OT4765 Bachelor of Information Technology

OT4978 Graduate certificate in information technology

OT4979 Graduate diploma in information technology

College of Engineering, Construction and Living Sciences (ECL)

Programme Document

Version 3 - July 2009
Version 4 – March 2020

SUMMARY INFORMATION

Title: Bachelor of Information Technology
Abbreviated Title: **BInfoTech**
Level: 7
Credits: 360
This is a three year programme delivered full-time and part-time.
The programme was delivered for the first time in 1996. It will have a major review on or before 2014.
Business Unit Number (BUN) is 10659
Approvals Database Application Number is:

10659.73 Bachelor of Information Technology
11488.17 OT4978 Graduate Certificate in Information Technology
11489.30 OT4979 Graduate Diploma in Information Technology

Business Unit Number (BUN) is **10659** (Bachelor of Information Technology) for all three programmes
OT4765 Bachelor of Information Technology, OT4978 Graduate Certificate in Information Technology and OT4979 Graduate Diploma in Information Technology

DOCUMENT CONTROL INFORMATION

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Version Control – electronic

Version Number	Approvals Database Number	Academic Board Paper Number	Date Approved	New Programme or Category of change	Summary of Changes, including section numbers	Person Responsible for changes to document
1	10275.00	A12/95	2-Mar-95	New programme		
2	10659.12	A52/02	20-Mar-02	Revised programme document		
3	10659.32	A98/09	22-Jul-09	Revised programme document	Courses moved to 15 credits	Lesley Smith

Version Number	Approvals Database Number	Academic Board Paper Number	Date Approved	New Programme or Category of change	Summary of Changes, including section numbers	Person Responsible for changes to document
4	10659.73	A035/20	12-May-2020	Type 2	Programme Revision	MW/MH
4	11488.17 11489.30	A035/20	12-May-2020		Add OT4978 Graduate Certificate in Information Technology, and OT4978 Graduate Diploma in Information Technology – making only one document for the three qualifications	MW

Table of Contents

1. PROGRAMME PHILOSOPHY RATIONALE and BACKGROUND

1.1. Rationale

This update to the programme document is part of the five-year review cycle. The opportunity has been taken to review the whole qualification to ensure that the graduate profile and pathways through the degree meet current industry and professional requirements.

We acknowledge the ubiquity of information technology in modern society and the need to prepare our learners for a diverse range of professional pathways. We can best serve the information technology industry by producing graduates with a variety of backgrounds, skills, interests and perspectives. Our programme must provide effective pedagogy for a wide range of learners.

To enable us to provide a sufficiently broad educational experience, we require a wide variety of knowledge and skills in our teaching staff. Lecturers have both a pedagogical and a pastoral responsibility to each learner. They should strive to tailor the educational experience to each learner's individual needs. Learners, in turn, are responsible for setting and striving for high personal standards of achievement.

We offer a practical, applied degree with a primary focus on preparing our graduates for immediate employment at a professional level. While acknowledging the value of the theoretical foundations of information technology, we believe that its primary role in an applied degree is to support the acquisition of practical skills and establish a framework for lifelong learning. Our emphasis is therefore on "learning through doing", with pedagogical strategies that emphasise application of knowledge and reflect, as much as possible, the standards and practices of the work environment.

Information technology is a service discipline. Information technology professionals best benefit the wider community when their primary motivation is to understand and adapt to the needs of the client. This ethos is reflected throughout our curriculum in an emphasis on professional ethics and issues of environmental, social, cultural and personal sustainability. Our goal is for our graduates to be able to make decisions that reflect an understanding of the responsibility that they have for those around them.

And finally, we have also taken the opportunity to incorporate the Graduate Certificate in Information Technology and the Graduate Diploma in Information Technology regulations into this document, so that there is only one document for reference.

1.2. Programme Philosophy and Background

The Bachelor of Information Technology (BInfoTech) was accredited in 1995 and was first offered in 1996. The original degree was purchased from Waikato Polytechnic. Significant changes were made before introduction at Otago Polytechnic.

Over the course of its lifetime, internal changes have combined with the external pressure of a rapidly evolving computer technology to force significant evolution in the curriculum. The current structure of the degree bears little resemblance to that originally purchased package and many papers are now offered covering content that did not even exist when the degree was born.

Today the Otago Polytechnic Bachelor of Information Technology has a distinctive character and has developed a reputation for currency, flexibility, community involvement, a supportive learning environment and the production of first-rate graduates.

Our commitment is to deliver an information technology educational programme that is inclusive, up to date, tailored to the individual, industry-focussed, and which rests on a firm foundation of professional ethics and societal responsibility.

Information Technology, as a component of the broader discipline of Computer Science, enjoys a rigorous theoretical foundation incorporating mathematics, linguistic, physics and engineering. For any individual degree programme, the relevance of this material must be considered in the context of the institution's specific goals. As the overarching goal of the Otago Polytechnic Bachelor of Information Technology is to produce work-ready graduates who can make an immediate contribution to the information technology industry, theoretical material must be incorporated into the curriculum in such a way as to support and not interfere with this outcome. For example, the extensive proofs of correctness commonly presented in the study of algorithms are considered to be of minimal value to the professional programmer. Available course time in this area is better devoted to honing of application design and programming technique.

While maintaining a pragmatic focus on current industry needs and practices, it is important not to lose sight of the fact that Information Technology, as an industry and as an academic discipline, changes rapidly. To maintain professional viability after completing their formal education, IT learners must be prepared to seek out and master new techniques, materials and theoretical advances in their areas of expertise. To develop this ability, the Bachelor of Information Technology curriculum progresses toward an increasingly independent learning focus from first year to third.

In parallel with learning the building blocks—the materials—with which the IT practitioner works in courses covering the fundamentals of the discipline, it is also important to learn to use these materials in the context for which they are intended. Thus, as well as learning to use the materials of IT in an educational context, learners will practice applying these using the most up-to-date tools and processes in an industry-like context from day one. This approach aligns well with Otago Polytechnic's focus on building capabilities and experiential learning, allowing learners to build professional habits over the course of their studies.

1.3. Sustainability

In recent years, our position on sustainability has evolved from the early, somewhat naive focus on purely environmental issues (saving electricity through automatic computer shutdowns, correct disposal of eWaste, etc.) to a broader conception of sustainable systems as those which do not overconsume the resources—physical, social and intellectual—which they require to function. This focus is embedded into all aspects of the BIT curriculum.

In addition to being environmentally responsible, a sustainable IT industry must be ethically and societally responsible. Important issues include:

The risk of built-in obsolescence: The digital industries—software and hardware—release new models with frightening frequency. Each year new mobile phones are produced, new software is released, new development environments and libraries are published, and the consumer is assured that all these new items are essential. This leads

to a rapid consumption and discard cycle that is wasteful and expensive. In the BIT we teach learners to observe these commercial pressures with an analytical eye. For example, in our Software Development papers, we demonstrate that, with correct application configuration, it is actually very easy to write software that runs correctly on "old" devices. We promote resource-saving IT practices such as virtualisation (as opposed to physical hardware).

Engaging in Open Source: "Open Source Software" (OSS) describes code that is made public and may be used free of charge. Members of the "open source community" are encouraged to use OSS for their projects and to extend and contribute to open source code bases. OSS simultaneously makes software available to a range of users who might be unable to afford the high licensing costs of proprietary software and leverages the skills of many thousands of programming learners and professionals to strengthen and develop that software. The model is strong, pervasive and inherently sustainable as those who need to use the software are able to ensure that it continues to meet their requirements. Many influential software projects have been Open Source since their inception (e.g. the Linux operating system and the Android Mobile development libraries). Recently, even Microsoft—long a "proprietary-only" vendor—has made its Visual Studio development environment open source. The OSS movement is now so embedded in the industry that it is considered standard practice for programmers to include on their CVs links to their open source contributions.

In our programme we have for a long time encouraged participation in the Open Source community both explicitly and implicitly. For example, in 2016 we had a software engineer from Canonical (the Ubuntu arm of the Linux operating system project) speak to our learners about how best to become involved in Open Source. We train learners thoroughly in the tools they must use to make contributions to the OSS community (e.g. code collaboration and version control hosting platforms such as, in 2019, GitHub). Most importantly, we choose Open Source software whenever possible for use in our own classes.

Social Issues in IT: Sustainability in IT also involves a variety of non-technical issues. For example, to be sustainable, an industry must be diverse. An industry that does not include a wide variety of viewpoints and outlooks will become stagnant—i.e. is not sustainable. We are therefore concerned about the known lack of both gender and ethnic diversity in the IT industry. We encourage discussion of these issues in our classes and, as much as is possible, strive to broaden our own diversity by ensuring that learners of all cultural backgrounds and genders find an accepting and supportive home in our programme. A sustainable industry must be equitable. Thus, we are concerned at the international "digital divide" where wealthy countries have access to IT facilities that developing countries do not. We encourage our learners to be aware of this issue by, for example, teaching methods for web site development that make content available to the millions of users world-wide who have no smart phones or internet access (i.e. they use feature phones and cell transmission only). A sustainable industry must support the health and well-being of its participants. Thus, we encourage our learners to develop a clear concept of work-life balance, and to view the "real geeks are online 24-7" stereotype sceptically.

Ethics in IT: The growth in online storage of personal data—financial, health, personal—has introduced critical ethical concerns for IT professionals. We believe this is, in fact, a sustainability issue, in that to be sustainable, an industry must not be harmful. Our learners are taught both the technical aspects of digital security and the professional aspects—the ethical responsibilities of those who potentially have access to the private data of others. These issues are embedded in every paper, along with related ethical concerns such as digital rights management, risks of anonymous discourse (trolling), and online safety.

Throughout the programme we endeavour to help learners understand and internalise all precepts of ethical, sustainable and socially responsible behaviour to prepare them to become positive, contributing members of the IT industry, and modern digital society.

1.4. Research and Enterprise

After teaching and learner support, formal research is the highest priority task of the staff of the BIT. At the time of writing, we have ongoing research projects in computer science education, assistive technologies, multi-agent systems, digital tools for group interaction and collaboration, use of computer games for language instruction in primary schools, and the implementation of LoRaWAN networks for the Internet of Things.

Staff research directly informs our teaching practice in two ways: First, many of our staff publish action research in computer education itself. That is, part of the research programme is the testing and analysis of specific classroom interventions, curricular manipulations, etc. Formal experimental methodologies and statistical tests of efficacy allow us to identify those approaches that are most useful for the teaching of complex and challenging subjects such as computer programming. Inclusion of these methods strengthens our work "at the coal face". Publication of our results allows us to share our knowledge with CS educators in New Zealand and internationally. Our CS education works has won awards (Wood, Parsons, & Haden, 2015) and numerous studies and teaching materials have incorporated our techniques (see Parsons & Haden, 2002)

Second, learners are able to participate in research activities through the 3rd Year Studio courses. Currently, both the Assistive Technology and LoRaWAN research programmes include teams of senior learners, with a supervising staff member as principal investigator. Through this work, learners acquire formal methodological skills, and more general experience with research as an act of intellectual inquiry.

Skills for structured knowledge search and exploration are intentionally incorporated into all 3rd Year projects, regardless of intended publication outcomes, as learners are supported to perform literature reviews, data collection, and critical analyses of information. While most overtly placed in the 3rd year Studio, the value of information exploration is highlighted in all papers, across all years. For example, in Year 1 learners do a number of small development projects where they are responsible for choosing and researching their project topics.

Throughout learner-involved research, the BIT maintains an emphasis on community value and engagement. For example, learners in our first Web Development paper build web sites for a local school, charity or small business. Recent 3rd Year projects focus on assistive technology, a project to improve scheduling of deliveries for Meals on Wheels volunteers, a mobile application to help users learn Māori vocabulary and another to aid visitors to the Dunedin Botanic Garden.

Our goal is for learners to become intellectually adventurous, independent learners who are aware of the impact of IT on society.

1.5. Internationalisation

The information technology industry operates in a global environment, conducting business across physical and political boundaries. Learners studying in this domain need to be

prepared for the international and intercultural issues that may affect their work, whether in the context of development projects, teamwork or the competitive business environment.

The Bachelor of Information Technology curriculum has been developed with reference to international benchmarks such as the ACM Computing Curriculum (2008) and guided by the New Zealand International Education Strategy 2018 – 2030. This curriculum is designed to "facilitate the movement of professionals across nations."

Learners are prepared for work in the international community through the use of modern software, modern industry protocols and global digital community participation through online communication tools and participation in the Open Source Software community.

Significant numbers of international learners complete the Bachelor of Information Technology, with representation from India, China, the Philippines and the Pacific Islands. These learners bring a wider perspective to the classroom and often incorporate their cultural heritage into project work.

The School of Information Technology works closely with International Office and wider agencies to ensure that international learners are fully supported in the classroom, in accordance with the Ministry of Education Code of Practice for the Pastoral Care of International Learners.

It has been our experience that international learners benefit most if they enter the BIT as first-year learners and complete the entire programme of study. This is true even for learners who have had prior formal IT education in their home countries. In many cases, the educational model of their previous institutions is much more narrowly focussed than ours. With a narrow skill set—even if highly proficient—international learners have struggled to find employment in the New Zealand IT industry, where a general and flexible training is highly valued. We thus recommend that international learners spend the entire three years with us if possible, gaining a broad and solid IT foundation, along with an area of advanced specialisation. This will prepare them for the NZ IT job market.

1.6. Learner Capability Framework

From 2020 all Otago Polytechnic learners will be offered the opportunity to use the ‘I am Capable’ online platform to showcase their work-ready skills. The work-ready, or transferable skills are integrated into the teaching of programmes across OP. We have stated that Otago Polytechnic graduates are capable; this means they are personally effective, future focused and able to practise sustainably. The Capability Framework sets out the characteristics and key behavioural indicators for each of OP's twenty-five learner capabilities.

The framework and its associated tools are intended to be used by staff and learners within each programme in several ways. The framework will guide the development of learning activities that purposefully build capability. The online am Capable self-assessment tool enables learners, in collaboration with teachers, mentors, workplace supervisors and peers to measure and track their capability development. Evidence of capability gathered by learners and assessed by staff help to build a graduate's capability profile that can be provided to future employers.

In this way, Otago Polytechnic graduates can provide future employers with evidence both of qualification attainment and level of capability as identified through the framework.

2. PROGRAMME AIM and OUTCOMES

Bachelor of Information Technology

2.1. Aim

The aim of Otago Polytechnic Bachelor of Information Technology is to prepare work-ready information technology professionals who are able to make an immediate contribution to the IT industry. Our graduates will have attained a recognised qualification which has prepared them for entry into a wide range of IT fields, including: software design and development, systems administration, IT infrastructure and operations, network administration and support, IT training, IT service and support. They will be critical thinkers who are able to maintain discipline currency in a rapidly changing industry throughout their careers.

2.2. Graduate Profile

Graduates of the Otago Polytechnic Bachelor of Information Technology will have a solid foundation of skills and knowledge across the IT discipline, with in-depth understanding of their chosen areas of specialisation. They will be pragmatic and work-ready but will also have the ability to independently acquire new information and to apply their training to novel problems. They will have experience with real clients and colleagues and be prepared to step directly into a professional role in the IT industry.

