (U) (17 Units) <i>Compulsory U1 –U3= 12 Units</i>	SEA205E/4 (International)			
<i>Option</i> Choose (A) or (B) (A) Packaged Co-Curriculum (6- 10 Units)	Packaged Co-Curriculum/(2-3)		Packaged Co-Curriculum/(2-3)	
(B) Co-Curriculum + Skill /Foreign Language/Option (1-4 Units)	Co-Curriculum / Option / Skill / Foreign Language (1-2 Units)			Co-Curriculum / Option / Skill / Foreign Language (0-2 Units)
#Unit (#Courses)	17 - 25 (6 - 8)	12 (1)	15 - 19 (5 - 6)	16 (5 - 6)

4.1.3 Bachelor of Computer Sciences (Software Engineering)

A. Programme Learning Outcome Matrix

	Course Code /Unit	Course Title	Programme Learning Outcomes										
			Knowledge & Understanding	Practical Skills	Cognitive Skills	Communication Skills	Interpersonal Skills	Ethics and Professionalism	Personal Skills	Entrepreneurship Skills	Leadership, Autonomy and Responsibility	Digital Skills	Numeracy Skills
			PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
CORE COMPUTING COURSES													
1.	CPT111/3	Principles of Programming	C2	P3	C3								
2.	CPT112/4	Discrete Structures	C3		C3							C3	
3.	CST131/4	Computer Organisations	C3						A3			C3	
4.	CPT113/3	Programming Methodology and Data Structures	C3	P4	C4								
5.	CPC151/4	Fundamentals of Logic and Artificial Intelligence	C3		C4								
6.	CPC152/4	Foundations and Programming for Data Analytics		P4	C2	A4						C3	
7.	CAT201/2	Integrated Software Development Workshop	C3	P4	C3						P4		
8.	CMT221/4	Database Organisations and Design	C4	P4			A3						
9.	CST232/3	Operating Systems	C2	P2	C4		A3						
10.	CSE241/4	Foundations of Software Engineering	C4		C4					A3	P2		
11.	CPT212/4	Design and Analysis of Algorithms	C3	P4								C4	
12.	CST235/4	Principles of Computer Networks and Information Security	C3		C5			A3					
13.	CAT302/12	Industrial Training		P4	C3	A3	A5	A2	A5		A4	P4	
14.	CAT304/3	Group Innovation Project and Study for Sustainability		P4		A3	A3		A3		A3		
15.	CAT402/2	Professional & Technopreneurship Development				A2		A3		A1	A4		

	Course Code /Unit	Course Title	Programme Learning Outcomes										
			Knowledge & Understanding	Practical Skills	Cognitive Skills	Communication Skills	Interpersonal Skills	Ethics and Professionalism	Personal Skills	Entrepreneurship Skills	Leadership, Autonomy and Responsibility	Digital Skills	Numeracy Skills
			PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
CORE SPECIALISATION COURSES													
1.	CSE242/3	Software Requirements Analysis and Modelling	C2		C4							A4	
2.	CSE341/3	Software Architecture and Design	C2	P3	C5								
3.	CST435/3	Parallel and Cloud Computing	C4	P4	C5								
4.	CSE442/3	Software Testing	C3	P4	C5								
5.	CAT404/8	Final Year Project		P4	C3	A2		A3	A4	A3			
FIELD ELECTIVE SPECIALISATION COURSES													
1.	CMT321/3	Management and Engineering of Databases	C3		C6				A3				
2.	CMT323/3	Information Systems Theory and Management	C4		C5				A3				
3.	CMT425/3	Enterprise Architecture and Systems	C4		C5		A3						
4.	CSE441/3	Software Process and Quality Assurance	C3	P4	C5								
5.	CMT426/3	Business Intelligence and Analytics	C2	P4	C4								
OTHER FIELD ELECTIVE COURSES													
1.	CSE342/3	Dependable Software Systems Engineering	C2		C4		A3						
2.	CMT322/3	Web Engineering and Technologies	C4	P4			A3			A3			
3.	CSE443/3	Real-Time Software Engineering	C4	P5	C5								

B. Study Scheme

TYPE OF COURSE (CODE)	YEAR I		YEAR II	
	SEMESTER I	SEMESTER II	SEMESTER I	SEMESTER II
Core (T) (80 Units) <i>Core Computing = 60 units</i>	CPT111/3 - Principles of Programming CPT112/4 – Discrete Structures CST131/4 - Computer Organisation	CPT113/3 - Programming Methodology & Data Structures CPC151/4 - Fundamentals of Logic and Artificial Intelligence CPC152/4 – Foundations and Programming for Data Analytics	CAT201/2 - Integrated Software Development Workshop CMT221/4 - Database Organisations & Design CST232/3 - Operating Systems CSE241/4 - Foundations of Software Engineering	CPT212/4 - Design & Analysis of Algorithms CST235/4 - Principles of Computer Networks & Information Security
<i>Core Specialisation = 20 units</i>				CSE242/3 – Software Requirement Analysis and Modelling
Field Elective (E) (24 Units) <i>Specialisation Field Elective = 15 unit</i>				
<i>Other Field Elective = 9 unit</i>				
Free Modules (E) <i>(12 units taken from other schools)</i> OR Minor (M) (20 Units)		Free Module 1 (4 units) OR 4 Units (AKW104)	Free Module 2 (4 units) OR 4 Units (AKW103)	Free Module 3 (4 units) OR 4 Units (AKP202)
University (U) (17 Units) <i>Compulsory U1 – U3 = 12 Units</i>	LKM400/2 (Local) LKM100/2 (International) HFF225/2	ENGLISH I [LSP201/2- MUET Band 4.5 & below & International, LSP301/2 - MUET Band 5, LHP4xx-MUET Band 6] HFE224/2 (Local)	ENGLISH II [LSP301/2 -MUET Band 4.5 & below & International, LHP4xx/2 -MUET Band 5/6]	WUS101/2 (Local)
<i>Compulsory U4</i>		WAR122/2 (Local)		Any Co-Curriculum (2 credits) (International)
<i>Option</i> Choose (A) or (B)	Packaged Co-Curriculum/(2-3)		Packaged Co-Curriculum/(2-3)	
(B) Co-Curriculum + Skill /Foreign Language/Option (1-4 Units)			Co-Curriculum / Option / Skill / Foreign Language (1-2 Units)	
Prerequisite (Z)	LSP101/2 (MUET Band 3.5 & below only)			
#Units (#Courses)	15 - 17 (5 - 7)	17 - 21 (5 - 7)	21 (6)	17 (5)

TYPE OF COURSE (CODE)	YEAR III		YEAR IV	
	SEMESTER I	SEMESTER II	SEMESTER I	SEMESTER II
Core (T) (80 Units) <i>Core Computing = 60 units</i>	CAT304/3 - Group Innovation Project and Study for Sustainability	CAT302/12 - Industrial Training	CAT402/2 - Professional and Technopreneurship Development	
<i>Core Specialisation = 20 units</i>	CSE341/3 – Software Architecture and Design		CAT405/8(4) – Intelligent Computing Major Project CST435/3 –Parallel and Cloud Computing	CAT404/8(4) – Final Year Project CMT425/3 – Enterprise Architecture and Systems
Field Elective (E) (24 Units) <i>Specialisation Field Elective = 15 unit</i>	CMT323/3 – Information Systems Theory and Management CMT321/3 – Management and Engineering of Databases		CSE441/3 – Software Process and Quality Assurance	CMT426/3 – Business Intelligence and Analytics CSE442/3 – Software Testing
<i>Other Field Elective = 9 unit</i>	CSE342/3 – Dependable Software System Engineering		CMT322/3 – Web Engineering and Technologies	CSE443/3 – Real-time Software Engineering
Minor (M) <i>20 units</i>	4 Units (AKP201)		4 Units (AKP302)	
University (U) (17 Units) <i>Compulsory U1 –U3= 12 Units</i>	SEA205E/4 (International)			
<i>Option</i> Choose (A) or (B) (A) Packaged Co-Curriculum (6- 10 Units)	Packaged Co-Curriculum/(2-3)		Packaged Co-Curriculum/(2-3)	
(B) Co-Curriculum + Skill /Foreign Language/Option (1-4 Units)	Co-Curriculum / Option / Skill / Foreign Language (1- 2 Units)			Co-Curriculum / Option / Skill / Foreign Language (0-2 Units)
#Unit (#Courses)	17 - 25 (6 - 8)	12 (1)	15 - 19 (5 - 6)	16 (5 - 6)

4.2 Course Registration Guideline

Computer Science Students are required to follow the specific study scheme starting Year 2 Semester II according to their specialisation choice. Pre-requisite and sequential/concurrent courses are shown in Appendix B. Students are advised to understand and follow the given guidelines.

All Computer Science students are not allowed to enrol for co-curricular courses (except for uniform co-curriculum packages) during Year 3 Semester II due to the compulsory industrial training during that period.

Only students in their final semester may apply to enrol for more than 25 units. Approval from Deputy Dean (Academic, Career and International) is required.

All Probation students must obtain the approval of the Deputy Dean (Academic, Career and International) for registration after consulting their respective Academic Advisors during the Online Course Registration (OCR).

For CAT403/CAT404/CAT40, a setting of 4 units will be given in Semester I, and 4 units will be given in Semester II even though the course needs to be registered as 8 units for both semesters.

Please note that some University courses are offered for students of the School of Computer Sciences only for certain semesters, as given below:

Course	Semester
HFE224	II (Year I)
HFF225	I (Year I)
WAR122	II (Year I)
WUS101	II (Year II)
LKM400	I (Year I)
SEA205E	I (Year III)
English Language	I & II

4.3 Unit Exemption/Credit Transfer

All diploma students applying for Unit Exemption must sit for a placement test that will be held during the 1st week of Semester I. This is a one-hour test that assesses the students on four basic knowledge areas in Computer Science namely, Programming and Data Structures, Databases, Software Engineering Fundamentals, and Computer Networks. Only students who pass the test will be considered for Unit Exemption.

Computer Science courses that may be considered for unit exemption are limited to the following courses:

Course Code	Course Title	Unit
CPT111	Principles of Programming	3
CPT112	Discrete Structures	4
CPT113	Programming Methodology & Data Structures	3
CPC151	Fundamentals of Logic and Artificial Intelligence	4
CST131	Computer Organisation	4
CAT201	Integrated Software Development Workshop	2
CMT221	Database Organisations & Design	4
CSE241	Foundations of Software Engineering	4
CST232	Operating Systems	3
CST235	Principles of Computer Networks and Information Security	4

4.4 Industrial Training

The Industrial Training programme is one of the most important components of equipping Computer Science graduates with useful skills in professional contexts. The trainee is expected to practice his/her theoretical knowledge and work in an environment that will be encountered in most organisations. A trainee is expected to enhance his/her ability to manage projects, prepare documentations, prepare and deliver a presentation, design/implement/maintain a system, etc.

Course code:	CAT302	Course title:	Industrial Training
Length:	24 weeks (6 months)		
Units:	12	Semester:	Semester II + Long Vacation (Year 3) Course Registration in Semester II
Type:	Core	Assessment method:	100% coursework
<p>Note: During the Industrial Training period students are not allowed to enrol in any courses during the Courses During the Long Vacation (KSCP) period. Incomplete grade (TL) will normally be given on serious medical reason.</p>			

Among the objectives of this training programme are:

1. To provide students with an opportunity to familiarise themselves with the operations, administration and organisational development of a computer department or organisation.
2. To allow students to observe computing applications in daily practice.
3. To expose students to "real" working situations and the problems normally

encountered by an organisation.

4. To enable organisations to identify appropriate good students as their potential employees upon graduation.

At the end of the course, the students will be able to:

1. Apply theoretical knowledge in managing project or task given.
2. Conform to the ethical work values and professionalism in an organization.
3. Execute organizational assignment using technical artefact according to the current trend.
4. Propose ideas towards the betterment of the organisation's management and business.
5. Arrange teamwork in organization.

