School of Continuing and Lifelong Education

1 Faculty's Commitment

Established in January 2016, the School of Continuing and Lifelong Education (SCALE) allows NUS to expand its Continuing and Professional Education (CPE) presence and offerings in a concerted and strategic way that furthers NUS' mission to be a leading global university, as well as fulfil NUS' role as a public university in Singapore.

SCALE aims to:

• Provide opportunities for working adults to acquire new knowledge and skills from Asia's leading university, NUS;
• Help Singapore companies and industries stay competitive by providing lifelong learning experiences for their employees; and
• Effectively support national manpower needs.

The Bachelor of Technology (BTech) programme, offered on a part-time basis, is one of SCALE's core offering. The BTech programme has a strong reputation among Polytechnic upgraders and working adults, and students of this programme have, by all accounts, benefitted greatly from the NUS experience. In addition, SCALE also has a suite of executive and professional development programmes and short courses that are designed to meet the lifelong learning needs of the working adult. All programmes are designed and developed in close consultation with the industry, and will leverage highly on technology in the delivery.

3 Undergraduate Education

3.1 Degrees Offered

Bachelor of Technology (BTech) Computing

SCALE offers the following three BTech programmes in Computing disciplines in partnership with the NUS School of Computing, one of the leading computing schools in the world with faculty members who are both internationally recognised researchers and inspiring teachers:

- Bachelor of Technology (Business Analytics)
- Bachelor of Technology (Cybersecurity)
- Bachelor of Technology (Software Engineering)

Bachelor of Technology (BTech) Engineering

SCALE in partnership with the Faculty of Engineering offers the following five BTech programmes in Engineering disciplines:

- Bachelor of Technology (Chemical Engineering)
- Bachelor of Technology (Civil Engineering)
- Bachelor of Technology (Electronics Engineering)
- Bachelor of Technology (Industrial & Management Engineering)
- Bachelor of Technology (Mechanical Engineering)

These programmes are accredited by the relevant engineering bodies, and taught by highly qualified Engineering faculty members using first-class laboratory facilities in NUS.

3.2 Curriculum Structure and General Academic Matters

Unlike full-time degree programmes which cater primarily to students admitted with GCE 'A' Level qualifications, BTech part-time degree programmes are specially tailored to suit the needs and background of polytechnic graduates holding relevant full-time jobs in industry. The BTech curriculum give recognition to the fact that Polytechnic upgraders have all attained a certain level of training in addition to acquiring some actual work experience. As such, although almost all the upper-year modules are identical to those of the equivalent full-time degree programmes, the modules in the earlier years are somewhat different and are specially designed to cater to the unique needs of BTech students.

Periods of Study in each AY: In addition to the two normal semesters of study in each Academic Year (Semesters 1 and 2), the BTech Programme also runs a 10-week Special Term during the period from May to July.

Minimum and Maximum Candidature: SCALE recognises the need to equip potential adult learners with the necessary skills within a reasonable amount of time so that they stay relevant in the industry upon graduation. As such, the minimum and maximum candidature periods are two-and-a-half and six years respectively, inclusive of approved periods of leave of absence. Nonetheless, records show that if work, family and other commitments permit, students typically attend classes three evenings a week and should typically be able to complete their degree requirements in four years. The curriculum structure is completely modular and flexible and students should study at their own comfortable pace. Unless their other commitments allow them sufficient time and peace of mind to focus on, and gain the most out of, their studies, students are strongly advised not to rush through their programmes. If taking an extra semester to complete their degree requirements results in greater benefit from their studies and perhaps a better class of honours for the degree, it might be worthwhile to do so as the benefits are lifelong.

Workload: In any normal semester, unless otherwise approved by the Dean of SCALE, a student may register for up to 14 MCs of modules during a normal semester and 2 modules in a Special Term, excluding Industrial Practice module.

General: Students are advised to read carefully other relevant information presented in this document as

well as published by the Registrar's Office (www.nus.edu.sg/registrar). Of particular importance are information relating to: the Modular System, Undergraduate Education Continuation and Graduation Requirements, Academic Calendar, Responsibility for Notices/Circulars, Update of Personal Particulars, Acceptance Record, Leave of Absence, Grading Policy and Exam Process, Graduation, Discipline, Module Enrolment, S/U Option Declaration, and Commencement amongst others. Academic and administrative rules and regulations set out by the University will apply to every NUS student.

3.3 Bachelor of Technology (BTech) Computing

Admission Intake: The BTech Computing programmes have one intake in each Academic Year for Semester 1 in August.

All diploma holders admitted into the BTech Computing programmes will generally be granted a set of Advanced Placement Credits (APCs) automatically. Further credits will be considered for holders of certain ICT-related diplomas which have been accredited for admission. Additional credits can also be granted for the completion of relevant Advanced Diplomas and by opting to select and register to sit for Module Advanced Placement Credit Tests.

The structure and design of each of the BTech programmes in Computing are based on those of the corresponding four-year full-time Bachelor of Computing (BComp) programmes offered by the School of Computing. To qualify for a BTech degree in Computing, a student must take and pass a minimum of 160 MCs of modules, as tabulated below, and achieve a CAP of at least 2.0.

Table: 160-MC BTech Computing curriculum structure

	Minimum MCs required
University Level Requirements	
General Education (GE) Modules [1]	20
Sub-total	**20**
Programme Requirements	
Foundation & Major Requirements	104
Sub-total	**104**
Unrestricted Elective Modules [2]	**36**
Grand-total	**160**

Notes:

A limited selection of GE modules (from the wide range available in the University) which can best meet

the interests and professional needs of BTech students, will be offered specially in the evenings. The list of modules will be available in the SCALE website in due course.

20 MCs of UEMs will normally be given as Advanced Placement Credits to holders of diploma or higher qualifications. UEMs enable students to pursue their interests without any restrictions. Students may select any module at any level from among Technical or GE modules to meet this requirement.

Stage Promotion: Students will be deemed to have progressed to the next stage of study if they have obtained at least the number of MCs, including exemptions, as stated below:

To move to Stage 2 (Year 2): 32 MCs
To move to Stage 3 (Year 3): 64 MCs
To move to Stage 4 (Year 4): 108 MCs

Degree Requirements & Recommended Study Schedule

3.3.1 [Bachelor of Technology (Business Analytics)](#)

3.3.2 [Bachelor of Technology (Cybersecurity)](#)

3.3.3 [Bachelor of Technology (Software Engineering)](#)

3.3.1 Bachelor of Technology (Business Analytics)

The BTech (Business Analytics) programme is offered in partnership with the School of Computing. The BTech (Business Analytics) programme enables students to attain the following learning outcomes by the time of graduation:

1. Strong knowledge of data analytics foundations and fundamentals, including:
   a. familiarity with data analytics and programming principles, and
   b. high and broad understanding of the application of analytics in various industrial domains.

2. An ability to function effectively in teams to accomplish a common goal.
3. An understanding of professional, ethical, legal, security, and social issues and responsibilities of analytics professionals.
4. An ability to analyse the local and global impact of data analytics on individuals, organisations and society.
5. Clear recognition of the need for and an ability to engage in continuing professional development.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Business Analytics):

- Complete a minimum of **160 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the School of Computing, or the University.

List of modules – BTech (Business Analytics), comprise:

All modules are 4MCs, except when otherwise stated.

A. **University Level Requirements (20MCs)**
   - Quantitative Reasoning (module with prefix GER)
   - Thinking and Expression (module with prefix GET)
   - Human Cultures (module with prefix GEH)
   - Asking Questions (module with prefix GEQ)
   - Singapore Studies (module with prefix GES)

B. **Programme Requirements (104MCs), comprising**
   1. Major Requirements – Essential Modules (84MCs)

Computing Foundations
   - TBA2103 Data Visualisation
   - TBA2105 Web Mining

- TIC1001 Introduction to Computing and Programming I
- TIC1002 Introduction to Computing and Programming II
- TIC1101 Professional, Ethical and Social Issues in Computing
- TIC2001 Data Structures and Algorithms
- TIC2601 Database and Web Applications
- TIC2901 Communication for Computing Professionals
- TIC3901 Industrial Practice (12 MCs)

Business Analytics Requirements
- TBA2101 Building an Analytics Organisation
- TBA2102 Introduction to Business Analytics
- TBA2104 Predictive Analytics
- TBA3102 Text Analytics
- TBA3103 Application Systems Development for Business Analytics
- TBA3204 Web Analytics
- TBA4212 Search Engine Optimisation and Analytics

Mathematics Requirements
- TMA1001 Introductory Mathematics
- TMA2101 Calculus for Computing
- TMA2103 Probability and Statistics

2. <u>Major Requirements – Elective Modules (20 MCs, selected from the list below)</u>

– At least 3 out of 5 modules must be at level 4000.

– Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time.
- TBA3150 Mobile App and Game Analytics
- TBA3222 Marketing Analytics
- TBA3241 Social Media Analytics
- TBA4204 Financial Analytics
- TBA4215 Workforce Analytics
- TBA4230 Audit Analytics
- TBA4250 Healthcare Analytics

C. **Unrestricted Elective Modules (36MCs)**
Note: 20 MCs will normally be given as Advanced Placement Credits to holders of diploma or higher qualifications. They will need to complete 16MCs.

