



UNIVERSITY  
of  
TECHNOLOGY,  
MAURITIUS

**School of Innovative Technologies and Engineering**

# **BSc (Hons.) Green Computing and Communications**

**PROGRAMME DOCUMENT**

*BCC v1.0*  
April 2013



## A. Programme Information

The Bachelor of Science (Honours) Green Computing and Communications is a three-year programme which is conducted by the School of Innovative Technologies and Engineering.

The International Telecommunication Union estimates that the ICT sector accounts for a growing percentage of the total global carbon emissions. It is also believed that the energy consumption and carbon emissions of the ICT sector will double by the year 2020. Over the past few years, there have been rapid developments in the ICT sector in Mauritius which has automatically led to a rise in the carbon emissions. In line with the government's *Maurice Ile Durable* concept, this new programme aims at promoting sustainable development in the ICT sector. Government bodies and private companies require trained graduates to help achieve a low carbon emission existence.

The programme primarily focuses on two fields which are computing and communications. It provides prospective graduates with core communications and computing competencies including strong programming skills so as to allow the graduate to work as an ICT/IT professional. Additionally, the programme aims at equipping students with the required knowledge to help address energy efficiency issues in the different areas of the ICT sector. Emerging efficient communications and computing technologies are also presented in numerous specialised modules.

## B. Programme Aims

Current green IT trends are mainly characterised by the IT management of companies to more efficiently and effectively use IT resources to reduce the environmental impact. As such, the increased global consciousness regarding the need for environment friendliness and a decreasing carbon footprint has opened up vast fields of business and research potentials in the field of green computing and communications.

And Mauritius is not lagging behind and has demonstrated its willingness to engage on the path of sustainability. It is in this context that the proposed programme fits in – to prepare a pool of graduates that would have the right computing and communication skills adequately complemented with the required green computing knowledge to assist companies, Government and academy to further their vision of “going green”.

Indeed, the convergence of computing and communication in the recent years has called for an integrated approach. We thus expect our graduates to start their career in any of the two fields or their combination while providing their employers with the added capacity of providing strong support for their green projects.



### C. Programme Objectives

The first year of the programme introduces the core computing skills as well as focuses on the importance of sustainability in the ICT sector. The second year of studies further enhances the programming and general computing skills as well as allowing students to learn about how to achieve energy efficiency in specific areas of the ICT sector. The third year of studies introduces technologies which promotes green computing such as Advanced Web Technologies. In third year, the students will also use their acquired skills to develop a sustainable ICT project for an organization.

After successful completion of the programme, the graduate will be able to:

1. Understand the principles of software development through modules such as Object Oriented Software Development and Internet Programming;
2. Develop advanced knowledge through specialised computing modules such as Database technologies for Green Computing and Securing Green Systems;
3. Develop essential communications knowledge through modules such as Communications Systems Fundamentals and Networks;
4. Understand advanced and latest sustainable communications concepts through modules such as Multicarrier Wireless Communications, Optical Networks and Sustainable Wireless Architectures;
5. Develop mobile and web applications;
6. Appreciate the different energy policies and regulations;
7. Define, plan and monitor sustainable ICT projects in organisations;
8. Develop analytical skills and ability to understand and implement emerging ICT technologies;
9. Understand the concept of climate change, sustainability and importance of renewable energy;
10. Communicate both orally and in writing using traditional and electronic media.



## Part I – Regulations

### D. General Entry Requirements

As per UTM'S Admissions Regulations, and 'Admission to Programmes of Study at First Degree Level'.

### E. Programme Entry Requirements

'A' Level in Mathematics and in another science subject.