To qualify for the industrial training programme students must completed the following pre-requisites:

1. Attained CGPA of 2.0.
2. Accumulated 60 credits.
3. An active academic status.
4. Taken and passed all of the following core courses with a GPA of 2.0:
 - CPT111/3 – Principles of Programming
 - CPT113/3 – Programming Methodology & Data Structures
 - CST131/4 – Computer Organisation
 - CMT221/4 – Database Organisations & Design
 - CSE241/4 – Foundations of Software Engineering
 - CAT201/2 – Integrated Software Development Workshopand is taking the following course at the time of application:
 - CAT304/3 – Group Innovation Project and Study for Sustainability
5. Attained Band 4 in MUET **or** passed at least with a C grade in LMT100 – Preparatory English.
6. Has a possibility of graduating within three semesters after the completion of the Industrial Training.

Students are expected to obtain a full-time placement at an organisation which can provide appropriate Industrial Training experience to a future graduate of the Bachelor of Computer Science. Learning is achieved through the supervision process, practical work (including projects) and independent learning.

Students have to apply to government or private agencies for training placement through the Programme Manager (Industrial Training, Student Activities and Community Engagement) via the CS Internship Management System. Most organisations pay a nominal wage training allowance. Medical services (as for normal semesters at panel clinics and government hospitals only) are provided by the university. Insurance (PA) will be covered by USM Alumni.

Students undergo Industrial Training for a period of 24 weeks (6 months). The experience gained from the training varies from one organisation to another, but the experience usually has the following attributes:

1. Exposure to daily work environment; including organisational structure, functions, regulation and work material/resource.
2. Participation in group work involving systems analysis, design, implementation maintenance and evaluation.
3. Enhancement of oral and written communication skill through documentation preparation and oral/multimedia presentation activities.
4. Development of manpower skills such as leadership, cooperation, and independence.
5. Opportunity to practice elements of courses taken during their study especially programming for project and research developments.

An organisation would normally be allowed to recruit trainees only if they have the capability to provide an appropriate work environment suitable for a trainee who is a candidate for the Bachelor of Computer Science. Organizations that are deemed to be suitable for recruiting are filtered by the Program Manager and the Internship Committee, and are added in the internship management system.

Currently, there are around 180 organisations in Peninsular Malaysia, Sabah, Sarawak and Singapore that are capable and ready to recruit USM Computer Science trainees. The organisations cover all socio-economic spectrums and include:

- Multinational corporations.
- Academic and research institution.
- Government and semi-government bodies.
- Hardware suppliers, software and integrated solution companies.
- Factories.
- Banks, insurance firms and financial institution.
- Consultancy and high value services organisation.

This course is evaluated as pass or fail. In order to pass, a candidate has to fulfil the following conditions:

1. Received a positive evaluation from the USM lecturer assigned to do the evaluation.
2. Received a positive evaluation from the supervisor in the organisation where the trainee is trained.
3. Written a comprehensive report with a quality appropriate for a student who is a candidate for Bachelor of Computer Science.

4.5 Group Innovation Project and Study for Sustainability

The course provides an opportunity for students to acquire training in professional software development that is oriented towards systematic innovation based on TRIZ and sustainability through a group project. Therefore, this course introduces the concepts of Theory of Inventive Problem Solving (TRIZ), sustainable software systems, Sustainable Development Goals (UNESCO) and group dynamics. This course also trains students in

writing technical paper, presenting a paper dan demonstrating a project. Therefore, this course also covers topics in research process, publication process, literature review, writing techniques for technical paper and software documentation, and techniques for effective presentation of a paper and software demonstration.

The main objective of this course is to expose students to the basic skills in conducting professional software development projects and technical study in a group that is infused with innovation and sustainable elements. In addition, this course aims to train students in the research process, literature review, writing a project report and technical paper, presenting papers and demonstrating software. The course also serves as a preparation for the industrial training and final year major project.

Course code:	CAT304		
Course title:	Group Innovation Project and Study for Sustainability		
Units:	3	Semester:	Long Vacation + Semester I, Course Registration in Semester I
Type:	Core	Assessment method:	100% coursework

At the end of the course students will be able to:

- Construct software that exhibits innovation and sustainable attributes.
- Demonstrate software effectively and with confidence.
- Work on a project in a team with full responsibility.
- Display ability to make decision ethically and understand issues in sustainability in professional practice.
- Report the results of literature review and its sources using scientific methods.

Student will work in a group of 3 to 4 students and will be supervised by a lecturer for both group innovation project and group study. The groups are expected to meet regularly and they are also expected to meet their supervisor regularly. Each group will be assigned a supervisor at the end of the Second Semester of the Second year so that students may start working on their project and group study during the long vacation.

Students are encouraged suggest their own project title or to continue with the project that they have carried out in CSE241 Foundation of Software Engineering, but must infuse their project with innovation and sustainable elements. Students are required to discuss with their respective supervisor on the scope and specification of their projects so as to ensure that their project fulfil the requirement of the project.

The types of software used are not restricted to a particular programming language or software package. Students may use the hardware facilities provided by the School of Computer Sciences or their own personal computers. The choice of hardware must be suitable with the type of project and software.

By working in the same group, students are also required to carry out an independent study which includes literature review on a topic related to their group project. At the end of the

course, the students are required to produce a technical paper, and produce a video presentation of the paper.

Each group is required to submit only a single report. The format and timeline of the project are as follows:

Submission of Reports	Implementation Period/ Submission Deadlines	Maximum Number of Pages
1. Extended Proposal	Phase 1/First half of Semester I	10 (including Appendices)
2. Final report	Phase 2/Second half of Semester I	30 (including Appendices)

The group innovation project (open presentation, final report and system developed) will be evaluated by the supervisor and two other lecturers. The technical paper and the video presentation will be evaluated by the supervisor. The breakdown of the evaluations is as follows:

Presentation (Project (Open) + Technical Paper (Video))	10 %
Project (Extended Proposal + Final Report + System Developed)	60 %
Peer and Supervisor’s Evaluation on Group Dynamics	15 %
Technical Paper	

Please refer to the course Guideline and e-learning portal for further information. The guideline will be provided to you by the course coordinator when you register for the course.

4.6 Student Learning Time (SLT)

Student Learning Time (SLT) for all courses is given in Appendix C. Students should refer to the suggested SLT as the guide in managing their study time. SLT can be described as follows:

- Effective learning time or student effort in learning or the learning volume (a quantitative measurement of all learning activities) in order to achieve the specified learning outcomes;
- Inclusive of all learning time components (learning activities), that is formal and informal. Total time required by student to learn a particular component of curriculum;
 - Official Contact Time + Guided Learning Time + Self Study.
 - Time (Independent learning) + Assessment Time.
- Synonymous to student’s academic load.

(Source: MOE/MQA)

5.0 MINOR PROGRAMMES

All students that choose to do Computer Science with Minor programme must choose one minor programme and commence their minor study in the second semester of the first year of their studies. These students must complete 20 units of the courses in the minor package.

Among the minor programmes offered are:

School	Minor Package	Code
School of Biological Sciences	Biology	0B01
School of Physics	Astronomy	0Z01
School of Chemical Sciences	Chemical Sciences	0K01
School of Mathematical Sciences	Mathematics	0M01
School of Humanities	English Language Malay Linguistics Geography Literature Islamic Studies History Philosophy & Civilisations Translation and Interpretation	0H01 0H02 0H03 0H04 0H05 0H06 0H15 0H14
School of Languages, Literacies & Translation	Japanese Language Studies Chinese Language Studies Communicational Arabic French Language Studies English Language for Professional	0L01 0L02 0L06 0L08 0L07
School of the Arts	Fine Arts Pedagogy and Performing Art Communicational Graphics Acting and Directing Music Technology Heritage Sciences	0H07 0H08 0H12 0H13 0V01 0V02
School of Communication	Communication	0Y05
School of Management	Management	0A03
Centre for Global Archaeological Research	Archeology	0U01
School of Social Sciences	Anthropology and Sociology Economics Political Science Development Planning and Management Public Policy and Administration International Relation South-East Asian Studies Psychology	0S01 0S02 0S05 0S07 0S09 0S10 0S11 0S12
School of Industrial Technology	Food Technology Bio-Resource, Paper & Coating Technology Environmental Technology	0I06 0I08 0I09
Centre for Global & Sustainability Studies	Sustainability	0N01

Computer Science students are strongly encouraged to minor in the following minor programmes:

(a) Management (0A03)

No.	Code	Units	Course Title	Semester
1.	AKW103	4	Introduction to Management	I
2.	AKW104	4	Finance and Accounting	II
3.	AKP201	4	Marketing	I
4.	AKP202	4	Organizational Behaviour	II
5.	AKP302	4	Operations Management	I

Courses 1 and 2 are compulsory and prerequisites to other courses.

(b) Economics (0S02)

No.	Code	Units	Course Title	
1.	SKW109	3	Pengantar Isu-Isu Ekonomi	} Compulsory Minor students are allowed to take these courses in Semester II
2.	SEW101	3	Mikroekonomi	
3.	SEW103	3	Makroekonomi	
4.	SEP206	3	Ekonomi Malaysia	
5.	SEU224	3	Ekonomi Pemasaran Pertanian dan Koperasi	
6.	SEU227	3	Ekonomi Pembangunan	
7.	SEU230	3	Ekonomi Buruh	
8.	SEU231	3	Ekonomi Islam	
9.	SEU332	3	Ekonomi Perlakuan	
10.	SEU334	3	Wang, Perbankan dan Pasaran Kewangan	
11.	SEU336E	3	Ekonomi Persekitaran dan Sumber Asli	
12.	SEU339E	3	Perancangan Ekonomi dan Analisis Projek	

(c) Psychology (0S12)

No.	Code	Units	Course Title
1.	STU231	4	Asas-Asas Psikologi (Compulsory)
2.	STU241	4	Psikologi Kesihatan
3.	STU242	4	Psikologi Sosial
4.	STU243	4	Psikologi Perkembangan
5.	STU244	4	Psikologi Tak Normal
6.	STU338	4	Kaunseling
7.	STU245	4	Psikologi Positif

(d) Southeast Asian Studies (OS11) (Open for International Students)

No.	Code	Units	Course Title
1.	SEA301	4	Politics and Regionalism in ASEAN
2.	SEA302	4	Economic Transformation in Southeast Asia
3.	SEA303	4	Societies and Culture of the Nusantara
4.	SEA306	4	Independent Studies/Directed Readings
5.	SAU300E	4	Work and Life
6.	SPU314E	4	International Politics and Regional Cooperation

} Compulsory

(e) Translation and Interpretation (OH14)

No.	Code	Units	Course Title
1.	HBT106	4	Asas Pengajian Penterjemahan
2.	HBT201	4	Teori dan Kaedah Terjemahan I
3.	HBT208	4	Teori dan Kaedah Terjemahan II
4.	HBT223	4	Makna dan Penterjemahan
5.	HBT320	4	Ideologi, Sosiobudaya dan Penterjemahan

(f) Islamic Studies (OH05)

No.	Code	Units	Course Title
1.	HIA101	4	Pengantar Pengajian Islam
2.	HIU123	4	'Aqidah Islamiyyah: Konsep dan Penghayatan
3.	HIS213	4	Sumber dan Prinsip Perundangan Islam
4.	HIS224	4	Institusi Kekeluargaan Islam
5.	HIU226	4	Akhlak dan Kerohanian Islam
6.	HIS315	4	Mu'amalat: Konsep dan Pelaksanaan
7.	HIU321	4	Al-Quran, Tauhid dan Sains

} Compulsory

(g) Communication Studies (OY05)

No.	Code	Units	Course Title	
1.	YKT101	3	Pengantar Komunikasi Manusia	} Compulsory (Choose 1)
2.	YKT102	3	Pengantar Komunikasi Massa	
3.	YKT104	3	Pengantar Pengajian Komunikasi	
4.	YKT218	3	Teori Komunikasi I	Compulsory
5.	YKT216	3	Komunikasi dan Masyarakat	} Compulsory (Choose 1)
6.	YKT220	3	Teori Komunikasi II	
7.	YBP201	3	Komunikasi untuk Pembangunan Lestari	
8.	YFP324	3	Kajian Sinema	} (Choose 4)
9.	YFP407	3	Apresiasi dan Kritikan Skrin	
10.	YFP321	3	Kajian Televisyen	
11.	YBP223	3	Periklanan	
12.	YBP224	3	Perhubungan Awam	
13.	YBP326	3	Komunikasi Korporat	
14.	YBP300	3	Komunikasi Pemasaran Bersepadu	
15.	YKT221	3	Undang-Undang dan Etika Media	
16.	YWP223	3	Penulisan Rencana	
17.	YWP315	3	Media dan Gender	
18.	YWP402	3	Komunikasi Antarabangsa	