Study Schedule

There is only one intake per academic year in Semester 1 (i.e. August). One sample study schedule for a four-year candidature is shown below. This assumes the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1ˢᵗ Year of studies	
Sem 1:	TMA1001 Introductory Mathematics (4) TIC1001 Introduction to Computing and Programming I (4) TBA2102 Introduction to Business Analytics (4)
Sem 2:	TIC1002 Introduction to Computing and Programming II (4) TMA2101 Calculus for Computing (4) TBA2101 Building an Analytics Organisation (4)
SpTerm:	General Education Module 1 – Quantitative Reasoning (4) TIC2001 Data Structures and Algorithms (4)
2ⁿᵈ Year of studies	
Sem 1:	TMA2103 Probability and Statistics (4) TIC1101 Professional, Ethical and Social Issues in Computing (4) TIC2601 Database and Web Applications (4)
Sem 2:	TBA2103 Data Visualisation (4) TBA3204 Web Analytics (4) TBA2104 Predictive Analytics (4)
SpTerm:	General Education Module 2 – Asking Questions (4) General Education Module 3 – Thinking and Expression (4)
3ʳᵈ Year of studies	
Sem 1:	*TIC3901 Industrial Practice TBA4212 Search Engine Optimisation and Analytics (4) TBA2105 Web Mining (4) TIC2901 Communications for Computing Professionals (4)
Sem 2:	*TIC3901 Industrial Practice (12) TBA3102 Text Analytics (4) Elective Module 1 (4) Elective Module 2 (4)
SpTerm:	General Education Module 4 – Human Cultures (4) General Education Module 5 – Singapore Studies (4)

4th Year of studies	
Sem 1:	TBA3103 Application Systems Development for Business Analytics Elective Module 3 Unrestricted Elective Module 1
Sem 2:	Elective Module 4 Elective Module 5 Unrestricted Elective Module 2
SpTerm:	Unrestricted Elective Module 3 Unrestricted Elective Module 4

3.3.2 Bachelor of Technology (Cybersecurity)

The BTech (Cybersecurity) programme is offered in partnership with the School of Computing. The BTech (Cybersecurity) programme enables students to attain the following learning outcomes by the time of graduation:

1. Strong knowledge of computer science foundations and fundamentals, including:
    a. familiarity with common computer science themes and principles,
    b. high-level understanding of systems as a whole, and
    c. understanding of the theoretical underpinnings of computer science and their influences in practice.

2. An ability to function effectively in teams to accomplish a common goal.
3. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
4. An ability to analyse the local and global impact of computing on individuals, organisations, and society.
5. Clear recognition of the need for and an ability to engage in continuing professional development.
6. An ability to design, implement, and evaluate a computer-based system, process, components, or programme to meet the security needs.
7. An understanding of the processes and challenges that support the delivery and management of information security in an organisation.
8. An ability to use the current techniques, skills, and tools necessary for information security practice.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Cybersecurity):

* Complete a minimum of **160 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
* Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
* Satisfy any other additional requirements that may be prescribed by SCALE, the School of Computing, or the University.

   List of modules – BTech (Cybersecurity), comprise:
   All modules are 4MCs, except when otherwise stated.

   A. **University Level Requirements (20MCs)**
   * Quantitative Reasoning (module with prefix GER)
   * Thinking and Expression (module with prefix GET)
   * Human Cultures (module with prefix GEH)
   * Asking Questions (module with prefix GEQ)
   * Singapore Studies (module with prefix GES)

   B. **Programme Requirements (104MCs), comprising**
      1. Major Requirements – Essential Modules (92MCs)

Computing Foundations
- TIC1001 Introduction to Computing and Programming I
- TIC1002 Introduction to Computing and Programming II
- TIC1101 Professional, Ethical, and Social Issues in Computing
- TIC1201 Discrete Structures
- TIC2001 Data Structures and Algorithms
- TIC2002 Introduction to Software Engineering
- TIC2301 Introduction to Information Security
- TIC2401 Computing Systems
- TIC2501 Computer Networks and Applications
- TIC2601 Database and Web Applications
- TIC2901 Communication for Computing Professionals
- TIC3901 Industrial Practice (12 MCs)

Cybersecurity Requirements
- TIC2101 Information Systems and Organisations
- TIC3301 Information Security Management
- TIC3302 Computer Systems Security
- TIC4301 Information Security Practicum I
- TIC4302 Information Security Practicum II

Mathematics Requirements
- TMA1001 Introductory Mathematics
- TMA2101 Calculus for Computing
- TMA2102 Linear Algebra
- TMA2103 Probability and Statistics

2. Major Requirements – Elective Modules (12MCs, selected from the list below)
Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time.
- TIC4303 Software Security
- TIC4304 Web Security
- TIC4305 Network Security
- TIC4306 Information Security Governance and Audit

C. **Unrestricted Elective Modules (36MCs)**
Note: 20 MCs will normally be given as Advanced Placement Credits to holders of diploma or higher qualifications.

Study Schedule

There is only one intake per academic year in Semester 1 (i.e. August). One sample study schedule for a four-year candidature is shown below. This assumes the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):
1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.
2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 1:	TMA1001 Introductory Mathematics (4)
	TIC1001 Introduction to Computing and Programming I (4)
	TIC1101 Professional, Ethical, and Social Issues in Computing (4)
Sem 2:	TIC1201 Discrete Structures (4)
	TIC1002 Introduction to Computing and Programming II (4)
	TMA2101 Calculus for Computing (4)
SpTerm:	General Education Module 1 – Quantitative Reasoning (4)
	TIC2001 Data Structures and Algorithms (4)
2nd Year of studies	
Sem 1:	TIC2501 Computer Networks and Applications (4)
	TIC2301 Introduction to Information Security (4)
	TIC2101 Information Systems and Organisations (4)
Sem 2:	TIC2401 Introduction to Computer Systems (4)
	TIC2601 Database and Web Applications (4)
	TMA2102 Linear Algebra (4)
SpTerm:	General Education Module 2 – Asking Questions (4)
	General Education Module 3 – Thinking and Expression (4)
3rd Year of studies	
Sem 1:	*TIC3901 Industrial Practice
	TIC2901 Communication for Computing Professionals (4)
	TIC3301 Information Security Management (4)
	TIC2002 Introduction to Software Engineering (4)
Sem 2:	*TIC3901 Industrial Practice (12)
	TIC3302 Computer Systems Security (4)
	TMA2103 Probability and Statistics (4)
	Unrestricted Elective 1 (4)
SpTerm:	General Education Module 4 – Human Cultures (4)
	General Education Module 5 – Singapore Studies (4)

4ᵗʰ Year of studies	
Sem 1:	TIC4301 Information Security Practicum I (4) Elective 1 (4) Unrestricted Elective 2 (4)
Sem 2:	TIC4302 Information Security Practicum II (4) Elective 2 (4) Elective 3 (4)
SpTerm:	Unrestricted Elective 3 (4) Unrestricted Elective 4 (4)

3.3.3 Bachelor of Technology (Software Engineering)

The BTech (Software Engineering) programme is offered in partnership with the School of Computing. The BTech (Software Engineering) programme enables students to attain the following learning outcomes by the time of graduation:

1. Strong knowledge of computer science foundations and fundamentals, including:
    a. familiarity with common computer science themes and principles,
    b. high-level understanding of systems as a whole, and
    c. understanding of the theoretical underpinnings of computer science and their influences in practice.

2. An ability to function effectively in teams to accomplish a common goal.
3. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
4. An ability to analyse the local and global impact of computing on individuals, organisations, and society.
5. Clear recognition of the need for and an ability to engage in continuing professional development.
6. Individual competence in applying sound principles and rigorous thinking to:
    a. analyse an application problem,
    b. understand user's requirement,
    c. formulate the problem in terms of computation requirements,
    d. conceive novel solution ideas,
    e. design appropriate solutions that meet the requirements,
    f. implement the solution, and
    g. evaluate the effectiveness of the solution.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Software Engineering):

- Complete a minimum of **160 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the School of Computing, or the University.

> **List of modules – BTech (Software Engineering), comprise:**
> All modules are 4MCs, except when otherwise stated.
>
> A. **University Level Requirements (20MCs)**
> - Quantitative Reasoning (module with prefix GER)
> - Thinking and Expression (module with prefix GET)
> - Human Cultures (module with prefix GEH)
> - Asking Questions (module with prefix GEQ)
> - Singapore Studies (module with prefix GES)

B. **Programme Requirements (104MCs), comprising**
    1. <u>Major Requirements – Essential Modules (92MCs)</u>

Computing Foundations
- TIC1001 Introduction to Computing and Programming I
- TIC1002 Introduction to Computing and Programming II
- TIC2001 Data Structures and Algorithms
- TIC1201 Discrete Structures
- TIC1101 Professional, Ethical, and Social Issues in Computing
- TIC2301 Introduction to Information Security
- TIC2401 Computing Systems
- TIC2501 Computer Networks and Applications
- TIC2601 Database and Web Applications
- TIC2002 Introduction to Software Engineering
- TIC2901 Communication for Computing Professionals
- TIC3901 Industrial Practice (12 MCs)

Software Engineering Requirements
- TIC2701 Principles of Programming Languages
- TIC3001 Software Requirements Analysis and Design
- TIC3002 User Interface Design and Implementation
- TIC4001 Software Engineering Practicum I
- TIC4002 Software Engineering Practicum II

Mathematics Requirements
- TMA1001 Introductory Mathematics
- TMA2101 Calculus for Computing
- TMA2102 Linear Algebra
- TMA2103 Probability and Statistics

2. <u>Major Requirements – Elective Modules (12MCs, selected from the list below)</u>

Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time.
- TIC4003 Software Project Management
- TIC4004 Software Quality Control
- TIC4005 Parallel and Distributed Software Engineering
- TIC4303 Software Security

C. **Unrestricted Elective Modules (36MCs)**

Note: 20 MCs will normally be given as Advanced Placement Credits to holders of diploma or higher qualifications.

