



UNIVERSITY
of
TECHNOLOGY,
MAURITIUS

School of Innovative Technologies and Engineering

Department of Industrial Systems Engineering

BSc (Hons) Computer Science with Network Security

PROGRAMME DOCUMENT

VERSION 5.1
April 2017

University of Technology, Mauritius

La Tour Koenig, Pointe aux Sables, Mauritius

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BSc (Hons) Computer Science with Network Security

A. Programme Information

The Bachelor of Computer Science with Network Security aims at producing graduates with knowledge and skills to have a productive career as professionals in the computing industry more specifically in the area of network and security administration of computing resources.

This programme is a three-year program of study that emphasizes the mathematical and theoretical foundations of computing as well as the key skill of programming with focus on networking aspect and security. The student embark on general computing studies such as computer architecture, software development, database system, operating systems as well as network and security related areas such as network programming, data and network security and wireless network security. The programme also prepares the student for management, communication, and legal aspects through interactive seminars.

B. Programme Aims

Most information system is growing more and more complex and networked. At the same time, the risks of security attacks on such networks is becoming significant as most business relies on the computer system for storage and processing of critical and sensitive information. The BSc (Hons) Computer Science with Network Security is thus designed to produce graduates with a sound knowledge of today's networked infrastructure and skills to be able to properly design, implement and secure such complex and distributed systems. The curriculum provides a balanced and intellectually stimulating programme of theoretical and practical work.

Job Prospects:

- Network Administrator
- Network Engineer
- System Administrator
- Security Administrator
- IT Manager
- Web Developer
- Software Developer

C. Programme Objectives

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

- Appreciate the functioning of a computer system and its operating systems
- Understand the principles of software development and data modelling
- Develop standalone or distributed applications
- Develop web and mobile applications
- Design and develop network based solutions
- Design a secured network using different available technologies such as cryptography, firewalls and intrusion, detection systems
- 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 Degree Level' or APL / APEL requirements.

E. Programme Entry Requirements

'A' Level in Mathematics or in another science subject including Computer Science or related subject.

F. Programme Mode and Duration

Full Time: Min 3 years, Max 6 years (Min 6 semesters, Max 12 semesters)

Part Time: Min 4 1/2 years, Max 7 1/2 years (Min 9 semesters, Max 15 semesters)

G. Teaching and Learning Strategies

- Lectures, Tutorials and Practical Sessions
- Structured Discussions and Self-Directed Study
- Workshops and Seminars
- Work Placement or Project Portfolio
- Case Study of real world problems

H. Student Support and Guidance

Each cohort of the programme is allocated a Programme coordinator who acts as a liaison between the students and school management and provides support for academic management of the programme.

I. Attendance Requirements

As per UTM's Regulations and Policy

J. Credit System

1 module = 3 or 4 credits

Computer Science Project = 9 credits

For the award of a Certificate, a minimum of 33 credits are required.

For the award of a Diploma, a minimum of 66 credits are required.

For the award of an Ordinary Degree, a minimum of **96** credits are required.

For the award of a Honours Degree, **105** credits are required.

K. Student Progress and Assessment

The programme is delivered mainly through lectures, tutorials, and practical sessions. Students are expected to be as autonomous as possible and activities may include reading research articles, delivering presentations, taking part in quizzes, case-studying, organize and participate in workshops, amongst others.

For the award of the Degree, all modules must be passed overall with passes in the examination, coursework, and other forms of assessment.

Each module carries 100 marks and unless otherwise specified will be assessed as follows:

- Continuous assessment (coursework) carries a minimum of 30% and a maximum of 40% of the total marks. Continuous assessment can be based on a combination of assignments, field study, workshops, surveys, practical and class tests;
- Modules Programming Concepts, Object Oriented Software Development, Visual Programming, and Database Design will be assessed by 50% coursework and 50% exams.
- Modules Professional Practice Seminar, and Research and Development Seminar will be assessed by 100% coursework. The coursework must consist of at least two assessments.