(h) Communicational Graphics (0H12)

No.	Code	Units	Course Title	
1.	VGT103	3	Tipografi	} Compulsory
2.	VRA104E	3	Introduction to Computer Graphics	
3.	VRA105	2	Sejarah Seni dan Rekabentuk	
4.	VGT101	4	Pengiklanan Grafik	
5.	VGT104	3	Identiti Korporat dan Penjenamaan	
6.	VGT202	3	Ilustrasi Grafik	
7.	VRA102E	2	Theory and Practice of Visual Communication	
8.	VRA106	3	Asas Naratif dan Penjanaaan Imej	
9.	VGT201	2	Reka Bentuk Pembungkusan	

(i) Mathematics (0M01)

No.	Code	Units	Course Title	Semester
1.	MAA101	4	Calculus for Science Students I (Compulsory)	I & II
2.	MAA102	4	Calculus for Science Students II	II
3.	MAA111	4	Algebra for Science Students (Compulsory)	I & II
4.	MAA161	4	Statistics for Science Students	I & II
5.	MAT203	4	Vector Calculus	II
6.	MAT223	4	Differential Equations I	I
7.	MAT263	4	Probability Theory	II
8.	MAT323	4	Differential Equations II	I
9.	MSS311	4	Modern Algebra	II
10.	MSG162	4	Applied Statistical Methods	II
11.	MSG362	4	Quality Control	

(j) Archeology (0U01)

No.	Code	Units	Course Title	Semester
1.	UAW101	4	Pengantar Arkeologi	I
2.	UAW201	4	Perkembangan Manusia dan Tamadun	I
3.	UAW302	4	Sains dalam Arkeologi	II
4.	UAW303	4	Arkeologi Asia Tenggara	II
5.	UAW304	4	Ekskavasi Arkeologi	I

For students wishing to minor in other areas other than Management Studies, please make sure that time-tabling and course scheduling allows you to graduate in the stipulated period. See Minor Programmes Handbook for further information on Minor Specialisations.

6.0 FACILITIES

6.1 Computer Labs Facilities for Undergraduate Teaching

The School offers five teaching labs, located on the 3rd floor. Each lab consists of an average of 45-60 personal computers (PC) and teaching aids such as a LCD TV, projector, screen and PA system. Each lab is equipped with integrated door access system and CCTV to manage access control and lab security.

There are nine technical staffs who are responsible to operate the labs. The labs are open during office hours, semester breaks, and are open until 10:00 pm during the semester. The lab Office is located on Level 3 (Room 305).

Specification and software for each computer for the teaching lab are as listed below:

Labs	Location	Description/Software
Computer Lab 1	301	IMac Computer Model 17 inch - Intel Core 2 Duo 1.83 GHz - 2.5GB Ram - 18 Unit IMac Computer Model 21.5 Inch - 2.7GHz Intel Core i5 - 8GB Ram - Mac OS Mojave version 10.14 *All Dual boot Mac OS or Windows OS
Computer Lab 2	302	HP Prodesk 400 - Intel Core i5-6500 3.2Ghz - 8GB DDR4 Ram - 1TB Hardisk - OS: Windows 10 Enterprise 64Bit
Computer Lab 3	303	Dell OptiPlex 790 - Intel Core i5-2400 3.1Ghz - 8GB DDR3 Ram - OS: Windows 10 Enterprise 64Bit
Computer Lab 4	312	ASUS Intel Core i5 - 11th Gen Intel(R) Core(TM)i5-1500@2.7GHz - 8GB DDR4 Ram - OS: Windows 10 Enterprise 64bit
Computer Lab 5	313	HP Prodesk 400 - Intel Core i5-6500 3.2Ghz - 8GB DDR4 Ram - 1TB Hardisk - OS: Windows 10 Enterprise 64Bit

The regulations on the lab usage are as follows:

- Students must scan their student/staff card to enter the labs using the door access system.
- Students are not allowed to eat, drink and bring in any food or drinks into the lab.
- Students can enter the lab according to the times and periods as allocated through course scheduling in each lab.
- Students must use the equipment properly and ensure that all documents, software and hardware are protected from virus attacks or infected by virus.
- Students are not allowed to bring in or take out any lab equipment (computers, printers, etc.) except with permission from the lab staff.
- Students must switch off the equipment used before leaving the lab.
- Students must dress properly, conforming to the university's dress code when entering the lab.
- Students are not allowed to unplug any type of cables attached to the computer.
- Students must always keep the lab clean.
- Students are not allowed to install any kind of software without permission of the lecturers or technicians of the lab.

6.2 Final Year Undergraduate Major Project Labs

The School also provides special labs to the students for the final year undergraduate major projects which are located at the 5th floor (i.e. rooms 504/505, 511, 519 & 524). The labs are equipped with Ethernet network points and WiFi to facilitate the development of their software systems. Students are encouraged to bring their own PC or laptops for their final year projects.

The labs are open 24 hours a day to students who have been given permission to use the labs, and the list of the students allowed to use the labs will be posted on each lab.

6.3 Network Facilities

The School provide robust, reliable and secure LAN (Local Area Network) and WiFi services, for connection to the campus network USMNet and WAN (Wide Area Network) services to support all ICT requirements.

The network facilities in the building are equipped with network switches that are connect to an internal Gigabit Ethernet Fiber backbone for the school. A Cisco Catalyst 6500 Layer 3 switch is used as a main router and uplinked using redundant 10 Gbps connections to USMNet.

Each computer laboratory has its own Virtual LAN, which is networked using gigabit Ethernet links. Fibre optic cabling is laid throughout the building via trunking and risers from each lab switch to the main routers.

The main campus network (USMNet) is connected to the Internet through a 2Gbps TM leased line and a 10Gbps MyREN (Malaysian Research Network) leased line. The MyREN

Internet line also provides dedicated links among local and international universities for research and academic purposes.

Wireless 802.11ax (Wifi6) access is available in the entire school building. The wireless network service is managed by the School's Technical Support. Access to wireless network is available to all staff, students and guests.

6.4 Data Centre

Our data centre servers are located on level 3 & 4 and they are connected directly through switched Gigabit Ethernet ports, supplying excellent bandwidth for network services such as database systems, file services, file hosting and digital multimedia content. There are more than 40 physical and virtual servers assigned for networking purposes, services, teaching/learning and research. The servers are also available for the final year project students to use as it will be an exposure for the students to get the real experience in project implementation with most high-end platforms and technologies.

6.5 Active Directory and Email Account

Each student of the school is automatically enrolled with an Active Directory (AD) account. This account provides services such as an e-mail account, cloud storage, and various communication and collaboration tools.

Each student is entitled to one email account with 50GB mailbox storage and 1TB cloud storage (Microsoft OneDrive).

AD account is used as single sign-on id for accessing the hundreds/thousands of applications and services supported by the University such as Web-based/LAN based Library Access, Wi-Fi access, Campus Online access, E-learning portal and Microsoft Azure for Teaching access.

6.6 Licensed Software

All free licensed software for registered students are provided by Microsoft Azure for Teaching. Students can download most of the latest software, operating systems (for personal computer, workstation, and/or server), developer tools, and databases. Follow these few steps for the activation of Microsoft Azure for Teaching:

Step 1: Log into the following URL:

https://portal.azure.com/#blade/Microsoft_Azure_Education/EducationMenuBlade/software using your USM identity account.

Step 2: If the list shows less than 30 software, then access the following URL

<https://azureforeducation.microsoft.com/devtools> for activation. Tick all checkboxes and Accept Terms.

Step 3: Reload page in Step 1. Click on the software you like to download/use and view the key. Use the key during activation of the software. Some software may need you to login using your USM identity account.

The following product families are included in the Azure Dev Tools for Teaching subscriptions:

- Advanced Threat Analytics
- Agents for Visual Studio
- Azure DevOps Server
- BizTalk Server
- Host Integration Server
- Hyper-V Server
- Machine Learning Server
- R Server
- Remote Tools for Visual Studio
- SharePoint Server
- Skype for Business Server
- SQL Server Developer
- SQL Server Enterprise
- SQL Server Mobile Report Publisher
- SQL Server Standard
- SQL Server Web
- System Center
- Visual Studio Code
- Visual Studio Community
- Visual Studio Enterprise
- Visual Studio for Mac
- Windows Server
- There are three Microsoft Office applications (Excel, PowerPoint, Word) not available

Proof of student status is required to download software and obtain product keys. Students can verify their identity using official students email addresses. Students remain verified for 12 months afterwards and can renew after the 12 month period using their official email.

6.7 Computer Labs Facilities for Postgraduate Research

There are three main research clusters and labs for postgraduate students as shown in the table below.

Research Cluster (Head)	Room Number
Service Computing (Dr. Nor Athiyah Abdullah)	404-1, 405-1 & 406-1
Data to Knowledge (Dr. Gan Keng Hoon)	401 & 402
Enabling Technologies and Infrastructures (Ts. Dr. Mohd Najwadi Yusoff)	402-1 & 404

6.8 Lecture Halls and Tutorial Rooms

Most lectures are conducted at DKG31 which is located at the ground floor of the Schools of Computer Sciences and Mathematical Sciences building (G31). The School of Computer Sciences shares the lecture hall mainly with the School of Mathematical Sciences. Other lectures or tutorials are conducted at dedicated lecture halls and tutorial rooms around the campus.

Some tutorials and lectures for smaller group of students are conducted at the following rooms in the G31 building:

- ELL (Room 045)
- Tutorial Room (Room 507)
- Teaching Lounge - SCL 1 (Room 211-1)
- Teaching Room - SCL 2 (Room 211-2)
- Auditorium (Room 211-3)

Students are not allowed to eat and drink in the lecture halls and the tutorial rooms. In addition, students must dress properly, conforming to the university's dress code when entering any lecture halls and tutorial rooms when attending their lectures or tutorials. The lecturers have the right to prohibit students who do not wear proper attire when attending their lectures or tutorials. Students should not use the facility provided in the rooms without the permission of the respective lecturer.

6.9 Undergraduate Student Lounge

Undergraduate Student Lounge is located at room 211-4 level 2 which is exclusively meant for undergraduate students. They can meet, socialise, study and hang out with fellow colleagues. This room provides a few facilities for students such as high tables, small tables, sofas and other amenities.

Please note the basic rules to use the room.

- Keep the room clean and tidy.
- Be courteous and respect others whilst using the room.
- Switch off the lights and other appliances when nobody is in the room.

7.0 GENERAL INFORMATION

7.1 Industry-Community Advisory Panel (ICAP)

The creation of Industry-Community Advisory Panels within schools and centres of USM is in direct compliance with the university's overall efforts taken towards building a lighter working framework with industry, companies and the community. ICAP is considered timely and useful for enhancing institutional competitiveness. The ICAP members comprise selected academic staff, senior executives from the private sector and well-respected leaders from the community. ICAP meetings serve as a platform to discuss issues on curriculum, training solutions for coordinating industry/community expectations and relevance, best practices to be adopted, and practical approaches to address contemporary issues and other areas of concern to all parties. ICAP members are also involved in our curriculum review process by providing feedbacks on the relevancy of our curriculum to the current and future trends.

