



UNIVERSITY
of
TECHNOLOGY,
MAURITIUS

School of Innovative Technologies And Engineering

BSc (Hons.) Software Engineering

PROGRAMME DOCUMENT

BSE v8.0
August 2021

A. Programme Information

The BSc (Hons) Software Engineering is designed to satisfy the increasing demand for well-trained graduates to work in the export-oriented software development industry. The curriculum provides a balanced and intellectually stimulating programme which combines together state-of-art techniques and emerging trends to produce skilled software engineers.

The programme introduces students to the necessary foundations in computing and mathematical techniques. Following which, software engineering knowledge and skills are developed with modules focusing on programming, databases, web development, security and systems analysis and design. More specific technical skills and emerging techniques are further introduced with Web Services, Mobile computing, Internet of Things, Blockchain, Artificial Intelligence and Machine Learning. The programme also prepares the students for research, communication and entrepreneurship.

Work placement attached with the software development industry is an integral part of this course and allows students to gain practical work experience during between year 2 and year 3 of the programme.

B. Programme Aims

This programme aims at producing graduates who have a keen interest in software development and who aspire to work as software developers in the export-oriented software development industry.

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 data modelling
- Solve problems through optimal modelling and implement solutions by developing applications
- Design and develop network-based solutions
- Communicate both orally and in writing using traditional and electronic media
- Understand how a business is organised and relate to how ICT is ubiquitously applied across the different business functions
- Identify and solve research problems in the software industry
- Define, plan and monitor ICT projects in organisations
- Design and develop interactive multimedia applications
- Define and implement quality management systems in a software engineering environment
- Develop web and mobile applications using a variety of technologies and architectures
- Understand the concepts and applications of emerging technologies

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 or Computer Science.

F. Programme Mode and Duration

Full Time: Minimum 3 Years, Maximum 6 Years (Minimum 6 Semesters, Maximum 12 Semesters)

G. Teaching and Learning Strategies

The programme can be delivered in different modes, including face-to-face sessions, online and blended modes.

- Lectures, Tutorials and Practical Laboratory Sessions;
- Class tests and Assignments;
- Structured discussions and Self-directed study;
- Research projects;
- Workshops / Seminars / Lab Sessions;
- Case study material & scenario centred on real world problems;
- Work placement (full time mode only).
- Virtual and/or recorded lectures, tutorials, practical exercises.

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.
- Academic tutoring: Individual/group tutoring sessions can be arranged for students upon request
- Student counselling is provided upon request through the UTM Wellness Centre.
- Project Supervision

I. Attendance Requirements

As per UTM's Regulations and Policy.

J. Credit System

This programme is in line with the European Credit Transfer System (ECTS)

1 module: 6 credits

System Development Project: 12 credits

Minimum Credits Required for Award of:

Certificate: 60

Diploma: 120

Ordinary Degree: 168

Honours Degree: 180

K. Student Progress and Assessment

Each module consists of 150 hours of learning, comprising of 45 hours of delivery and 105 hours of self-study. Each module carries 100 marks and unless otherwise specified will be assessed as follows:

- Written and/or practical examination, and continuous assessment carrying up to 50% of total marks.
- Continuous assessment can be based on a combination of assignments, workshops, practical and class tests.
- Modules which are evaluated on continuous assessment only (100% coursework) must consist of a **minimum of three assessments, inclusive of one class test**. The following is a list of modules which may be evaluated by continuous assessment only: Object Oriented Software Development, Mobile Application Development, Advanced Mobile Application Development, Web Service Development and Computer Game Development, Software Security, Smart IoT Applications, Research & Innovation, AI & Machine Learning Techniques, Professional Issues in ICT.
- The system development project carries 300 marks (12 credits)
- Module grading structure:

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

L. Evaluation of Performance

1. The % mark at Level 1 contributes a 20% weighting towards the degree classification.
2. The % mark at Level 2 contributes a 30% weighting towards the degree classification.
3. The % mark at Level 3 contributes a 50% weighting towards the degree classification.