### F. Programme Mode and Duration

- Full Time: 3 years (6 semesters)
- Part Time: 4  $\frac{1}{2}$  years (9 semesters)

### G. Teaching and Learning Strategies

- Lectures, Tutorials and Practical Laboratory Sessions
- Structured Discussions
- Workshops
- Seminar modules assessed through coursework only

### H. Student Support and Guidance

- Academic tutoring: 3 hours per week per module

### I. Attendance Requirements

- As per UTM Regulations

### J. Credit System

- One module = 3 or 4 credits
- Final Year Project = 9 credits

### K. Student Progress and Assessment

For the award of the Degree, all modules must be passed overall with passes in the examinations, coursework and other forms of assessment. All modules will carry 100 marks and will be assessed as follows (unless otherwise specified):

- Written examination, inclusive of reading time, of duration of 2 - 3 hours for modules carrying 3 credits and not less than 3 hours for modules carrying 4 credits, and continuous assessment carrying up to 40% of total marks.
- Seminars are assessed on continuous assessment only. Each seminar must consist of a minimum of two assessments.
- Continuous assessment can be based on workshops, practical labs or/and assignments or class tests.



## L. Evaluation of Performance

- The percentage mark at Level 1 contributes a 20% weighting towards the degree classification.
- The percentage mark at Level 2 contributes a 30% weighting towards the degree classification.
- The percentage mark at Level 3 contributes a 50% weighting towards the degree classification.
- Maximum marks attainable:

Level 1	1000
Level 2	1000
Level 3	1000

- Module grading structure:

Grade	Marks x (%)
A	$70 \leq x$
B	$60 \leq x < 70$
C	$50 \leq x < 60$
D	$40 \leq x < 50$
F	$x < 40$
A-D	Pass
F	Fail

## M. Award Classification

Overall weighted mark y (%)	Classification
$y \geq 70$	1 <sup>st</sup> Class Honours
$60 \leq y < 70$	2 <sup>nd</sup> Class 1 <sup>st</sup> Division Honours
$50 \leq y < 60$	2 <sup>nd</sup> Class 2 <sup>nd</sup> Division Honours
$45 \leq y < 50$	3 <sup>rd</sup> Class Honours
$40 \leq y < 45$	Pass Degree
$y < 40$	No Award

## N. Programme Organisation and Management

Programme Director: Dr. Vandana Bassoo

Contact Details:

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**Part II – Programme Structure**

**O. BSc (Hons) Green Computing and Communications (Full-time)**

YEAR 1							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+ P/T	Credits	Code	Modules	Hrs/Wk L+ P/T	Credits
MATH1105C	Mathematics for ICT I	2+1	3	MATH1106C	Mathematics for ICT II	2+1	3
SUST1101C	Principles of Sustainability	2+1	3	WAT1116C	Internet Programming I	2+2	4
SEM1101C	Professional Practice Seminar	2+1	3	OSS1110C	Energy Aware OS	2+1	3
PROG1115C	Object Oriented Software Development I	2+2	4	PROG1116C	Object Oriented Software Development II	2+2	4
TELC1101C	Communications Systems Fundamentals	2+1	3	SUST1102C	ICT Sustainability	2+1	3
				CAN1102C	Networks	2+1	3

YEAR 2							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+ P/T	Credits	Code	Modules	Hrs/Wk L+ P/T	Credits
CAN2113C	Efficient Switching and Routing	2+1	3	MGMT2106C	Quality Management and Sustainability	2+1	3
TELC1117C	Multicarrier Wireless Communications	2+2	4	CAN2114C	Emerging Networking Protocols	2+1	3
MULT1115C	Multimedia Processing and Compression	2+2	4	SUST2103C	Energy and Environmental Policies and Regulations	2+1	3
DBT1112C	Database Technologies for Green Computing	2+2	4	MCT2105C	Mobile Device Application Development	2+2	4
WAT2117C	Internet Programming II	2+2	4	MGMT2107C	Research Methodology	2+1	3

YEAR 3							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+ P/T	Credits	Code	Modules	Hrs/Wk L+ P/T	Credits
TELC2118C	Optical Networks	2+2	4	TELC3119C	Sustainable Wireless Architectures	2+1	3
WAT2126C	Advanced Web Technologies	2+2	4	SECU3120C	Securing Green Systems	2+1	3
SEM2114C	Project Management for Sustainability	2+1	3		Elective B	2+2	4
	Elective A	2+1	3				
PROJ2114C	Sustainable ICT Project			PROJ2114C	Sustainable ICT Project		9