Module Grading Structure

Grade	Marks x (%)
A	$70 \leq x < 100$
B	$60 \leq x < 70$
C	$50 \leq x < 60$
D	$40 \leq x < 50$
F	$x \leq 40$
A-D	Pass
F	Fail

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.

M. Award Classification

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

N. Programme Organisation and Management

Programme Director: Dr Sandhya Armoogum

Contact Details:

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Part II - Programme Structure

O. BSc (Hons) Computer Science with Network Security – Full Time (Version 5.1)

YEAR 1 (Level 1)							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
MATH1206C	<i>Mathematics for Computer Science</i>	2+1	3	WAT1116C	<i>Internet Programming I</i>	2+2	4
PROG1101C	<i>Programming Concepts</i>	2+2	4	PROG1119C	<i>Object Oriented Software Development</i>	2+2	4
SEM1119C	<i>Professional Practice Seminar</i>	2+1	3	CAN1101C	<i>Networks</i>	2+1	3
CAN1103C	<i>Data Communications</i>	2+1	3	SDT2102C	<i>Analysis and Design</i>	2+1	3
DBT1111C	<i>Database Design</i>	2+2	4	HCA1103C	<i>Computer and Microprocessor architecture and programming</i>	2+2	4

YEAR 2 (Level 2)							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L T/P	Credits	Code	Modules	Hrs/Wk L T/P	Credits
WAT2117C	<i>Internet Programming II</i>	2+2	4	CAN5108C	<i>Network Programming</i>	2+2	4
PROG2106C	<i>Visual Programming</i>	2+2	4	MCT2104C	<i>Mobile Application Development</i>	2+2	4
CAN2105C	<i>Switching techniques</i>	2+2	4	MGMT2104C	<i>Research & Development Seminar</i>	2+1	3
SECU2123C	<i>Data and Network Security I</i>	2+1	3	PROJ2119C	<i>Work Placement</i>		4
OSS2113C	<i>Operating System Administration</i>	2+2	4				

YEAR 3 (Level 3)							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L T/P	Credits	Code	Modules	Hrs/Wk L T/P	Credits
CAN3102C	<i>Communication & Networking Design & Management</i>	2+2	4	SECU3122C	<i>Computer Forensics</i>	2+2	4
SECU3124C	<i>Data and Network Security II</i>	2+2	4	SCG3101C	<i>Artificial Intelligence</i>	2+2	4
UTM2101C	<i>Life skills & Good practices</i>	2+2	4	CAN3116C	<i>Emerging Networks and Technologies</i>	2+1	3
WAT2124C	<i>Web Services</i>	2+2	4				
PROJ3106C	<i>Computer Science Project</i>			PROJ3106C	<i>Computer Science Project</i>		9

P. BSc (Hons) Computer Science with Network Security – Part Time (Version 5.1)

YEAR 1							
→ Start of Level 1							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L P DS	Credits	Code	Modules	Hrs/Wk L P DS	Credits
MATH1206C	Mathematics for Computer Science	2+1	3	SEM1119C	Professional Practice Seminar	2+1	3
CAN1103C	Data Communications	2+1	3	PROG1101C	Programming Concepts	2+2	4
DBT1111C	Database Design	2+2	4	CAN1101C	Networks	2+1	3

YEAR 2							
				→ Start of Level 2			
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L P DS	Credits	Code	Modules	Hrs/Wk L P DS	Credits
HCA1103C	Computer and Microprocessor architecture and programming	2+2	4	WAT2117C	Internet Programming II	2+2	4
SDT2102C	Analysis and Design	2+1	3	CAN2105C	Switching techniques	2+2	4
WAT1116C	Internet Programming I	2+2	4	OSS2113C	Operating System Administration	2+2	4
PROG1118C	Object Oriented Software Development	2+2	4				
End of Level 1 →							

YEAR 3							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L P DS	Credits	Code	Modules	Hrs/Wk L P DS	Credits
SECU2123C	Data and Network Security I	2+2	4	MCT2104C	Mobile Application Development	2+2	4
PROG2106C	Visual Programming	2+2	4	MGMT2104C	Research & Development Seminar	2+1	3
CAN5108C	Network Programming	2+2	4				
				PROJ2118C	Mini Project	2+1	4
				End of Level 2 →			