By the end of this programme learners will:

- Demonstrate a broad foundation of knowledge and skills suitable for a range of careers involving Information Technology.
- Apply Information Technology industry tools, processes and standards to respond to organisational, cultural and community requirements.
- Apply critical thinking and independent judgement to develop Information Technology solutions to complex real-world problems.
- Engage in independent learning to maintain discipline currency in a rapidly changing Information Technology industry.
- Be prepared to contribute effectively as a member or leader in diverse cross functional Information Technology teams.
- Integrate cultural, ethical and sustainable practice consistent with Information Technology codes of conduct and informed by the principles of Te Tiriti O Waitangi.

Graduate Certificate in Information Technology and Graduate Diploma in Technology

2.3. Aim

The purpose of the qualifications is to allow graduates, or those deemed to have degree-equivalent status, from a range of disciplines to gain useful skills and a qualification in Information Technology.

Graduate Certificate in Information Technology

The Graduate Certificate in Information Technology is designed as a vehicle/medium for graduates to broaden or deepen skills or knowledge already gained in their own domain of study in an undergraduate programme; as bridging programmes for graduates developing educational, professional or vocational knowledge in a new but complementary discipline, profession or subject area.

Graduate Diploma in Information Technology

The Graduate Diploma in Information Technology is designed as a vehicle for graduates (or those deemed to have equivalent status) to pursue further study at an undergraduate level. The structure is designed to allow the broadening of knowledge and skills in their own domain of study or to enhance what has been studied previously by developing knowledge and skills in a new but complementary area.

With the qualification requiring a minimum of 72 credits at level 7, it provides an opportunity for learners to immerse themselves in a specialist subject area at a high level in one year.

2.4. Graduate Profile

By the end of this programme learners will:

- Demonstrate a broad foundation of knowledge and skills suitable for a range of careers involving Information Technology.
- Apply Information Technology industry tools, processes and standards to respond to organisational, cultural and community requirements.
- Apply critical thinking and independent judgement to develop Information Technology solutions to complex real-world problems.
- Engage in independent learning to maintain discipline currency in a rapidly changing Information Technology industry.
- Be prepared to contribute effectively as a member or leader in diverse cross functional Information Technology teams.
- Integrate cultural, ethical and sustainable practice consistent with Information Technology codes of conduct and informed by the principles of Te Tiriti O Waitangi.

In general, employment opportunities for graduates are to provide re-entry to the work force through up-skilling or for those currently employed to provide increased capabilities and competencies within the context of a coherent path of study.

Graduates from this programme will be able to enter, re-enter or continue employment, with the understanding that they are 'au fait' with the most recent practices pertaining to the information technology industry, have leading-edge knowledge of this industry and be capable of applying these skills in the workplace.

Information technology is increasingly at the forefront of many fields. People with backgrounds other than Information Technology benefit from enhancing information technology skills in a manner that would contribute to their own domain of study. By undertaking study made up of Bachelor of Information Technology courses students can build on and enhance what they have done previously. As graduates, they will have developed study skills and a mature attitude to learning and will also bring a varied perspective from previous degree level study. Computing professionals will also benefit from this course in broadening and deepening their knowledge base.

Depending on specific entry requirements into post graduate programmes, these qualifications may enable entry into post-graduate study.

2.5. Pathways

It is envisaged learners will be graduates, or those deemed to have degree-equivalent status, including

- New graduates wanting to 'change direction' or enhance the scope of their degree or other prior qualification
- People planning to return to work who need to update skills/knowledge
- People anticipating postgraduate study but who need to engage in study at a lower level to boost their confidence
- People seeking to develop their knowledge in related fields

Those people utilizing these programmes for professional development purposes

An indicative pathways structure foe these programmes can be found in Appendix 4.

3. PROGRAMME DESIGN

3.1. Title of the Programme

The title of the programme is appropriate.

Title: Bachelor of Information Technology

Abbreviation: BInfoTech

This is a 3 year full-time programme - . ~~34~~ 32 teaching weeks, 8 holiday weeks, gross weeks ~~42~~ 40 per year.

Title: Graduate Diploma in Information Technology

Abbreviation: GradDipInfoTech

This is a one year full-time programme - ~~34~~ 32 teaching weeks, 8 holiday weeks, gross weeks 40 ~~42~~

Title: Graduate Certificate in Information Technology

Abbreviation: GradCertInfoTech

This is a 60 credit programme delivered over semester full-time – ~~17~~ 16 teaching weeks, 2 holiday weeks, gross weeks 18 ~~19~~.

3.2. Relationship with Treaty of Waitangi/ Engagement with Kai Tahu

In 2004, Otago Polytechnic signed a Memorandum of Understanding (MOU) with kā Papatipu Rūnaka ki Araiteuru as its Treaty partner, and all programmes have an obligation to consult with rūnaka via Komiti Kāwanataka (a sub-committee of the Polytechnic Council) as part of the development process. As a result of the MOU, Otago Polytechnic established the position of Kaitohutohu at an executive level. Komiti Kāwanataka was established at a governance level to provide a strong functional relationship between kā Papatipu Rūnaka, the Polytechnic Council and senior management to ensure an effective Treaty relationship.

The Māori Strategic Framework (MSF), was developed by Kōmiti Kāwanataka and launched in November 2006. It provides the vision, guiding principles and priorities for the Polytechnic, articulating our ongoing commitment to our Treaty partner. All programme development is aligned to this framework.

The Information Technology programmes support the MOU and contribute to the achievement of the MSF priorities in a number of ways, e.g. increasing Māori learner achievement via strategies for recruitment and retention; offering local Maori businesses the opportunity to work with 3rd project learners; and consultation with our Maori learners to create a more inclusive leaning environment. Academic staff continue to update their knowledge of the Treaty of Waitangi and all staff are encouraged to complete Te Reo for Workplace Edubits.

3.3. Structure of the Programme

The structure of the programme is appropriate to the aim, content and learner needs.

The compulsory and elective combination of components is consistent with the aim of the programme.

The combination of components makes a coherent programme.

Bachelor of Information Technology

Compulsory first year courses provide a broad general knowledge base for all learners. Curriculum delivery typically follows a spiral model with topics addressed several times throughout the programme with increasing depth. In their second and third years, learners can choose to specialise in areas of interest (threads). A graduate of the degree programme will be aware of current developments across the field and will have expertise in at least one thread and a firm foundational understanding of the others. Identified major threads are:

- Software development
- IT Infrastructure and operations
- Network engineering
- Alternative digital platforms (hardware, IoT, etc.)

Courses in the Bachelor of Information Technology programme are based on a 15 credit model, in keeping with similar qualifications across New Zealand. Learners take four courses each semester, over a two-semester year. Semesters are 16 weeks long, including one assessment week.

A standard learner pathway will consist of:

- Eight compulsory Level 5 courses in first year
- Two compulsory Studio Level 6 papers and six Level 6 elective courses in second year
- Two compulsory Studio Level 7 papers and five Level 7 elective courses and one other 15 credit course from Level 5, 6 or 7

Variations are possible within these rules – learners could replace a Level 6 course with a Level 7, and the 15 additional credits can be drawn from courses outside the Bachelor of Information Technology, using unspecified credits.

Graduate Certificate in Information Technology

Courses for the Graduate Certificate in Information Technology are approved courses from the Bachelor of Information Technology.

A standard learner pathway will consist of:

Four courses, of which 3 must be at level 7.

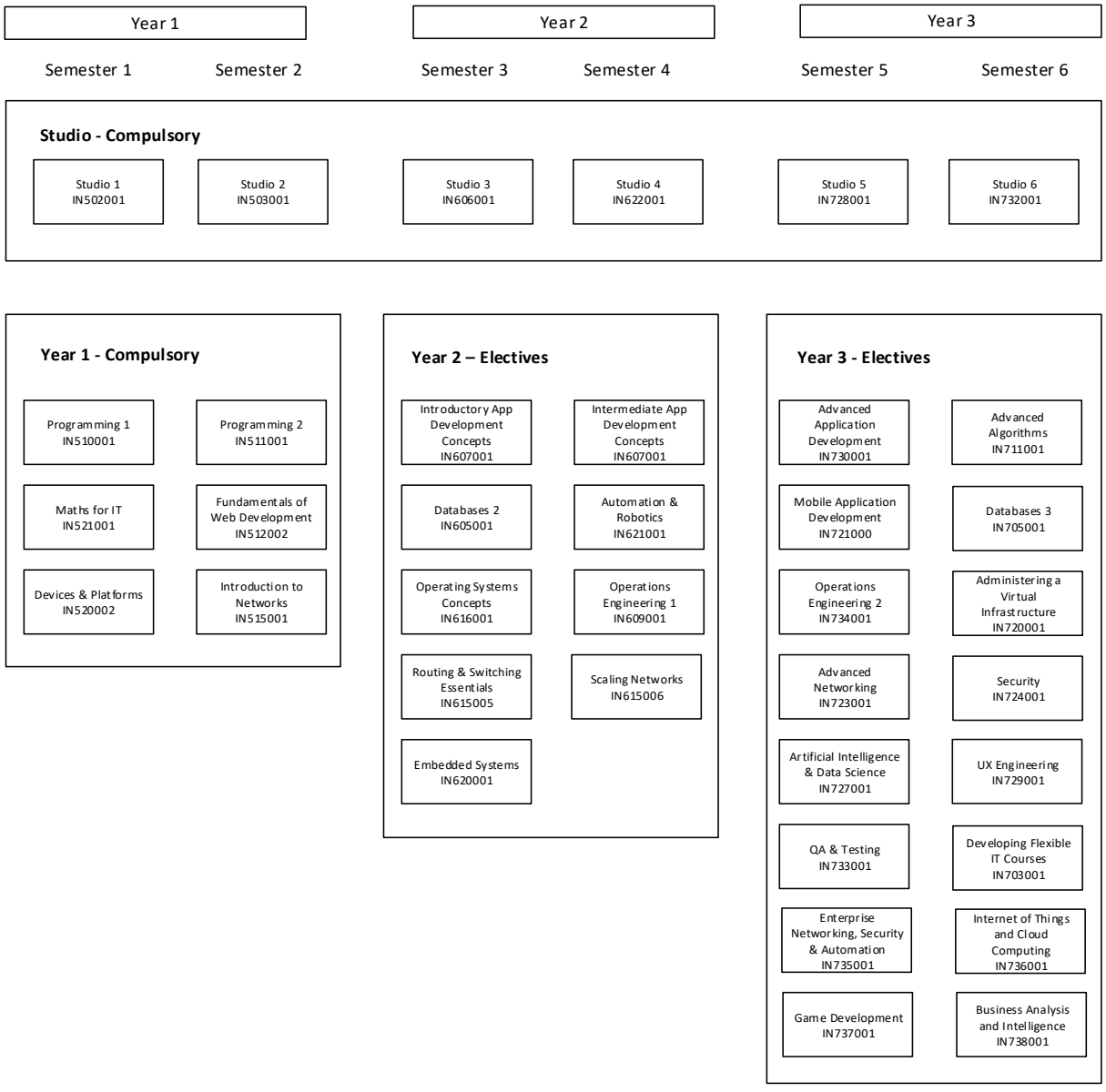
Graduate Diploma in Information Technology

Courses for the Graduate Certificate in Information Technology are approved courses from the Bachelor of Information Technology.

A standard learner pathway will consist of:

Eight courses, of which 5 must be at level 7.

Bachelor of Information Technology programme Structure Diagram



3.4. Studio

Studio is a new offering that takes the traditional approach of the older third year Project model and extends it through the degree as a compulsory paper in each semester. Studio replaces the older papers of Professional Practice, Systems Analysis and Software Engineering while assimilating and delivering key components of these to ensure graduate profile outcomes e.g. professionalism and ethics. The Studio concept looks at the degree from a top down perspective considering how graduates can best be prepared for real-world working environments. Historically Project has done this in year three; however, many learners did not feel well prepared for this environment and struggled to maximise its benefits. Studio will take this approach from year one, starting with curated in-house projects and gradually moving onto projects with real world clients. Studio projects will allow learners to utilise and further develop technical skills taught within their compulsory and elective papers. From day one Studio will place a strong emphasis on promoting teamwork, collaboration, communication, professionalism and integrity, all of which have been identified by the Learner Capability Framework and our PEAC as highly desirable characteristics in our graduates.

Within Studio, learners will gain greater exposure to and a better understanding of the software development and service delivery methodologies employed in the industry (e.g. Agile, ITIL) which strongly influence the ways in which IT teams function and work together. Studio will not be tied to any explicit methodologies but flexible enough to adjust to trends in the industry. The Studio papers will use competency based assessment.

Competency based assessment is introduced specifically for the new Studio courses. The Studio courses are designed to foster professional attitudes in order to ensure work-readiness; as such, the assessments in these courses resemble the type of Performance and Development Review process an employee might encounter to judge their performance in the workplace. Each semester a learner will be assessed at a final Performance and Development review meeting in which they will discuss evidence that they have completed the work required to achieve the course's objectives. As this meeting will take place at the end of the course, there will not be an opportunity for a resit without redoing the course, but one or more formative meetings are held throughout the semester to ensure the learner is performing to the required standards and to put more support in place if this is not the case. The assessments are designed to allow reasonable opportunity for learners to achieve each objective according to context and circumstances, using evidence and judgement statements to set clear parameters for each objective.

3.5. Path of Study

It has been recognised by local industry that a strength of the BIT programme is that learners graduate with a broad IT skillset. The Bachelor of Information Technology does not have explicit specialisations. However, the programme is flexible enough to provide study options in several specialist areas. When electives become available in second and third year, learners are required to study within more than one specialist area as no single 'thread' can consume all electives. This is by design to ensure leaners graduate with a more comprehensive skillset and are more desirable within the industry as they are better equipped to learn and adapt to new technologies.

At the end of each year, all leaners will engage in an internal process called 'Path of Study'. The Path of Study process requires that each learner has a formal one on one meeting with a lecturer of their choice to plan their elective course selections for the following year.

The Path of Study process offers significant benefits to learners, including:

- To validate that the learner's chosen study pathway (elective choices) will best lead to the learner's desired outcome post-graduation.
- To offer guidance in identifying an IT career path that is sought by industry or to ensure options are kept open when a specific area of interest or career has yet to be identified.
- To ensure chosen elective courses fulfil any perquisite requirements for identified paths of study.

To assist with the path of study process three common industry pathways have been identified and are provided in the diagrams in Appendix 4. Each pathway indicates courses that should be taken to maximise the learning within that field. Space is available within each pathway for additional elective courses to be taken from other specialist areas.

Paths of study can be found in Appendix 4

3.6. Transition Arrangements

BIT programme changes will be rolled out in two stages.