**P. Programme Structure (Part-time)**

YEAR 1							
→ <i>Start of Level 1</i>							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+ P/T	Credits	Code	Modules	Hrs/Wk L+ P/T	Credits
SUST1101C	Principles of Sustainability	2+1	3	MATH1106C	Mathematics for ICT II	2+1	3
MATH1105C	Mathematics for ICT I	2+1	3	PROG1115C	Object Oriented Software Development I	2+2	4
SEM1101C	Professional Practice Seminar	2+1	3	OSS1110C	Energy Aware OS	2+1	3
TELC1101C	Communications Systems Fundamentals	2+1	3	SUST1102C	ICT Sustainability	2+1	3

YEAR 2							
				→ <i>Start of Level 2</i>			
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+ P/T	Credits	Code	Modules	Hrs/Wk L+ P/T	Credits
WAT1116C	Internet Programming I	2+2	4	WAT2117C	Internet Programming II	2+2	4
PROG1116C	Object Oriented Software Development II	2+2	4	CAN2113C	Efficient Switching and Routing	2+1	3
CAN1102C	Networks	2+1	3	TELC1117C	Multicarrier Wireless Communications	2+2	4
				MULT1115C	Multimedia Processing and Compression	2+2	4
<i>End of Level 1</i> →							

YEAR 3							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+ P/T	Credits	Code	Modules	Hrs/Wk L+ P/T	Credits
DBT1112C	Database Technologies for Green Computing	2+2	4	MCT2105C	Mobile Device Application Development	2+2	4
MGMT2106C	Quality Management and Sustainability	2+1	3	MGMT2107C	Research Methodology	2+1	3
CAN2114C	Emerging Networking Protocols	2+1	3	SUST2103C	Energy and Environmental Policies and Regulations	2+1	3
				<i>End of Level 2</i> →			



YEAR 4							
→ <i>Start of Level 3</i>							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+ P/T	Credits	Code	Modules	Hrs/Wk L+ P/T	Credits
TELC2118C	Optical Networks	2+2	4	TELC3119C	Sustainable Wireless Architectures	2+1	3
WAT2126C	Advanced Web Technologies	2+2	4	SECU3120C	Securing Green Systems	2+1	3
SEM2114C	Project Management for Sustainability	2+1	3	PROJ2114C	Sustainable ICT Project		

YEAR 5			
Semester 1			
Code	Modules	Hrs/Wk L+ P/T	Credits
	Elective A	2+1	3
	Elective B	2+2	4
PROJ2114C	Sustainable ICT Project		9
<i>End of Level 3</i> →			

ELECTIVES A			
Code	Modules	Hrs/Wks L+T/P	Credits
MKTG3101C	Marketing & Sustainable Practices	2+1	3
SUST2104C	Green IT Governance	2+1	3

ELECTIVES B			
Code	Modules	Hrs/Wks L+T/P	Credits
SECU3122C	Computer Forensics	2+2	4
CAN2103C	Communication & Networking Design & Management	2+2	4





## Q. Module Outline

### MATH1105C MATHEMATICS FOR ICT I

- Mathematical logic
  - Propositions, truth tables
  - Predicates, Quantifiers
- Mathematical proofs
  - Proof by Contradiction and Contraposition
  - Proof by Induction
- Sets
- Relations
  - Equivalence Relations
  - Partial Order Relations
- Functions
  - Bijective and Inverse Functions
  - Recursion
- Number systems
  - Divisibility of integers, Primes
  - The Euclidean Algorithm
- Matrices and solutions of linear systems
  - Cramer's rule and adjoint method
  - Gauss elimination method
  - LU Factorisation
- Graphs
  - Representations of Graphs
  - Paths, cycles, and connectivity
  - Planar Graphs