M. Award Classification

| Overall weighted mark y (%) | Classification |
|-------------------------------|--|
| $70 \leq y \leq 100$ | 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 and Coordinator: **Dr. Geerish Suddul**

Contact Details:

- Telephone number: 207 5250 (Fax: 234 1767)
- Email: g.suddul@umail.utm.ac.mu

Programme Review Committee: Dr. G. Suddul, Dr. S. Panchoo, Dr. S. Armoogum, Mr. R. Foogooa, Mr. J. Narsoo, Mr. P. Kanaksabee, Mr. H. Seegobin, Mr. A. Tulsi.

Part II - Programme Structure

O. BSc (Hons) Software Engineering – Full Time (Version 8.0)

This programme is offered on a Full-Time basis only.

| YEAR 1 (Level 1) | | | | | | | |
|------------------|--------------------------------------|--------------------|---------|------------|--------------------------------------|--------------------|---------|
| Semester 1 | | | | Semester 2 | | | |
| Code | Modules | Hrs/Wk L+T/P+SS | Credits | Code | Modules | Hrs/Wk L+T/P+SS | Credits |
| HCA1106C | Computer Organisation & Architecture | 2+1+7 | 6 | MATH1215C | Computational Methods | 2+1+7 | 6 |
| PROG1101C | Programming Concepts | 2+1+7 | 6 | PROG1119C | Object Oriented Software Development | 2+1+7 | 6 |
| MATH1103C | Decision Mathematics | 2+1+7 | 6 | WAT1146C | Website Design & Development | 2+1+7 | 6 |
| ITE1108C | Professional Issues in ICT | 2+1+7 | 6 | DBT1120C | Database Design Concepts | 2+1+7 | 6 |
| CAN1104C | Networking Essentials | 2+1+7 | 6 | OSS1112C | Operating System Concepts | 2+1+7 | 6 |

| YEAR 2 (Level 2) | | | | | | | |
|------------------|---|--------------------|---------|------------|--------------------------------|--------------------|---------|
| Semester 1 | | | | Semester 2 | | | |
| Code | Modules | Hrs/Wk L+T/P+SS | Credits | Code | Modules | Hrs/Wk L+T/P+SS | Credits |
| PROG2110C | Data Structures & Algorithms | 2+1+7 | 6 | MCT2104C | Mobile Application Development | 2+1+7 | 6 |
| WAT2133C | Web Application Development | 2+1+7 | 6 | WAT2104C | Web Service Development | 2+1+7 | 6 |
| SDT2120C | UI/UX Design | 2+1+7 | 6 | SEM2121C | Agile Project Management | 2+1+7 | 6 |
| DBT2122C | Advanced Database Design & Implementation | 2+1+7 | 6 | SECU2130C | Software Security | 2+1+7 | 6 |
| SDT1119C | System Analysis & Design | 2+1+7 | 6 | SEM2124C | Research and Innovation | 2+1+7 | 6 |

| PRE – LEVEL 3 ACTIVITY | | | |
|------------------------|----------------|--|---|
| Code | Activity | Hrs/Wk | Credits |
| PROJ2119C | Work Placement | Two-month training in an ICT industry or at UTM which will start immediately after the 15 th week of the 4 th Semester of the programme of study | 6 credits Compulsory Submission of a Portfolio upon completion |

| YEAR 3 (Level 3) | | | | | | | |
|-------------------|---|--------------------|---------|-------------------|----------------------------|--------------------|---------|
| <i>Semester 1</i> | | | | <i>Semester 2</i> | | | |
| Code | Modules | Hrs/Wk L+T/P+SS | Credits | Code | Modules | Hrs/Wk L+T/P+SS | Credits |
| MCT2109C | Advanced Mobile Application Development | 2+1+7 | 6 | MGMT2108C | Technopreneurship | 2+1+7 | 6 |
| MUL2120C | Computer Game Programming | 2+1+7 | 6 | SCG2136C | Blockchain Systems | 2+1+7 | 6 |
| SCG3126C | AI & Machine Learning Techniques | 2+1+7 | 6 | SEM2123C | Software Quality & Testing | 2+1+7 | 6 |
| WAT2124C | Smart IoT Applications | 2+1+7 | 6 | | | | |
| PROJ3105C | System Development Project | | | | | | 12 |