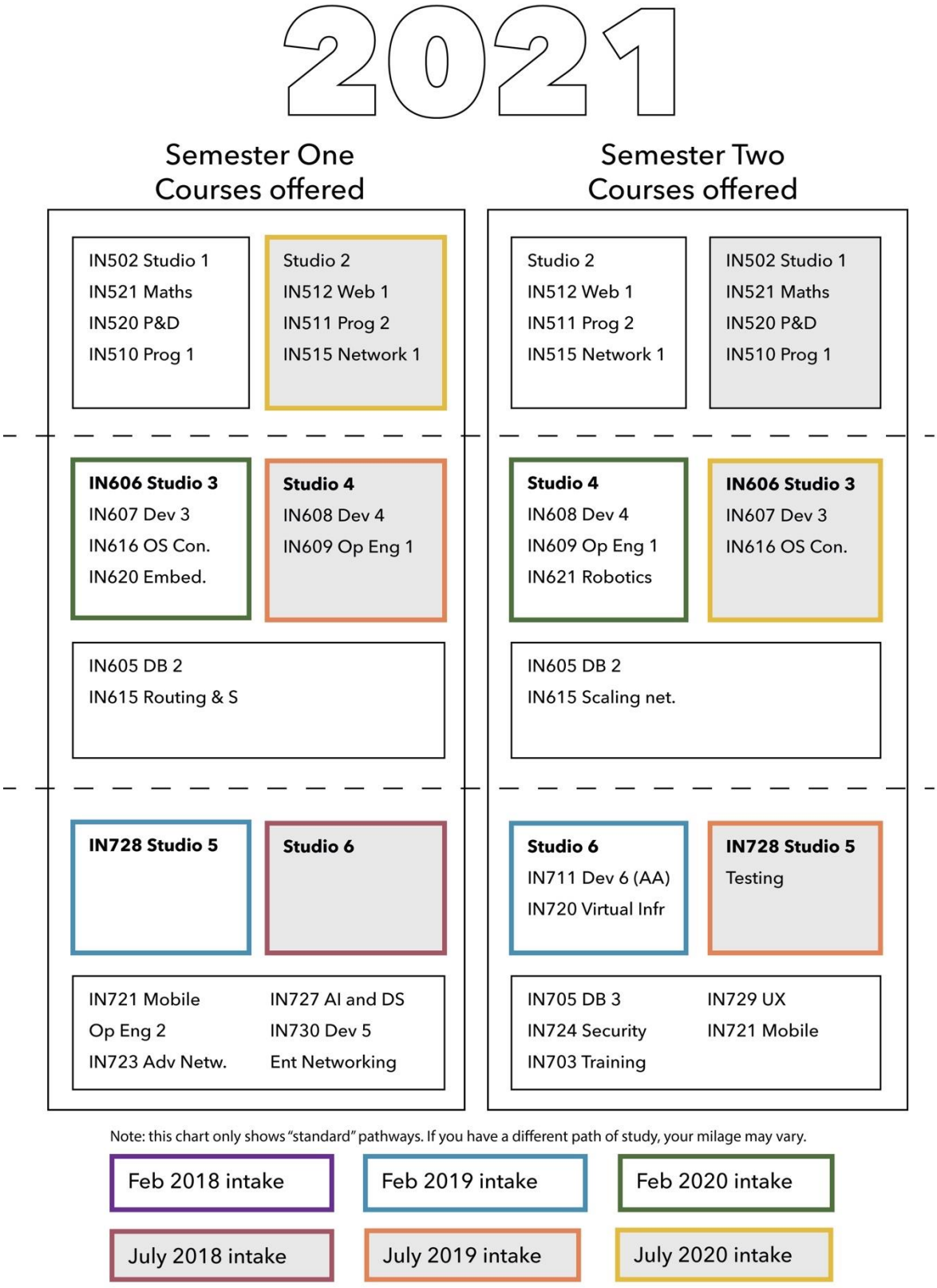
- The first stage is intended for delivery in semester two of 2020. This is reflected in the '2020 Course Schedule' provided below.
- The second stage changes are for delivery in semester one of 2021. At this time the schedule of courses will reflect the programme structure defined in 3.3

To assist with the transition a planning chart has been compiled that through the process of identifying a learner's starting year/semester cohort indicates which papers a learner should choose from in order to maintain their existing pathway. Exceptions for more complex learner pathways, such as for those returning from a break in study, are handled within the mandatory one on one learner path of study meetings.

Lecturers are aware that during the transition period and potentially later, learners may come into newer courses from pathways consisting of older papers. Individualised pathways can be negotiated to ensure learners are not disadvantaged and can complete course learning outcomes. Such cases are mostly confined within the Programming thread and Studio papers. Course pre-requisites have been adjusted to reflect old and new pathways.

BIT course transition charts for 2020 and 2021

Notes:
1. "Dev" means "Application Development" so Dev 1 is Introductory Application Development and so on.
2. OS Concepts is Operating Systems Concepts
3. "Training" is Developing Flexible IT Courses



Programme Management

3.7. Programme Ownership

The programme is owned and managed by a clearly identified organisation.

This programme is owned and managed by Otago Polytechnic.

3.8. Off-site Practical/Work Based Components

There are arrangements for ensuring that any off-site practical/work-based components are fully integrated into the relevant programmes.

3.9. Work Based Components

In this programme, off-site practical components will comply with Otago Polytechnic safety requirements and requirements for contracts with employers.

3.10. Approval of Sites (Workplace)

Workplace sites approval is not required for this programme.

3.11. Approval of sites (Delivery)

This programme is approved for delivery in Dunedin (6013/01), and Auckland (6013/06)

3.12. Delivery Methods

This programme is approved for face-to-face, blended and distance delivery.

4. PROGRAMME REGULATIONS

4.1. Length of the Programme

The length of the programme is clearly defined and appropriate.

3 year/s full-time – 32 teaching weeks, 8 holiday weeks, gross weeks 40 per year.

4.2. Admission to the Programme – Bachelor of Information Technology

Minimum academic entry criteria:

University Entrance (UE):

NCEA Level 3 including:

Three subjects at Level 3 or above, made up of:

- 14 credits in three approved subjects
- Remaining credits may come from either achievement or unit standards

And

Literacy -10 credits at Level 2 or above, made up of:

- 5 credits in reading
- 5 credits in writing

And

Numeracy -10 credits at Level 1 or above, made up of:

- achievement standards - specified achievement standards available through a range of subjects, or
- unit standards - package of three numeracy unit standards (26623, 26626, 26627 - all three required)

OR

NZ2594 New Zealand Certificate in Information Technology Essentials (Level 4) or equivalent

Discretionary entry may be given to applicants over 20 years of age who do not have University Entrance. The Bachelor of Information Technology programme leader will interview and assess the formal and informal learning of these applications.

An interview can be requested at the discretion of the Bachelor of Information Technology programme leader.

4.3. Admission to the Programme – Graduate Certificate in Information Technology and Graduate Diploma in Information Technology

Minimum academic entry criteria:

Minimum entry requirements for students who wish to enrol in these graduate certificates or graduate diploma are an undergraduate degree qualification in computing or a related discipline or degree-equivalent practical, professional or scholarly experience.

Applicants will be engaged in a Path of Study process, which provides guidance with course selection and ensures learners have the required prerequisite knowledge.

4.4. International Learners

In addition to meeting the entry criteria outlined as above, the following criterion also applies:

Overall Academic IELTS 6.0 with no individual band score lower than 5.5 (achieved in one test completed in the last two years), or

Acceptable alternative evidence of the required IELTS (see the NZQA proficiency table for list of recognised proficiency tests).

Refer to AP0520 English Language Requirements for International Learners and those for whom English is an additional language.

4.5. Recognition of Prior Learning, Cross Credit, and Credit Transfer

The programme utilises the Otago Polytechnic institutions policy as per expectations for degree programmes.
Refer to AP0501 Recognition of Prior Learning.

4.6. Assessment

Availability of Assessment in Te Reo
Refer to AP0900.06 Assessment.

Reassessment/Resits
Reassessments/resits are not part of a bachelor degree programme.

Resubmissions
Learners may be requested to resubmit an assessment following a rework of part/s of the original assessment. Resubmissions are completed within a short time frame (no more than five working days) and must be completed within the timing of the course to which the assessment relates. A resubmission does not count as a reassessment.

Criteria for an Aegrotat Pass & Impaired Performance
Refer to AP0907.01 Impaired Performance Aegrotat.

Appeals Process
Refer to AP0600 Academic Appeal Process for Learners.

Learner Rights and Responsibilities

All learners can access learner rights and responsibilities and other information via the Otago Polytechnic website.

Course Outlines
Each paper has a course outline that is created using a standardised template. The course outline has all the details of the course including learning outcomes, timetable, learning schedule, assessment details, etc. Course outlines will be held in a central repository and be provided to all learners in the first class for each paper.

4.7. Moderation

The BIT Assessment Committee is responsible for both pre and post moderation of all assessments.

- Monitors the overall assessment processes used in each course to ensure validity, reliability and usability of assessments, and compatibility with the intent of curricula.
- Monitors that the assessment processes presented reflect the outcomes of the course as a whole.
- Monitors that criteria applied to the assessment are consistent with the outcomes and content of the course.
- Ensures that the moderation processes are established which can ensure that the assessment processes are fair.
- Monitors each assessment to ensure that it reflects the outcomes of the course and the appropriate criteria are in place to enable consistent application of assessments.
- Ensures consistency of marking criteria.
- Consultation with the course coordinators to ensure that a moderation process is in place for each assessment.
- Reports to College Assessment Committee and bring to their notice any aspects of the assessment process which requires further consideration.
- Ratify final results of learner assessments at the end of each semester.
- Provide advisory role when requested regarding learner appeals and learners for concern.

Institutional Moderation or Assessment policy (which covers both internal and external moderation) - refer to : AP0908.01 Moderation of Assessment

4.8. Progression –

4.9. Bachelor of Information Technology

Learners are required to complete the Bachelor of Information Technology within six years from the commencement of study. Learners are able to complete the programme as a part-time learner. All learners will be offered academic advice in planning their studies.

All learners are required to take the six compulsory Studio papers (IN502001 Studio1, IN503001 Studio2, IN606001 Studio3, IN622001 Studio4, IN728001 Studio5, IN732001 Studio6) throughout the degree. If a learner does not pass a Studio paper, it should be repeated as a priority over any other papers.

Pre-requisites are used for many papers to ensure that learners have the necessary skills and knowledge. All learners have access to the list of pre-requisites. This discussion forms the basis of the individual yearly path of study meetings.

Course prerequisites can be waved at the discretion of the Programme Leader.

Learners can only enrol in each paper a maximum of three times. If the learner does not pass any of compulsory papers (the six Studio papers) on the third enrolment, the learner will be required to leave the programme. Refer to AP0521 Programme Entry Continuation and Exclusion.

4.10. Graduate Certificate and Diploma in Information Technology

Learners are required to complete the Graduate Certificate in Information Technology within two years from the commencement of study and the Graduate Diploma in Information Technology within four years. Learners are able to complete the programme as a part-time learner. All learners will be offered academic advice in planning their studies.

All learners are required to take the IN732001 Studio 6 course.

Pre-requisites are used for many papers to ensure that learners have the necessary skills and knowledge. All learners have access to the list of pre-requisites. This discussion forms the basis of the individual path of study.

Course prerequisites can be waved at the discretion of the Programme Leader.

Learners can only enrol in each paper a maximum of three times

4.11. Certification

The title and nomenclature of the programme accord with NZQA's interpretation.

OT4765 Bachelor of Information Technology

To be awarded the **Bachelor of Information Technology**, learners must successfully complete 360 credits with at least 75 credits at level 7, and must pass all compulsory papers identified in the programme structure diagram/Programme schedule.

To be awarded the Bachelor of Information Technology, with Merit a learner must achieve a credit weighted average in the "B to B+ grade range" (70-79%) over all courses within the last year of the qualification

To be awarded the Bachelor of Information Technology, with Distinction a learner must achieve a credit weighted average in the "A grade range" (≥ 80%) over all courses within the last year of the qualification.

Refer to Otago Polytechnic policy Grade Tables, Honours, Distinction and Merit

OT4978 Graduate Certificate in Information Technology (Level 7)

To be awarded the **Graduate Certificate in Information Technology (Level 7),** students must successfully complete 60 credits at level 5 or above with a minimum 45 credits at level 7 or above. All students must complete IN732001 Studio 6.

OT4979 Graduate Diploma in Information Technology

To be awarded the **Graduate Diploma in Information Technology,** students must complete 120 credits at level 5 or above with a minimum of 75 credits at level 7.All students must complete IN732001 Studio 6.

Credits from the achievement of the Graduate Certificate in Information Technology (Level 7), may be counted towards the Graduate Diploma in Information Technology.

4.12. Grade Table

This programme utilises both competency-based assessment and criterion referenced assessment. The grade tables are:

C:GNQF - GENERIC NQF GRADE TABLE

J:CRA - GRADE TABLE: CRITERION REFERENCED ASSESSMENT

Refer to Otago Polytechnic policy Grade Tables, Honours, Distinction and Merit

5. PROGRAMME DELIVERY

5.1. Experiential Learning

Experiential learning is the underpinning learning and teaching methodology used at Otago Polytechnic. It is used to facilitate learning through experience, reflection and taking action. In addition to experiential learning all Otago Polytechnic programmes are required to use a blended learning approach. All programmes must provide opportunities for online learning, authentic work experiences and learner-managed learning. Programmes are expected to embed experiential learning and blended learning as part of the curriculum design process.

Definition: Experiential learning is learning through reflecting on experience within the context of programmes and courses, including the face-to-face activities, online activities, learner-managed activities and authentic work experiences that have been designed to enable learning.

Further explanation: Experiential learning experiences are designed to engage learners in an activity and to initiate the reflection process. Learning takes place through a cycle whereby learners reflect on the activity (think about it; asking 'what?'), explore abstract concepts (ideas, theories, beliefs; asking 'so what?') and make connections between theory and the learner's actual experiences (linking, correlations, relationships; asking 'now what?') and apply this learning to new activities or work contexts (take action).

The experiential learning cycle encourages learners to think more deeply, reflect, develop critical-thinking skills, transfer their learning into action and apply what they learned in one situation into another. Experiential learning happens through the learner's reflection "in" and "on" experiences using analytic skills (investigation and questioning). The cycle includes more than one reflection point. It involves constant reflecting, reinforcing and re-examining to gain a deep understanding. It can occur with or without facilitation by a teacher.

Learning through everyday experience is not enough; it is the on-going reflective process of multiple cycles of action, reflection and taking action as a result of the reflection that facilitates an individual's learning. Through this process learners will develop their own understandings and conclusions relevant to them. The learning will be personal to each learner and the teacher cannot predict the learning an individual will take from the experience.

Individuals may take very different messages from a single event. When learners engage in on-going cycles of experience/activity, reflection, conceptual thinking and identification and application of learning their learning is enhanced. A learning experience is a means to an end, not an end in itself. The essence of effective experiential learning is that the entire process is centred on the learner and not the task, allowing the learner to derive meaning from an experience and developing the learner as an individual.

Teachers can support experiential learning by:

Creating an appropriate learning environment where learners are able to undertake each element of the experiential learning cycle safely to develop reflection skills and critical thinking skills

Designing a meaningful experience (activity) that will initiate the experiential learning process

Guiding thinking, purposefully questioning and challenging learners' thinking to develop understanding

Ensuring that any conceptual thinking is progressed to meaningful conclusion and opportunities for improvement identified

Where appropriate, ensuring opportunities for learners to plan their own learning outcomes within specific courses such as electives and within specific assessments, e.g. learner managed projects.

How does the programme incorporate experiential learning into course design?

In an applied technical programme such as ours, a critical pedagogical challenge is the connection of theory to practice. Without a solid foundation in theory, learners gain only superficial mechanical skills and will struggle to extend their mastery to novel contexts and problems. Without application of theory, learners gain only an abstract understanding but are not able to *do.* We make the bridge between theory and practice with a tightly scaffolded curriculum designed to flow smoothly across all three years of the degree, in which theoretical principles are introduced in well-delineated modules, and **always** accompanied by a connected practical task, activity or project that demonstrates the practical application of the theoretical material. Theoretical content, even in areas such as mathematics, is presented in a realistic IT context that allows learners to understand the relevance of the material and to incorporate the new material into their existing cognitive schemata.