### SUST1101C: PRINCIPLES OF SUSTAINABILITY

- Broad overview of the origins & concept of sustainability;
- The guiding principles for the development process;
- Key concepts & drivers of sustainability;
- Roles of stakeholders, institutions, the business community, government, consumers & NGOs;
- Sustainable development issues & socio-cultural sustainability;
- The triple bottom line: economics, environment & equity;
- Resource production & consumption;
- Environmental impacts & environmental indicators;
- Climate change;
- Fundamental ecological concepts;
- Ecosystem services;
- Sustainable industry & business;
- The future of energy;
- Eco-efficiency & carbon trading



## **PROG1115C OBJECT ORIENTED SOFTWARE DEVELOPMENT I**

- Introduction to object programming paradigm
- Introduction to the programming language and IDE
- Basic Data Types
- Sequence Selection and Iteration
- Classes and Objects
  - Defining and using the class
  - Controlling access to field and methods
  - Constructors, destructors and Garbage collection
  - Methods: Objects as arguments, Returning objects
  - Static Classes
- Collections Classes:
  - Arrays
  - Lists
- Exception Handling
  - Exception hierarchy
  - Try, catch and finally blocks
  - Chained exceptions
  - Declaring new exceptions

## **SEM1101C PROFESSIONAL PRACTICE SEMINAR**

- Organization Structure and role of ICT in organizations
- Ethics in ICT Profession
- Health & Safety Issues in ICT
- IT Contracts
- Intellectual Property – copyright & patents
- Data Protection
- Computer Misuse
- Electronic Transactions
- Green Issues
- Professional communication
  - Carry out presentations
  - Participate and organize meetings
  - Electronic communication

## **TELC1101C COMMUNICATIONS SYSTEMS FUNDAMENTALS**

- Communications channel
- Baseband transmission
- Digital modulation, transmission, impairments
- Radio wave propagation.
- Aerial design.
- Radio frequency,
- Signal generation and detection.
- Transmitter and receiver circuits.
- Computers and devices,
- Networks and Network Operating systems.
- Scientific programming languages and simulators,
- Wireless Communications (Cellular, Satellite communications etc).
- Digital radio systems.
- Standards



## **SUST1102C ICT SUSTAINABILITY**

- Information revolution
- Importance of ICT as a tool for development
- Rise in pervasive and ubiquitous computing
- Global ICT footprint
- Power usage of common ICT elements and trends in future demand
- Power management software for different devices
- Cooling issues
- Emerging green technologies
- Managing resource consumption and demand in ICT sector
- Choosing recycling friendly materials
- Sustainable procurement policies – vendor and product analysis
- EPEAT/ Energy star programs
- Managing waste – Technology related recycling programs
- Changing user behavior

## **CAN1102C NETWORKS**

- Overview of Networking
- Communications Model, ISO-OSI Reference Model, TCP/IP Suite
- Popular application layer protocols such as: HTTP, FTP, SMTP and DNS
- Transport Layer protocols: TCP and UDP
- Connection Management, Reliable Data Transfer, Flow Control, Error Control, Congestion Control
- Network Layer protocols: Ipv4 and IPv6, DHCP, ARP, RARP
- Fragmentation
- Network Design: Topologies
- Networking issues: Subnetting, NAT
- Networking Devices (Hubs, Switch, Bridge, Router,..) and Media

## **PROG1116C OBJECT ORIENTED SOFTWARE DEVELOPMENT II**

- Inheritance
  - Superclasses and subclasses
  - Protected members
  - Relations between superclasses and subclasses
  - Constructors in superclasses
- Interface and Polymorphism
  - Abstract classes and methods
  - Final methods and classes
  - Creating and using interfaces
- Streams and files
- Data Structures and Algorithms:
  - Stacks, Queues.
  - Searching: sequential searches, binary search and trees.
  - Sorting: bubble, heap, quick.
- Complexity Analysis