YEAR 4								
→ Start of Level 3								
Semester 1				Semester 2				
Code	Modules	Hrs/Wk		Credits	Code	Modules	Hrs/Wk	
		L	P DS				L	P DS
CAN3102C	<i>Communication & Networking Design & Management</i>	2	2	4	SCG3101C	<i>Artificial Intelligence</i>	2	2
SECU3124C	<i>Data and Network Security II</i>	2	2	4	CAN3116C	<i>Emerging Networks and Technologies</i>	2	1
UTM2101C	<i>Life Skills & Good Practices</i>	2	2	4				
					PROJ3106C	<i>Computer Science Project</i>		

YEAR 5				
Semester 1				
Code	Modules	Hrs/Wk		Credits
		L	P DS	
SECU3122C	<i>Computer Forensics</i>	2	2	4
WAT2124C	<i>Web Services</i>	2	2	4
PROJ3106C	<i>Computer Science Project</i>			9
				End of Level 3 →

Q. MODULE OUTLINE

MATH1206C: MATHEMATICS FOR COMPUTER SCIENCE

Proofs, proof by contradiction. Well ordering principle. Propositional logic. Sets, functions and relations. Predicates and quantifiers. Graphs and digraphs. State machines. Counting, binomial theorem and combinatorial identities. Pigeonhole principle. Counting repetitions. Inclusion-exclusion. Generating functions. Discrete probability theory. Conditional probability and independence. Sampling and confidence.

PROG1101C: PROGRAMMING CONCEPTS

Introduction to the basic programming concepts using a problem-solving approach. Writing Algorithms. Definition of Source Code & Compiler. Integrated Development Environments (IDEs). Data types & Variables. Conditional Statements. Arrays. Loops. Basic Input and Output System. Functions/Methods: definition, passing parameters/arguments, return types. Calling Methods. Overview of packages & libraries.

SEM1119C : PROFESSIONAL PRACTICE SEMINAR

Organization Structure and role of ICT in organizations. Description of communication process, Barriers to communication. Writing Skills: Prepare Curriculum Vitae, Writing job applications, business letters and reports (in the ICT context). Electronic Communication: Formal writing using electronic media i.e. emails, Websites & Social Media. Oral Communication: Job interviews, carry out presentations on a theme, organise and participate in meetings. Ethics in ICT Profession. Health & Safety Issues in ICT. Intellectual Property Rights – copyrights & Patents. Electronic transactions. Computer Misuse. Data protection & Privacy.

CAN1103C: DATA COMMUNICATIONS

Introduction to data communication. Frequency response, bandwidth, filtering and noise. Fourier series and Fourier transform. Information theory concepts: Nyquist's theorem, Shannon's theorem. Analog and digital modulation techniques. Communication systems circuits and devices. Data encoding. Physical layer protocols. Data link control (point to point communication, design issues, link management, error control, flow control). Multiplexing and switching

DBT1111C: DATABASE DESIGN

Introduction to Databases. Database Environment. Database Architecture. The Relational Model. Relational Integrity. Entity Relationship Modelling. Normalisation. Relational Algebra. SQL: Data definition and Data Manipulation. Triggers.

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.

PROG1119C: OBJECT ORIENTED SOFTWARE DEVELOPMENT

Introduction to object programming paradigm. Object & Class Concepts. Inheritance. Interface and Polymorphism. Casting Collection Classes. Exception Handling. Streams & File Manipulation.

CAN 1101C: 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. Network Design: Topologies. Networking issues: Subnetting, NAT. Networking Devices (Hubs, Switch, Bridge, Router,...) and Media.

SDT2102C: ANALYSIS AND DESIGN

Intro to Large Scale Systems development. Software Life Cycles. Model-view-controller (MVC) concept. Software development methodologies (waterfall, agile & hybrids). Object Oriented Analysis & Design with UML. Testing Techniques & Strategies.