In the earliest years, the connection of theory to practice is made explicit, with the tutor describing, for example, how modulo arithmetic is used in the management of computer passwords. As the learner progresses through the degree, they are gradually led to make these connections independently, through analysis and reflection. In their final advanced programming paper, for example, learners are required to choose between alternative algorithms for solving complex real-world software problems by performing theoretical efficiency analyses.

Our tightly scaffolded curriculum, in which content elements are carefully ordered across all years, and each new element builds carefully upon those previously mastered, allows for a flexible and iterative learning experience. For example, in early programming papers, initial weeks are spent implementing a set of related code modules. Each module is part of a formative assessment, so learners receive detailed guidance and support during construction, and feedback about their work upon completion. They refactor and modify their code in response. Learners then perform a large summative assessment project which uses the code modules they have already built. This process requires an integration of course material—both theoretical and conceptual—leading to an even richer understanding.

The process is inherently experiential, contextualised in the real world, cognitively constructive, iterative, individual, requiring reflection and deep problem solving.

5.2. Blended Learning

Definition: Learning through a blend of modes including face-to-face, online, authentic work experiences and learner-managed learning.

Further explanation: All Otago Polytechnic on-campus programmes will be designed to ensure learning opportunities that blend face-to-face learning, on-line learning, authentic work experiences and learner-managed learning. While programmes must blend these four modes, individual courses may use single modes or a combination of modes to best facilitate learner learning within the course. All learning opportunities will be underpinned by experiential learning.

Face-to-face learning is where learners are physically present with others involved in the learning process. For example: classroom learning experiences; small group tutorials; laboratories; studios; community experiences; and learner projects.

On-line learning uses electronic technology to deliver learning materials and activities. Learners can engage in online learning activities at the same time (synchronous), for example in online tutorials or discussion. Learner can engage with online activities in their own time (asynchronous), for example working through modules on the Learning Management System or website, posting a blog or engaging in a discussion forum. For all courses learners will have online access to course information including timetables, assessments, online modules, work experience information and course-related messages from teachers.

Authentic work experiences cover a wide range of learning opportunities focussed on work. These might be real work experiences, or they might be interactive learning activities that have been designed to replicate as much as possible the tasks or activities or settings of real-world work. In other words, activities that are designed to 'feel' like a real workplace situation.

Learner-managed learning can be in any mode. It is where the learner engages in learning activities without the presence of the teacher and the learner is required to self-manage to complete the activity within the expected timeframe. The learning activities may be designed by the teacher but carried out by the learner alone or in groups, for example in a learner-managed project, asynchronous online learning or preparation of an assessment task. Learner-managed learning can also be learner-directed whereby the learner chooses to explore topics of interest to them as an adjunct to the formal learning designed by the teacher.

How does the programme incorporate blended learning into course design?

We are preparing learners to work in the Information Technology industry. To this end, they must be familiar with the wide range of digital tools, techniques and systems that are currently used in business, education and other modern enterprises. There is no need for us to introduce these tools in any artificial context—we simply require the learners to use them as they will use them after graduation. Examples include:

Digital version control and collaboration: Our learners use the ubiquitous Git system for version control, assignment submission and team workflow support, starting in the first year. Git servers (GitHub, GitBucket, etc.) are also used for issue tracking and ticketing. These systems make it possible for lecturers to view learner code remotely 24/7, when learners need help resolving bugs or architectural problems outside of normal school hours.

Online materials access: All digital course materials (e.g. lecture PowerPoints, practical task handouts, code samples and skeletons) are available online via a variety of channels including remote servers, virtual machines and web access tools. Textbooks are made available via a digital library platform for continuous online access. Video tutorials and interactive online tools are included in course materials as appropriate.

Digital communication channels: Staff maintain open communication with learners outside of class via Teams, Facebook and other online forums tools. These systems allow both one-to-one conversation for learners who have specific questions and class-wide discussion and announcements.

These online tools are a natural and essential part of any IT professional's training, and our learners master them without difficulty. However, we also wish to note the indispensable pedagogical value of face-to-face teaching. There is considerable empirical evidence that computer programming and related complex IT skills cannot be taught effectively through 100% remote delivery. Because of the scaffolded information architecture of our discipline, small confusions early in a learner's training are likely to lead to catastrophic problems

later. This pattern is posited to be the cause of the unusually high failure rates seen in many IT programmes internationally. With face-to-face teaching by an experienced and observant instructor, these small problems can be identified and resolved quickly, avoiding frustration and failure.

5.3. Learning and Teaching

The BInfoTech (BIT) curriculum is applied, industry-relevant and current. Our pedagogical techniques are engaging and practical, employing experiential learning practices wherever possible with theoretical material contextualised in the real-world IT environment. Our teaching approach is learner-centred and highly pastoral; each learner's strengths are nurtured and respected. The resulting programme is attractive to, and effective for, learners from an unusually wide range of interests, academic backgrounds, and life stories. Learners receive a rich and unique educational experience, and upon graduation can have a firm expectation of being ready to take their places in the professional IT community.

The Otago Polytechnic Bachelor of Information Technology is one of three IT baccalaureate degrees available locally. Our degree is distinguished from the other two by its unwavering focus on high-end technical skills and industry-relevance. Our staff maintain constant contact with industry professionals and use their feedback to inform the design of the programme as a whole and the content of individual papers. Technical papers are updated regularly to ensure that the course material accurately reflects the state of the rapidly changing IT industry. The theoretical underpinnings of computer science are recognised as essential, but specifically to the extent that they support the acquisition of industry-relevant practical skills and provide a structure for the independent self-education that is required of a modern IT professional throughout his or her career.

Our main pedagogical approach embeds the didactic presentation of theoretical content in applied, practical skill-building, with the opportunity to employ those skills in an industry-like context using experiential, team-based project work. For example, a typical class session for an introductory programming paper would comprise a brief presentation of a syntactic feature, followed by a series of in-class programming exercises using that feature. Learners complete the practical exercises with the direct, hands-on support of the lecturer. They then put those concepts to use in the context of a larger body of work in a Studio course in order to form a better understanding of how each feature might contribute to a greater whole. As learners move through more advanced programming training, the content and the exercises become increasingly complex and greater independence is required, but the core model remains theory contextualised in practice, experiential, skill-focussed learning, guided and supported directly by the lecturer.

Course materials and techniques are designed to prepare learners for the life of an IT professional. For example, learners learn Systems Administration skills by performing them on actual (albeit virtual) sets of servers; learners learn web design by building real web sites for real users; assessments designed as mock job interviews prepare learners for the real interviews they will face upon graduation.

Similarly, from their first semester, learners learn to use the digital tools and infrastructure that the industry uses. Our learners use the same programming languages, development environments, digital version control tools, group work systems and online communication channels as do the majority of modern IT companies. Upon graduation, they are thus able to step into a real IT industry position and make a meaningful contribution from day one.

In addition to technical skills and familiarity with the tools of their future profession, our programme prepares learners for the unique challenge of the IT industry—the alarming speed of change. There are IT tools and systems that are ubiquitous today which did not even exist three years ago. And those tools may well be considered obsolete in another

three years. It is essential, therefore, that our learners not only master the content of their papers today, they must also learn how to learn—efficiently, confidently and independently. We foster this by treating it like any other skill—something to be modelled, discussed and practiced at increasingly advanced levels as the degree progresses. To achieve this, we embed independent learning components into practical work at all levels. In the first year, learners may be asked to do online research of a particular topic, or to work through some carefully selected video tutorials. By their final year, learners can be asked to independently come to grips with a new software library, new development environment, or even, a completely new programming language. Their exploration is supported by lecturers as needed, but the work is the learners' own. They are expected to make mistakes and to sometimes take wrong paths. They are guided to resolve their own challenges and to reflect on the process—just as they will have to do in industry.

A second key ethos of the IT industry is group work. Modern IT industries—development, infrastructure and service—all frequently use teams and team-oriented work protocols. To participate effectively on these teams, learners must master two areas: the formal methodologies of IT group work (e.g. "Agile development") and the general personal skills that make one an effective team member (e.g. active listening, clear oral communication, conflict resolution). Our programme aims to foster both aspects through didactic presentation of the components of the formal protocols and frequent real group work, monitored and supported by experienced lecturers, throughout the degree. From the introduction of "paired programming" in their first semester and iterative team projects throughout the Studio courses, to the year-long team-based development projects in their third year, our learners are shown that group work is as important, and as integral, as any technical skill.

To allow our programme to cover the wide spectrum of IT disciplines—software, ops, infrastructure and hardware - we require a diverse teaching team. Our current teaching staff bring a rich range of academic and industry experience, and teaching and research skills. But for all members of staff, our learners are the highest priority. Our staff understand that maintaining discipline currency, using the latest computer science (CS) education research to inform our teaching practice, and providing a personalised, pastoral education to each learner are non-negotiable requirements, in spite of the demands this places upon us in terms of course and materials preparation, and direct learner/lecture interaction (both face to face and remote).

6. COURSE SUMMARIES

6.1. Studio 1

SMS Code	IN502001	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	None	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To introduce learners to the fundamentals of professionalism in a technical environment.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Communicate appropriately in informal and semi-formal written and verbal contexts.
2. Discern functional and non-functional aspects within a problem domain in the context of data modelling.
3. Use collaboration tools and workflows to contribute to a simple group project.

Indicative Content

- Problem domains
- Design thinking
- Introduction to databases
- Time management
- Report writing
- Oral presentations
- Version control (GitHub)
- Object-oriented concepts

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Performance and output review	100%	1, 2, 3	Competency	Must pass

6.2. Studio 2

SMS Code	IN503001	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	nil
Credits	15	*Self Directed Learning hours*	90
Prerequisites	IN502001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To introduce learners to user-centric and technical project planning techniques to create solutions to simple IT problems.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Employ sound communication in order to elicit user requirements to inform the planning process.
2. Work as a member of a team to produce a simple technical output.

Indicative Content

- Basic iterative development
- UML
- Basic project management skills and tools
- Design thinking
- Stand-up meetings
- Client interviews
- Introduction to user stories

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Performance and output review	100%	1, 2	Competency	Must pass

6.3. Programming 1

SMS Code	IN510001/IX510001	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	None	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To introduce learners to the concepts of program design and programming fundamentals.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Create programs using basic programming constructs and simple data structures to solve specified problems.
2. Apply a logic depiction method to decompose appropriate simple problems.

Indicative Content

- Program Design
- Algorithms
- Structured diagrams UML
- If statements, Nested Ifs, Switch statements
- Loops
- Arrays
- Data Types and Records
- Reading Files of Records
- Text files
- Version control

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Weekly Checkpoints	10%	1,2	Percentage	Cumulative 50% pass
Assignment	20%	1,2	Percentage	
Practical Test	35%	1,2	Percentage	
Final Exam	35%	1,2	Percentage	

6.4. Programming 2

SMS Code	IN511001/IX511001	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN510001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to build simple object-oriented (OO) applications and to identify situations that are most appropriate for OO implementation.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Build interactive, event-driven GUI applications using pre-built components.
2. Declare and implement user-defined classes using encapsulation, inheritance and polymorphism.

Indicative Content

IN511001 is a second programming course with a focus on Object Oriented programming, and as such uses an object oriented programming language and development environment.

- Problem analysis and decomposition
- Principles of good class design
- Logic of basic algorithms
- Use of core complex data structures
- Good programming practices that are independent of the language or model used

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Project 1	25%	1,2	Percentage	Cumulative 50% pass
Project 2	35%	1,2	Percentage	
Theory examination	30%	1,2	Percentage	
Classroom Tasks	10%	1,2	Percentage	

Resources:

6.5. Fundamentals of Web Development

SMS Code	IN512002/IX512002	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN510001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to use basic technologies for the development of web-based functionality

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Develop simple web-based applications using industry relevant client/server-side programming languages and basic client/server communication.
2. Use industry relevant tools and workflows in the development of web-based applications.

Indicative Content

- Web communication (client/server relationship)
- HTML, CSS and JavaScript
- Libraries/frameworks
- Responsive design
- APIs
- Basic deployment

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Skills Based Assessment	30%	1, 2	Percentage	Cumulative 50% pass
Project	70%	1, 2		

6.6. Introduction to Networks

SMS Code	IN515001/IX515001	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	none	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology*			

Aims

To introduce learners to fundamental networking concepts and technologies. To cover the basics of network theory and skills needed to implement a simple network.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Design and build a simple local area network using device addressing schemes and basic network configurations.
2. Configure and troubleshoot end-to-end connectivity between local and remote networks using security best practices.

Indicative Content

- OSI model
- Types of networks
- Application layer functionality
- Transport layer protocols (TCP/UDP)
- Network Layer protocols (IPv4)
- Layer 3 Addressing and subnetting
- Data link layer concepts and addressing
- Network cabling
- Configuring and testing a network

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion requirements**
Weekly quiz	20%	1,2	Percentage	Cumulative 50% pass
Skills based assessment	50%	1,2	Percentage	
Theory Exam	30%	1,2	Percentage	

A single final result to be entered in SMS at completion.

Resources Required:

Cisco Network Academy Routing and Switching series “Introduction to Networks.”
Student Lab Manual”

6.7. Platforms and Devices

SMS Code	IN520003/IX520002	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	None	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

The aim of this course is to enable learners to use a range of devices, platforms and concepts utilised within the IT industry.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Install and configure operating systems on devices for functionality and network connectivity.
2. Select and apply systems tools, command line and scripting to configure, maintain, and secure operating systems in local and virtual settings.
3. Troubleshoot hardware and operating system faults for the main components of a computer.

Indicative Content

- Installing, configuring and selecting PC hardware components
- Operating systems installation and maintenance (systems tools)
- Overview of operating systems (mobile, desktop, service, etc.)
- Use a VM & develop basic understanding of virtualisation
- Basic use of transmission protocols (e.g. FTP, SSH)
- File systems
- Backup and RAID systems
- Troubleshooting hardware and software
- Connecting and configuring devices (Bluetooth, Wi-Fi, printers, etc.)/Mounting drives
- Command line proficiency
- Basic network configuration
- 'Embedded' (Raspberry Pi, Arduino, Development platforms)
- Environmental impact of IT
- Identify sustainability issues involved in purchasing, using and disposing of devices.

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Exam	40%	1, 2,	Percentage	Cumulative 50% pass
Skills-based assessment	40%	1, 2, 3	Percentage	
Assignment 1	10%	2	Percentage	
Assignment 2	10%	1, 3	Percentage	

A single final result to be entered in SMS at completion.

Resources

Online/Lab Book

6.8. Maths for IT

SMS Code	IN521001/IX521001	*Directed Learning hours*	60
Level	5	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	none	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To introduce learners to mathematical concepts and methods that underpin computer systems. This course is primarily sited within the field of discrete mathematics.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Use the mathematical structures and algorithms that underpin digital systems.
2. Apply mathematical methods to solve problems that are sited in an Information Technology context.

Indicative Content

All theoretical areas will be presented within an information technology context.