### **OSS1110C ENERGY AWARE OS**

- Brief overview of computer hardware, architecture and data representation.
- Modern operating systems: Single-user vs. multi-user; interactive vs. non- interactive systems; multiprogramming, multi- processing, time-sharing systems; real-time.
- File Management: File access system calls; file permissions; secondary storage management; file system implementation.
- Memory Management, swapping; virtual memory systems
- Resource Management & processor scheduling.
- The hardware interface: Memory; input/output; interrupts; direct memory access; peripherals.
- The user interface: Graphical Interfaces and principles of HCI e.g. Microsoft Windows
- Virtualisation: different types of virtualization technology.
- Understanding of how to use several optimization techniques to improve the performance of operating systems

### **MATH1106C MATHEMATICS FOR ICT II**

- Further differentiation and integration
- Taylor series
- Polar coordinates
- Partial differentiation
- Eigenvalues and eigenvectors
- Vectors: Dot and cross products
- Linear programming
  - Graphical method
  - Simplex method
- Counting
  - Permutations and Combinations
  - Binomial Coefficients
  - The Pigeonhole Principle
- Probability
  - Events and probabilities
  - Conditional probability, independence
  - Random variables, expectation and variance
  - Binomial, Poisson and Hypergeometric distributions
  - Normal distribution

### **WAT1116C INTERNET PROGRAMMING I**

- Intro to Internet & WWW Concepts
- Intro to HTML5, XHTML
- Headings, Linking, Images
- Lists, Tables, Forms
- Internal Linking, meta Elements
- CSS3, Embedded Style Sheets, Positioning Elements, Element Dimensions, Box Model & Text Flow
- Drop Down Menu using CSS
- User Style Sheets
- Intro to JavaScript and JQuery
- JavaScript Control Statements
- JavaScript Functions, Arrays, Objects, Events



## **DBT1112C DATABASE TECHNOLOGIES FOR GREEN COMPUTING**

- Main Features of Green Computing
- Evolution of Databases.
- Relational Databases and relational Integrity
- Modelling for Database Design
- Normalization
- Relational Algebra & SQL
- Green Database Technologies (e.g. Advanced Configuration and Power Interface (ACPI), Data migration, storage farms with large storage arrays, Innovative Hardware & Networking technologies, Power management, Major changes of the underlying operating system architecture + new hardware driver model).
- A case study (for e.g. CLUSTERPOINT) to show the major features of a generic approach to Green Database Technologies.

## **TELC1117C MULTICARRIER WIRELESS COMMUNICATION**

- Overview of wireless systems,
- Transmission basics
- Analogue and digital data transmission,
- Bandwidth and channel capacity,
- Transmission impairments,
- Transmission media, analogue
- Digital modulation-demodulation – High order QAM
- High Efficiency Multi Carrier Schemes such as OFDM
- Wireless Transmitter and Receiver Architectures

## **MGMT2106C QUALITY MANAGEMENT AND SUSTAINABILITY**

- Definitions of quality
- Quality philosophies
- Process definition, assessment& improvement
- Quality Management System: ISO9001, CMMI, Six Sigma
- Total Quality Management
- Continuous Improvement (CI)
- CI Tools & Techniques
- Statistical Quality Control
- Quality assurance in IT projects
- Software testing techniques
- Sustainability issues in quality management

## **MGMT2107C RESEARCH METHODOLOGY**

- Research view
- Documenting, literature review
- Research ethics
- Research support
- Research proposals
- Tools of research
- Creativity, synthesis and evaluation
- Research types, measurement, analysis, models and simulations, optimization
- Writing the piece of work
- Presentation



### **MULT1115C MULTIMEDIA PROCESSING AND COMPRESSION**

- Image acquisition and display using digital devices
- Properties of human visual perception
- Sampling and quantization
- Image enhancement
- Image restoration
- Morphological operations
- Noise removal
- Image deblurring
- Edge detection
- Image registration
- Geometric transformation
- Current and novel compression techniques for efficient storage and transfer of Multimedia components
- Video communication standards
- Object recognition and image understanding