HCA1103C: COMPUTER AND MICROPROCESSOR ARCHITECTURE AND PROGRAMMING

Introduction to computer architecture & organization: RISC /CISC, superscalar. Instruction Set Architecture: addressing modes and formats, data types, operands and operations. Computer Evolution & Performance: Moore's Law, CPI, benchmarking tools and standards. Buses, Interrupts, Memory: cache, internal & external, I/O and operating system support. Computer arithmetic: Floating point arithmetic, RPN, Boolean algebra, Logic. Design: Logic Gates, K-Maps, MSI chips, Circuits and latches, Sequential Circuit design. Advanced CPU functions: pipelining, branch prediction, ILP, etc. Microprogramming (Assembly language program development environment and tools, Analysis and development of microprograms, Standard program constructs: sequence, selection and iteration, Organising microprograms: assembler macros).

WAT2117C: 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.

PROG2106C: VISUAL PROGRAMMING

Visual programming paradigm. Comparative study with structured programming. Event-driven and object-driven. Visual programming Fundamentals. Human-Computer-Interaction issues. HCI Design principles (e.g Norman, User centered, etc). Design model, system model and user's model. Mapping and forcing functions. Feedback, affordance, etc. Menus and screen-based controls; file handling. Error trapping and handling. Validation. DB programming. Disconnected architecture. Datasets and data controls. Quality attributes to DB programming.

CAN2105C: SWITCHING TECHNIQUES

Introduction to Switching and Networks. Ethernet. Distributed Packet Switching for Local Computer Networks. Queueing in Networks. Single Stage Switching Systems, Multistage Switching Systems with Dynamic Routing. Multicast Switch Architectures with Dynamic routing (ATM Switch). Multistage Switching Systems with Static Routing. Unbuffered Switching Networks.

SECU2123C: DATA AND NETWORK SECURITY I

Security services and mechanisms. Common security threats and attacks. Physical Security and Disaster recovery. Authentication of users: Password, Smart card/Token, Biometrics. Authorisation: Models (DAC, MAC, RBAC), Access Control lists, Centralised & decentralised access control (RADIUS, Domains & Trust). Use of symmetric cryptography in Security. Kerberos for authentication and authorisation in networks. Use of hash and MAC algorithm for security. Use of Public key cryptography, digital certificates and digital signatures for security.

OSS2113C: OPERATING SYSTEM ADMINISTRATION

Building blocks of modern operating systems. Process management, synchronization, deadlocks. Threading & parallel processing. Memory management. File management system. Input/output. Mobile Operating Systems. Administration of OS services in Linux, and/or Windows.

CAN5108C: NETWORK PROGRAMMING

Based on Java Programming. The Layers of a Network IP, TCP, and UDP, The Internet, The Client/Server Model, Internet Standards. Web Concepts: URIs, HTML, SGML, and XML, HTTP, MIME Media Types, Server-Side Programs. Streams: Output Streams, Input Streams, Filter Streams, Reader & Writers. Threads: Running threads, Synchronisation, Deadlock,

Thread Sheduling. Looking Up Internet Address: The InetAddress Class, the NetworkInterface class. URLs and URIs: URL and URI class, URLEncoder & Decoder, Proxies. Sockets for clients, Sockets for Servers, Secure sockets. UDP Datagrams and Sockets. Multicast Sockets. RPC, Remote Method Invocation.

MCT2104: MOBILE APPLICATION DEVELOPMENT

Overview of wireless communication networks: Wireless Wide Area Networks (Cellular Networks), Wireless LAN (IEEE 802.11), Wireless Personal Area Networks (Bluetooth), Wireless Sensor Networks. Mobile Platforms and Development Tools. Developing for the Mobile Web (HTML5, CSS3, Server Side Scripting). Developing Native Mobile Applications (possible platforms: Android SDK or Objective C). Hybrid Mobile Applications (Convergence of Native and Web).

MGMT2104C: RESEARCH & DEVELOPMENT SEMINAR

Role of research & innovation in business. Research process. Literature review. Developing & justifying a research problem. Choosing a research method (case study, survey, experiment) for a specific problem. Planning project – scope and schedule development. Presenting and analysing findings. Product development process. Entrepreneurship perspective. Funding a venture. Managing & Sustaining innovation.