P. MODULE OUTLINE

HCA1106C COMPUTER ORGANISATION & ARCHITECTURE

Introduction to digital Computers. Boolean algebra, Truth tables, Logic Gates, Karnaugh Maps, De Morgan's Theorem. The Number System & Information Representation using different bases. Main Architecture Components of a computer system: Control, data processing & memory; CPU Organisation & Architecture: the fetch-execute cycle, instruction set, assembly language, Programme Control, Arithmetic Logic Unit. Multiplexers, Decoders/Encoders, Flip-flops, counters, registers, memory unit. RISC Processors & Parallel Processing; Memory Organisation.

PROG1101C PROGRAMMING CONCEPTS

This module introduces 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.

MATH1103C DECISION MATHEMATICS

Digital Systems: number systems and codes, digital arithmetic operations, Boolean algebra & logic gates and combinational logic circuits. Linear Programming Involving Two Variables: formulation, graphical solution, feasible and optimal solutions and integer-valued problems. Sets: set operations & identities and computer representation of sets. Functions. Probability: axioms of probability, discrete & continuous random variables, probability density function & cumulative distribution function and expectation & variance.

ITE1108C PROFESSIONAL ISSUES IN ICT

Organization Structure and role of ICT in organizations; Ethics in ICT Profession; Health & Safety Issues in ICT; IT Contracts; Intellectual Property – copyright & patents, Ownership; Data Protection & Privacy; Computer Misuse, Ethics; Electronic Transactions; Green Issues; Professional communication: Carry out presentations, Participate and organize (virtual & face-to-face) meetings, electronic communication. Employability Development Skills.

CAN1104C NETWORKING ESSENTIALS

Protocols, Circuit Switching, packet switching; Physical/logical LAN topologies. Communication devices and technologies used in LAN; LAN extension: repeaters and bridges, Switched LAN, WAN. Communication devices and technologies used in LAN. TCP/IP and LAN/WAN interconnection. The Internet as the single global network of networks. LAN interconnection through WAN: Routing, VLAN, VPN, RAS and tunnelling. Mobile networking. LAN/WAN standards.

MATH1215C COMPUTATIONAL METHODS

Discrete Mathematics: Logic and proofs, Relations and mappings: One-to-one and onto functions, Inverse and composite functions, Exponential, logarithmic and trigonometric functions, Differentiation and integration, Taylor series expansion, Growth of functions. Complexity of algorithms. Matrices and vectors: Matrix algebra, Dot and cross products, Two-dimensional graphical transformations using matrices. Counting techniques: The Pigeonhole principle, Permutations and combinations. Recurrence Relations: Solving linear recurrence relations using generating functions. Computer arithmetic and error Analysis. Numerical solutions of nonlinear equations in one variable by direct and iterative methods. Polynomial interpolation. Numerical differentiation and numerical integration. Numerical solution of linear systems of equations by direct and iterative methods

PROG1119C OBJECT ORIENTED SOFTWARE DEVELOPMENT

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

WAT1146C WEBSITE DESIGN & DEVELOPMENT

Building foundational skills in a full range of technologies, including HTML5, CSS3, Javascript / other JS libraries, CSS Preprocessors LESS and SASS. Basics of web design, HTML5, Site development processes, Design principles, create web pages using basic elements to control layout and style, creating various types of Navigation bars: tabs, pills, dropdown; Creating a Responsive Website using Bootstrap, UI Component using BS Cards building accessibility, and usability into your responsive websites. Form development and Client-side scripting with JS libraries; Work through a structured process from idea generation, development, testing, and publishing of a website.