The panel members of the ICAP for the School of Computer Sciences are as follows:

No.	Name	Position / Organisation
1.	En. Chow Kin Weng	Senior Software Group Manager NI Malaysia Sdn. Bhd. No. 8, Lebuah Batu Maung 1, 11960 Bayan Lepas, Pulau Pinang.
2.	En. Muhammad Imran Kunalan Bin Abdullah	Principal Consultant - National Human Capital Development HUAWEI Technologies Co. Ltd. J2-F1-C, Huawei Industrial Base Bantian Longgang District, Shenzhen 518129, P.R. China.
3.	En. Yeoh Shih Hoong	Senior Vice President ViTrox Technologies Sdn Bhd No. 85-A, Lintang Bayan Lepas 11 Bayan Lepas Industrial Park, Phase 4 11900 Bayan Lepas, Pulau Pinang.

4.	En. Tan Kim Lai @ Leonard Tan	Director, Product Engineering Operations - Global Configuration Service Dell Global Business Centre Industrial Park, Plot 76 , Mukim, 11, Jalan Bukit Tengah, Bukit Tengah, 14000 Bukit Mertajam, Pulau Pinang.
5.	Pn. Nur Balkis Binti Amairuddin	Head of Education and Tertiary Skymind Holdings Berhad B01-D, Level 12, Boutique Office 1, (Pillar 11 KL Eco City, Pantai Baru, Jalan Bangsar, 59200 Kuala Lumpur.

7.2 Computer Industrial Forum (CIF)

School of Computer Sciences has established the Computer Industrial Forums (CIF) with the intention to collaborate and enhance its relation with the industrial sector, business, government bodies and other organisations in computer or IT-related fields. The forum aims:

1. To provide a mechanism to spread computing practices and development that can be benefited by academia and industries.
2. To provide a channel for evaluating the local computing needs.
3. To encourage technology transfer by assisting the academic staff with entrepreneurial inclination in developing new promising computing products for marketing through collaboration research, consultancy and other means.
4. To acquire research grants and consultation to enhance R&D efforts and scholarships from the industrial sector to excellent students.
5. To ensure output of graduates with high quality and well-sought after by the market/computer industries.

Among the various activities organised by CIF are:

- (a) Meeting to discuss relevant issues.
- (b) Organising technical seminars, courses and workshops.
- (c) Strengthening cooperation in research and development work.
- (d) Exchange of technical information.
- (e) Consultancy work with the industry.
- (f) Increasing scholarship and employment opportunities.
- (g) Carrying out surveys to get appropriate feedback of the effectiveness of the programmes of study.
- (h) Industrial training placement.
- (i) Staff attachment or sabbatical leave in industry.

7.3 Academic Staff – Student Committee

This committee acts as an official channel of communication between the students and the staff of the School of Computer Sciences. Among the objectives of the committee are to:

- (a) inculcate closer relationship between academic staff and students.
- (b) plan and carry out activities that support the above objective in (a).
- (c) plan and to carry out activities that will help new students to familiarise themselves with the new learning environment.
- (d) function as a forum to discuss problems faced by students.

Members of the committee consist of academic staff of the School of Computer Sciences and student representatives.

7.4 Sustainable Student Workshop (*Bengkel Siswa Lestari*) (Year I)

Sustainable Student Workshop consists of compulsory weekly 1-2 hour seminars where the First Year students will be introduced to the School of Computer Sciences, discipline of Computer Science including specialisation areas offered in the programme and research activities. This workshop also provides sessions that would assist First Year students to familiarise and adapt themselves to university-level education and in building up their personal development and soft skills.

7.5 Microsoft Student Partners (MSP) Programme

Microsoft Student Partner (MSP) is a programme designed to groom and recognise bright, passionate, technology students for their contribution to the academic community on a one-year renewable term. It is an opportunity for top young minds to build vital technical and soft skills, sharing with students and peers about technology and bringing out the best in them. The School of Computer Sciences has been part of MSP Programme since 2006. Activities carried out by MSP are trainings and coaching for students as well as competitions such as the Imagine Cup. More details can be found at <https://studentpartners.microsoft.com/en-us>

7.6 Google Developer Student Clubs (GDSC)

Google Developer Student Clubs (GDSC) are community groups for college and university students interested in Google developer technologies. Students from all undergraduate or graduate programs with an interest in growing as a developer are welcome. By joining a GDSC, students grow their knowledge in a peer-to-peer learning environment and build solutions for local businesses and their community. When GDSC USM first started, it was one of three Malaysian chapters (in public and private institutions), but the community has since grown to 17 and counting. GDSC USM actively organizes workshops and events that introduce students to not only Google development tools, but other essential development skills and knowledge.

7.7 Computer Science Society

CS Society (also known as Computer Science Society) is a student organization supervised by the School of Computer Sciences, Universiti Sains Malaysia. It aims to lead the CS students' profession by providing all-rounded support through innovative and practical approaches. This society paves a formal communication channel between the CS students, School of Computer Sciences and Universiti Sains Malaysia. CS Society is committed to creating an innovative and evolving environment that supports the enrichment and empowerment of academic, personal, and professional growth of every USM Computer Science student. CS Society is also the umbrella organization that centralizes and encourages tech initiatives. Some impactful flagship programs that the CS Society has organised include:

1. CSBersamamu
2. V Hack (Varsity Hackathon)
3. CSIRF (Computer Science Internship and Recruitment Fair)
4. PIXEL (Project Innovation & eXploration in CS Education and Learning)
5. Web Development & C++ Workshops
6. Career Booster Summit
7. CS Log Off Night (Annual Dinner)
8. Major Minor Exploration Event (ME2)

CS Society always strives to provide a space for CS students to explore the world of industrial technology and business, paving the way for them to become all-rounded graduates.

7.8 Project Innovation & Exploration in CS Education and Learning (PIXEL)

PIXEL is a half-day Expo for Computer Science Final Year Project, an extension of the existing FYP evaluation to showcase selected FYP to the public. Students have the opportunities to showcase their projects. Their projects will be evaluated by panel members comprising CS industry partners. The incentives include cash prizes and certificates. By having the expo, it provides the avenue for students to showcase their work and potentially engage with the industry and community. This expo provides the opportunity for the final year students to:

1. Feature students' work among their peers, industry and community members.
2. Exchange knowledge and experience among the students, academics and community.
3. Enhance their soft skills particularly in presenting their ideas to the public.

7.9 Prizes and Awards

Computer Science prizes and awards are divided into two categories, at the School level and at the University level.

7.9.1 School Level

Dean's Certificate

Dean's Certificate is awarded to students who excel (obtained GPA ≥ 3.5) and acquired at least 12 credits of courses with grade points for a particular semester.

7.9.2 University Level

The Gold Medal Award is awarded to the best final year student in the Bachelor of Computer Science degree programme. Other awards include the best Final Year students in all areas, i.e. *Hadiah Buku* Universiti Sains Malaysia by ViTrox Corporation Berhad, Chancellor's Gold Medal, Royal Education Award, and USM Gold Medal by USM Woman Society.

Prizes are also given to the best students in academic field to Computer Science students in Years I, II and III.

7.10 Research and Higher Degree Programmes

The research areas of the School of Computer Sciences can be divided into three clusters that reflect the available expertise within the School. The three clusters and their respective research focus areas include:

- **Service Computing:** Enterprise Computing, Software Engineering, Social and Sustainable Computing, and Multimedia Computing.
- **Data to Knowledge:** Computational Intelligence, Computer Vision and Image Processing, Visual Computing, and Language and Knowledge Engineering.
- **Enabling Technologies and Infrastructures:** High Performance Computing, Networks, and Information Security.

The research clusters largely overlap with the major specialisation and the respective field elective courses offered in the Bachelor of Computer Science programme (see Section 4.1).

Research Programmes

Postgraduate programmes leading to MSc and PhD in Computer Science are open to candidates who have obtained a good honours degree. The degree can be pursued through research in the research clusters stated above under the supervision of at least one academic staff of the school. A candidate is required to complete a thesis in a stipulated time period. Usually, candidates for an MSc complete their thesis in 12 – 18 months and for a PhD in 30 – 40 months. Undergraduate students who are interested to pursue postgraduate studies may refer to the Postgraduate Study Handbook that is available at the school for more detailed information.

Mixed Mode and Coursework Programmes

Three postgraduate programmes are offered namely Master of Science (Computer Science) by mixed mode (coursework and research), Master of Informatics by coursework and Master of Science (Data Science and Analytics) by coursework.

Master of Science (Computer Science) is offered to graduates in Computer Science or related areas. Areas of concentration offered under this programme include Data & Knowledge Engineering and Enabling Technologies & Infrastructure. The programme requires a minimum of one year and a maximum of two years for completion.

Master of Informatics is offered to graduates in any field. This programme allows students to study Business Informatics, Biomedical Informatics, or Informatics Technopreneurship. Candidates require at least one and half years to complete the programme.

Master of Science (Data Science and Analytics) is offered to graduates in any field from numerate disciplines such as computing, engineering, physical science, and fields that contains sound statistical background (e.g. business, accounting, economics, life sciences, health sciences). Two focus areas are offered namely business analytics and multimodal analytics. Candidates require at least one and half years to complete the programme.

Details on postgraduate studies can be obtained from the Institute of Postgraduate Studies and via its website: <http://www.ips.usm.my>

7.11 School's Website and E-learning Portal

Information pertaining to the School of Computer Sciences can be obtained from the school's website at <http://www.cs.usm.my>

The School uses Moodle (Modular Object-Oriented Dynamic Learning Environment) which is an open source e-learning platform to help lecturers create an effective online learning environment. Moodle has many features expected from an e-learning platform including forums, content management, quizzes, surveys, chat and peer assessment.

The system can be accessed at elearning.usm.my using USM ID. USM ID will be provided by Pusat Pengetahuan Komunikasi dan Teknologi (PPKT) USM.

Students are responsible to check their USM email regularly for the latest announcements and updates in related matters. Some urgent announcements are posted on the notice boards at the School. Students must be alert to all related announcements besides those posted online.

8.0 LIST AND DESCRIPTION OF COURSES

8.1 List of Courses for all programmes

All courses in the table below are conducted in English.

Code	Course Title	Units	Sem	Year	C'work	Exam	Coursework Breakdown/ Assessment
CPT111	Principles of Programming (Prinsip Pengaturcaraan)	3	I / II	I	50	50	30% Assignments 20% Tests
CPT112	Discrete Structures (Struktur Diskret)	4	I	I	40	60	20% Assignments 20% Tests
CPT113	Programming Methodology and Data Structures (Metodologi Pengaturcaraan dan Struktur Data)	3	I / II	I	50	50	30% Assignments 20% Tests
CST131	Computer Organisation (Organisasi Komputer)	4	I	I	50	50	30% Assignments 20% Tests
CPC151	Fundamentals of Logic and Artificial Intelligence (Asas Logik dan Kecerdasan Buatan)	4	II	I	50	50	25% Tests 15% Projects 10% Presentation
CPC152	Foundations and Programming for Data Analytics (Asas dan Pengaturcaraan untuk Analitik Data)	4	II	I	60	40	20% Assignments 20% Tests 20% Projects
CMT221	Database Organisation and Design (Organisasi dan Reka Bentuk Pangkalan Data)	4	I / II	II	50	50	25% Assignments 20% Tests 5 % Practical
CPT212	Design & Analysis of Algorithms (Reka Bentuk dan Analisis Algoritma)	4	II	II	50	50	30% Assignments 20% Tests
CSE241	Foundations of Software Engineering (Asas Kejuruteraan Perisian)	4	I	II	50	50	26% Report 20% Tests 10% Planning participation