Study Schedule

There is only one intake per academic year in Semester 1 (i.e. August). One sample study schedule for a four-year candidature is shown below. This assumes the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

<table>
<tr><td colspan="2">1st Year of studies</td></tr>
<tr><td>Sem 1:</td><td>TMA1001 Introductory Mathematics (4)
TIC1001 Introduction to Computing and Programming I (4)
TIC1101 Professional, Ethical, and Social Issues in Computing (4)</td></tr>
<tr><td>Sem 2:</td><td>TIC1201 Discrete Structures (4)
TIC1002 Introduction to Computing and Programming II (4)
TMA2101 Calculus for Computing (4)</td></tr>
<tr><td>SpTerm:</td><td>General Education Module 1 – Quantitative Reasoning (4)
TIC2001 Data Structures and Algorithms (4)</td></tr>
<tr><td colspan="2">2nd Year of studies</td></tr>
<tr><td>Sem 1:</td><td>TIC2501 Computer Networks and Applications (4)
TIC2301 Introduction to Information Security (4)
TIC2002 Introduction to Software Engineering (4)</td></tr>
<tr><td>Sem 2:</td><td>TIC2401 Introduction to Computer Systems (4)
TIC2601 Database and Web Applications (4)
TMA2102 Linear Algebra (4)</td></tr>
<tr><td>SpTerm:</td><td>General Education Module 2 – Asking Questions (4)
General Education Module 3 – Thinking and Expression (4)</td></tr>
<tr><td colspan="2">3rd Year of studies</td></tr>
<tr><td>Sem 1:</td><td>*TIC3901 Industrial Practice
TIC3002 User Interface Design and Implementation (4)
TIC2701 Principles of Programming Languages (4)
TIC2901 Communication for Computing Professionals (4)</td></tr>
</table>

Sem 2:	*TIC3901 Industrial Practice (12)
	TIC3001 Software Requirements Analysis and Design (4)
	TMA2103 Probability and Statistics (4)
	Unrestricted Elective 1 (4)
SpTerm:	General Education Module 4 – Human Cultures (4)
	General Education Module 5 – Singapore Studies (4)

4th Year of studies

Sem 1:	TIC4301 Information Security Practicum I (4)
	Elective 1 (4)
	Unrestricted Elective 2 (4)
Sem 2:	TIC4302 Information Security Practicum II (4)
	Elective 2 (4)
	Elective 3 (4)
SpTerm:	Unrestricted Elective 3 (4)
	Unrestricted Elective 4 (4)

3.3.2 Bachelor of Technology (Cybersecurity)

The BTech (Cybersecurity) programme is offered in partnership with the School of Computing. The BTech (Cybersecurity) programme enables students to attain the following learning outcomes by the time of graduation:

1. Strong knowledge of computer science foundations and fundamentals, including:
   a. familiarity with common computer science themes and principles,
   b. high-level understanding of systems as a whole, and
   c. understanding of the theoretical underpinnings of computer science and their influences in practice.

2. An ability to function effectively in teams to accomplish a common goal.
3. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
4. An ability to analyse the local and global impact of computing on individuals, organisations, and society.
5. Clear recognition of the need for and an ability to engage in continuing professional development.
6. An ability to design, implement, and evaluate a computer-based system, process, components, or programme to meet the security needs.
7. An understanding of the processes and challenges that support the delivery and management of information security in an organisation.
8. An ability to use the current techniques, skills, and tools necessary for information security practice.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Cybersecurity):

- Complete a minimum of **160 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the School of Computing, or the University.

> **List of modules – BTech (Cybersecurity), comprise:**
> All modules are 4MCs, except when otherwise stated.
>
> A. **University Level Requirements (20MCs)**
> - Quantitative Reasoning (module with prefix GER)
> - Thinking and Expression (module with prefix GET)
> - Human Cultures (module with prefix GEH)
> - Asking Questions (module with prefix GEQ)
> - Singapore Studies (module with prefix GES)
>
> B. **Programme Requirements (104MCs), comprising**
> 1. Major Requirements – Essential Modules (92MCs)

Computing Foundations
- TIC1001 Introduction to Computing and Programming I
- TIC1002 Introduction to Computing and Programming II
- TIC1101 Professional, Ethical, and Social Issues in Computing
- TIC1201 Discrete Structures
- TIC2001 Data Structures and Algorithms
- TIC2002 Introduction to Software Engineering
- TIC2301 Introduction to Information Security
- TIC2401 Computing Systems
- TIC2501 Computer Networks and Applications
- TIC2601 Database and Web Applications
- TIC2901 Communication for Computing Professionals
- TIC3901 Industrial Practice (12 MCs)

Cybersecurity Requirements
- TIC2101 Information Systems and Organisations
- TIC3301 Information Security Management
- TIC3302 Computer Systems Security
- TIC4301 Information Security Practicum I
- TIC4302 Information Security Practicum II

Mathematics Requirements
- TMA1001 Introductory Mathematics
- TMA2101 Calculus for Computing
- TMA2102 Linear Algebra
- TMA2103 Probability and Statistics

2. Major Requirements – Elective Modules (12MCs, selected from the list below)
Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time.
- TIC4303 Software Security
- TIC4304 Web Security
- TIC4305 Network Security
- TIC4306 Information Security Governance and Audit

C. **Unrestricted Elective Modules (36MCs)**
Note: 20 MCs will normally be given as Advanced Placement Credits to holders of diploma or higher qualifications.

Study Schedule

There is only one intake per academic year in Semester 1 (i.e. August). One sample study schedule for a four-year candidature is shown below. This assumes the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):
1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.
2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 1:	TMA1001 Introductory Mathematics (4) TIC1001 Introduction to Computing and Programming I (4) TIC1101 Professional, Ethical, and Social Issues in Computing (4)
Sem 2:	TIC1201 Discrete Structures (4) TIC1002 Introduction to Computing and Programming II (4) TMA2101 Calculus for Computing (4)
SpTerm:	General Education Module 1 – Quantitative Reasoning (4) TIC2001 Data Structures and Algorithms (4)
2nd Year of studies	
Sem 1:	TIC2501 Computer Networks and Applications (4) TIC2301 Introduction to Information Security (4) TIC2101 Information Systems and Organisations (4)
Sem 2:	TIC2401 Introduction to Computer Systems (4) TIC2601 Database and Web Applications (4) TMA2102 Linear Algebra (4)
SpTerm:	General Education Module 2 – Asking Questions (4) General Education Module 3 – Thinking and Expression (4)
3rd Year of studies	
Sem 1:	*TIC3901 Industrial Practice TIC2901 Communication for Computing Professionals (4) TIC3301 Information Security Management (4) TIC2002 Introduction to Software Engineering (4)
Sem 2:	*TIC3901 Industrial Practice (12) TIC3302 Computer Systems Security (4) TMA2103 Probability and Statistics (4) Unrestricted Elective 1 (4)
SpTerm:	General Education Module 4 – Human Cultures (4) General Education Module 5 – Singapore Studies (4)

4th Year of studies	
Sem 1:	TIC4301 Information Security Practicum I (4) Elective 1 (4) Unrestricted Elective 2 (4)
Sem 2:	TIC4302 Information Security Practicum II (4) Elective 2 (4) Elective 3 (4)
SpTerm:	Unrestricted Elective 3 (4) Unrestricted Elective 4 (4)

3.3.3 Bachelor of Technology (Software Engineering)

The BTech (Software Engineering) programme is offered in partnership with the School of Computing. The BTech (Software Engineering) programme enables students to attain the following learning outcomes by the time of graduation:

1. Strong knowledge of computer science foundations and fundamentals, including:
    a. familiarity with common computer science themes and principles,
    b. high-level understanding of systems as a whole, and
    c. understanding of the theoretical underpinnings of computer science and their influences in practice.

2. An ability to function effectively in teams to accomplish a common goal.
3. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
4. An ability to analyse the local and global impact of computing on individuals, organisations, and society.
5. Clear recognition of the need for and an ability to engage in continuing professional development.
6. Individual competence in applying sound principles and rigorous thinking to:
    a. analyse an application problem,
    b. understand user's requirement,
    c. formulate the problem in terms of computation requirements,
    d. conceive novel solution ideas,
    e. design appropriate solutions that meet the requirements,
    f. implement the solution, and
    g. evaluate the effectiveness of the solution.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Software Engineering):

- Complete a minimum of **160 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the School of Computing, or the University.

>   **List of modules – BTech (Software Engineering), comprise:**
>   All modules are 4MCs, except when otherwise stated.