DBT1120C DATABASE DESIGN CONCEPTS

Principles of data models and multi-level architectures; relational data model concepts; database logical and physical design; user requirements; Normalisation; SQL standard (DML; DDL; DCL and TCL; Query processing and optimization).

OSS1112C OPERATING SYSTEM CONCEPTS

System Software, Application Software, Utility Programmes, Library programmes, Language translation. Evolution of Operating Systems. Overview of Computer System Structure. Building blocks of modern operating systems. System Calls & Interrupt driven systems. Process management, synchronisation, CPU Scheduling, deadlocks. Threading & parallel processing. Memory management. Virtual Memory management. File management system (File Organisation and Access.).

PROG2110C DATA STRUCTURES & ALGORITHMS

Implementation of simple and Complex data structures using an object-oriented approach: Queues, Nodes, unordered & ordered Lists, Stacks, Sorting & Searching, Recursion, Tree Algorithms, Graph Algorithms, Complexity Analysis.

WAT2133C WEB APPLICATION DEVELOPMENT

Overview of the .NET FRAMEWORK, Programming with C#, Data Validation and Sanitization, Advanced Control Programming Using Rich Control, Creating Custom controls, AJAX and user control, Authentication and Authorization, Data Management with ADO.NET, Advanced-Data handling techniques using CRUD operations, Working with Parameterized queries to prevent SQL Injection attacks; Creating stored procedures, Concurrency Controls, Error Handling Techniques; Introducing the MVC Architecture; Deploying an Application

SDT2120C UI/UX DESIGN

Design-centric approach to user interface and user experience design; UX Design Principles to create effective screen-based experiences for websites and apps, Defining Project strategy and information architecture; Developing sitemaps, wireframes to clickable prototypes; Mobile UI Frameworks; The Principal Timeline; Managing Content and Views; Models of the user in design, Visual Elements of User Interface Design, Visual Communication Principles and Evaluation Techniques

DBT2122C ADVANCED DATABASE DESIGN AND IMPLEMENTATION

To develop an understanding of designing and implementing a database application using Form Builder and Report Builder using the Oracle database Technology. This module covers the basic understanding of SQL: Generating SQL Script, VIEWS, GROUP FUNCTIONS and SINGLE ROW FUNCTIONS. The students will be introduced to PLSQL: Create PL/SQL decision control structures, Use SQL queries in PL/SQL programs, Create loops in PL/SQL programs and Exception Handlers. The Form Builder will be used to design the Application Interface and the Report Builder will help the students to generate reports to be displayed in the web browser.

SDT1119C SYSTEM ANALYSIS & DESIGN

Software Life Cycles; Software Development methodologies: Tools, Methods, Techniques; Initiating and planning systems development projects; Contract and scope: Context diagram; Feasibility Study; Requirements Determination; Traditional methods of fact finding; Contemporary methods: JAD, prototyping. Analysing system requirements; Research of the proposed system: Process re-engineering; innovation; Object Oriented Analysis with UML: Class diagram; Design and prototyping; Forms and Report design; Interface dialogue; Implementation planning: Testing Strategies and techniques, installation, documentation, training; Maintenance.

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. Development Models: Hybrid, Cross-platform and Native. Developing for the Mobile Web. Screen Size Detection; UI Frameworks; Understanding the mobile context. Location Based Services with Global Positioning System and W3C Geolocation API.

WAT2104C WEB SERVICE DEVELOPMENT

Software Architecture. Data Format for Messaging: XML and JSON: Definition and Role of XML & JSON, XML Syntax and Semantics. XML & JSON Message encoding and decoding. Overview of the Service Oriented Architecture: Service, Service Bus, Registry. Service Consumers/Application Front-ends, Specifications: SOAP, WSDL, UDDI. Interoperability between different platforms and programming languages. Overview of Resource Oriented Architecture Approach: Working with Web APIs and understanding the RESTful Approach.