- Logic circuits
- Decimal and binary number systems
- Vectors and matrices
- Randomness and probability
- Factorials, permutations and combinations
- Check digits
- Random number generation
- Encryption
- Algorithms, iteration, recursion
- Hash tables and hash functions
- Computational complexity

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading scheme**	**Completion requirements**
Test 1	25%	1,2	Percentage	Cumulative 50% pass
Test 2	25%	1,2	Percentage	
Test 3	25%	1,2	Percentage	
Test 4	25%	1,2	Percentage	

Resources

6.9. Year One Special Topic

SMS Code	IN530151	*Directed Learning hours*	30
Level	5	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	120
Prerequisites	none	*Total Learning Hours*	150
Course approved in another Programme: Yes Special Topic papers are approved within a number of programmes			

Aims

This course is designed for learners to pursue an individual course of study which will focus in depth on a particular aspect of Information Technology.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Analyse a specific topic whilst applying the underlying principles and concepts to the field of study.

Indicative Content

The process may include

- Producing a proposal for the Special Topic
  - Purpose and scope of the Special Topic identified
  - Skills and knowledge required in the Special Topic identified
  - Learning and assessment plan developed
- Carrying out Special Topic work.
  - Work log/progress report compiled
  - Progress reviewed with supervisor
  - Assessment material/report presented

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Negotiated project	100%	1	Percentage	50% pass

Resources

Required:

- For permission to undertake this course, pre-arranged supervision with a staff member with specialist knowledge in the learner's proposed topic area is required. Specific content to meet the outcomes will be agreed between the lecturer and learner.

6.10. Studio 3

SMS Code	IN606001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN503001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to use an industry-relevant project management approach to produce simple, functional group outputs.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Analyse user requirements to inform technical project work and produce user-centric functionality.
2. Employ ethical and sustainable development methodologies and tools in a team environment.

Indicative Content

- Iterative design thinking strategies
- User-driven development
- Modern team collaboration and development frameworks
- Sound communication and project management strategies
- High-quality technical outputs

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Performance and outputs review	100%	1, 2	Competency	Must pass

6.11. Studio 4

SMS Code	IN622001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN606001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To produce a professional, high-quality group project, adhering to industry-relevant quality assurance and ethical practices.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Select and apply industry-standard tools and processes to solve non-trivial problems in a team environment.
2. Analyse and manage development challenges to create production-quality outputs.

Indicative Content

- Security, privacy, quality, user experience and deployment
- Modern quality assurance practices
- Appropriate use of automation
- Efficient cross-discipline teamwork

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Performance and output review	100%	1, 2	Competency	Must pass

6.12. Databases 2

SMS Code	IN605001/IX605001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN505001, IN511001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To give an understanding of the fundamentals of database management systems with emphasis on relational systems.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Plan and build a normalised relational database to solve a specified problem.
2. Use syntactically correct SQL to write database queries that ensure data integrity.

Indicative Content

- Role of relational databases and relational database management systems
- Formal database theory – relational algebra, functional dependencies and normalisation.
- Architecture of relational database management systems
- Query construction and optimisation
- Data modelling
- Design and implementation of relational databases
- Principles of database administration and database security

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Worksheets	20%	2	Percentage	Cumulative 50% pass
Design and build assignment	40%	1,2	Percentage	
Examination	40%	1,2	Percentage	

Resources Required:

Churcher, Clare (2012) Beginning database design: From novice to professional. Apress.

6.13. Introductory Application Development Concepts

SMS Code	IN607001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self Directed Learning hours*	90
Prerequisites	IN511001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To introduce the concepts of application development including algorithms, data structures and design patterns that are required to use a simple, industry-relevant development framework.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Design and build secure applications with dynamic database functionality following an appropriate software development methodology.

Indicative Content

- Server and client-side programming
- Design patterns e.g. MVC (Model View Controller)
- Database integration (ORMs)
- Database migration
- Automated testing
- Session based authentication

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Practical	20%	1	Percentage	Cumulative 50% pass
Project	80%	1	Percentage	

6.14. Intermediate Application Development Concepts

SMS Code	IN608001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self Directed Learning hours*	90
Prerequisites	IN607001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To extend the concepts of application development including algorithms, data structures and design patterns that are required to use a complex, industry-relevant frameworks or libraries.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Apply design patterns and programming principles using software development best practices.
2. Design and implement full-stack applications using industry relevant programming languages.

Indicative Content

- APIs (Application Programming Interfaces)
- Database integration
- Deployment
- Design patterns
- Frameworks or libraries
- ORMs (Object-Relational Mappings)
- Session based authentication
- Automation testing
- Security
- Parallelism

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Practical	20%	1	Percentage	Cumulative 50% pass
Assessment 1	20%	1, 2	Percentage	
Assessment 2	30%	1, 2	Percentage	
Assessment 3	30%	1, 2	Percentage	

Resources

No required text

6.15. Switching, Routing and Wireless Essentials

SMS Code	IN615008	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN515001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

The aim of this course is to enable learners to apply knowledge of router and switch operation, network architecture and services to configure small-to-medium business networks.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Design and build a network for availability and redundancy.
2. Configure and troubleshoot flexible local area networks using virtual and wireless technologies.

Indicative Content

- Basic switching concepts and the operation of Cisco switches
- Enhanced switching technologies such as VLANs, VLAN Trunking Protocol (VTP), Rapid
- Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Protocol (PVSTP), and 802.1q
- The purpose, nature, and operations of a router, routing tables, and the route lookup process
- Static routing and default routing
- How VLANs create logically separate networks and how routing occurs between them
- Dynamic routing protocols, distance vector routing protocols, and link-state routing protocols
- Basic operations of routers in a small routed network:
- The purpose and types of access control lists (ACLs)
- The operations and benefits of Dynamic Host Configuration Protocol (DHCP)
- Wireless LAN concepts and configuration
- LAN security concepts

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Weekly tests	10%	1, 2	Percentage	Cumulative 50% pass
Skills based assessment	30%	1, 2	Percentage	
Assignment	40%	1, 2	Percentage	
Theory exam	20%	1, 2	Percentage	

A single final result to be entered in SMS at completion.

Resources

Required:

Cisco Network Academy “Switching, Routing and Wireless Essentials” online course access.

6.16. Operating Systems Concepts

SMS Code	IN616001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN510001 & IN520002	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

This course aims to introduce the basic mechanisms of an operating system, and its management among various components. Learners will navigate, configure, and manage contemporary operating systems for basic system administration. This course lays a solid foundation for more advanced courses in system administration, virtualization, and security.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Perform automated user and permissions management in a computing system.
2. Analyse and manage process, memory, storage, and network management modules in operating systems.
3. Evaluate the design and process models of contemporary operating systems.

Indicative Content

- Core operating system concepts: scheduling, memory management, process management
- Operating system design aspects: monolithic vs microkernel, case study of Linux.
- Linux shell commands and exploring system internals with shell
- User, process, file and memory management with Linux commands
- Customizing Linux Kernel and loadable kernel modules
- Process/Thread management and synchronization
- Services and Daemons, networking interface
- Bash Scripting
- Basic System Administration tasks with scripting
- File systems
- Networking with Linux Systems

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Assignment	30%	All	Percentage	Cumulative 50% pass
Class exercises	40%	1, 2	Percentage	
Exam	30%	All	Percentage	

6.17. Operations Engineering 1

SMS Code	IN609001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN616001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

This course will provide learners with the knowledge and hands-on skills to perform systems administration tasks securely within different computing platforms using the command line interface.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Identify the key tools/services for administering different computing systems
2. Develop advanced shell scripts to automate system administration tasks
3. Use cloud and directory services for enterprise computing infrastructure

Indicative Content

- Network and firewall configuration
- Advanced user/group management and permissions
- Advanced scripting for system administration
- Ticketing for system administration
- Backup and disaster recovery
- Directory services in different OSs
- Configuring and deploying cloud services and resources
- Hardening operating systems and networks
- Containers

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Assignment	30%	2	Percentage	Cumulative 50% pass
Practical	40%	1, 2, 3	Percentage	
Exam	30%	1, 2, 3	Percentage	

Resources

6.18. Embedded Systems

SMS Code	IN620001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN520002	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To introduce learners to the core principles of computer hardware and architecture and to acquaint them with a range of embedded application contexts. (This paper is ***not*** intended to provide the skills required to design a better CPU, nor is it intended to teach learners to write in assembler.)

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Analyse the parameters of a problem domain that can be solved with an embedded systems solution.
2. Implement a complete embedded systems solution that meets the requirements of solving a problem domain.

Indicative Content

- Low-level hardware (registers, buses, and clocks, memory, storage, I/O, addressing, etc.)
- Low-level instruction processing
- CPU design principles
- High-level architecture (e.g. caching, VM, dedicated hardware, multicore processing, etc.)
- Embedded application areas with microprocessors and microcontrollers
- Theory and principles of embedded/control systems
- Embedded system hardware
- Embedded system software
- Embedded system project work

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Project work	100%	1,2	Percentage	Cumulative 50% pass

Resources

Required:

This paper will require appropriate hardware, materials and SDKs for construction of modern embedded systems.

6.19. Automation and Robotics

SMS Code	IN621001	*Directed Learning hours*	60
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN620001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To extend and refine learners micro-electronics skills in order to build artefacts which are physically complex, behaviourally complex and highly interactive.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Apply core electronic and mechanical principles to robotics/automated systems design.
2. Design a robotics/automated solution to a specified problem following principles of interaction design.
3. Use an appropriate software development platform to implement simple interactive robotics/automated systems.

Indicative Content

- Discussion of historical development of automated systems
- Survey of application areas
- Robotics simulator work
- Sensors
- Hardware of robotics/automated/ubiquitous systems
- Development software – options and issues
- Interaction design – human factors and machine design principles
- Project work – Design and construction of interactive robotics/automated systems

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
In-class practicals	10%	3	Percentage	Cumulative 50% pass
Theory examination	10%	1,2,3	Percentage	
Project 1	30%	1,2,3	Percentage	
Project 2	50%	1,2,3	Percentage	

6.20. Year Two Special Topic

SMS Code	IN630151	*Directed Learning hours*	30
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	120
Prerequisites	120 credits at L5	*Total Learning Hours*	150
Course approved in another Programme: Yes Special Topic papers are approved within a number of programmes			

Aims

To allow learners to carry out semi-independent exploration into a specific information technology topic to a depth not supported by an existing Bachelor of Information Technology paper. Learners will negotiate objectives, learning plan, assessment criteria and time frame with a supervising lecturer who will provide direction throughout the project.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Examine and discuss a specific topic whilst applying the underlying principles and concepts to the field of study.

Indicative Content

Learners will research and apply chosen aspects of their information technology topic. Sources would typically include academic journals, textbooks, and credible web sites. Selection and location of resource materials will be supported by a staff supervisor. Content will include both theoretical material and applied skills development.

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Negotiated project	100%	1	Percentage	50% pass

A single final result to be entered in SMS at completion.

Resources

Recommended:

Because of the independent work required, Special Topic papers are more challenging, and require more mature academic skills than traditional format papers at the same level. It is suggested that Special Topics only be permitted when learners have:

- Demonstrated excellent literacy and work habits in previous courses
- Pre-arranged supervision with a staff member with specialist knowledge in the learner's proposed topic area.

6.21. Studio 5

SMS Code	IN728001	*Directed Learning hours*	15
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	135
Prerequisites	IN622001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to apply technical skills within complex IT projects. To extend learner professional behaviour through group work, professional development activities and external engagement.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Analyse real-world problems and create IT systems to solve them;
2. Apply technical and theoretical skills to unfamiliar and complex situations;
3. Contribute as a member of a team in a structured development process.

Indicative Content

Learners complete the development of large, real client driven projects under supervision.

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Performance and output review	100%	1, 2, 3	Competency	Must pass

6.22. Studio 6

SMS Code	IN732001	*Directed Learning hours*	15
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	135
Prerequisites	IN728001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to extent their skills within a complex IT project. ***Learning Outcomes***

At the successful completion of this course, learners will be able to:

1. Critically evaluate and apply a range of processes to unfamiliar and complex problems.
2. Engage in advanced study in specialist areas.
3. Demonstrate responsibility for leadership within a project group.

Indicative Content

Learners complete the development of large, real client driven projects under supervision.

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Performance and output review	100%	1, 2, 3	Competency	Must pass

Resources

Required:

Varies according to project needs.

6.23. Developing Flexible IT Courses

SMS Code	*IN703001*	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN502001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To prepare learners for the training role that is often performed by information technology professionals.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Design, create, implement and evaluate a computer-based tutorial to teach technical skills or knowledge to a specified audience.
2. Design, conduct and evaluate a blended IT training programme to meet a specified set of needs including Treaty of Waitangi considerations.

Indicative Content

- Evaluate training materials
- Screen recording software
- Writing interactive quizzes
- Tutorial writing
- Learning Tools
- Learning styles and adult learners
- Training needs analysis for a new system
- Training methods
- Conduct training sessions
- Evaluation
- Computer based training
- Interactive facilitation

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Tutorial Creation	50%	1, 2	Percentage	Cumulative 50% pass
Teach a lesson	50%	1, 2	Percentage	

6.24. Quality Assurance and Software Testing

SMS Code	IN733001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	None	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To lay the foundation for a potential career in the Information Technology field as a software tester. To understand the fundamental principles and processes of software testing, including production of detailed test plans and effective test results. To develop practical software testing skills enabling the production of more robust code.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Plan, execute and document the testing process using automated and manual tests.
2. Analyse and critique industry standard software testing theory, the significance of software testing and its place in the software development life cycle.

Indicative Content

- Static testing – reviews, walkthroughs, static analysis etc…
- Dynamic testing
    - Structure-based – statement, decision, condition
    - Specification-based – equivalence partitioning, boundary analysis, state transition, decision table, use case
    - Experience-based testing – error guessing, exploratory
- Software Testing theory (including an ISTQB Foundation Level qualification)
- Winapp driver and Appium
- Selenium Webdriver
- Test Plan production – automated and flexible
- Practical detection of errors in a variety of unfamiliar contexts
- Writing correct, clear, and professional test results to allow developers to reproduce and fix errors.
- Researching and exploring the (ethical and social) implications of major software failures

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Presentation	15%	2	Percentage	

Software Testing Theory Exam	30%	2	Percentage	Cumulative 50% pass
Applied Testing Checkpoints	15%	1, 2	Percentage	
Applied Testing Project	40%	1, 2	Percentage	

6.25. Databases 3

SMS Code	IN705001/IX705001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN605001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To provide learners with skills and understanding necessary to design and implement enterprise databases, and to administer database management systems. To become acquainted with the range of tools and platforms available for developing large databases. To explore current areas of research in database implementation, use and management.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Implement troubleshooting techniques to solve complex database performance issues.
2. Design and develop relational databases to meet specified requirements that are subject to high-availability, high-reliability, security, and performance constraints.
3. Critically analyse database administrator tasks in order to determine a management approach.

Indicative Content

- Application areas
- Information analysis techniques
- Survey of modern software and hardware for database construction and management
- Advanced data modelling
- Use of stored procedures
- Construction of complex queries
- Transactions and concurrency
- Advanced topics in data security
- Data mining and other processing methodologies

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Exam	25%	2,3	Percentage	Cumulative 50% pass
Project Work	65%	1,2,3	Percentage	
DBA assessment	10%	2,3	Percentage	

6.26. Security

SMS Code	IN724001/IX724001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN616001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To provide learners with theoretical knowledge and accompanying technical skills in the field of information security. Learners are guided through the process of identifying and analysing security threats and vulnerabilities, then mitigating them by implementing robust and industry-accepted solutions. The course uses an attack then defend mentality - allowing learners to learn how attacks are conducted, then mitigating the vulnerabilities.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Analyse and apply information security best practices to mitigate common applications, network and system security vulnerabilities for enterprise networks
2. Examine essential cryptography concepts and implement appropriate solutions to maintain information security requirements for modern information systems

Indicative Content

- Information security mechanisms
- Cryptography
- Network security
- Web application security
- Server hardening
- Computer forensics

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Laboratory Assessment	15%	1,2	Percentage	Cumulative 50% pass
Assignments	60%	1,2	Percentage	
Exam	25%	1,2	Percentage	

Resources Required:

6.27. Advanced Application Development Concepts

SMS Code	IN730001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self Directed Learning hours*	90
Prerequisites	IN608001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to build and deploy optimised and efficient applications using a range of advanced industry tools and frameworks.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Critically evaluate and implement a range of programming paradigms to solve unfamiliar problems.
2. Create efficient full-stack applications using advanced industry techniques, tools and frameworks.