### **CAN2113C EFFICIENT SWITCHING AND ROUTING**

- Review of basic switching and routing in computer networks
- Energy awareness in network design and routing
- Energy efficient protocols (Energy-efficient Ethernet, Power over Ethernet, etc)
- Energy efficient network devices (e.g. switches, routers, racks)
- Technologies for efficient switching (such as network coding, smart sleeping, dynamic adaptation)
- Case studies of Industry progress in the field of energy efficient switching and routing (e.g. Cisco EnergyWise, Intel Routing and Switching)

### **MCT2105C MOBILE DEVICE APPLICATION DEVELOPMENT**

- Overview of Mobile Platforms and Development Tools.
- Developing SMS based applications
- Developing Mobile Web
  - Progressive Enhancement
  - User Interface Design, Touch Design Patterns, Styling with CSS3, Screen Size and orientation Detection
  - HTML and CSS for mobile browsers
  - JavaScript mobile
  - Geolocation and Maps
- Developing Native Mobile Applications
  - Architecture and Design
  - Collect user input and event handling
  - Working with Images, Camera, accelerometer and other enhancing features
  - Location Based Services
- Testing Debugging and performance



### **CAN2114C EMERGING NETWORKING PROTOCOLS**

- IPv6 features vs. IPv4 features for the Internet
- Internet applications such as voice over IP (IP telephony & IP video)
- Introduction to Wireless Internet, Mobile IP, TCP in wireless domain, WAP
- Ad Hoc wireless network protocols
- Routing protocols for wireless networks: on demand routing protocols, hybrid routing protocols, routing protocols with efficient flooding mechanisms, power aware routing protocols
- Transport layer and security protocols for wireless networks: WEP, Secure Routing
- Quality of service in wireless and wired networks including multimedia networks
- System power management schemes
- Wireless sensor and hybrid network protocols.

### **SUST2103C ENERGY AND ENVIRONMENTAL POLICIES AND REGULATIONS**

- Definitions and scope of Energy and Environmental Policies
- Review of National and International Energy sources (fossil fuel, coal, bagasse, renewable including photovoltaic, wind and solid waste, nuclear, biofuels such as ethanol)
- Global issues (e.g. climate change and geopolitics) and impact on energy supply
- Review of the National Energy policy, review of the National Environment Policy (NEP white paper of 2007), energy-related regulations and environmental regulations (Electricity Act 2005, Energy Efficiency Act 2011, Environment Protection Act 2002, Energy Policy 2007-2025, Mauritius Environment Outlook 2011, etc)
- Support mechanisms (Ministry of Public Utilities, Energy Efficiency Management Office, independent power producers scheme, etc)
- Frameworks for Energy policy analysis
- Standards and reporting systems such as ISO 14001 and ISO 50001 for environmental management systems, Global Reporting Initiative (GRI) Standards and Carbon Disclosure Project (CDP) reports among others.
- Planning issues for energy infrastructure
- Public acceptance and processes of public engagement.

### **WAT1116C INTERNET PROGRAMMING II**

- Architecture of internet-based applications (Client/Server model, 3-tier Model)
- Design and implementation of complete Internet-based applications
- Web-enabled databases
- Development of Multitiered web applications
- Components usage
- Server-side scripting (ASP.NET) to code business logic
- Survey of classes/types of web applications



### **TELC2118C OPTICAL NETWORKS**

- Light waves and propagation
- Single/Multimode fibres
- Wavelength Division Multiplexing
- Components of WDM Networks
- Optical Transmission
- SONETs
- PONs
- FTTx
- Optical Packet Switching
- Optical Burst Switching