>   A. **University Level Requirements (20MCs)**
>   - Quantitative Reasoning (module with prefix GER)
>   - Thinking and Expression (module with prefix GET)
>   - Human Cultures (module with prefix GEH)
>   - Asking Questions (module with prefix GEQ)
>   - Singapore Studies (module with prefix GES)

B. **Programme Requirements (104MCs), comprising**
    1. <u>Major Requirements – Essential Modules (92MCs)</u>

Computing Foundations
- TIC1001 Introduction to Computing and Programming I
- TIC1002 Introduction to Computing and Programming II
- TIC2001 Data Structures and Algorithms
- TIC1201 Discrete Structures
- TIC1101 Professional, Ethical, and Social Issues in Computing
- TIC2301 Introduction to Information Security
- TIC2401 Computing Systems
- TIC2501 Computer Networks and Applications
- TIC2601 Database and Web Applications
- TIC2002 Introduction to Software Engineering
- TIC2901 Communication for Computing Professionals
- TIC3901 Industrial Practice (12 MCs)

Software Engineering Requirements
- TIC2701 Principles of Programming Languages
- TIC3001 Software Requirements Analysis and Design
- TIC3002 User Interface Design and Implementation
- TIC4001 Software Engineering Practicum I
- TIC4002 Software Engineering Practicum II

Mathematics Requirements
- TMA1001 Introductory Mathematics
- TMA2101 Calculus for Computing
- TMA2102 Linear Algebra
- TMA2103 Probability and Statistics

2. <u>Major Requirements – Elective Modules (12MCs, selected from the list below)</u>

Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time.
- TIC4003 Software Project Management
- TIC4004 Software Quality Control
- TIC4005 Parallel and Distributed Software Engineering
- TIC4303 Software Security

C. **Unrestricted Elective Modules (36MCs)**
Note: 20 MCs will normally be given as Advanced Placement Credits to holders of diploma or higher qualifications.

Study Schedule

There is only one intake per academic year in Semester 1 (i.e. August). One sample study schedule for a four-year candidature is shown below. This assumes the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 1:	TMA1001 Introductory Mathematics (4) TIC1001 Introduction to Computing and Programming I (4) TIC1101 Professional, Ethical, and Social Issues in Computing (4)
Sem 2:	TIC1201 Discrete Structures (4) TIC1002 Introduction to Computing and Programming II (4) TMA2101 Calculus for Computing (4)
SpTerm:	General Education Module 1 – Quantitative Reasoning (4) TIC2001 Data Structures and Algorithms (4)
2nd Year of studies	
Sem 1:	TIC2501 Computer Networks and Applications (4) TIC2301 Introduction to Information Security (4) TIC2002 Introduction to Software Engineering (4)
Sem 2:	TIC2401 Introduction to Computer Systems (4) TIC2601 Database and Web Applications (4) TMA2102 Linear Algebra (4)
SpTerm:	General Education Module 2 – Asking Questions (4) General Education Module 3 – Thinking and Expression (4)
3rd Year of studies	
Sem 1:	*TIC3901 Industrial Practice TIC3002 User Interface Design and Implementation (4) TIC2701 Principles of Programming Languages (4) TIC2901 Communication for Computing Professionals (4)

Sem 2:	*TIC3901 Industrial Practice (12) TIC3001 Software Requirements Analysis and Design (4) TMA2103 Probability and Statistics (4) Unrestricted Elective 1 (4)
SpTerm:	General Education Module 4 – Human Cultures (4) General Education Module 5 – Singapore Studies (4)

4th Year of studies

Sem 1:	TIC4301 Information Security Practicum I (4) Elective 1 (4) Unrestricted Elective 2 (4)
Sem 2:	TIC4302 Information Security Practicum II (4) Elective 2 (4) Elective 3 (4)
SpTerm:	Unrestricted Elective 3 (4) Unrestricted Elective 4 (4)

3.4 Bachelor of Technology (BTech) Engineering

Admission Intakes: Each of the BTech Engineering programmes has two intakes in each Academic Year, one for Semester 1 in August and the other for Semester 2 in January of the following year except for the following:

- BTech (Chemical Engineering) offers only one intake in Semester 2 in January.
- BTech (Civil Engineering) offers only one intake in Semester 1 in August.

As all students admitted into BTech programmes in Engineering must have the minimum of a recognised polytechnic diploma, all students are granted, upon admission, advanced placement credits of 40 MCs which is equivalent to one year of the four-year full-time degree requirements. As such, all BTech Engineering students are admitted directly as Stage 2 (Year 2) students. Students with additional post-diploma academic qualifications may, on a case-by-case basis, apply and be considered for additional advanced placement credits. The granting of such additional credits will be entirely at the discretion of the University.

The structure and design of each of the BTech programmes in Engineering are based on those of the corresponding four-year full-time Bachelor of Engineering (BEng) programmes offered by the Faculty of Engineering. To qualify for a BTech degree in Engineering, a student must take and pass a minimum of 120 MCs of modules, as tabulated below, and achieve a CAP of at least 2.0.

Table: 120-MC BTech Engineering curriculum structure

	Minimum MCs required
University Level Requirements	
General Education (GE) Modules [1]	20
Sub-total	**20**
Programme Requirements [2]	
Ethics in Engineering	4
Foundation & Major Requirements	85 – 96

	Minimum MCs required
Sub-total	**89 – 100**
Unrestricted Elective Modules [3]	**0 – 12**
Grand-total	**120 – 121**

Notes:

A limited selection of GE modules (from the wide range available in the University) which can best meet the interests and professional needs of BTech students, will be offered specially in the evenings. The list of modules will be available in the SCALE website in due course.

These are specific to the individual BTech programme and reference should be made to the relevant sections.

UEMs enable students to pursue their interests without any restrictions. Students may select any module at any level from among Technical or GE modules to meet this requirement.

Stage Promotion: Students will be deemed to have progressed to the next stage of study if they have obtained at least the number of MCs, including exemptions, as stated below:

To move to Stage 2 (Year 2): 36 MCs
To move to Stage 3 (Year 3): 76 MCs
To move to Stage 4 (Year 4): 112 MC

Degree Requirements & Recommended Study Schedule

3.4.1 [Bachelor of Technology (Chemical Engineering)](#)

3.4.2 [Bachelor of Technology (Civil Engineering)](#)

3.4.3 [Bachelor of Technology (Electronics Engineering)](#)

3.4.4 [Bachelor of Technology (Industrial & Management Engineering)](#)

3.4.5 [Bachelor of Technology (Mechanical Engineering)](#)

3.4.1 Bachelor of Technology (Chemical Engineering)

The BTech (Chemical Engineering) programme is offered in partnership with the Department of Chemical and Biomolecular Engineering.   The programme is accredited by the Engineering Accreditation Board (EAB) of the Institution of Engineers Singapore (IES). Via this accreditation, all signatories in the Washington Accord recognize the substantial equivalence of this programme in satisfying the academic requirements for the practice of engineering at the professional level in many countries including Canada, United States of America, United Kingdom, Hong Kong, New Zealand, Australia and others.

The **educational objectives** of the BTech (Chemical Engineering) programme are to:

- develop knowledge and skills required for immediate employment as a professional engineer in Chemical Engineering;
- develop an understanding of and an ability to apply basic mathematics, chemical, physical and information sciences to the practice of Chemical Engineering;
- prepare students for future career paths and life-long learning; and
- enable students to better contribute to national development in the context of globalisation.

The programme aims to achieve the following **learning outcomes**:

- *Core*: Understanding of and ability to apply the science, mathematics and engineering knowledge fundamental to the discipline.
- *Breadth*: Basic competence in a range of technical areas relevant to Chemical Engineering.
- *Depth*: Be able to understand and apply in-depth knowledge of one or more specialisations within Chemical Engineering.
- *Design*: An enhanced ability to perform engineering design by the process of creative thinking, synthesis and integration of interdisciplinary knowledge.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Chemical Engineering):

- Complete a minimum of **121 MCs** with a minimum CAP of 2.00 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the Faculty of Engineering, or the University.

   List of modules – BTech (Chemical Engineering), comprise:

   1. All modules are 4MCs, except when otherwise stated.

   2. A module with module code TCNxxxx is equivalent to the module CNxxxx/CNxxxxR offered to full-

time students. Subject to the approval from the Dean of SCALE and the ChBE Department, a student may select a full-time equivalent module in place of any TCNxxxx module.

A. **<u>University Level Requirements (20MCs)</u>**
- Quantitative Reasoning (module with prefix GER)
- Thinking and Expression (module with prefix GET)
- Human Cultures (module with prefix GEH)
- Asking Questions (module with prefix GEQ)
- Singapore Studies (module with prefix GES)

B. **<u>Programme Requirements (89MCs), comprising</u>**
1. <u>Faculty Requirements (4MCs)</u>
   - TTG2415 Ethics in Engineering
2. <u>Major Requirements – Essential Modules (65MCs)</u>
   - TCN1111 Chemical Engineering Principles
   - TCN1005 MatLab Programming for Chemical Engineers
   - TCN1411 Mathematics for Chemical Engineers 1
   - TCN2411 Mathematics for Chemical Engineers 2
   - TCN1422 Materials for Chemical Engineers
   - TCN2116 Chemical Kinetics and Reactor Design
   - TCN2121 Chemical Engineering Thermodynamics
   - TCN2122 Fluid Mechanics
   - TCN2125 Heat and Mass Transfer
   - TCN3121 Process Dynamics and Control
   - TCN3124 Particle Technology
   - TCN3132 Separation Processes (5MCs)
   - TCN3421 Process Modelling & Numerical Simulation
   - TCN3135 Process Safety, Health and Environment (3MCs)
   - TCN4122 Process Synthesis and Simulation (3MCs)
   - TCN4124 Design Project (6MCs)

3. <u>Major Requirements – Elective Modules (20MCs, selected from the list below)</u>
   Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time. Subject to the approval of the Dean of SCALE, a student may select one Level-3000 or higher module from other programmes within the Faculty of Engineering.