Indicative Content

- Progressive web applications
- Database replication
- Advanced design patterns
- Code optimisation e.g. tree shaking, code splitting, dynamic loading
- Code minimisation and obfuscation
- Code compression
- Benchmarking tools
- CDNs (Content Delivery Networks)
- Client/server-side caching techniques
- Message queues
- WebSockets

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Practical	20%	1	Percentage	Cumulative 50% pass
Project	80%	1, 2	Percentage	

Resources

No required text

6.28. Advanced Algorithms

SMS Code	IN711002	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN608001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to use a wide variety of advanced algorithms and tools required for development of efficient solutions to complex computational problems.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Evaluate the ecosystem of algorithmic tools available to produce efficient software.
2. Implement appropriate algorithms and data structures to solve nontrivial computational problems.
3. Optimize the usage of computational resources while programming.

Indicative Content

- Genetic (i.e. evolutionary) algorithms
- Computer graphics
- Modelling and simulation
- Natural language processing
- Optimization
- Data analytics
- Measuring algorithmic efficiency
- Industrial control
- Signal processing
- Block chain
- Searching, sorting and hashing
- Learning algorithms
- Security

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Programming Assignment 1	25%	1,2,3	Percentage	Cumulative 50% pass
Midyear exam	25%	1,2,3	Percentage	
Programming Assignment 2	25%	1,2,3	Percentage	
Final exam	25%	1,2,3	Percentage	

Resources

Required: No required text, learners will be directed to online materials.

6.29. Mobile Application Development

SMS Code	IN721001/IX721001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	*0*
Credits	15	*Self Directed Learning hours*	90
Prerequisites	IN607001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To learn the specifics of mobile applications design and development. Learners will be able to develop a mobile application and publish it to a mainstream app store.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Implement and publish complete, non-trivial, industry-standard mobile applications following sound architectural and code-quality standards
2. Identify relevant use cases for a mobile computing scenario and incorporate them into an effective user experience design.
3. Follow industry standard software engineering practice in the design of mobile applications.

Indicative Content

- Interaction and interface design for mobile
- Advantages and limitations of native mobile apps vs. web-based apps
- User-centred design and testing
- Hardware opportunities and constraints.
- SDKs, APIs, libraries and other tools
- Software architectures for mobile
- Publishing policies and procedures

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Practical	20%	2, 3	Percentage	Cumulative 50% pass
Project	80%	1, 2, 3	Percentage	

Resources

No required text

6.30. Artificial Intelligence and Data Science

SMS Code	IN727001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN511001, IN521001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

The aim of this course is to enable learners to choose and deploy the appropriate machine intelligence tool to solve problems that demand a cognitive component. Possible applications are: computer vision, natural language processing, recommendation systems, data analytics, anomaly detection, conversational agents (i.e. chatbots), machine translation, autonomous navigation, robotic control and a myriad of others.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Analyze the principles, advantages, limitations, applications and implications of data-driven artificial intelligence to be a productive and responsible practitioner.
2. Choose, implement and evaluate models to solve machine learning problems.
3. Apply data science techniques to fetch, scrub, explore, manipulate, visualize, evaluate and interpret complex quantitative data.

Indicative Content

- Artificial neural network (convolutional, LSTMs, GRUs)
- Web crawling and scraping to gather data
- Data analytics
- Transfer learning
- Language models (word embeddings, contextualized word embeddings, chatbots)
- Generative models (generative adversarial networks, Autoencoders)
- Reinforcement learning
- GPU computation
- Ethics and AI
- Learning theory (bias/variance tradeoffs, sensitivity/specificity trade-offs, validation, regularization, learning curves);
- Machine intelligence APIs

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Assignment 1	25%	1,2,3	Percentage	Cumulative 50% pass
Assessment 1	25%	1,2,3	Percentage	
Assignment 2	25%	1,2,3	Percentage	

Assessment 2	25%	1,2,3	Percentage	

6.31. Operations Engineering 2

SMS Code	IN734001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN609001	*Total Learning Hours*	150
NQF Unit standards assessed in this course: No			
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to practice the configuration, management and troubleshooting of systems within an enterprise network including aspects of both application and operating systems components.

Learning Outcomes

At the successful completion of this course, students will be able to:

1. Implement advanced system operations and administration tasks for Information Technology systems.
2. Formulate disaster recovery and mitigation policies for enterprise infrastructures.
3. Discuss aspects of ethics and social responsibility in a systems administration role.
4. Use a configuration management scheme for systems operation and management.

Indicative Content

- Building and distributing packages
- Managing different servers for system operations
- Performance tuning and troubleshooting of computing systems
- Deploying network monitoring systems
- Implement configuration management systems for systems operation
- Social responsibility and ethics of working in a systems administration role.
- Configuration of backup systems for disaster recovery – including backup, recovery and availability management
- Implementing system administration best practices

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Individual Performance Review	20	1,2,3	Percentage	Cumulative 50% pass
Team Operational Exercise	60	1,2,3,4	Percentage	

Exam	20	1,2,3,4		

6.32. UX Engineering

SMS Code	IN729002	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	*nil*
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN608001	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to build upon front-end development skills with a view to designing and building screens with inclusive, flexible and sound user experience. This course highlights the importance of both technical and design excellence in sustainable and ethical software development.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Use advanced front-end technologies and workflows to efficiently develop high-quality user interfaces.
2. Design and build optimal solutions to complex user experience problems.

Indicative Content

- Design thinking processes
- Usability principles, metrics, and heuristics
- UXD research and planning techniques
- User's needs and requirements, including those with special needs
- User testing and design testing
- Advanced CSS and preprocessors
- Semantic, inclusive and sustainable markup

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Practical	40%	1, 2	CRA	Cumulative 50% pass
Development assignment	60%	1, 2		

Resources

6.33. Administering a Virtual Infrastructure

SMS Code	IN720001/IX720001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN719001	*Total Learning Hours*	150
NQF Unit standards assessed in this course: No			
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

Learners will gain in-depth knowledge and techniques used to efficiently implement, optimize and trouble-shoot a virtual infrastructure.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Plan, install and configure a virtual infrastructure with storage and networking
2. Deploy virtual machines and virtual applications in cloud platforms
3. Establish, monitor and troubleshoot service levels for enterprise cloud infrastructure
4. Critically analyse key performance factors in virtualised systems.

Indicative Content

- Install and configure a virtual environment
- Management techniques and key performance metrics used to identify CPU, network, memory and application performance bottlenecks in a virtualised environment.
- SAN planning and implementation
- Troubleshooting hypervisor problems

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Case study – plan and evaluate	25	1,2	Percentage	Cumulative 50% pass
Case study – implement and deploy	25	2,3,4	Percentage	
Exam	30	All	Percentage	
Skills Based Assessment	20	1,3	Percentage	

Note: Literacy and/or numeracy assessed within current assessment tasks are mapped against Learning Progressions.

Resources

Required:

VMware VCP learner manual for vSphere 5
VMware VCP and Lab Excercises for vSphere 5

Recommended:

Cafaro, M. & Aloiso, G. (2011). *Grids, Clouds and Virtualization.* Springer-Verlag: London. [ISBN 978-0-85729-049-6]

Wolf, C. & Halter, E.M. (2005). *Virtualization*. Springer-Verlag: New York. [ISBN: 978-1590594957]

Gaurav S. (2010).*Scheduling and Isolation in Virtualization*.VDM Verlag Dr. Müller.[ISBN: 978-3639295139]

Boursas, L.; Carlson, M.; Hommel, W.; Sibilla, M.; Wold, K. (Eds.), (2009). *Systems and Virtualization Management: Standards and New Technologies*. Springer- Verlag: Germany. [ISBN: 978-3540887072]

Haletky, E.L., (2011). *VMware ESX Server in the Enterprise,* Pearson: Boston MA. [ISBN: 978-0132302074]

Edward Haletky, (2011) *VMware ESX and ESXi in the Enterprise: Planning Deployment of Virtualization Servers* (2nd ed.). Pearson: Boston MA. [ISBN: 978-0137058976]

6.34. Advanced Networking

SMS Code	IN723001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN615006	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To provide learners with an understanding of how to evaluate and apply advanced networking protocols, services and concepts to the design, deployment and maintenance of medium to large scale networks.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Design and implement scalable, fault tolerant solutions for facilitating high performance local area and wide area networks.
2. Design and implement policies to provide network security and increased performance.
3. Investigate and evaluate new industry technologies for the purpose of increasing network flexibility and performance.

Indicative Content

- Border gateway protocol (BGP)
- Spanning Tree (STP)
- Link aggregation (PAgP, LACP)
- Hot standby routing protocol (HSRP), gateway load balancing protocol (GLBP)
- Multi area open shortest path first (OSPF)
- Virtual routing and forwarding (VRF)
- Multi protocol label switching (MPLS) virtual private networks (VPN)
- Software defined networking (SDN)
- Quality of service (QoS)

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Research assignment	15%	3	Percentage	Cumulative 50% pass
Design and implementation project	40%	1,2,3	Percentage	
Final theory exam	25%	1,2,3	Percentage	
Final practical exam	20%	1,2	Percentage	

Resources

6.35. Enterprise Networking, Security and Automation

SMS Code	IN735001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	nil
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN615008	*Total Learning Hours*	150
This course approved in another Programme Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology.*			

Aims

To enable learners to understand and apply knowledge of architectures and considerations related to designing, securing, operating, and troubleshooting enterprise scale networks.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Design and implement scalable and secure solutions for enterprise networks.
2. Implement network management and monitoring services to provide increased networking availability and integrity.
3. Investigate and evaluate how virtualisation, automation and controller-based architectures affect modern networks.

Indicative Content

- Network design
- Quality of service
- Access control lists
- Network address translation
- Advanced routing protocols
- Network virtualisation
- Network automation
- Network management
- Software defined networking

Assessment

This course is developed, and quality controlled by Cisco. The weighting of the assessments has been localised. The chapter exam and theory exam assessments are controlled by Cisco.

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Assignment	50%	1,2,3	Percentage	Cumulative weighted average of 50% or more
Skills Based Assessment	30%	1	Percentage	
Theory Exam	20%	1,2,3	Percentage	

A single final result to be entered in SMS at completion.

Resources **Required:**

Cisco Network Academy “Enterprise, Networking, Security and Automation” online course access.

6.36. Internet of Things and Cloud Computing

SMS Code	IN736001 / IX736001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN620001 and IN609001	*Total Learning Hours*	150
This course approved in another Programme: Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology*			

Aim

To enable learners to investigate and analyse the applicability of an IoT solution for a real-world problem and develop an IoT application involving cloud computing.

Learning Outcomes

On successful completion of this course, learners will be able to:

1. Analyse models, methodologies and standards in cloud-based information systems infrastructure
2. Critically analyse IoT systems architecture, components, and applications in relation to the cloud
3. Construct technical design specification and develop IoT solutions to be deployed on the cloud

Indicative Content

- Introduction to the Internet of Things
- Machine-to-Machine Communications
- IoT applications, benefits, opportunities, and challenges
- IoT use cases and scenarios (smart home, agritech, healthcare, activity monitoring etc.)
- IoT system architecture
- IoT cloud platform
- Interoperability in IoT
- IoT networks (Sigfox, LoRa, etc.)
- Cloud computing core concepts, benefits, value proposition
- Cloud computing models: IaaS, PaaS, SaaS
- Sensor-Cloud
- Cloud applications in the industry
- DevOps and cloud
- Security of cloud computing
- IoT Security

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Case Study Analysis	40%	1	Percentage	

Project: Design and Develop a Cloud-based IoT Solution	60%	1, 2, 3	Percentage	Cumulative weighted average of 50% or more

Resources

Recommended Texts

Gu, J. (2020). Cloud Computing Architecture: Technologies and Practice (Advances in Computer Science), De Gruyter, 1 edition.

Lea, P. (2018). Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, Packt Publishing, ISBN-13: 978-1788470599.

Erl, T., Puttini, R. (2013). Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 1 edition.

Greengard, S. (2015). The Internet of Things (The MIT Press Essential Knowledge series), The MIT Press, ISBN-13: 978-0262527736.

Online

Internet of Things with Python and Raspberry Pi, LinkedIn Learning, https://www.linkedin.com/learning/internet-of-things-with-python-and-raspberry-pi?u=76194218

Learning Cloud Computing: Core Concepts, LinkedIn Learning, https://www.linkedin.com/learning/learning-cloud-computing-core-concepts-2/change-your-career-with-cloud-computing?u=76194218

Learning Cloud Computing: Cloud Governance, LinkedIn Learning, https://www.linkedin.com/learning/learning-cloud-computing-cloud-governance-2?u=76194218

Cybersecurity with Cloud Computing, LinkedIn Learning, https://www.linkedin.com/learning/cybersecurity-with-cloud-computing?u=76194218

AWS Academy (Accessible via OPAIC)

Microsoft Self-paced Labs, https://www.microsoft.com/handsonlabs/SelfPacedLabs

6.37. Game Development

SMS Code	IN737001 / IX737001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	90
Prerequisites	IN511001/IX511001	*Total Learning Hours*	150
This course approved in another Programme: Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology*			

Aim

To enable learners to apply game programming techniques and tools to develop an effective game.

Learning Outcomes

On successful completion of this course, learners will be able to:

1. Design and develop a game using industry standard tools, technologies and practices.

Indicative Content

- Game graphics and audio concepts
- Graphical game programming
- Game programming with C#
- Unity3D Development
- Scripting in Unity
- AR and VR concepts
- Google VR
- ARCore
- Game APIs

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Assignment	30%	1	Percentage	Cumulative 50% pass
Project: Game Development + Demo	70%	1	percentage	

Resources

Recommended Texts

Byl, P.D. (2019). Holistic Game Development with Unity 3e: An All-in-One Guide to Implementing Game Mechanics, Art, Design and Programming, CRC Press; 3 edition, ISBN-13: 978-1138480629.

Gregory, J. (August 15, 2014). Game Engine Architecture, A K Peters/CRC Press; 2 edition, ISBN-13: 978-1466560017.

Online

C# for Unity Game Development, LinkedIn Learning, https://www.linkedin.com/learning/c-sharp-for-unity-game-development/welcome?u=56590297

C++ Game Programming, LinkedIn Learning https://www.linkedin.com/learning/c-plus-plus-game-programming-1/the-course-overview?u=56590297

Google for Games: https://games.withgoogle.com/

Game Code School: http://gamecodeschool.com/tutorials/

GameDev Academy, https://gamedevacademy.org/category/tutorials/vr-ar-tutorials/

VR Game Development, https://vrgamedevelopment.pro/

Unity: AR Visualization 01 Basic Concepts, Linkedin Learning, https://www.linkedin.com/learning/unity-ar-visualization-01-basic-concepts?u=76194218

Tools and Development Platforms

Unity (unity.com)

Google VR for everyone

Google ARCore

AR/VR Headsets / Goggles

Smartphones

Google cardboard

6.38. Business Analysis and Intelligence

SMS Code	IN738001 / IX738001	*Directed Learning hours*	60
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	Self-Directed Learning hours	90
Prerequisites	IN606001 & IN521001/IX521001	Total Learning Hours	150
This course approved in another Programme: Yes *Name of other Programme: Graduate Certificate in Information Technology, and Graduate Diploma in Information Technology*			

Aim

To enable learners to apply the theories, methods, and tools for analysing business processes, and propose solutions for a variety of organisational problems.