Code	Course Title	Units	Sem	Year	C'work	Exam	Coursework Breakdown/ Assessment
CST232	Operating Systems (Sistem Pengendalian)	3	I	II	50	50	30% Assignments 20% Tests
CST235	Principles of Computer Networks and Information Security (Prinsip Rangkaian Komputer dan Keselamatan Maklumat)	4	II	II	50	50	30% Assignments 20% Tests
CAT201	Integrated Software Development Workshop (Bengkel Pembangunan Perisian Bersepadu)	2	I	II	100	-	50% Projects 30% Tests 20% Assignments
CAT302	Industrial Training (Latihan Industri)	12	II & KSCP	III	100	-	50% Supervision 20% Report 20% Log book 10% Presentation
CAT304	Group Innovation Project and Study for Sustainability (Projek Inovasi dan Kajian Kumpulan untuk Kelestarian)	3	I	III	100	-	50% Project 25% Report 15% Planning participation 10% Presentation
CAT402	Professional and Technopreneurship Development (Pembangunan Profesional dan Tekno-keusahawanan)	2	I	IV	100	-	30% Tests 30% Assignments 20% Projects 10% Presentation
CPC251	Machine Learning and Computational Intelligence (Pembelajaran Mesin dan Kecerdasan Komputan)	3	II	II	60	40	20% Assignments 20% Tests 20% Project
CPT411	Automata Theory and Formal Languages (Teori Automata dan Bahasa Formal)	3	II	IV	40	60	20% Assignments 20% Tests
CAT405	Intelligent Computing Final Year Project (Projek Tahun Akhir Perkomputeran Cerdas)	8	I & II	IV	100	-	40% Report 35% Programming 25% Presentation
CPT316	Programming Language Implementation and Paradigms	3	I	III	50	50	30% Assignments 20% Tests

Code	Course Title	Units	Sem	Year	C'work	Exam	Coursework Breakdown/ Assessment
	<i>(Pelaksanaan dan Paradigma Bahasa Pengaturcaraan)</i>						
CST236	Digital Systems Design <i>(Reka Bentuk Sistem Digital)</i>	3	II	II	50	50	20% Projects 10% Assignments 10% Tests 10% Practical Tests
CST431	Systems Security and Protection <i>(Keselamatan dan Perlindungan Sistem)</i>	3	II	IV	50	50	20% Assignments 20% Tests 10% Quizes
CST435	Parallel and Cloud Computing <i>(Perkomputeran Selari dan Awan)</i>	3	I	IV	50	50	30% Assignments 20% Tests
CAT403	Computing Infrastructure Final Year Project <i>(Projek Tahun Akhir Infrastruktur Komputeran)</i>	8	I & II	IV	100	-	40% Report 35% Programming 25% Presentation
CSE242	Software Requirements Analysis & Modelling <i>(Pemodelan dan Analisis Keperluan Perisian)</i>	3	II	II	50	50	20% Projects 20% Tests 10% Assignments
CSE341	Software Architecture and Design <i>(Seni Bina dan Reka Bentuk Perisian)</i>	3	I	III	50	50	30% Assignments 20% Tests
CSE441	Software Process and Quality Assurance <i>(Proses dan Jaminan Mutu Perisian)</i>	3	I	IV	50	50	20% Test 15% Project 15% Assignments
CSE442	Software Testing <i>(Pengujian Perisian)</i>	3	II	IV	50	50	20% Test 15% Project 15% Assignments
CAT404	Software Engineering Final Year Project <i>(Projek Tahun Akhir Kejuruteraan Perisian)</i>	8	I & II	IV	100	-	40% Report 35% Programming 25% Presentation

Code	Course Title	Units	Sem	Year	C'work	Exam	Coursework Breakdown/ Assessment
CPC351	Principles of Data Analytics (Prinsip Analitik Data)	3	I	III	60	40	20% Project 20% Test 15% Assignments 5 % Presentation
CPC353	Natural Language Processing (Pemprosesan Bahasa Tabii)	3	I	III	50	50	30% Assignments 20% Tests
CPC354	Computer Graphics and Visualisation (Grafik Komputer dan Visualisasi)	3	I	III	50	50	30% Assignments 20% Tests
CPC357	IoT Architecture and Smart Applications (Seni Bina IOT dan Aplikasi Pintar)	3	I	IV	60	40	20% Project 20% Test 10% Assignments 10 % Quiz
CPC451	Big Data Technologies and Management (Teknologi dan Pengurusan Data Raya)	3	II	IV	60	40	20% Assignments 20% Tests 20% Project
CPC452	Animation & Virtual Reality (Animasi & Realiti Maya)	3	II	IV	50	50	20% Assignments 20% Tests 10% Presentation
CMT321	Management and Engineering of Databases (Pengurusan dan Kejuruteraan Pangkalan Data)	3	I	III/IV	50	50	30% Assignments 20% Tests
CMT322	Web Engineering & Technologies (Kejuruteraan & Teknologi Web)	3	I	III/IV	50	50	30% Assignments 20% Tests
CMT323	Information Systems Theory and Management (Teori dan Pengurusan Sistem Maklumat)	3	I	III	50	50	30% Assignments 20% Tests
CMT425	Enterprise Architecture and Systems (Seni Bina dan Sistem Perusahaan)	3	II	IV	50	50	30% Assignments 20% Tests
CMT426	Business Intelligence and Analytics	3	II	IV	50	50	30% Assignments 20% Tests

Code	Course Title	Units	Sem	Year	C'work	Exam	Coursework Breakdown/ Assessment
	<i>(Kecerdasan dan Analitik Perniagaan)</i>						
CSE342	Dependable Software Systems Engineering <i>(Kejuruteraan Sistem Perisian Boleh Dipercayai)</i>	3	I	III	50	50	20% Tests 15% Projects 15% Assignments
CSE443	Real-Time Software Engineering <i>(Kejuruteraan Perisian Masa Nyata)</i>	3	II	IV	50	50	20% Tests 20% Projects 10% Case Study
CST337	Network Configuration and Protocols <i>(Konfigurasi dan Protokol Rangkaian)</i>	3	I	III/ IV	60	40	20% Assignments 20% Tests 10% Report 10% Practical Tests
CST338	Network and Communication Security <i>(Keselamatan Rangkaian dan Komunikasi)</i>	3	I	III/ IV	50	50	20% Tests 15% Projects 10% Assignments 5% Quizes
CST339	Information Security Management and Assurance <i>(Pengurusan dan Jaminan Keselamatan Maklumat)</i>	3	I	III	50	50	30% Assignments 20% Tests
CST432	Microprocessors and Embedded Systems <i>(Mikropemproses dan Sistem Terbenam)</i>	3	II	IV	50	50	15% Tests 15% Projects 15% Assignments 5% E-Learning
CST434	Wireless Networks and Mobile Computing <i>(Rangkaian Tanpa Wayar dan Perkomputeran Bergerak)</i>	3	II	IV	50	50	30% Assignments 20% Tests
CST436	Digital Forensics and Investigations <i>(Forensik dan Siasatan Digital)</i>	3	II	IV	60	40	20% Tests 20% Projects 10% Assignments 10% E-Learning

8.2 Course Descriptions

Level 100

CPC151/4 Fundamentals of Logic and Artificial Intelligence

This course introduces basic logic concepts and techniques in constructing and evaluating arguments including forming a standard argument, differentiating validity of argument, applying rules to prove validity of arguments. In addition, it also exposes students to basic approaches of fundamental artificial intelligence, including basic search strategies, basic knowledge representation and reasoning and basic machine learning.

At the end of the course, the students will be able to:

- Apply the basic concept of propositional logic including proposition, arguments, premises, and conclusions and validity of arguments. Follow the rules of programming development.
- Apply the basic concepts of predicate logic and the use of quantifiers and proving the validity of predicate logic in problem solving.
- Analyse fundamental approaches of artificial intelligence that includes search strategies, knowledge representation and reasoning, and machine learning.
- Demonstrate artificial intelligence approaches in problem solving using current technologies.

CPC152/4 Foundation for Data Analytics

This course introduces the fundamentals and logic of Python programming language and its application in data analytics. Students will learn how to design and write programs using Python programming language and to perform data analysis by using these skills. Basic programming concepts of data structures and programming constructs as well as debugging and good programming practises will also be covered. The course introduces the basic goals and concepts of machine learning, linear algebra and provides some useful data visualization and statistical analysis techniques for data analytics. At the end of the course, students will be equipped with practical skills and statistics to explore and managing data, developing and evaluating data models and presenting results.

- Explain the fundamentals concepts and logic of Python programming and its application in data analytics.
- Practice the use of data visualization techniques and its usage to present the result effectively to audience of all levels.
- Develop the Python programming language and machine learning techniques in data analytics projects.
- Discuss the fundamentals concepts and logic of Statistics and Linear Algebra in data analytics.

CPT111/3 Principles of Programming

The main emphasis of the course is on the basic principles of programming using the C++ programming language. This course covers basic concepts of computer system, introduction to problem solving techniques, basics of programming, control structures, modular programming, data file processing, reference variable, pointers and one-dimensional array.

At the end of the course, the students will be able to:

- Explain the basic concepts of programming, control structure, modular programming, file, array and computational thinking component in problem solving techniques.
- Construct programs using C++ language.
- Apply problem solving techniques in program development.

CPT112/4 Discrete Structures

Discrete mathematics is the study of mathematical structures that are fundamentally discrete. Discrete structure serves as a fundamental concept which lies at the core of a Computer Science study. Computer system is essentially a finite discrete system which understanding such system can be aided by modelling it as a discrete mathematical system.

At the end of the course, the students will be able to:

- Select the right mathematical structures to be used in problem representation by using the concepts and characteristics of mathematical structures.
- Practice basic computing concepts and theories in other computer science courses
- Follow an appropriate algorithmic approach in problem solving.

CPT113/3 Programming Methodology and Data Structures

This course exposes students to data structures e.g. dynamic arrays, lists, stacks, queues, and fundamental binary trees. This course also strengthens further programming skills in C++ using computational thinking methods through topics that include recursion, object-oriented design, data abstraction, and classes. This course gives fundamental knowledge on abstract data types and data structures in problem solving.

At the end of the course, the students will be able to:

- Use data structures in problem solving and object-oriented programming.
- Construct object-oriented programming with the appropriate data structures.
- Analyze the requirements and design for object-oriented programming and problem solving.

CST131/4 Computer Organisation

This course introduces the structure and functional units of the computer that are responsible for storing and processing information. It focuses on the functioning of individual components, interaction between components, techniques and technologies used, various number systems and simple digital logic circuits.

At the end of the course, the students will be able to:

- To explain the basic functional units of the computer such as CPU, input/output and memory, and also number systems.
- To create digital logic circuit.
- To explain the memory organisation in computers.

Level 200

CAT201/2 Integrated Software Development Workshop

This course introduces the practical aspects of collaborative software development and graphics programming especially in JAVA programming, and web platform-based development. Basic concepts of human-computer interaction are also provided especially from the aspects of usability, user-centric design and GUI evaluation. Students are taught various models of software development, pair-programming and code management techniques. Students are required to put into practice the taught concepts through a GUI-based software development project.

At the end of the course, the students will be able to:

- Explain software development concept based on Web Platform.
- Construct a software based on JAVA programming language with user-friendly graphical user interface and graphics program.
- Practice the latest Human-computer interaction (HCI) principles in designing, assessing and implementing interactive computing systems.

CMT221/4 Database Organisation and Design

The course starts with the discussion on the importance of data to an organisation and how the data should be processed and managed. Then the concept of database is introduced. Database management system (DBMS) will be viewed as a solution to the problems of file processing system. Aspects of relational database design will be covered in detail. Students will also be guided through the database development life cycle, database architecture, various data models, and normalisation process. Database implementation will be covered in the discussion of query languages such as SQL and QBE. The course ends with some discussions on selected current topics in database technologies. The students'

understanding is further enhanced by the implementation of phased project assignments throughout the course.

At the end of the course, the students will be able to:

- Explain the fundamental concepts, theories, designs and management of database.
- Construct a database using structured query language (SQL).
- Work on database project in group.

CPC251/4 Machine Learning and Computational Intelligence

The first part of the course introduces methods of learning from data and explains the concepts behind various machine learning techniques. The course covers the basics of both supervised and unsupervised learning paradigms. Students will learn to identify the characteristics of datasets, select features and machine learning algorithms, evaluate the performance of the machine learning models, and work on how to get the best performance. Students will also practice to construct machine learning models by integrating machine learning libraries and tools for various datasets and case studies. The second part of the course introduces the various techniques of computational intelligence. Various knowledge sources that are relevant to computational intelligence problems will be discussed. Students will also be exposed to advanced knowledge representation and reasoning approaches.

At the end of the course, the students will be able to:

- Analyze machine learning and computational intelligence techniques for a particular problem.
- Construct machine learning models by integrating machine learning libraries and tools.
- Study the characteristics of datasets and knowledge sources for machine learning and computational intelligence problems.