   - TCN4119 BTech Dissertation (8MCs)
   - TCN4203 Polymer Engineering
   - TCN4205 Pinch Analysis and Process Integration
   - TCN4208 Biochemical Engineering
   - TCN4210 Membrane Science and Engineering
   - TCN4211 Petrochemicals & Processing Technology
   - TCN4215 Food Technology and Engineering
   - TCN4216 Electronic Materials Science
   - TCN4217 Processing of Microelectronic Materials
   - TCN4227 Advanced Process Control
   - TCN4231 Downstream Processing of Biochemical and Pharmaceutical Products

- TCN4238 Chemical & Biochemical Process Modeling
- TCN4240 Unit Operations and Processes for Effluent Treatment
- TCN4242 Optimization of Chemical Processes
- TCN4246 Chemical and Bio-Catalysis
- TCN4229 Computer Aided Chemical Engineering
- TCN4233 Good Manufacturing Practices in Pharmaceutical Industry

C. **Unrestricted Elective Modules (12MCs)**

Study Schedule

There is only one intake per academic year in Semester 2 (i.e. January). One sample study schedule for a four-year candidature is shown below. This assumes the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

Sample Study Schedule (4-year candidature beginning in Semester 2 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 2:	TCN1411 Mathematics for Chemical Engineers 1 (4)
	TCN1422 Materials for Chemical Engineers (4)
	TCN1111 Chemical Engineering Principles (4)
SpTerm:	TCN2411 Mathematics for Chemical Engineers 2 (4)
	General Education Module 1 – Quantitative Reasoning (4)
Sem 1:	TCN1005 MatLab Programming for Chemical Engineers (4)
	TCN2121 Chemical Engineering Thermodynamics (4)
	TCN2122 Fluid Mechanics (4)
2nd Year of studies	
Sem 2:	TCN2116 Chemical Kinetics & Reactor Design (4)
	TCN2125 Heat and Mass Transfer (4)
	TCN3124 Particle Technology (4)

SpTerm:	TCN3135 Process Safety, Health and Environment (3)
	General Education Module 2 – Asking Questions (4)
Sem 1:	TCN3121 Process Dynamics & Control (4)
	TCN3132 Separation Processes (5)
	TCN3421 Process Modelling & Numerical Simulation (4)

3rd Year of studies

Sem 2:	TCN4119* BTech Dissertation / Technical Elective Module (4)
	Technical Elective Module 1 (4)
	General Education Module 3 (4)
SpTerm:	TTG2415 Ethics in Engineering (4)
	TCN4119* BTech Dissertation
	General Education Module 4 (4)
Sem 1:	TCN4119* BTech Dissertation (8) / Technical Elective Module (4)
	TCN4122 Process Synthesis and Simulation (3)
	TTG3001* Industrial Practice / Unrestricted Elective Module (4)

4th Year of studies

Sem 2:	TCN4124* Final Year Design Project
	TTG3001* Industrial Practice (12) / Unrestricted Elective Module (4)
	General Education Module 5 (4)
SpTerm:	TCN4124* Final Year Design Project (6)
	Unrestricted Elective Module (4)
Sem 1:	Technical Elective Module 2 (4)
	Technical Elective Module 3 (4)

3.4.2 Bachelor of Technology (Civil Engineering)

The BTech (Civil Engineering) programme is offered in partnership with the Department of Civil and Environmental Engineering beginning in August 2017. The curriculum for the part-time BTech Programme is formulated based on the current broad based fulltime B.Eng. programme but with stronger emphasis on practice.

As this is a new programme, we are seeking accreditation from the Engineering Accreditation Board (EAB) of the Institution of Engineers Singapore (IES). We expect to be provisionally accredited for the first 2 years after the launch of the programme and full accreditation will be expected in about 3 years thereafter. With successful accreditation, all signatories in the Washington Accord will recognize the substantial equivalence of this programme in satisfying the academic requirements for the practice of engineering at the professional level in many countries including Canada, United States of America, United Kingdom, Hong Kong, New Zealand, Australia and others.

The *educational objectives* of the programme are as follows:

* depth in fundamental knowledge of core civil engineering disciplines;
* breadth in integrative skills to apply the knowledge gained;
* appreciation of interactions between engineering, business and technology in modern society;
* drive for life-long learning and continuous self-development; and
* understanding of their role as civil engineers in the development of society at the national and global context.

In addition, the programme ensures that graduates are equipped with the basic civil engineering core competencies to meet the requirements for the practice of civil engineering in Singapore in accordance to the Professional Engineers Board.

The *student learning outcomes* are aligned to those required by the Engineering Accreditation Board on outcomes for civil engineering graduates and these are as follows:

* apply knowledge of mathematics, science and engineering;
* design and conduct experiments, analyze, interpret data and synthesize valid conclusions;
* design a system, component, or process, and synthesize solutions to achieve desired needs;
* identify, formulate, research through relevant literature review, and solve engineering problems reaching substantiated conclusions;
* use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints;
* communicate effectively; (listening, writing and speaking skills);
* recognize the need for, and have the ability to engage in lifelong learning;
* understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development;
* function effectively within multidisciplinary teams and understand the fundamental precepts of effective project management; and

- understand professional, ethical and moral responsibility in the workplace.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Civil Engineering):

- Complete a minimum of **120 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the Faculty of Engineering, or the University.

List of modules – BTech (Civil Engineering), comprise:

1. All modules are 4MCs, except when otherwise stated.

2. A module with module code TCExxxx is equivalent to the module CExxxx, OTxxxx, ESExxxx

and TPxxxx offered to the full-time students. Subject to the approval from the Dean of SCALE and the

Department of Civil & Environmental Engineering, a student may select a full-time equivalent module

in place of any TCExxxx module.

A. **University Level Requirements (20MCs)**
   - Quantitative Reasoning (module with prefix GER)
   - Thinking and Expression (module with prefix GET)
   - Human Cultures (module with prefix GEH)
   - Asking Questions (module with prefix GEQ)
   - Singapore Studies (module with prefix GES)

B. **Programme Requirements (100MCs), comprising**
   1. Faculty Requirements (8MCs)
      - TTG2415 Ethics in Engineering
      - TCE2331 Communicating Engineering or equivalent module
   2. Major Requirements – Essential Modules (80MCs)
      - TCE1109 Statics and Mechanics of Materials
      - TTG1401 Engineering Mathematics I
      - TME2401 Engineering Mathematics II
      - TCE2112 Soil Mechanics
      - TCE2134 Hydraulics
      - TCE2155 Structural Mechanics and Materials
      - TCE2183 Construction Project Management
      - TCE2184 Infrastructure & the Environment
      - TCE2407 Engineering & Uncertainty Analyses
      - TCE3115 Geotechnical Engineering
      - TCE3116 Foundation Engineering
      - TCE3121 Transportation Engineering
      - TCE3132 Water Resources Engineering

- TCE3155 Structural Analysis
- TCE3165 Structural Concrete Design
- TCE3166 Structural Steel Design and System
- TCE4103 Design Project
- TCE3001 Water Quality Engineering
- TCE4104 BTech Dissertation (8MCs)

3. <u>Major Requirements – Elective Modules (12MCs, selected from the list below)</u>

Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time. Subject to the approval of the Dean of SCALE, a student may select one Level-3000 or higher module from other programmes within the Faculty of Engineering.

Construction
- TCE4282 Building Information Modeling for Project Management
- TCE5604 Advanced Concrete Technology
- TCE5611 Precast Concrete Technology
- TCE5805 Construction Equipment and Methods

Environmental Engineering and Hydraulics
- TCE4247 Treatment Plant Hydraulics
- TCE4401 Water & Wastewater Engineering 2
- TCE4408 Environmental Impact Assessment

Geotechnical Engineering
- TCE5106 Ground Improvement
- TCE5107 Pile Foundations
- TCE5108 Earth Retaining Structures
- TCE5113 Geotechnical Investigation & Monitoring

Offshore Engineering
- TCE5202 Analysis & Design of Offshore Structures
- TCE5206 Offshore Foundations

Structural Engineering
- TCE4257 Linear Finite Element Analysis
- TCE4258 Structural Stability & Dynamics
- TCE5509 Advanced Structural Steel Design
- TCE5510 Advanced Structural Concrete Design

Transportation Engineering
- TCE4221 Design of Land Transport Infrastructures
- TCE5025 Intelligent Transportation Systems
- TCE5026 Transportation Management & Policy

Study Schedule

There is only one intake per academic year in Semester 1 (i.e. August). One sample study schedule for a four-year candidature is shown below. This assumes the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 1:	TCE1109 Statics and Mechanics of Materials (4) TCE2112 Soil Mechanics (4) TCE2155 Structural Mechanics and Materials (4)
Sem 2:	TTG1401 Engineering Mathematics I (4) TCE2134 Hydraulics (4) TCE3115 Geotechnical Engineering (4)
SpTerm:	General Education Module 1 – Quantitative Reasoning (4) General Education Module 2 – Asking Questions (4)
2nd Year of studies	
Sem 1:	TCE2183 Construction Project Management (4) TCE2184 Infrastructure & the Environment (4) TME2401 Engineering Mathematics II (4)
Sem 2:	TCE3116 Foundation Engineering (4) TCE3165 Structural Concrete Design (4) TCE3166 Structural Steel Design and System (4)
SpTerm:	TCE2407 Engineering & Uncertainty Analyses (4) General Education Module 3 – Thinking & Expression (4)
3rd Year of studies	
Sem 1:	TCE3155 Structural Analysis (4) TCE3001 Water Quality Engineering (4) TCE3132 Water Resources Engineering (4)
Sem 2:	TCE2331 Communicating Engineering or equivalent TCE3121 Transportation Engineering (4) General Education Module 4 – Human Cultures or Singapore Studies (4)