PROJ2119C: WORK PLACEMENT

Students will have the opportunity to gain professional / practical experience during the work placement where the student will be attached to the industry under the supervision of a UTM coordinator and an Industry based Work Placement Supervisor.

PROJ 2118C: MINI PROJECT

Demonstration of the ability to understand a problem statement and apply knowledge to implement a small industrial based project. The teaching strategies will include 45 hours of face-to-face contact hours.

CAN3102C: 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.

SECU3124C: DATA AND NETWORK SECURITY II

Web Security: Secure Socket Layer. Email Security & Malware. Secure for online payments. Firewall & Intrusion Detection systems. IPSec and VPN. Wireless Network Security issues & attacks(Wardriving, SSID issues, eavesdropping, jamming, rogue access point,...). Wireless Network Security: WEP & WEP Vulnerabilities. Wireless Network Security: WPA (TSN/TKIP, EAPoL). Wireless Network Security: WPA2 (RSN). Ethical Hacking concepts: Process & Stages. Ethical Hacking concepts: Reconnaissance/Fingerprinting. Ethical Hacking concepts: Scanning.

UTM2101C: LIFE SKILLS & GOOD PRACTICES

Employability development skills. Good Governance. Prevention of corruption. Personal development skills and role of youth in addressing societal challenges. Coping skills. Addressing Societal Challenges including Substance Abuse, Poverty, Climate Change, Social Media and Family problems.

WAT2124: WEB SERVICES

Software Architecture, Overview of XML (Definition and Role of XML, XML Syntax and Semantics, XML Schema Syntax and Semantics). Service Oriented Architecture (Service, Service Bus, Registry, Service Consumers/Application Front-ends). Web Service Development (SOAP, WSDL, UDDI, Interoperability between different platforms and programming languages, RESTFull Approach).

SECU3122C: COMPUTER FORENSICS

Understanding the importance of computer forensics. Computer Forensic Process: Incident Response (on site). Computer Forensic Process: Data Acquisition & Analysis (in lab). Data storage in hard-drives and SSD. Understanding & Analysis of FAT12, FAT16 and FAT32 file systems for evidence recovery. Understanding & Analysis of NTFS file system for evidence recovery. Live data capture, memory analysis. Evidence from routers. Email forensics.

SCG3101C : ARTIFICIAL INTELLIGENCE

Definition of Artificial Intelligence (AI). The Turing test. Introducing the concepts of weak and strong AI. Studying the history of AI. Understanding the concept of rationality. Studying the nature of different environments. Analyzing the structure of various agent programs. Introducing problem-solving agents. Exploring different types search strategies. Presenting propositional logic and first order logic and their applications. Examining expert systems and their applications. Programming of classical AI concepts using PROLOG/LISP language.

CAN3116C: EMERGING NETWORKS AND TECHNOLOGIES

Virtualisation. Cloud Computing Concept. Cloud Computing Service Models: IaaS, PaaS, SaaS. Cloud Computing Deployment Models: Public, Private, Hybrid. Security in Cloud Computing. Understanding Big data. Storing Big Data (SQL & noSQL). Big Data analysis & challenges. Internet of Things (IoT). Opportunistic Networks. Ad-Hoc Networks, VANET, MANET. Wireless Sensor networks.

PROJ3106: COMPUTER SCIENCE PROJECT

Demonstration of core competencies acquired on the degree. Demonstration of creative acumen, self-management and self-development skills. Computer Science Project can be of the following type (extract from the Computer Science Project handbook). Planning, design and management of an enterprise network. Development of a software application involving Network Security and/or Management e.g. Network Monitoring software; Encryption software; Network Protocol Analysers; Instant Messaging; Collaboration Tools; IP telephony; Cluster Computing; Streaming Multimedia; etc...; Ubiquitous devices such as mobile phones or PDAs; P2P networking e.g. file sharing. Developing real-time interactive applications such as a control system, or games e.g. Single-user application/game; Multi-user application/game using e.g. Bluetooth technology; etc... Research based study supported by simulations. Solving an IT problem using some algorithmic approach.