CPT212/4 Design and Analysis of Algorithms

The essence of this course is on advanced data structures and the design and analysis of algorithms. The course covers a broad range of algorithms and their analysis in OOP environment that include sorting, searching, and graph algorithms. The course also introduces algorithms for string processing, memory management, and advanced topics on algorithms.

At the end of the course, the students will be able to:

- Describe the various algorithm designs based on their categories and purpose.
- Apply fundamental techniques of algorithms and algorithm design, and their associated data structures in problem solving and programming.

- Distinguish between various algorithm designs based on elementary analysis.

CSE241/4 Foundations of Software Engineering

This course describes the foundations of software engineering including aspects of software processes, requirements engineering, system modelling, system architecture and system design, system implementation, system testing, system maintenance and project management. The focus is on the discipline required as best practice, in the process of software development. The modelling that needs to be learned in system specification includes use cases using the UML approach. Examples of systems and case studies will be discussed to enable students to build their knowledge in system theory and application. Emphasis on real systems through software development processes using the Agile method, begins with the requirements engineering up to the project management process. Approaches to practical issues will be given to enable students to build theoretical and application knowledge in software engineering through theoretical description and illustration, as well as system prototype development and case studies using the UML approach.

At the end of the course, the students will be able to:

- Point out the basic concepts of software engineering principles, requirements engineering, software system development processes, process and evolution of systems, and project management.
- Follow the phases in software development including requirements engineering, and system modelling and design using Unified Modelling Language (UML).
- Practice software systems development process through a group project.

CSE242/3 Software Requirements Analysis and Modelling

This course provides an intensive focus on conceptual and practical aspect in carrying a good software requirement activity in software product development. Software requirement is basically an early activity of any software product development and several key topics are covered specifically on two main tasks namely elicitation stage and modelling stage. The elicitation stage emphasises on the techniques and methods during information gathering in understanding the customers and software problem. Techniques such as focus group, stakeholder analysis, feasibility studies are the main key topics as it refines the problem faced by the customers. Next key topic is the software modelling stage in which emphasize on the techniques and styles of transforming the information obtained during the elicitation stage into a good software model. UML based modelling technique is applied in a great extend toward establishing software models. Student will be exposed to a real-life stories and experiences related to software requirement task. Team project assignment will be given with the main focus is to practice elicitation and modelling activities.

At the end of the course, the students will be able to:

- Explain the basic concepts of software Requirement Engineering including its four core activities such as elicitation, documentation, validation and negotiation, and management
- Apply suitable methods and techniques for gathering software requirement for system development project.
- Propose software model sets that can be used to identify software requirements and increase the clarity for the function of the system.

CST232/3 Operating Systems

To understand the workings of an entire computer system, it begins with an understanding of an operating system. It is because operating system manages every piece of hardware and software. This course is to explore what operating systems are, how they work, what they do and why. Therefore, this course introduces the basic principles of operating system such as memory management, process management, file and device management as well as system programming.

At the end of the course, the students will be able to:

- Explain the functions and methods of implementing operating system components such as the management of memory, processes, files and devices.
- Display the ability to use system commands to accomplish the user's tasks.
- Propose the different techniques used by the operating system in the usage of resources.

CST235/4 Principles of Computer Networks and Information Security

This course exposes to the students the general knowledge, principles and technologies that are related to the network system and security in computing contexts. For the network system aspects, students are exposed to the principals of data communications, architecture and types of network such as LAN, WAN, Internet: network topology, network protocols, network models especially OSI and TCP/IP also standard used in regards to addressing, IPv6. For security aspects, students are exposed to the general knowledge of security which is concepts and models of CIA (Confidentiality, Integrity, Availability); risk concepts, threat, weaknesses and attack also its vector; The principals of authentication and authorization and access control; trust and trustworthiness concepts, and secure system development. Besides, students will be exposed with knowledge about threat to human resources and the roles that should be played by them in security system.

At the end of the course, the students will be able to:

- Analyze various type of network technologies, and security requirements.
- Demonstrate various aspects and steps that need to be taken to improve security in different network models and layers.
- Practice secure software development in computing.

CST236/3 Digital Systems Design

This course aims are to make sure student able to analyse, design and evaluate digital system circuits, of medium complexity, that are based on microcontroller interfacing with MWICOM and related electronic devices to construct a functional digital system.

At the end of the course, the students will be able to:

- Explain the fundamentals needed in designing a digital system.
- Construct a working digital system.
- Propose suitable techniques to design a digital system.

Level 300

CAT302/12 Industrial Training
(Please refer to Section 4.4: Industrial Training)

CAT304/3 Group Innovation Project and Study for Sustainability
(Please refer to Section 4.5: Group Innovation Project and Study for Sustainability)

CMT321/3 Management and Engineering of Databases

The first part of this course covers concepts, techniques and protocols related to transaction, concurrency control, recovery and security of databases. In the second part of the course, students will learn about the characteristics, components and data design of other types of databases (distributed databases, object-oriented databases) as well as data warehouse, OLAP and data mining. Students also will investigate issues and latest development in database applications and technologies.

At the end of the course, the students will be able to:

- Explain concepts, methods and protocol of transaction, concurrency control, recovery and security for databases.
- Differentiate characteristics, components and type of databases.
- Report on issues and latest development in databases.

CMT322/3 Web Engineering & Technologies

Web Engineering introduces a structured methodology utilized in software engineering to Web development projects. The course addresses the concepts, methods, technologies, and techniques of developing Web sites that collect, organize and expose information resources. Topics covered include requirements engineering for Web applications, design methods and technologies, interface design, usability of web applications, accessibility,

testing, metrics, operation and maintenance of Web applications, security, and project management.

At the end of the course, the students will be able to:

- Select concepts and technologies related to Web-based application development including basic needs, models, designs and architecture.
- Build Web-based applications using knowledge in Web engineering concepts and technologies.
- Organise development of Web-based application in team.

CMT323/3 Information Systems Theory and Management

Information systems are enablers for modern organizational activities, as well as drivers of new and modified goals and activities. Information Systems management is very much related to the organizational strategy, goals and operations. At the same time, the technical nature of information systems and the rapid changes in technology make unique demands to managers. This course provides the basis for understanding the role and activities of information systems in organizations. It is also a valuable complement to the theoretical and technical material you have studied in other courses.

At the end of the course, the students will be able to:

- Explain the foundation and theory of information systems (IS), types of IS and the importance of information and knowledge in business and public organizations.
- Identify different types of IS (including ERP, CRM, SCM and e-collaboration) to support operational and strategic activities and also to achieve competitive advantage.
- Choose different IS/IT aspects (database, artificial intelligence, system development, networking etc) in solving real business case studies.

CPC351/3 Principles of Data Analytics

This course introduces the basic goals and techniques in data science and analytics process with some theoretical foundations which include machine learning concepts so that the process can transform hypotheses and data into actionable predictions. The course provides basic principles on important steps of the process which include data collecting, curating and analysing, building predictive models and reporting and presenting results to audiences of all levels. R programming language technique is introduced based on examples such as from marketing, business intelligence and decision support.

At the end of the course, the students will be able to:

- Explain effectively all the necessary steps in any data science and analytics real-world project.

- Practice the skills needed by data scientist in a team which include acquiring the data, managing the data, choosing the modelling technique, writing the code, and verifying and presenting the results.
- Present the result effectively and with confidence to audience of all levels.

CPC353/3 Natural Language Processing

Natural language processing is one of the fundamental courses in the area of artificial intelligence and big data analysis. This course introduces fundamental concepts in text and speech processing to students. Students will be introduced to the elementary knowledge and processing in speech such as the physics, phoneme, formant, pronunciation model, and speech features. In the text processing, pre-processing and modelling techniques such as tokenization, stemming, morphological analysis, sequence modelling, grammar, parsing, and semantic modelling will be discussed. The concepts and techniques will also be demonstrated in applications such as text classification, information retrieval, machine translation and automatic speech recognition.

At the end of the course, the students will be able to:

- Describe and differentiate morphology, grammar, syntax and computational semantic.
- Build solutions to specific problems in text and speech analysis and processing.
- Justify the natural language processing techniques and corresponding speech processing in the context of specific problems.

CPC354/3 Computer Graphics and Visualisation

This course provides a comprehensive knowledge and an in-depth understanding in computer graphics and basic visualisation. The course introduces graphics systems and models, graphics programming, and input and interaction in interactive graphics. Geometric objects and transformations and viewing transformation are also covered. The course concludes with discussion on shading, discrete techniques, implementation of graphics primitives, modelling and visualization techniques.

At the end of the course, the students will be able to:

- Explain the development, applications, models and systems in computer graphics and visualisation.
- Construct graphics application program.
- Discuss basic principles of computer graphics design and algorithms.

This course offers a timely opportunity to familiarise students with the fundamental principles and primary issues that define IoT. Students will learn the versatility of components that can be integrated into such systems, as well as the diversity of data types produced by the IoT edge-nodes. The successful development of IoT applications also requires communication between different levels (layers) of IoT architectures with the associated security and privacy issues.

At the end of the course, the students will be able to:

- Describe the IoT components, the different principles and the several aspects of designing the IoT architectures.
- Check the requirements and constraints in designing practical IoT architectures based on various IoT applications.
- Analyse the importance of the security, trust, privacy issues and preventive measure for IoT.
- Recognize the interplay and the role of diverse engineering and computer science fields that compose the IoT ecosystem.

The essence of this course is to expose students to the existence of various programming language paradigms and implementation. Knowledge of programming language paradigm and implementation is very important for students in choosing the appropriate programming language to effectively solve programming problems. Students will be exposed to basic concepts of implementation such as components involved in the compilation and interpretation of programming languages. This course also covers the basic concepts of programming language paradigm such as basic data types and program control structures. The paradigms of the programming language involved are parallel, imperative (object), function and logic.

At the end of the course, the students will be able to:

- Classify various programming language design and implementation methods.
- Construct problem solution in two or more programming paradigms.
- Differentiate various programming language designs and implementations in order to select the best programming language in problem-solving process.

CSE341/3 Software Architecture and Design

This course introduces students to the discipline of software architecture and design. It covers the architectural activities and related decisions on the design and implementation of a software architecture. Other topics covered are architecture documentation, quality attributes and architecture evaluation.

At the end of the course, the students will be able to:

- Define software architecture and design theory, concepts and design decisions that influence software architects and software architecture.
- Follow effective approach in making design decisions based on the desired quality attributes for a system.
- Identify architecturally relevant aspects of the business context and methods for evaluating software architecture.

CSE342/3 Dependable Software Systems Engineering

This course provides a firm foundation of computer system dependability by covering the conceptual and definition of dependable system, what it means for a system to be dependable, fault/failure models and how to build a dependable software system and present rigorous techniques that can improve the quality of software.

At the end of the course, the students will be able to:

- Point out concept and software engineering elements of dependability.
- Build dependability-engineering process including dependability requirements, analysis and how to deal with faults.
- Complete a system which takes into account dependability aspect by investigating dependability requirement and how to manage the occurrence of faults.

CST337/3 Network Configuration and Protocols

This course introduces network management principles, theories and practices, including the implementation and administration of network core services in a network environment. This course provides a handy laboratory experience in managing router configuration, DHCP, DNS, distance access, security and network management services. This course also discusses the network and firewall security, as well as the use of the Access Control List (ACL) to control network access. In addition, this course is also a course that prepares students to take Huawei Certified Network Analyst (HCNA) certification exams.

At the end of the course, the students will be able to:

- Demonstrate the concept, and how to plan, implement and administer each network service.
- Follow a handy approach by taking into account technical knowledge and understanding of routing configuration, router routing, and network security issues.
- Integrate the knowledge and experience in the principles of network architecture and design as well as the use of internet protocols for configuring a variety of networks.

CST338/3 Network and Communication Security

This course presents fundamentals of network monitoring and network security. In network monitoring, it covers the fundamentals of packet capture, packet analysis, and monitoring element placement and enterprise monitoring. In network security, it covers network security devices, internet security, abnormalities within networks, policies, audits and cyber terrorism.