SpTerm:	General Education Module 5 – Human Cultures or Singapore Studies (4)
	TTG2415 Ethics in Engineering (4)

4th Year of studies

Sem 1:	TCE4103 Design Project (4)
	*TCE4104 BTech Dissertation
	Technical Elective 1 (4)
Sem 2:	*TCE4104 BTech Dissertation (8)
	Technical Elective 2 (4)
	Technical Elective 3 (4)

3.4.3 Bachelor of Technology (Electronics Engineering)

The BTech (Electronics Engineering) is offered in partnership with the Electrical & Computer Engineering (ECE) Department. The programme aims to graduate professional electronic engineers who have a strong foundation in the relevant sciences and technology and who are able to contribute to society through innovation, enterprise and leadership. The programme provides students with an education that enhances and complements their knowledge and experiences, offers the requisite balance of breadth and depth for a professional electrical engineering education, and seeks to establish a solid foundation for lifelong learning throughout an electronic engineer's career.

The programme comprises of three components – a strong core in mathematics, computing and engineering; technical competence through a minimum of breadth and depth modules; and general education. The core – which includes group projects, a product design and innovations project, and individual research and design projects – provides knowledge and skills considered essential for electronics engineers. A minimum number of breadth modules ensures that each student is exposed to many aspects of the state-of-the-art areas; in addition, students can achieve depth in one or two areas of their choice. General education modules complement the technical education through a wide array of modules in humanities, social sciences and professionalism to make our graduates educated members of the global community.

The programme is accredited by the Engineering Accreditation Board (EAB) of the Institution of Engineers Singapore (IES). Via this accreditation, all signatories in the Washington Accord recognize the substantial equivalence of this programme in satisfying the academic requirements for the practice of engineering at the professional level in many countries including Canada, United States of America, United Kingdom, Hong Kong, New Zealand, Australia and others.

The structure of the BTech (Electronics Engineering) programme is designed to achieve the following ***educational objectives*** to prepare engineers who will be:

- technically competent to solve complex problems in electronics engineering and can adapt effectively in a fast changing environment;
- able to critically think, analyse and make decisions that give due consideration to global issues in business, ethics, society and the environment;
- able to communicate effectively, act with integrity, and have the inter-personal skills needed to engage in, lead, and nurture diverse teams; and
- committed to lifelong learning, resourceful and embrace global challenges and opportunities to make a positive impact in society.

The success of the programme is assessed through the attainment of ***learning outcomes*** as follows:

- apply knowledge of mathematics, science and engineering to the solution of complex engineering problems;
- design and conduct experiments such as to analyse, interpret data and synthesise valid conclusions;
- design a system, component, or process, and synthesise solutions to achieve desired needs;
- identify, formulate, research through relevant literature review, and solve engineering problems reaching substantiated conclusions;
- use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints;
- communicate effectively;
- recognize the need for, and have the ability to engage in lifelong learning;
- understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development;
- function effectively within multidisciplinary teams and understand the fundamental precepts of effective project management;
- understand professional, ethical and moral responsibility; and
- have a good understanding of the principles and applications of advanced mathematics, including probability and statistics, differential and integral calculus, linear algebra and complex variables.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Electronics Engineering):

- Complete a minimum of **120 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the Faculty of Engineering, or the University.

List of modules – BTech (Electronics Engineering), comprise:

1. All modules are 4MCs, except when otherwise stated.

2. A module with module code TEExxxx is equivalent to the module EExxxx offered to the full-time students. Subject to the approval from the Dean of SCALE and the ECE Department, a student may select a full-time equivalent module in place of any TEExxxx module.

A. **University Level Requirements (20MCs)**
- Quantitative Reasoning (module with prefix GER)
- Thinking and Expression (module with prefix GET)
- Human Cultures (module with prefix GEH)
- Asking Questions (module with prefix GEQ)
- Singapore Studies (module with prefix GES)

B. **Programme Requirements (92MCs), comprising**

1. <u>Faculty Requirements (4MCs)</u>
   - TTG2415 Ethics in Engineering
2. <u>Major Requirements – Essential Modules (64MCs)</u>
   - TTG1401 Engineering Mathematics I
   - TEE2002 Engineering Mathematics II
   - TEE2003 Advanced Mathematics for Engineers
   - TEE2101 Programming Methodology
   - TEE1001 Emerging Technologies in Electrical Engineering
   - TEE2011 Engineering Electromagnetics
   - TEE2020 Digital Fundamentals (5MCs)
   - TEE2021 Devices & Circuits
   - TEE2023 Signals & Systems
   - TEE2024 Programming for Computer Interfaces (5MCs)
   - TEE2031 Circuit and Systems Design Lab (3MCs)
   - TEE2032 Signals and Communications Design Lab (3MCs)
   - TEE3031 Innovation & Enterprise I
   - TEE4001 BTech Dissertation (12MCs)

3. <u>Major Requirements – Elective Modules (24MCs, selected from the list below)</u>
   Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time. Unless approval for exemption is obtained from the Dean of SCALE, a student must read at least three Level-4000 electives, two outer core electives (from: TEE3013, TEE3104, TEE3131, TEE3331, TEE3431, TEE3408, TEE3501, TEE3731 and TEE3201) and one design module (from: TEE3013, TEE3207, TEE3208, TEE3407, TEE3408, TEE3501, TEE4415 and TEE3801).

   Communications
   - TEE3104 Introduction to RF and Microwave Systems & Circuits
   - TEE3131 Communication Systems
   - TEE3731 Signal Processing Methods
   - TEE4101 RF Communications
   - TEE4112 HF Techniques
   - TEE4113 Digital Communications and Coding

   Computer Engineering
   - TEE3201 Software Engineering
   - TEE3204 Computer Communication Networks I
   - TEE3206 Introduction to Computer Vision and Image Processing
   - TEE3207 Computer Architecture
   - TEE3208 Embedded Computer Systems Design
   - TEE3731 Signal Processing Methods
   - TEE4210 Computer Communication Networks II
   - TEE4214 Real time Embedded Systems

   Microelectronics
   - TEE3408 Integrated Analog Design
   - TEE3431 Microelectronics Materials and Devices
   - TEE4415 Integrated Digital Design
   - TEE4435 Modern Transistors and Memory Devices
   - TEE4436 Fabrication Process Technology

   General
   - TIE2130 Quality Engineering I

- TEE3013 Labview for Electrical Engineers
- TEE3302 Industrial Control Systems
- TEE3331 Feedback Control Systems
- TEE3407 Analog Electronics
- TEE3501 Power Electronics
- TEE4305 Introduction to Fuzzy/Neural Systems
- TEE3801 Robust Design of Electronic Circuits
- TME4245 Robot Kinematics, Dynamics and Control

C. **Unrestricted Elective Modules (8MCs)**

Study Schedules

There are two intakes per academic year, in Semester 1 (i.e. August) and in Semester 2 (i.e. January). The respective sample study schedules for a four-year candidature are presented below. These assume the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 1:	General Education Module 1 (4)
	TTG1401 Engineering Mathematics I (4)
	TEE1001 Emerging Technologies in EE (4)
Sem 2:	TEE2002 Engineering Mathematics II (4)
	TEE2020 Digital Fundamentals (5)
	TEE2101 Programming Methodology (4)
SpTerm:	General Education Module 2 (4)
	General Education Module 3 (4)
2nd Year of studies	

Sem 1:	TEE2003 Advanced Mathematics for Engineers (4) TEE2024 Programming for Computer Interfaces (5) TEE2021 Devices & Circuits (4)
Sem 2:	TEE2011 Engineering Electromagnetics (4) TEE2031 Circuits and Systems Design Lab (3) TEE2023 Signals & Systems (4)
SpTerm:	General Education Module 4 (4)
3rd Year of studies	
Sem 1:	Elective 1 (4) General Education Module 5 (4) TTG3002* Industrial Practice TEE2032 Signals and Communications Design Lab (3)
Sem 2:	TEE3031 Innovation & Enterprise I (4) Elective 2 (4) Elective 3 (4) TTG3002* Industrial Practice (8)
SpTerm:	TTG2415 Ethics in Engineering (4)/ General Education Module 5 (4)
4th Year of studies	
Sem 1:	Elective 4 (4) Elective 5 (4) TEE4001* BTech Dissertation
Sem 2:	Elective 6 (4) TEE4001* BTech Dissertation (12)

B. Sample Study Schedule (4-year candidature beginning in Semester 2 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies

Sem 2:	TTG1401 Engineering Mathematics I (4)
	TEE2020 Digital Fundamentals (5)
	TEE2101 Programming Methodology (4)
SpTerm:	General Education Module 1 (4)
	General Education Module 2 (4)
Sem 1:	TEE2002 Engineering Mathematics II (4)
	General Education Module 3 (4)
	TEE1001 Emerging Technologies in EE (4)