Learning Outcomes

On successful completion of this course learners will be able to:

1. Select and apply business analysis theories, methods, and tools to solve organisational issues.
2. Analyse characteristics of business problems and the use of artificial intelligence for achieving business intelligence.
3. Analyse data and apply data analytics processes to propose justified recommendations for organisational problems.

Indicative Content

- Types, roles and skill sets of business analysts
- Business analysis core concepts
- Business analysis knowledge areas
- Business analysis perspective, tools, and techniques
- Business analysis competencies
- The digital BA
- Machine learning algorithms for business problems
- Data-driven innovation and disruption
- Potential for business improvements
- Data analytics
- Forecasting for businesses

Assessment

Assessment Activity	Weighting	Learning Outcomes	Assessment Grading Scheme	Completion Requirements
Case Study Analysis Report	30%	1	Percentage	

Project	70%	1, 2, 3	Percentage	Cumulative 50% pass

Resources

Recommended Texts

Albright, S., & Winston, W. (2017). Business analytics: Data analysis and decision making (6th ed.). Stamford, CT: Cengage Learning.

Sharda, R. (2020). Business Intelligence and Analytics: Systems for Decision Support (10th Edition), Pearson, ISBN-13: 978-0133050905.

IIBA. (2015). A Guide to the Business Analysis Body of Knowledge (Babok Guide). International Institute of Business Analysis.

Online

Business Analysis Foundations, LinkedIn Learning, https://www.linkedin.com/learning/topics/business-analysis?u=76194218.

Business Analysis Foundations: Business Process Modelling, LinkedIn Learning, https://www.linkedin.com/learning/topics/business-analysis?u=76194218.

Requirements Elicitation and Analysis, LinkedIn Learning, https://www.linkedin.com/learning/topics/business-analysis?u=76194218.

Become a Business Intelligence Specialist, LinkedIn Learning, https://www.linkedin.com/learning/paths/become-a-business-intelligence-specialist?u=76194218.

Business Intelligence Tutorial – Learn Latest BI Features & Applications, Data Flair, https://data-flair.training/blogs/business-intelligence/

Tools and Development Platforms

Power BI

Tableau

R

SWOT

Trello

6.39. Year Three Special Topic

SMS Code	IN730151/IX730151	*Directed Learning hours*	15
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	135
Prerequisites	120 L5 credits, 90 L6 credits	*Total Learning Hours*	150
Course approved in another Programme: Yes Special Topic papers are approved within a number of programmes			

Aims

To allow learners to carry out independent exploration into a specific information technology topic to a depth not supported by an existing Bachelor of Information Technology paper. Learners will negotiate objectives, learning plan, assessment criteria and time frame with a supervising lecturer.

Learning Outcomes

At the successful completion of this course, learners will be able to:

1. Critically analyse a specific topic whilst applying the underlying principles and concepts to the field of study.

Indicative Content

Learners will research and apply chosen aspects of their information technology topic. Sources would typically include academic journals, textbooks, and credible web sites. Content will include both theoretical material and applied skills development.

Assessment

Assessment Activity	**Weighting**	**Learning Outcomes**	**Assessment Grading Scheme**	**Completion Requirements**
Negotiated project	100%	1	Percentage	50% pass
			Assessment Grading Scheme	**Completion Requirements**
Portfolio		1 - 8		

Resources

Recommended:

Because of the independent work required, Special Topic papers are more challenging, and require more mature academic skills than traditional format papers at the same level. It is suggested that Special Topics only be permitted when learners have:

1. Demonstrated excellent literacy and work habits in previous courses
2. Pre-arranged supervision with a staff member with specialist knowledge in the learner's proposed topic area.

6.40. Unspecified Credits – Level 5

SMS Code	IN550001	*Directed Learning hours*	0
Level	5	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	0
Prerequisites	n/a	*Total Learning Hours*	0
Course approved in another Programme: Yes Special Topic papers are approved within a number of programmes			

Aims

This paper is intended to act as a repository for "unspecified credits" where the learner undertakes courses from outside the BInfoTech. Up to 15 credits of these may normally be used.

Any course that is recognised as contributing to a degree may be used for these credits. The contribution to a learner's credit count will be calculated on the basis of EFTS contribution of the external paper (ie 0..125 EFTS = 15 credits).

There will be no fee charged for this paper.

Learning Outcomes

The outcomes for the "unspecified credit" are not described here, as they are, by definition, external. To be eligible for this paper, the learning outcome of the external papers taken must not significantly overlap with other papers undertaken by that learner.

Indicative Content

n/a

Assessment

n/a

6.41. Unspecified Credits – Level 6

SMS Code	IN650001	*Directed Learning hours*	0
Level	6	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	0
Prerequisites	n/a	*Total Learning Hours*	0
Course approved in another Programme: Yes Special Topic papers are approved within a number of programmes			

Aims

This paper is intended to act as a repository for "unspecified credits" where the learner undertakes courses from outside the BInfoTech. Up to 15 credits of these may normally be used.

Any course that is recognised as contributing to a degree may be used for these credits. The contribution to a learner's credit count will be calculated on the basis of EFTS contribution of the external paper (ie 0.125 EFTS = 15 credits).

There will be no fee charged for this paper.

Learning Outcomes

The outcomes for the "unspecified credit" are not described here, as they are, by definition, external. To be eligible for this paper, the learning outcome of the external papers taken must not significantly overlap with other papers undertaken by that learner.

Indicative Content

n/a

Assessment

n/a

6.42. Unspecified Credits – Level 7

SMS Code	IN750001	*Directed Learning hours*	0
Level	7	*Workplace or Practical Learning hours*	0
Credits	15	*Self-Directed Learning hours*	0
Prerequisites	n/a	*Total Learning Hours*	0
Course approved in another Programme: Yes Special Topic papers are approved within a number of programmes			

Aims

This paper is intended to act as a repository for "unspecified credits" where the learner undertakes courses from outside the BInfoTech. Up to 15 credits of these may normally be used.

Any course that is recognised as contributing to a degree may be used for these credits. The contribution to a learner's credit count will be calculated on the basis of EFTS contribution of the external paper (ie 0.125 EFTS = 15 credits).

There will be no fee charged for this paper.

Learning Outcomes

The outcomes for the "unspecified credit" are not described here, as they are, by definition, external. To be eligible for this paper, the learning outcome of the external papers taken must not significantly overlap with other papers undertaken by that learner.

Indicative Content

n/a

Assessment

n/a

7. APPENDICES

7.1. Appendix 1: Prerequisite Schedule – During Transition

Year 1

Code	Course	Credits	Pre-requisites
IN501001	Professional Practice for IT	15	-
IN505001	Introduction to Systems Analysis	15	-
IN510001	Programming 1	15	-
IN511001	Programming 2	15	IN510001 (Prog1)
IN512001	Fundamentals of Web Development	15	IN510001 (Prog1)
IN515001	Introduction to Networks	15	-
IN520002	Devices and Platforms	15	-
IN521001	Maths for IT	15	-
IN530051	Year One Special Topic	5	Permission from Supervising Lecturer - Form signed
IN530052	Year One Special Topic	10	Permission from Supervising Lecturer - Form signed
IN530053	Year One Special Topic	15	Permission from Supervising Lecturer - Form signed
IN502001	Studio 1	15	
IN503001	Studio 2	15	IN502001 (Studio1) or IN501001 (PP)

Year 2

Code	Course	Credits	Pre-requisites
IN605001	Databases 2	15	IN505001 (SA), IN511001 (Prog1)
IN610001	Programming 3	15	IN511001 (Prog2)
IN615008	Routing and Switching Essentials	15	IN515001 (NW1)
IN615006	Scaling Networks	15	IN615005 (NW2)
IN616001	Operating Systems Concepts	15	IN510001 (Prog1), IN520002 (Devices)
IN620001	Embedded Systems	15	IN520002 (Devices)
IN621001	Automation and Robotics	15	IN620001 (Embedded)
IN630051	Year Two Special Topic	5	60 credits at Level 5, Special Topic Form signed
IN630101	Year Two Special Topic	10	120 credits at Level 5, Special Topic Form signed
IN630151	Year Two Special Topic	15	120 credits at Level 5, Special Topic Form signed
IN606001	Studio 3	15	IN502001 (Studio2) or IN501001 (PP)
IN622001	Studio 4	15	IN606001 (Studio3) or IN501001 (PP)
IN607001	Introductory Application Development (Dev3)	15	IN511001 (Prog2)
IN608001	Intermediate Application Development (Dev4)	15	IN610001 (Prog3) or IN607001 (Dev3)
IN616002	Operations Engineering 1	15	IN616001 (OSC)

Year 3

Code	Course	Credits	Pre-requisites
IN728001	Studio 5	15	120 credits at Level 5, min of 90 credits at Level 6 including IN602001 (SE) or Studio4

IN732001	Studio 6	15	IN700001 (Project1), IN728001 (Studio5)
IN703001	Developing Flexible IT Courses	15	IN501001 (PP) or IN502001 (Studio1)
IN705001	Databases 3	15	IN605001 (DB2)
IN711001	Advanced Algorithms	15	IN608001 (Dev4) or IN628001 (Prog4)
TBA	Operations Engineering 2	15	IN617001 (Linux) or IN616002 (OE1)
IN720001	Administering a Virtual Infrastructure	15	IN719001 (SA3) or IN734001 (OE2)
IN721000	Mobile Application Development	15	IN610001 (Prog3)
IN723001	Advanced Networking	15	IN615005 (NW2), recommend IN615006 (NW3)
IN730051	Year Three Special Topic	5	120 Level 5 credits, 60 Level 6 credits, Form signed
IN730101	Year Three Special Topic	10	120 Level 5 credits, 90 Level 6 credits, Form signed
IN730151	Year Three Special Topic	15	120 Level 5 credits, 90 Level 6 credits, Form signed
IN729002	UX Engineering	15	IN608001 (Dev4 - React)
IN724001	Security	15	IN616001 (OSC)
IN727001	Artificial Intelligence & Data Science	15	IN511001 (Prog2), IN521001 (Maths)
IN730001	Advanced Application Development	15	IN608001 (Dev4)
IN733001	Quality Assurance and Software Testing	15	-
IN735001	Enterprise Networking, Security & Automation	15	IN615005 (NW2)

7.2. Appendix 2: Prerequisite Schedule – Post Transition

Year 1

Code	Course	Credits	Pre-requisites
IN510001	Programming 1	15	-
IN511001	Programming 2	15	IN510001 (Prog1)
IN512001	Fundamentals of Web Development	15	IN510001 (Prog1)
IN515001	Introduction to Networks	15	-
IN520002	Devices and Platforms	15	-
IN521001	Maths for IT	15	-
IN530051	Year One Special Topic	5	Permission from Supervising Lecturer - Form signed
IN530052	Year One Special Topic	10	Permission from Supervising Lecturer - Form signed
IN530053	Year One Special Topic	15	Permission from Supervising Lecturer - Form signed
IN502001	Studio 1	15	-
IN503001	Studio 2	15	IN502001 (Studio1)

Year 2

Code	Course	Credits	Pre-requisites
IN605001	Databases 2	15	IN503001, IN511001
IN615005	Switching Routing and Wireless Essentials	15	IN515001 (NW1)
IN615006	Scaling Networks	15	IN615005 (NW2)
IN616001	Operating Systems Concepts	15	IN510001 (Prog1), IN520002 (Devices)
IN620001	Embedded Systems	15	IN520002 (Devices)
IN621001	Automation and Robotics	15	IN620001 (Embedded)
IN630051	Year Two Special Topic	5	60 credits at Level 5, Special Topic Form signed
IN630101	Year Two Special Topic	10	120 credits at Level 5, Special Topic Form signed
IN630151	Year Two Special Topic	15	120 credits at Level 5, Special Topic Form signed
IN606001	Studio 3	15	IN502001 (Studio2)
IN622001	Studio 4	15	IN606001 (Studio3)
IN607001	Introductory Application Development (Dev3)	15	IN511001 (Prog2)
IN608001	Intermediate Application Development (Dev4)	15	IN610001 (Prog3) or IN607001 (Dev3)
IN609001	Operations Engineering 1	15	IN616001 (OSC)

Year 3

Code	Course	Credits	Pre-requisites
IN728001	Studio 5	15	120 credits at Level 5, min of 90 credits at Level 6 including IN622001 (Studio4)
IN732001	Studio 6	15	IN728001 (Studio5)
IN703001	Developing Flexible IT Courses	15	IN502001 (Studio1)
IN705001	Databases 3	15	IN605001 (DB2)
IN711001	Advanced Algorithms	15	IN608001 (Dev4)
IN734001	Operations Engineering 2	15	IN616002 (OE1)
IN720001	Administering a Virtual Infrastructure	15	IN734001 (OE2)
IN721000	Mobile Application Development	15	IN607001 (Dev3)
IN723001	Advanced Networking	15	IN615005 (NW2), recommend IN615006 (NW3)
IN730051	Year Three Special Topic	5	120 Level 5 credits, 60 Level 6 credits, Form signed
IN730101	Year Three Special Topic	10	120 Level 5 credits, 90 Level 6 credits, Form signed
IN730151	Year Three Special Topic	15	120 Level 5 credits, 90 Level 6 credits, Form signed
IN729002	UX Engineering	15	IN608001 (Dev4 - React)
IN724001	Security	15	IN616001 (OSC)

IN727001	Artificial Intelligence & Data Science	15	IN511001 (Prog2), IN521001 (Maths)
IN730001	Advanced Application Development	15	IN608001 (Dev4)
IN733001	Quality Assurance and Software Testing	15	-
IN735001	Enterprise Networking, Security & Automation	15	IN615005 (NW2)
IN737001	Game Development	15	IN511001 (Prog2)
IN736001	Internet of Things and Cloud Computing	15	IN620001 (Embedded), IN609001 (OE1)
IN738001	Business Analysis and Intelligence	15	IN606001 (Studio 3), IN521001 (Maths for IT)