At the end of the course, the students will be able to:

- Relate the principles, practices and technologies to control and secure network and communications
- Manipulate the methods of penetration testing, auditing and monitoring, as well as security evaluation on network systems and communication.
- Explain various types of attacks and malware that has been used as agents in attacks on network systems or communications.

CST339/3 Information Security Management and Assurance

This course exposes to the students the fundamentals of information security and assurance in modern organization. Student also will be introduced to the principles and planning techniques and development of managerial strategy for information security and assurance. It can be noted that information security in modern organization is management problem and not only the solution in the context of technology. In the planning and information security development aspects, students will be exposed to the planning for information security, planning for contingency, information security policy, the development of security programs. In addition, models and practices of security management also will be explained. For the information security risk management, students will be exposed to the identification, evaluation and information security risk management control. Student will be also exposed to the information security protection mechanism that is currently used. Student will be explained on information on human resources, the need of SETA (security education, training and awareness), also the legality and ethics related to the information security management.

At the end of the course, the students will be able to:

- Relate aspects and factors that involves in management and information security assurance.

- Manipulate the management principals and information security assurance in modern organization
- Explain the security and assurance in modern organization which involves management issues and also the usage of technology.

Level 400

CAT402/2 Professional and Technopreneurship Development

This course is divided into three main components namely:

1. Computing / Software engineering professions. Professionalism. Comparison with other profession. Professional issues. Computer and techno-business ethics. Social implications. Intellectual property. Responsibilities dan risks. Security and privacy. Freedom of speech and censorship. Computer crimes and cyberlaws.
2. Professional career development: Career opportunities and development. Job seeking skills. Job applications and curriculum vitae preparation. Job interview. Job opportunities. Graduate studies in USM.
3. Technopreneurship Development: Understanding business. Defining business ideas. Creating business plan. Business start-up. Handling Business. Affiliate Marketing. Creativity and Innovation.

The first part covers professionalism aspects in computing / software engineering (including relevant professional bodies) in comparison to other professionals (such as doctors, lawyers, engineers). It also discusses issues and concern that a computing professional should be aware of and dealt with. This includes ethical, legal and social implications in computing and techno-business, intellectual property, cyber-crimes and cyberlaws, freedom of speech, privacy, etc.

The second part discusses about career development in computing field, exploring career opportunities and development such as job application and hunting skills, job interviews, career path and graduate studies.

The third part covers the “alternative employment” option i.e., creating employment via entrepreneurship with ICT-based products/services i.e., technopreneurship. It discusses ICT business plan development, from defining the business idea until a business plan is created. Students will be given understanding of five stages of entrepreneurship cycle: 1) New venture development, 2) Start-up activities, 3) Venture growth, 4) Business stabilization, and 5) Innovation or decline.

A series of workshops/seminars are planned where speakers/technopreneurs are invited to talk on related topics or share their experience with the students.

At the end of the course, the students will be able to:

- Plan self-advancement based on interests, motivation, academic qualifications and work experience in the context of career decision making.
- Present the business plan effectively and with full confidence.
- Work in a group to produce a good business plan.
- Relate the concepts of professionalism, role and duties of computing professional / software engineer with ethical and legal practices in problem-solving, decision making and applications of information and communications technology (ICT) and techno-business.
- Initiate the generation of ideas in technopreneurship up to establishing an IT based company.
- Propose a techno-business plan which is sustainable and profitable in the era of Industry 4.0

CMT425/3 Enterprise Architecture and Systems

Enterprise architecture (EA) is a practice to strategically utilize technology to improve performance of an enterprise through holistic view in terms of strategy, business process, information flow and technical resources. It is also known as a strategy and business-driven activity that support business planning and decision-making. It includes people, technologies and the activities for designing and describing enterprises through a set of artefacts. This course explains the fundamental concepts, implementation methodology, management planning as well as use and maintenance of EA. EA³ cube framework /approach is introduced as the main implementation methodology in this course. Various approaches in implementing EA for different types of organization are also discussed.

At the end of the course, the students will be able to:

- Explain concepts, development, implementation and use of enterprise architecture.
- Identify various approaches to EA for different types of enterprises.
- Propose recommendations to solve EA related issues from a case study in groups.

CMT426/3 Business Intelligence and Analytics

This course is about Internet-based enterprise systems for business analytics and business intelligence and business analytics. This course would lead to the understanding, innovative application and exploitation of the current service-oriented software tools, techniques and approaches related to data mining and data mapping, business and competitive intelligence, as well as business performance measurement and analytics.

At the end of the course, the students will be able to:

- Explain concepts, technologies and existing computer-assisted devices for business intelligence and business analytics

- Identify the design features of various business intelligence tools and business analytics.
- Report the methods and data collection in ethical way to develop business analytic systems.

CPC451/3 Big Data Technologies and Management

Managing big data addresses different issues compared to conventional databases. The course includes fundamental on big data technologies, management related issues and understanding of various storage infrastructure. The course provides exposure on recent technologies in manipulating, managing and analysing big data. The technologies include but not limited to Hadoop, MongoDB and Apache Cassandra.

At the end of the course, the students will be able to:

- Identify the related techniques in modern and traditional technologies in managing big data storage.
- Construct a database to support big data using related big data storage management system.
- Differentiate the usage of various data management infrastructures, concepts and technologies.

CPC452/3 Animation and Virtual Reality

For the part on animation, the course covers animation techniques and technologies, motion capture, procedural animation and deformation. In the second part which is virtual reality (VR), the course covers VR techniques and systems that include display and devices, collision detection, visibility, time critical rendering as well as VR technology, modelling, user interface, and applications in various fields.

At the end of the course, the students will be able to:

- Compare several technologies for motion capture.
- Manipulate several animation techniques to generate simple animation.
- Explain the various technologies, algorithm and techniques in virtual reality systems.

CPT411/3 Automata Theory and Formal Languages

This course introduces students to the theoretical foundation of computer science. It deals with the definitions and properties of mathematical models of computation. Students will learn finite state machines, regular grammars and regular expressions that are used to solve problems that can be encoded as regular languages. Besides, finite state transducers and weighted finite state machines are also taught. The properties of regular languages will be discussed. Students will also learn pushdown automata and context free grammars to solve

problem that can be defined as context free languages. The properties of context free languages will be discussed. Finally, students will learn Turing machine which is the theoretical computation model that can be used to model any algorithms that modern computer can do.

At the end of the course, the students will be able to:

- Describe the concept and properties of regular language, context-free language, and decidable language.
- Construct finite state machine, regular expression and context free grammars using software tools or libraries.
- Formulate solution using finite state machine, pushdown automata or Turing machine for a given problem.

CSE441/3 Software Process and Quality Assurance

This course introduces students to the concepts of software processes, software process models, and software quality assurance (SQA), as well as its standard practice and management. These include the quality concepts in software development and/or production, quality management process and software measurement.

At the end of the course, the students will be able to:

- Define software theory, concepts and practices to achieve software quality.
- Design relevant software artifacts and metrics to assess software quality attributes.
- Identify quality assurance practices and approaches to process improvement.

CSE442/3 Software Testing

This course introduces students to the theory and practice of software testing. The discussion of the course focuses on the importance of software testing in producing a quality software. This includes the study on the fundamentals of testing which includes the principles of testing, unit testing, integration testing, system testing, regression testing, acceptance testing and test plan. Besides that, this course also introduces test design techniques, test management, and tool support for testing.

At the end of the course, the students will be able to:

- Define software testing theory, principles, techniques and the importance of software testing
- Practice software testing practices while developing and/or maintaining software in a team so that the software meets the required standards including problem solving skills.
- Identify testing techniques and assessments that are appropriate to the system requirements to ensure that the system is highly developed.

CSE443/3 Real-Time Software Engineering

This course provides a firm foundation on the knowledge, skills and techniques required to develop and produce real-time systems, and in particular, embedded systems that include the requirement analysis and specifications, software design and program design. Introduction to real-time operating system, diagramming method, planning and developing software and software development tools are also discussed. The preparation of documentation is also emphasised for the development of real-time systems with current examples.

At the end of the course, the students will be able to:

- Point out basic design method and modern real time system design
- Construct real time software by combining theoretical and practical experiences.
- Compare between specification methods and between software design methods

CST431/3 Systems Security and Protection

In this course, various concepts of computing systems security architecture, operating systems security modes, and recovery procedures and security control models are discussed. For the aspects of computer system operations and protection, students will be exposed to methodologies of various attacks especially on operating systems, databases, and applications; backup and recovery techniques; security evaluation; and implementation of operational protection. Students will be explained in detail, control and protection techniques for multiuser operating systems i.e. Windows, and UNIX or Linux; and database systems. For the aspect of physical systems security, student will be exposed to physical security risks and various mitigations techniques.

At the end of the course, the students will be able to:

- Explain principles of computer security and cryptography for computer applications..
- Traces the usage of several cryptographic ciphers to complete security operations.
- Analyse current computer security techniques for solving existing computer security issues.
- Propose computer security characteristics for solving security vulnerabilities scenarios ethically.

CST432/3 Microprocessors and Embedded Systems

This course is an introduction to microprocessors and embedded systems. The use of Assembly Language in programming the microprocessor will be learnt via theory and practical components

At the end of the course, the students will be able to:

- Distinguish microprocessor and microcontroller features and operations in embedded systems.
- Use assembly language in embedded system programming.
- Apply suitable device control techniques in embedded systems programs.

CST434/3 Wireless Networks and Mobile Computing

This course provides vital up-to-date knowledge in wireless and mobile computing industry focusing on the eco-system of Devices, Network and Applications (DNA). The course focuses on three core aspects of the field, wireless transmission, mobile radio technologies and mobility, handover and routing. The course also covers many emerging trends in the field such as mobile terminal technologies, autonomous networks and cross-layer middleware.

At the end of the course, the students will be able to:

- Distinguish the fundamental theories and concepts in wireless networks and mobile computing.
- Appraise the emerging trends in mobile computing to understand in-depth knowledge of three main elements of Devices, Network and Applications (DNA).
- Display understanding and wisdom in future mobile computing and wireless networks fields with focus on 4IR use cases and applications.

CST435/3 Parallel and Cloud Computing

This course focuses on concepts and principles in the design and implementation of parallel and cloud computing. Students will be exposed to parallel architecture, data search, memory-sharing programming, communication and parallel modelling design. The course also covers parallel programming on the graphics processing unit. For cloud computing, the course covers the evolution of cloud computing, cross-layer communication, working status and machine conditions, cloud service models, cloud system architecture, resource allocation and scheduling, enrichment and isolation, overload reliability, cloud computing practical skills and titles – advanced titles.

At the end of the course, the students will be able to:

- Explain the concepts of parallel paradigm and cloud computing in the context of computational problem solving.
- Construct parallel programs using different parallel platforms and basic cloud services.
- Analyse issues in designing and developing parallel applications and cloud applications by using cloud services.

This course introduces basic knowledge and techniques in computer forensics and digital investigations. Starting with an overview of digital career analysts, issues in the investigation and digital forensic analysis in the evolution of evidence, methods of controlling and preserving evidence, and techniques for manual interpretation of raw binary data will be detailed. This course also aims to help students perform tasks as digital forensic analysts to help students in understanding the key principles, techniques, and requirements related to digital investigations, particularly the legal framework that must be observed in finding and collecting, and maintaining and ensuring the integrity of digital evidence. Students will also be trained to master some advanced techniques in rare digital forensics but arise consistently in the context of corporate investigations. In addition, relevant technical and legal difficulties in the search, extraction, maintenance and storage of digital evidence will be explained in accordance with the legal implications of such inquiry and the rules of the legal procedure relating to electronic evidence.

At the end of the course, the students will be able to:

- Organize digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis and reporting.
- Differentiate critically the relevant technical and legal information from emerging industry trends.
- Report the potential security breaches of computer data that suggest violations of legal, ethical, moral, policy and/or societal standards.