2nd Year of studies

Sem 2:	TEE2003 Advanced Mathematics for Engineers (4)
	TEE2011 Engineering Electromagnetics (4)
	TEE2023 Signals and Systems (4)
SpTerm:	General Education Module 4 (4)
Sem 1:	TEE2021 Devices & Circuits (4)
	TEE2032 Signals and Communications Design Lab (3)
	TEE2024 Programming for Computer Interfaces (5)
	TTG3002* Industrial Practice

3rd Year of studies

Sem 2:	TEE3031 Innovation & Enterprise I (4)
	TEE2031 Circuits and Systems Design Lab (3)
	Elective 1 (4)
	TTG3002* Industrial Practice (8)
SpTerm:	TTG2415 Ethics in Engineering (4)
Sem 1:	Elective 2 (4)
	Elective 3 (4)
	General Education Module 5 (4)

4th Year of studies

Sem 2:	Elective 4 (4) Elective 5 (4) TEE4001* BTech Dissertation
SpTerm:	TTG2415 Ethics in Engineering (4) TEE4001* BTech Dissertation
Sem 1:	TEE4001* BTech Dissertation (12) Elective 6 (4)

3.4.4 Bachelor of Technology (Industrial & Management Engineering)

The BTech (Industrial & Management Engineering) is offered in partnership with the Department of Industrial Systems Engineering and Management. The programme aims to graduate professional industrial and management engineers who have a strong foundation in the relevant modelling and methodological expertise together with a systems mindset, who can contribute to society through innovation, enterprise and leadership. The programme provides students with an education that enhances and complements their knowledge and experiences.

In order to prepare graduates for the rapidly evolving landscape of Industrial and Management Engineering (IME) and to upgrade polytechnic graduates into learning engineers, the programme is specially designed to comprise essential modules, elective modules (both technical and non technical), enrichment modules, and projects. The essential modules seek to equip students with a strong foundation in mathematics, probability and statistics in engineering fundamentals. The technical electives provide the breadth and depth in different areas of IME.

Design, which is the heart of engineering, is integrated through various project activities. Non-technical modules introduce students to methodologies of business and management. By providing graduates with a combination of broad-based fundamentals and specialised knowledge, the programme strives to graduate versatile engineers who would be best positioned to lead in a rapidly changing and increasingly knowledge-based economy.

The programme is accredited by the Engineering Accreditation Board (EAB) of the Institution of Engineers Singapore (IES). Via this accreditation, all signatories in the Washington Accord recognize the substantial equivalence of this programme in satisfying the academic requirements for the practice of engineering at the professional level in many countries including Canada, United States of America, United Kingdom, Hong Kong, New Zealand, Australia and others.

The **Program Educational Objectives** of the BTech (Industrial & Management Engineering) curriculum strive to equip graduates with the abilities to:

- Apply fundamental knowledge and skill sets required in the Industrial and Management Engineering profession.
- Adopt a systems approach to design, develop, implement, manage and innovate integrated systems that include people, technology, information, energy and resources taking into account global, societal, environmental and economic contexts.
- Work and communicate effectively with multi-disciplinary team members and different types of stakeholders.
- Recognize the need and continue to develop skills and knowledge to embrace changes in society and the profession.

The **Student Learning Outcomes** of the BTech (Industrial & Management Engineering) curriculum strive to equip graduates with the following attributes:

- **Engineering Knowledge:** Apply the knowledge of mathematics, science and engineering to the solution of complex engineering and management problems.
- **Problem Analysis**: Identify, formulate, research through relevant literature review, and analyze complex engineering and management problems to reach substantiated conclusions using mathematics and sciences.
- **Design/Development of Solutions:** Design and develop solutions for complex engineering and management problems including systems, components and/or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **Modern Tool Usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, to complex engineering and management activities including modelling and prediction with an understanding of the limitations.
- **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for, sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Industrial & Management Engineering):

1. Complete a minimum of **121 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
2. Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
3. Satisfy any other additional requirements that may be prescribed by SCALE, the Faculty of

Engineering, or the University.

List of modules – BTech (Industrial & Management Engineering), comprise:

1. All modules are 4MCs, except when otherwise stated.

2. A module with module code TIExxxx is equivalent to the module IExxxx offered to the full-time students. Subject to the approval from the Dean of SCALE and the ISE Department, a student may select a full-time equivalent module in place of any TIExxxx module.

A. <u>**University Level Requirements (20MCs)**</u>
- Quantitative Reasoning (module with prefix GER)
- Thinking and Expression (module with prefix GET)
- Human Cultures (module with prefix GEH)
- Asking Questions (module with prefix GEQ)
- Singapore Studies (module with prefix GES)

B. <u>**Programme Requirements (89MCs), comprising**</u>
  1. <u>Faculty Requirements (4MCs)</u>
     - TTG2415 Ethics in Engineering
  2. <u>Major Requirements – Essential Modules (69MCs)</u>
     - TTG1401 Engineering Mathematics I
     - TEE2101 Programming Methodology
     - TIE2010 Introduction to Industrial System
     - TIE2120 Probability and Statistics
     - TIE2100 Probability Models with Applications
     - TIE2110 Operations Research I
     - TIE2130 Quality Engineering I
     - TIE2140 Engineering Economy
     - TIE2150 Human Factors Engineering
     - TIE3100 Systems Design Project (8MCs)
     - TIE3101 Statistics for Engineering Applications
     - TIE3110 Simulation (5MCs)
     - TIE4240 Project Management
     - TIE4101 BTech Dissertation (8MCs)
     - TIE3010 Systems Thinking and Design

  3. <u>Major Requirements – Elective Modules (16MCs, selected from the list below)</u>
     Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time.

     - TIE4220 Supply Chain Modelling
     - TIE4230 Quality Engineering II
     - TIE4242 Cost Analysis and Management
     - TIE4229 Selected Topics in Logistics
     - TIE4239 Selected Topics in Quality Engineering
     - TIE4249 Selected Topics in Engineering Management
     - TIE4259 Selected Topics in Systems Engineering
     - TIE4299 Selected Topics in Industrial Engineering

- TME4209 Management of New Product Development
- IE5108 Facility Layout and Location
- IE5121 Quality Planning and Management
- IE5203 Decision Analysis
- IE5301 Human Factors in Engineering and Design

In the rare event that a student is unable to secure sufficient number of electives from the above list to complete their requirements, permission may be granted by the Dean of SCALE for the student to select one Level-3000 or higher module from other programmes within the Faculty of Engineering.

C. **Unrestricted Elective Modules (12MCs)**

Study Schedules

There are two intakes per academic year, in Semester 1 (i.e. August) and in Semester 2 (i.e. January). The respective sample study schedules for a four-year candidature are presented below. These assume the students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):
1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.
2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 1:	TTG1401 Engineering Mathematics I (4)
	TEE2101 Programming Methodology (4)
	TIE2010 Introduction to Industrial System (4)
Sem 2:	TIE2150 Human Factors Engineering (4)
	TIE2140 Engineering Economy (4)
	TIE2130 Quality Engineering I (4)
SpTerm:	General Education Module 1 (4)
	General Education Module 2 (4)
2nd Year of studies	

Sem 1:	TIE2120 Probability and Statistics (4) TIE2110 Operations Research I (4) TIE3110 Simulation (5)
Sem 2:	TIE2100 Probability Models with Applications (4) TIE3010 Systems Thinking and Design (4) General Education Module 3 (4)
SpTerm:	TTG2415 Ethnics in Engineering (4) General Education Module 4 (4)

3rd Year of studies

Sem 1:	TIE3101 Statistics for Engineering Applications (4) TIE3100* Systems Design Project TTG3001* Industrial Practice
Sem 2:	Elective 1 (4) TIE3100* Systems Design Project (8) TTG3001* Industrial Practice (12)
SpTerm:	General Education Module 5 (4) Elective 2 (4)

4th Year of studies

Sem 1:	TIE4240 Project Management (4) Elective 3 (4) TIE4101* BTech Dissertation
Sem 2:	Elective 4 (4) TIE4101* BTech Dissertation (8)

B. Sample Study Schedule (4-year candidature beginning in Semester 2 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies

Sem 2:	TTG1401 Engineering Mathematics I (4)
	TIE2140 Engineering Economy (4)
	TIE2130 Quality Engineering I (4)
SpTerm:	General Education Module 1 (4)
	General Education Module 2 (4)
Sem 1:	TEE2101 Programming Methodology (4)
	TIE2010 Introduction to Industrial System (4)
	TIE2120 Probability and Statistics (4)
2nd Year of studies	

2nd Year of studies

Sem 2:	TIE2100 Probability Models with Applications (4)
	TIE2150 Human Factors Engineering (4)
	TIE3010 Systems Thinking and Design (4)
SpTerm:	General Education Module 3 (4)
	General Education Module 4 (4)
Sem 1:	TIE2110 Operations Research 1 (4)
	TIE3110 Simulation (5)
	TIE3101 Statistics for Engineering Applications (4)
	TTG3001* Industrial Practice

3rd Year of studies

Sem 2:	TIE3100* Systems Design Project
	Elective 1 (4)
	General Education Module 5 (4)
	TTG3001* Industrial Practice (12)
SpTerm:	TIE3100* Systems Design Project
	TTG2415 Ethics in Engineering (4)
Sem 1:	TIE4240 Project Management (4)
	TIE3100* Systems Design Project (8)

4th Year of studies

Sem 2:	TIE4101* BTech Dissertation Elective 2 (4)
SpTerm:	TIE4101* BTech Dissertation Elective 3 (4)
Sem 1:	TIE4101* BTech Dissertation (8) Elective 4 (4)

3.4.5 Bachelor of Technology (Mechanical Engineering)

The BTech (Mechanical Engineering) programme is offered in partnership with the Department of Mechanical Engineering. The academic curriculum follows closely that of the equivalent BEng programme.