SEM2121C AGILE PROJECT MANAGEMENT

Agile movement. Agile Values. Agile methodologies. Business Case. Roll-wave planning. Software estimation. User stories. Managing self-organising teams. Project Monitoring. Project Termination & Closure

SECU2130C SOFTWARE SECURITY

Security attacks and vulnerabilities. OWASP Top 10 Risks. SANS Top 25 coding errors. Secure design principles. Software engineering practices and standards related to software security e.g. PCI. Threat modelling. SQL injection. Authentication. Securing password. Multilevel and multilateral security control. Role-based access control. Cryptography: concepts (encryption, hash, digital signature, etc). Web security using SSL/TLS. Securing E-commerce applications. Cross-site request forgery attacks and defence. Cross-site scripting attacks and defence. Client state manipulation. Static Application Security Testing (SAST) and Dynamic Application Security Testing (DAST). Risk based testing.

SEM2124C RESEARCH & INNOVATION

Role of research & innovation in business; Literature review; Developing a research problem; Justifying research projects; Choosing a research method (case study, survey, experiment) for a specific problem; Planning project – scope and schedule development; Managing risk in research projects; Implementation issues in research projects Principles of research ethics; Ethical issues in data collection; Ethics in data analysis (secondary, etc); Sustaining innovation in business.

MCT2109C ADVANCED MOBILE APPLICATION DEVELOPMENT

Overview of Mobile Platforms: iOS, Android, Windows Mobile. Mobile Application Development Approaches for Native Platforms. Android Development: IDE, SDK, Virtual Devices. Interaction Handling, User Interface Design, Android MVC, Offline Storage, Online Storage, Working with Web Services. Testing & Debugging with LogCat. Deployment on Android Devices.

MULT2120C COMPUTER GAME DEVELOPMENT

Approaches for Game Programming; Game production, development, and testing: Overview of mainstream multimedia technologies in 2D graphics, animation & sound. Computer graphics for games. Game application design and development. Sound & Image processing. Datasource connectivity. User interaction and scripting. Integration of multimedia and Internet technologies. Physics Engine Controls and Artificial Intelligence.

SCG3126C AI & MACHINE LEARNING

Foundation and definition of Artificial Intelligence with Machine Learning. Overview of Supervised, Unsupervised & Reinforcement Learning Techniques. Understanding and identifying Machine Learning Problems: Regression & Classification. Mapping Machine Learning problems to computer programs. Development of Basic Supervised Machine Learning Models (in python); working with Datasets; Identification of Overfitting and Underfitting cases; Evaluation of Machine Learning Models.

WAT2124C SMART IOT APPLICATIONS

Introduction to the Internet of Things (IoT) and Web of Things (WoT) Concepts & Technologies. Application of IoT in real world scenarios. Machine to Machine (M2M) communication strategies. Overview of microcontroller (e.g. Arduino, Raspberry Pi). Microcontroller programming Techniques. Working with sensors (data collection, storage and processing). Interfacing between microcontrollers and computer applications.

MGMT2108C TECHNOPRENEURSHIP

Entrepreneurship in digital perspective, Feasibility study – technical, operational and economic, Market research, Sources of finance, Legal structures for businesses, Preparing the business plan, Launching and nurturing the start-up. Market exploration, Market Mix and Plan; Operating for success, Production, management, leadership and managing risk.

SCG2136C BLOCKCHAIN SYSTEMS

Mathematical and cryptographical foundations for blockchain. Historical background of blockchain. Architectural choices for blockchain implementation. Designing use cases for blockchain applications. Smart contracts and their implementation. Maintaining blockchain networks. Future Trends

SEM2123C SOFTWARE QUALITY & TESTING

Specificity of quality in software engineering, Software Process improvement, Quality management frameworks, Use of process, design and coding standards for software quality, Quality Assurance – review techniques, Quality Control – test planning and execution, Use of metrics in software quality, Automated software testing.

PROJ3105 SYSTEM DEVELOPMENT PROJECT

Run a full-fledged software development project: from concept, through logical modelling and up to physical implementation. Demonstration of core competencies acquired on the degree. Demonstration of creative acumen, self-management and self-development skills