### **WAT2126C ADVANCED WEB TECHNOLOGIES**

- Service Oriented Architecture & Web Services
  - Service, Service Bus, Registry.
  - Service Consumers/Application Front-ends
  - Web Service Development (SOAP, WSDL, UDDI, Interoperability between different platforms and programming languages, RESTFull Approach)
- Virtualisation
  - Cloud Computing Concept
  - Understanding Elasticity, Resiliency, On-Demand and Measured Usage
  - Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) Cloud Delivery Models
  - Security and Inter-Operability issues regarding cloud computing.
  - Designing more energy efficient data centers.
  - Developing Applications for the Cloud
- Web 2.0 Concept and the Semantic Web
  - Overview of Social Networks, Blogs and Wikis, RSS
  - Overview of Web Application Programming Interfaces (APIs)
  - Use open development platform/language (PHP/Python/JSP)
  - Developing Web applications advanced APIs: Ajax, JQuery

### **SEM2114C PROJECT MANAGEMENT FOR SUSTAINABILITY**

- Project Management Fundamentals
- Defining and defending sustainable development projects
- Project planning
- Project organization
- Role of culture in sustainable project management
- Techniques for Project Scheduling
- Resource management
- Managing risks in an uncertain environment
- Stakeholder management
- Change management
- Project Monitoring
- Sustainable people management
- Project Evaluation and Termination





### **SECU3120C SECURING GREEN SYSTEMS**

- Cryptography: encryption and decryption of data using symmetric and/or public key cryptography, key management, digital certificates, digital signatures.
- Compression techniques, data often compressed and encrypted to reduce transmission time and thus increase efficiency.
- Firewalls as a perimeter security device.
- Intrusion detection systems for real time security monitoring.
- Access control in cloud environments.
- Security challenges for cloud computing.
- Security challenges for data centers.

### **TELC3119C SUSTAINABLE WIRELESS ARCHITECTURES**

- Importance of digitalization of wireless architectures
- Architecture of Green Base Stations
- Efficient Antennas - MIMO
- Cooperative Base Station Management – Self Organising Networks
- Heterogeneous Network – Femtocells, Picocells, Microcells and Macrocells, Network Planning
- Wireless Sensor Networks
- Cognitive Radio
- Cooperative Relaying – Fixed Relays, User Cooperation in Cellular Networks

### **PROJ2114C SUSTAINABLE ICT PROJECT**

- Demonstration of core competencies acquired on the degree
- Demonstration of creative and innovative acumen, self-management and self-development skills
- Develop a computing and/or telecommunications project in which students will be required to design and build sustainable software or hardware architectures.

### **MKTG3101C MARKETING & SUSTAINABLE PRACTICES**

- Green marketing;
- Importance of sustainability in modern organisations;
- Emergence of societal marketing concept;
- Contemporary relationship marketing and social marketing management;
- Online Customer Relationship Management as a sustainable development;
- Green marketing practice in local and international context;
- Industrial practice of eco-friendly marketing communications tools
- Rise of online marketing

### **SUST2104C GREEN IT GOVERNANCE**

- Definition and purpose of IT Governance (why do organizations need an IT/Business Governance Policy and Process)
- Review of IT Governance Best Practice Reference Models, Frameworks and Standards (e.g. ISO 38500)
- IT Service Management and Delivery (ITSMD) Excellence with reference to the ITIL Framework
- Performance Management, Management Controls and Risk Management
- IT Governance and Sustainability: the Link



### **CAN2103C COMMUNICATION & NETWORKING DESIGN AND MANAGEMENT**

- Survey of the current technologies applicable to the development of corporate LAN, LAN to LAN connection, LAN interconnection via WAN and mobile LAN.
- Analysis and design of corporate networks through case-studies.
- Managing network performance and security.
- Fault and configuration management in networks.

### **SECU3122C COMPUTER FORENSICS**

- Understanding the importance of computer forensics
- Review of computer hardware
- Incident response for forensics
- The computer forensic process, data acquisition
- Analysis of FAT & NTFS file system for evidence recovery
- Live data capture, memory analysis
- Evidence from routers
- Email forensics