LIST OF RECOMMENDED OPTION/INTER-DISCIPLINARY ELECTIVE COURSES

Option courses are courses that can be chosen to replace courses that are specified under the University requirements. Inter-Disciplinary Electives (8 units) must be taken by students in the Computer Science with Electives programme. The school recommends the following package of courses. Students are encouraged to explore a particular package rather than taking a few low-level courses from a number of different packages.

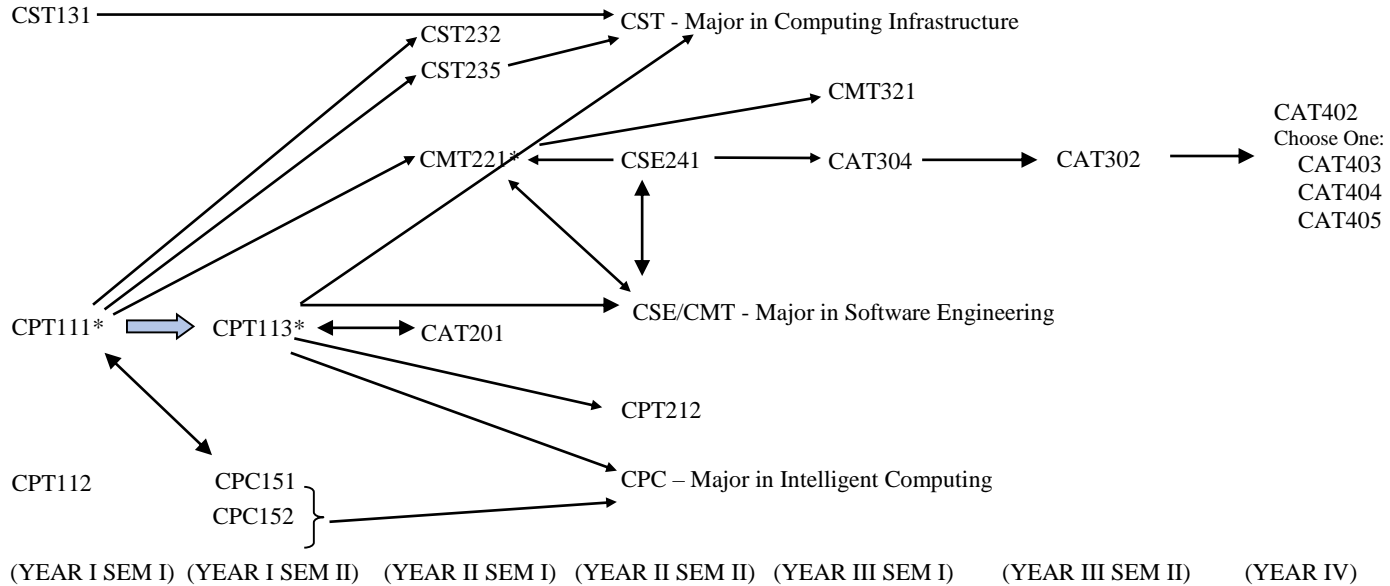
SCHOOL OF HUMANITIES			SCHOOL OF PHYSICS		SCHOOL OF SOCIAL SCIENCES	
Thinking Techniques	Critical Thinking	Islamic Studies	Electronics	Energy & Environment	Economics	Psychology
HTV201/2 (Offered only in Semester I)	HPW101/2	HIS213/4	ZCA102/4	ZCU100/2	SKW109/3	STU231/4
		HIS224/4	ZCA106/3 (Prerequisite ZCA102/4)		SEW101/3	STU242/4
		HIS315/4			SEW103/3	

SCHOOL OF MATHEMATICAL SCIENCES	SCHOOL OF COMMUNICATION	SCHOOL OF MANAGEMENT	SCHOOL OF THE ARTS		
MAA101/4	YKT101/3	AKW103/4	Sculpture	Graphics Design	Photography
MAA111/4	YKT102/3	AKW104/4	VHA101/4	VGT101/4	VHF101/4
MAA161/4	YKT103/3	-	VHA201/4	VHG201/4	VHF201/4

SCHOOL OF LANGUAGES, LITERACIES AND TRANSLATION	
English Language	Foreign Languages
See 3.6 (B) (v)	See 3.6 (B) (vi)

This list of option courses is subject to changes made by the respective schools.

SEQUENTIAL/CONCURRENT PRE-REQUISITES



→ Sequential

→ Sequential and passed with C Grade

↔ Sequential or Concurrent

* Offered in both Semester I and Semester I

APPENDIX C

STUDENT LEARNING TIME (SLT)

No	Course Code	Course Title	Unit	Face to Face Learning				Self-Learning Activity			Formal Assessment		Total SLT
				Lecturer-Centred Learning	Student-Centred Learning (SCL)			Non Face to Face Learning or SCL e.g. Assignments, Exercises etc.	Revision	Preparation for Assessment	Continuous Assessment	Final Assessment	
					Lecture	Tutorial	Practical						
1.	CPT111	Principles of Programming	3	28	7	7	0	22	42	10	2	2	120
2.	CPT112	Discrete Structures	4	42	14	0	0	20	56	18	3	3	156
3.	CPT113	Programming Methodology & Data Structures	3	28	7	7	0	22	42	10	2	2	120
5.	CPT212	Design & Analysis of Algorithms	4	42	14	0	0	32	56	10	4	2	160
6.	CPC152	Foundations and Programming for Data Analytics	4	11	0	5	16	22	78	8	18	2	160
7.	CPC151	Fundamentals of Logic and Artificial Intelligence	4	42	7	7	0	27	56	16	2	3	160
8.	CMT221	Database Organisations & Design	4	39	5	14	0	35	51	12	2	2	160
9.	CST131	Computer Organisation	4	36	12	0	12	30	54	12	2	2	160
10.	CST232	Operating Systems	3	28	10	2	0	30	38	10	2	2	122

APPENDIX C (contd.)

No	Course Code	Course Title	Unit	Face to Face Learning				Self-Learning Activity			Formal Assessment		Total SLT
				Lecturer-Centred Learning	Student-Centred Learning (SCL)			Non Face to Face Learning or SCL e.g. Assignments, Exercises etc.	Revision	Preparation for Assessment	Continuous Assessment	Final Assessment	
					Lecture	Tutorial	Practical						
11.	CST235	Principles of Computer Networks and Information Security	4	39	11	0	5	30	55	12	2	2	156
12.	CSE241	Foundations of Software Engineering	4	28	10	0	10	30	48	20	12	2	160
13.	CAT201	Integrated Software Development Workshop	2	14	0	14	6	25	17	4	2	0	82
14.	CAT302	Industrial Training	12	0	0	0	0	465	0	14	1	0	480
15.	CAT304	Group Innovation Project and Study for Sustainability	3	8	0	0	12	75	20	3	2	0	120
16.	CAT402	Professional and Technopreneurship Development	2	13	0	0	15	25	21	4	2	0	80
17.	CPC251	Machine Learning and Computational Intelligence	3	30	0	8	4	30	38	10	2	2	124
18.	CPT411	Automata Theory and Formal Languages	3	30	6	2	4	20	42	13	2	3	122

APPENDIX C (contd.)

No	Course Code	Course Title	Unit	Face to Face Learning				Self-Learning Activity			Formal Assessment		Total SLT
				Lecturer-Centred Learning	Student-Centred Learning (SCL)			Non Face to Face Learning or SCL e.g. Assignments, Exercises etc.	Revision	Preparation for Assessment	Continuous Assessment	Final Assessment	
					Lecture	Tutorial	Practical						
19.	CAT405	Intelligent Computing Final Year Project	8	0	0	0	15	280	15	8	2	0	320
20.	CPT316	Programming Language Implementation and Paradigms	3	28	7	10	0	30	37	10	2	2	126
21.	CST236	Digital Systems Design	3	14	0	26	0	30	40	10	2	2	124
22.	CST431	Systems Security and Protection	3	28	7	0	5	30	40	10	2	2	124
23	CST435	Parallel and Cloud Computing	3	28	0	12	0	36	34	6	2	2	120
24.	CAT403	Computing Infrastructure Final Year Project	3	0	0	0	15	280	15	7	3	0	320
25.	CSE242	Software Requirements Analysis & Modelling	3	28	6	0	9	28	38	10	2	2	123
26.	CSE341	Software Architecture and Design	3	28	0	4	8	26	40	10	2	2	120
27.	CSE441	Software Process and Quality Assurance	3	28	0	3	9	26	40	12	4	2	122

APPENDIX C (contd.)

No	Course Code	Course Title	Unit	Face to Face Learning				Self-Learning Activity			Formal Assessment		Total SLT
				Lecturer-Centred Learning	Student-Centred Learning (SCL)			Non Face to Face Learning or SCL e.g. Assignments, Exercises etc.	Revision	Preparation for Assessment	Continuous Assessment	Final Assessment	
					Lecture	Tutorial	Practical						
28.	CSE442	Software Testing	3	28	0	4	8	26	40	10	2	2	120
29.	CAT404	Software Engineering Final Year Project	8	0	0	0	15	280	15	8	2	0	320
30.	CPC351	Principles of Data Analytics	3	19	0	19	2	35	31	10	2	2	120
31.	CPC353	Natural Language Processing	3	34	0	8	0	30	34	10	2	2	120
32.	CPC354	Computer Graphics and Visualisation	3	36	5	2	0	30	43	10	2	2	130
33.	CPC357	IoT Architecture and Smart Applications	3	26	5	5	3	46	24	6	3	2	120
34.	CPC451	Big Data Technologies and Management	3	29	0	9	2	30	40	10	2	2	124
35.	CPC452	Animation & Virtual Reality	3	28	0	20	6	20	30	14	4	2	124
36.	CMT321	Management and Engineering of Databases	3	28	0	0	10	30	38	10	2	2	120
37.	CMT322	Web Engineering & Technologies	3	28	0	8	6	30	38	10	4	2	126

APPENDIX C (contd.)

No	Course Code	Course Title	Unit	Face to Face Learning				Self-Learning Activity			Formal Assessment		Total SLT
				Lecturer-Centred Learning	Student-Centred Learning (SCL)			Non Face to Face Learning or SCL e.g. Assignments, Exercises etc.	Revision	Preparation for Assessment	Continuous Assessment	Final Assessment	
					Lecture	Tutorial	Practical						
38.	CMT323	Information Systems Theory and Management	3	28	0	0	15	20	43	10	2	2	120
39.	CMT425	Enterprise Architecture and Systems	3	28	0	0	12	25	40	10	2	2	119
40.	CMT426	Business Intelligence and Analytics	3	31	0	9	2	30	37	10	2	2	123
41.	CSE342	Dependable Software Systems Engineering	3	28	0	8	0	30	40	10	2	2	120
42.	CSE443	Real Time Software Engineering	3	34	4	0	2	26	38	10	2	2	120
43.	CST337	Network Configuration and Protocols	3	14	0	28	0	30	35	12	3	2	124
44.	CST338	Network and Communication Security	3	28	10	0	4	30	0	10	2	2	126
45.	CST339	Information Security Management and Assurance	3	28	7	0	5	30	40	10	2	2	124
46.	CST432	Microprocessors and Embedded Systems	3	28	14	0	0	32	35	8	1	2	120

APPENDIX C (contd.)

No	Course Code	Course Title	Unit	Face to Face Learning				Self-Learning Activity			Formal Assessment		Total SLT
				Lecturer-Centred Learning	Student-Centred Learning (SCL)			Non Face to Face Learning or SCL e.g. Assignments, Exercises etc.	Revision	Preparation for Assessment	Continuous Assessment	Final Assessment	
					Lecture	Tutorial	Practical						
47.	CST434	Wireless Networks and Mobile Computing	3	28	0	0	14	30	34	10	2	2	120
48.	CST436	Digital Forensics and Investigations	3	26	4	6	4	30	40	10	2	2	124

SCHEDULE PLAN FOR GRADUATION

Core (T)				Minor (M)/Elective (E)				University (U)				Prerequisite (Z)/Audit (Y)/Others			
Required	90 Units			20 Units				15 Units				Unit			
Semester	Course Code	Unit	Grade	Semester	Course Code	Unit	Grade	Semester	Course Code	Unit	Grade	Semester	Course Code	Unit	Grade

Notes