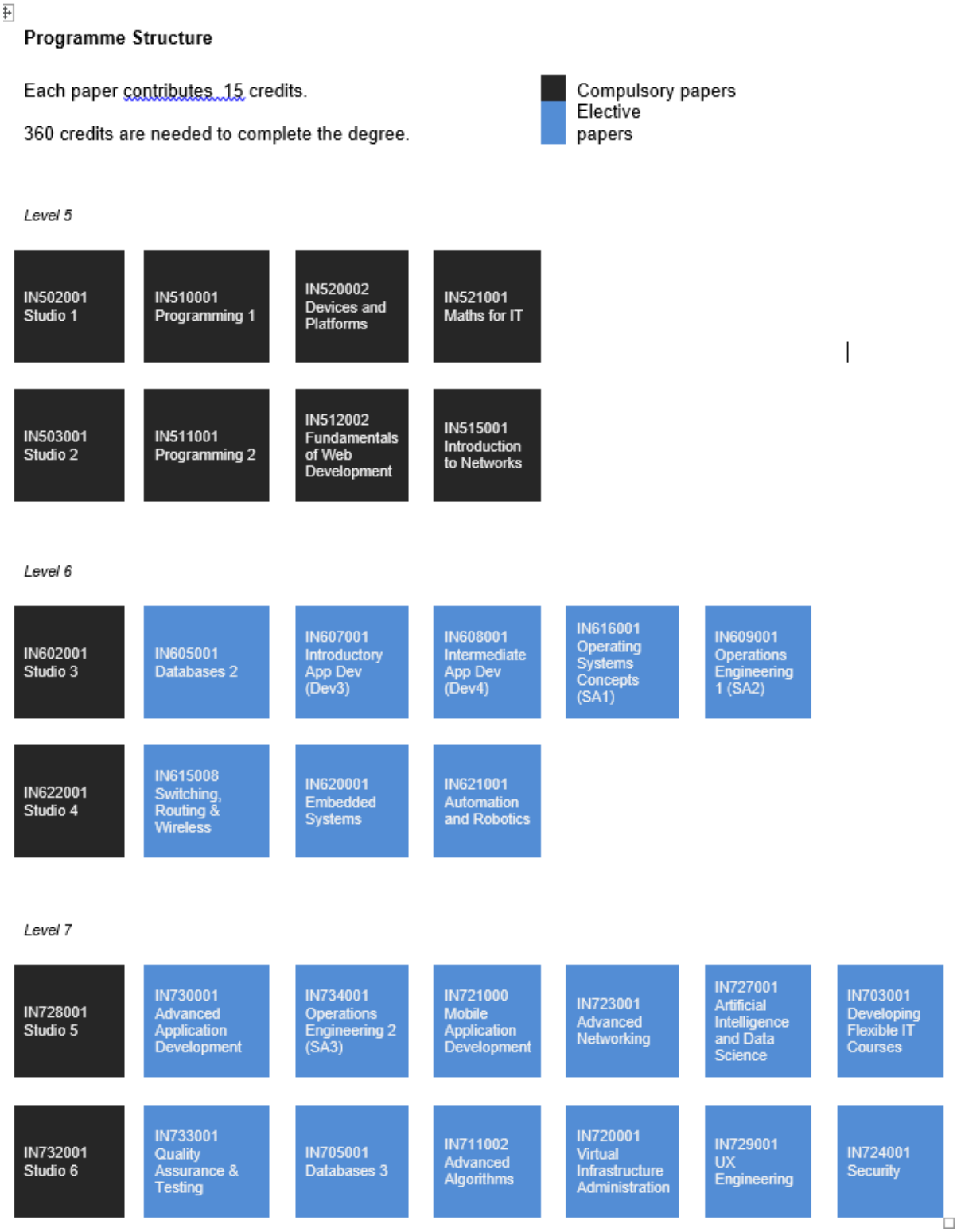
7.3. Appendix 3: Alignment of courses to Graduate Profile Outcomes

	Demonstrate a broad foundation of knowledge and skills suitable for a range of careers involving Information Technology.	Apply Information Technology industry tools, processes and standards to respond to organisational, cultural and community requirements.	Apply critical thinking and independent judgement to develop Information Technology solutions to complex real-world problems.	Engage in independent learning to maintain discipline currency in a rapidly changing Information Technology industry.	Be prepared to contribute effectively as a member or leader in diverse cross functional Information Technology teams.	Integrate cultural, ethical and sustainable practice consistent with Information Technology codes of conduct and informed by the principles of Te Tiriti O Waitangi.
Programming 1	x		x	x	x	
Programming 2	x		x	x		
Fundamentals of Web Development	x	x	x	x		x
Maths for IT	x	x	x			
Studio 1	x	x	x	x	x	x
Studio 2	x	x	x	x	x	x
Platforms & Devices	x	x		x		
Introduction to Networks	x	x				
Studio 3	x	x	x	x	x	x
Studio 4	x	x	x	x	x	x
Databases 2	x	x	x	x	x	
Introductory App Dev	x	x	x			
Intermediate App Dev	x	x	x		x	
Operations Engineering 1	x	x	x		x	
Operating Systems	x	x	x			
Switching Routing and Wireless Essentials	x	x	x			
Scaling Networks	x	x	x			

Automation and Robotics	x	x	x		x	
Embedded Systems	x	x	x		x	
Studio 5	x	x	x	x	x	x
Studio 6	x	x	x	x	x	x
Advanced Application Development	x	x	x	x		
Advanced Algorithms	x	x	x	x		
Mobile App Dev	x	x	x	x	x	x
UX Engineering	x	x	x	x		x
Quality Assurance & Testing	x	x	x			x
Game Dev	x	x	x			
Administering a Virtual Infrastructure	x	x	x	x	x	
Operations Engineering 2	x	x	x		x	x
Security	x	x	x		x	x
Advanced Networking	x	x	x	x	x	x
Enterprise Networking	x	x	x	x		
IoT & Cloud Computing	x	x	x			
Databases 3	x	x	x			x
AI & Data Science	x	x	x			x
Business Analysis and Intelligence	x	x	x			
Developing Flexible IT Courses	x	x		x		x

7.4. Appendix 4: Indicative Pathways

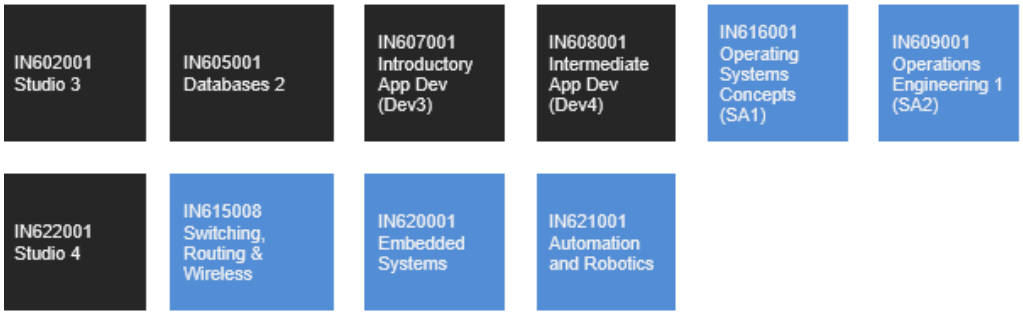
Indicative Pathways for the Bachelor of Information Technology



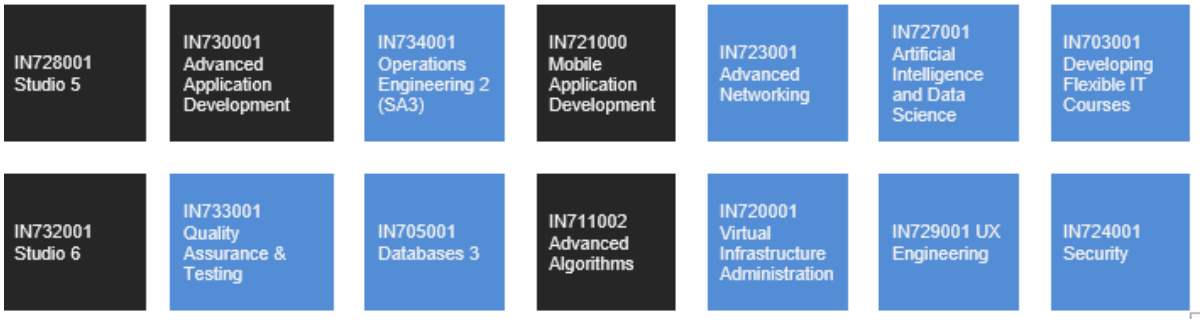
Development pathway

Level 5

Level 6



Level 7

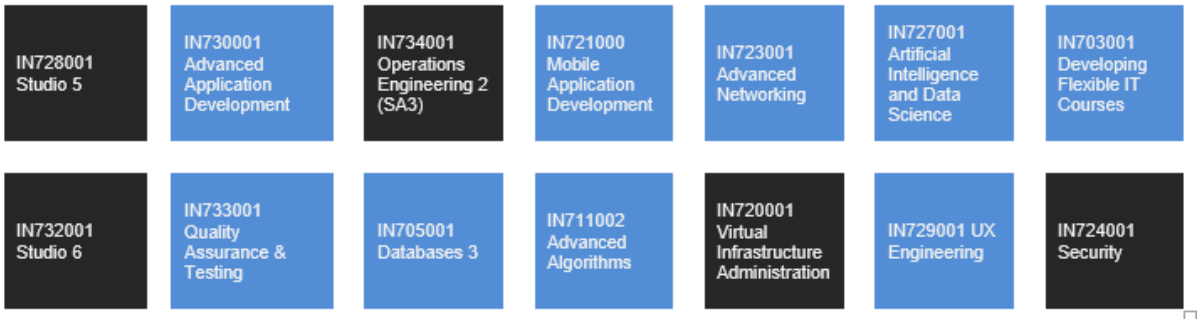


Operations pathway

Level 5

Level 6

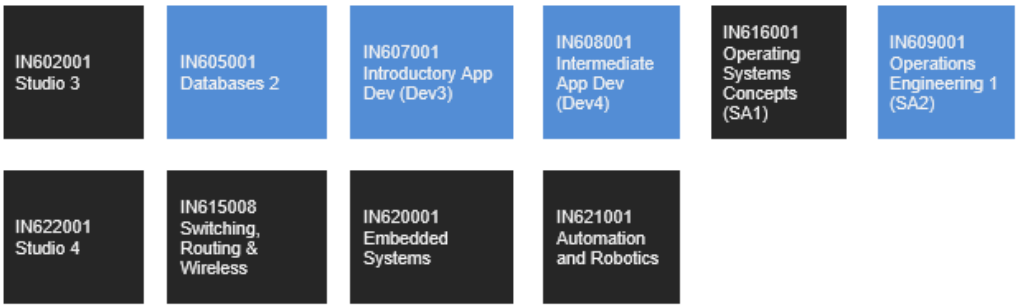
Level 7



Hardware/Networks pathway

Level 5

Level 6



Level 7

Specific examples of BIT Pathways

	Level 5	Level 6	Level 7
Compulsory papers	IN502001 Studio 1 IN510001 Programming 1 IN520002 Devices and Platforms IN521001 Maths for IT IN502001 Studio 2 IN511001 Programming 2 IN512002 Fundamentals of Web Development IN515001 Introduction to Networks	IN602001 Studio 3 IN622001 Studio 4	IN728001 Studio 5 IN732001 Studio 6
Development		IN605001 Databases 2 IN607001 Introductory App Dev (Dev3) *IN616001 Operating Systems Concepts (SA1)* IN608001 Intermediate App Dev (Dev4) *IN609001 Operations Engineering 1 (SA2)* *IN615008 Switching, Routing & Wireless*	IN730001 Advanced Application Development IN721000 Mobile Application Development *IN727001 Artificial Intelligence and Data Science* *IN705001 Databases 3* IN711002 Advanced Algorithms *IN729001 UX Engineering*
Operations		IN607001 Introductory App Dev (Dev3) IN616001 Operating Systems Concepts (SA1) *IN615008 Switching, Routing & Wireless* *IN605001 Databases 2* *IN608001 Intermediate App Dev (Dev4)* IN609001 Operations Engineering 1 (SA2)	IN734001 Operations Engineering 2 (SA3) *IN723001 Advanced Networking* *IN705001 Databases 3* *IN733001 Quality Assurance & Testing* IN720001 Virtual Infrastructure Administration IN724001 Security
Hardware / Networks		IN607001 Introductory App Dev (Dev3) IN616001 Operating Systems Concepts (SA1) IN620001 Embedded Systems *IN609001 Operations Engineering 1 (SA2)* IN615008 Switching, Routing & Wireless IN621001 Automation and Robotics	IN734001 Operations Engineering 2 (SA3) IN723001 Advanced Networking *IN703001 Developing Flexible IT Courses* *IN733001 Quality Assurance & Testing* *IN720001 Virtual Infrastructure Administration* IN724001 Security

The papers shown in italics could be replaced by other elective papers.

Indicative Pathway for Graduate Diploma in Information Technology

	Level 5	Level 6	Level 7
Compulsory papers			**IN732001 Studio 6**
Software Development	IN510001 Programming 1 IN511001 Programming 2 IN512002 Fundamentals of Web Development IN521001 Maths for IT	IN605001 Databases 2 IN607001 Introductory App Dev IN608001 Intermediate App Dev	IN730001 Advanced Application Development IN711002 Advanced Algorithms IN721001 Mobile App Dev IN729002 UX Engineering IN733001 Quality Assurance & Testing IN737001 Game Dev
Operations	IN502001 Studio 1 IN503001 Studio 2 IN520002 Platforms & Devices IN515001 Introduction to Networks	IN609001 Operations Engineering 1 IN616001 Operating Systems IN615005 Switching Routing and Wireless Essentials IN615006 Scaling Networks	IN720001 Administering a Virtual Infrastructure IN734001 Operations Engineering 2 IN724001 Security IN723001 Advanced Networking IN735001 Enterprise Networking IN736001 IoT & Cloud Computing
Data Management and Analytics	IN510001 Programming 1 IN521001 Maths for IT	IN605001 Databases 2	IN711002 Advanced Algorithms IN705001 Databases 3 IN727001 AI & Data Science
Embedded Systems and Automation	IN520002 Platforms & Devices IN510001 Programming 1 IN511001 Programming 2 IN521001 Maths for IT	IN621001 Automation and Robotics IN620001 Embedded Systems	IN727001 AI & Data Science IN736001 IoT & Cloud Computing IN738001 Business Analysis and Intelligence
Business Analysis and Intelligence	IN502001 Studio 1 IN503001 Studio 2 IN511001 Programming 1 IN521001 Programming 2	IN605001 Databases 2	IN711002 Advanced Algorithms IN727001 AI & Data Science IN703001 Developing Flexible IT Courses IN729002 UX Engineering IN738001 Business Analysis and Intelligence

Indicative Pathway for Graduate Certificate in Information Technology

	Level 5	Level 6	Level 7
Compulsory papers			**IN732001 Studio 6**
Software Development		IN605001 Databases 2 IN607001Introductory App Dev IN608001Intermediate App Dev	IN730001 Advanced Application Development IN711002 Advanced Algorithms IN721001 Mobile App Dev IN729002 UX Engineering IN733001 Quality Assurance & Testing IN737001 Game Dev
Operations		IN609001 Operations Engineering 1 IN616001 Operating Systems IN615005 Switching Routing and Wireless Essentials IN615006 Scaling Networks	IN720001 Administering a Virtual Infrastructure IN734001 Operations Engineering 2 IN724001 Security IN723001 Advanced Networking IN735001 Enterprise Networking IN736001 IoT & Cloud Computing
Data Management and Analytics		IN605001 Databases 2	IN711002 Advanced Algorithms IN705001 Databases 3 IN727001 AI & Data Science
Embedded Systems and Automation		IN621001 Automation and Robotics IN620001 Embedded Systems	IN727001 AI & Data Science IN736001 IoT & Cloud Computing IN738001 Business Analysis and Intelligence
Business Analysis and Intelligence		IN605001 Databases 2	IN711002 Advanced Algorithms IN727001 AI & Data Science IN703001 Developing Flexible IT Courses IN729002 UX Engineering IN738001 Business Analysis and Intelligence