The programme is accredited by the Engineering Accreditation Board (EAB) of the Institution of Engineers Singapore (IES). Via this accreditation, all signatories in the Washington Accord recognize the substantial equivalence of this programme in satisfying the academic requirements for the practice of engineering at the professional level in many countries including Canada, United States of America, United Kingdom, Hong Kong, New Zealand, Australia and others.

The *educational objectives* of the programme are as follows:

- To prepare graduates with the knowledge and competency for careers in, and related to, Mechanical Engineering
- To prepare graduates to become leaders in fields related to Mechanical Engineering
- To enable graduates to understand their role as engineers and their impact on society in both national and global contexts.

The *learning outcomes* for the programme are the abilities to:

- **Engineering knowledge**: Apply knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
- **Problem Analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and Team Work**: Function effectively as an individual, and as a member or leader in

diverse teams and in multidisciplinary settings.
- **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Degree Requirements

Candidates must satisfy the following requirements to be conferred the degree of BTech (Mechanical Engineering):

- Complete a minimum of **121 MCs** with a minimum CAP of 2.0 by taking modules as listed below;
- Comply with the requirement that the limit on the number of Level-1000 modules to be counted towards fulfillment of graduation requirements being 60 MCs (including exemption of 20 MCs for polytechnic diploma holders); and
- Satisfy any other additional requirements that may be prescribed by SCALE, the Faculty of Engineering, or the University.

   List of modules – BTech (Mechanical Engineering), comprise:
   1. All modules are 4MCs, except when otherwise stated.

   2. A module with module code TMExxxx is equivalent to the module MExxxx offered to the full-time students. Subject to the approval from the Dean of SCALE and the ME Department, a student may select a full-time equivalent module in place of any TMExxxx module.

   A. **University Level Requirements (20MCs)**
   - Quantitative Reasoning (module with prefix GER)
   - Thinking and Expression (module with prefix GET)
   - Human Cultures (module with prefix GEH)
   - Asking Questions (module with prefix GEQ)
   - Singapore Studies (module with prefix GES)

   B. **Programme Requirements (93MCs), comprising**
   1. Faculty Requirements (4MCs)
      - TTG2415 Ethics in Engineering
   2. Major Requirements – Essential Modules (65MCs)
      - TTG1401 Engineering Mathematics I
      - TME2401 Engineering Mathematics II
      - TME2114 Mechanics of Materials II (3MCs)
      - TME2121 Engineering Thermodynamics
      - TME2134 Fluid Mechanics I
      - TME2135 Fluid Mechanics II

- TME2142 Feedback Control Systems
- TME2143 Sensors and Actuators
- TME2151 Principles of Mechanical Engineering Materials
- TME3112 Mechanics of Machines
- TME3122 Heat Transfer
- TME3162 Manufacturing Processes
- TME2101 Fundamentals of Mechanical Design
- TME3101 Mechanical Systems Design (6MCs)
- TME4102 BTech Dissertation (8MCs)

3. <u>Major Requirements – Elective Modules (24MCs, selected from the list below)</u>

Not all electives modules may be offered in any semester/year. An elective module may not be offered if there is insufficient number of students opting for that module at any particular time. Subject to the approval of the Dean of SCALE, a student may select one Level-3000 or higher module from other programmes within the Faculty of Engineering.

- TME3211 Mechanics of Solids
- TME3233 Unsteady Flow in Fluid Systems
- TME3251 Materials for Engineers
- TME3241 Microprocessor Applications
- TME3242 Automation
- TME3261 Computer Aided Design and Manufacturing
- TME3263 Design for Manufacturing and Assembly
- TME3291 Numerical Methods in Engineering
- TME4213 Vibration Theory and Applications
- TME4223 Thermal Environmental Engineering
- TME4225 Applied Heat Transfer
- TME4234 Experimental Methods in Fluid Mechanics
- TME4245 Robot Mechanics and Control
- TME4254 Materials in Engineering Design
- TME4261 Tool Engineering
- TME4262 Automation in Manufacturing
- TME4283 Micro fabrication Processes
- TIE2010 Introduction to Industrial Systems
- TIE2130 Quality Engineering I
- TME4209 Management of New Product Development
- TME4256 Functional Materials and Devices
- TME4263 Manufacturing Simulation & Data Communication
- TME4264 Fundamentals of Automotive Engineering

C. **Unrestricted Elective Modules (8MCs)**

Study Schedules

There are two intakes per academic year, in Semester 1 (i.e. August) and in Semester 2 (i.e. January). The respective sample study schedules for a four-year candidature are presented below. These assume the

students' work and other commitments allow them sufficient time to properly cope with their studies. Students are strongly advised to slow down if necessary so that they progress at their own comfortable pace.

A. Sample Study Schedule (4-year candidature beginning in Semester 1 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 1:	TTG1401 Engineering Mathematics I (4) TME2121 Engineering Thermodynamics (4) TME2151 Principles of Mechanical Engineering Materials (4)
Sem 2:	TME2401 Engineering Mathematics II (4) TME2114 Mechanics of Materials II (3) TME2101 Fundamentals of Mechanical Design (4)
SpTerm:	General Education Module 1 (4) General Education Module 2 (4)
2nd Year of studies	
Sem 1:	TME2134 Fluid Mechanics I (4) TME3112 Mechanics of Machines (4) TME3162 Manufacturing Processes (4)
Sem 2:	TME2143 Sensors and Actuators (4) TME2135 Fluid Mechanics II (4) General Education Module 3 (4)
SpTerm:	TTG2415 Ethics in Engineering (4)
3rd Year of studies	
Sem 1:	TME2142 Feedback Control Systems (4) Elective 1 (4) Elective 2 (4) TTG3002* Industrial Practice

Sem 2:	TME3101 Mechanical Systems Design (6)
	TME3122 Heat Transfer (4)
	Elective 3 (4)
	TTG3002* Industrial Practice (8)
SpTerm:	General Education Module 4 (4)
	General Education Module 5 (4)

4th Year of studies	
Sem 1:	Elective 4 (4)
	Elective 5 (4)
	TME4102* BTech Dissertation
Sem 2:	Elective 6 (4)
	TME4102* BTech Dissertation (8)

B. Sample Study Schedule (4-year candidature beginning in Semester 2 of an AY):

1. The number of Modular Credits (MC) of a module is denoted by the number in the bracket.

2. Modules marked with an asterisk (*) are modules stretching over more than one semester and the total number of MCs will only be given upon completion of the module.

1st Year of studies	
Sem 2:	TTG1401 Engineering Mathematics I (4)
	TME2114 Mechanics of Materials II (3)
	TME2101 Fundamentals of Mechanical Design (4)
SpTerm:	General Education Module 1 (4)
	General Education Module 2 (4)
Sem 1:	TME2401 Engineering Mathematics II (4)
	TME2121 Engineering Thermodynamics (4)
	TME2134 Fluid Mechanics I (4)

2nd Year of studies	
Sem 2:	TME2143 Sensors and Actuators (4)
	TME2135 Fluid Mechanics II (4)
	TME3101 Mechanical Systems Design (6)

SpTerm:	General Education Module 3 (4)
Sem 1:	TME2151 Principles of Mechanical Engineering Materials (4) TME3112 Mechanics of Machines (4) TME3162 Manufacturing Processes (4) TTG3002* Industrial Practice

3rd Year of studies

Sem 2:	Elective 1 (4) TME3122 Heat Transfer (4) General Education Module 4 (4) TTG3002* Industrial Practice (8)
SpTerm:	General Education Module 5 (4)
Sem 1:	TME2142 Feedback Control Systems (4) Elective 2 (4) Elective 3 (4)

4th Year of studies

Sem 2:	TME4102* BTech Dissertation Elective 4 (4) Elective 5 (4)
SpTerm:	TME4102* BTech Dissertation TTG2415 Ethics in Engineering (4)
Sem 1:	TME4102* BTech Dissertation (8) Elective 6 (4)

3.5 Financial Assistance

The Ministry of Education (MOE) provides eligible Singaporeans and Singapore Permanent Residents (SPR) taking part-time undergraduate course in the local universities with a substantial tuition fee subsidy.

To be eligible for MOE's tuition fee subsidy, in addition to fulfilling the nationality criteria, students must also satisfy the following:

- At least 21 years old;
- Must not have previously received a government subsidy/sponsorship for a completed first degree; these include first degrees from NUS/NTU/SMU/SUTD/SUSS, or from an overseas university funded by government scholarship/bursary; and
- Must fulfill one of the following:
- 2 years of full-time work experience; OR
- fully discharged the NS liability; OR
- currently employed on a full-time basis.

It should be noted that part-time employment will not be considered as "full-time work experience". A part-time employee is one who works for less than 35 hours a week under a contract of service with an employer.

Finally, as part of Singapore's national initiative of encouraging continuing education and lifelong learning, MOE provides additional subsidy such that **Singaporeans aged 40 and above** will pay tuition fees that are 60% lower than the standard subsidised fees payable by Singaporeans who are below 40 years old.