MSc Computer Science with specialisation in either Distributed Systems & Multimedia or Software Engineering - E526

1.   Introduction

The field of Information Technology has been a continuously expanding one over the last three decades. There are good reasons to believe that it will remain so in the foreseeable future. The major challenges impacting the field throughout the world and also of high interests for Mauritius are:

(i)   Information Systems for Business organisations and industry are becoming more sophisticated and involved, resulting in a need to develop in a disciplined way to facilitate reuse of components and optimise on resources involved.

(ii)   The advent of high-speed computer networks and multimedia-enabled PCs have led to the convergence of the fields of multimedia and distributed systems. This has resulted in a high demand for the development of distributed multimedia applications in various spheres of daily activities.

The requirements of the industry in terms of professionals that can deliver highly specialised services and know-how to meet the above challenges are already being strongly felt and this tendency will grow with the current evolution of the local ICT sector. The MSc Computer Science programme is a taught course that aims at producing specialised professionals to meet the above needs.

Graduates will be equipped with the skills and knowledge to critically address and manage the issues in their subsequent roles as systems or application designers or technical managers.

2.   Aims and Objectives

- Increase technological awareness by providing students with in-depth knowledge and skills required to develop specialised computer systems;

- Equip students with the skills required for advanced systems development and the pursuit of research activities;

- Encourage effective software development by developing the skills of students in management, analysis and design of systems both as individuals and team members;

- Enhance the capacity of the students to continue professional and career development.

Objectives for the Distributed Systems & Multimedia Stream

On completion of this MSc Programme, students with different technical backgrounds and aspirations can:

- have a strong theoretical foundation in middleware technologies, multimedia systems and applications, mobile computing and multimedia networking;

- aspire to integrate the ICT industry with more profound knowledge for developing, maintaining and managing upcoming projects within the field of Distributed systems & Multimedia.

Objectives for the Software Engineering Stream

Students completing the MSc Computer Science with specialisation in Software Engineering can:

- gain thorough knowledge about the best practices in the principles and methods of software engineering;

- aspire to take up a leading role in the complex software engineering projects that are currently challenging the ICT industry;

- develop awareness of the concerns of software reliability, correctness, safety and usability.

3.   General Entry Requirements

At least a Second Class Honours Degree from a recognised University, GPA not less than 2.50, or alternative qualifications acceptable to the University of Mauritius.

4.   Programme Requirements

A degree in Computer Science, Mathematics with Computing, Information Systems or any other Computer related field from a recognised University. Preference will be given to candidates with at least two years of relevant work experience.

5.   General and Programme Requirements – Special Cases

The following may be deemed to have satisfied the General and Programme requirements for admission:

(i)   Applicants who do not satisfy any of the requirements as per Regulations 3 and 4 above but who submit satisfactory evidence of having passed examinations which are deemed by the Senate to be equivalent to any of those listed.

(ii)   Applicants who do not satisfy any of the requirements as per Regulations 3 and 4 above but who in the opinion of Senate submit satisfactory evidence of the capacity and attainments requisite to enable them to pursue the programme proposed.

(iii)   Applicants who hold a full practising professional qualification obtained by examination.

6.   Programme Duration

The normal duration of the Programme will be 2 years with a maximum of 4 years (8 semesters) subject to the approval of the Faculty. However, students wishing to exit before the end of the programme may do so as follows:

(i) after successfully completing **four (4)** modules for the award of a **Postgraduate Certificate**;
(ii) after successful completion of **eight (8)** modules, for the award of a **Postgraduate Diploma**.

7.   Credits per Semester: Minimum 3 credits subject to Regulation 6.

8. **Minimum Credits Required for Awards**

    Master's Degree: 36
    Postgraduate Diploma: 24
    Postgraduate Certificate: 12

    Breakdown as follows:

	Minimum Core Taught Modules	Project	Electives/ Optional Modules
Master's Degree:	18 credits	12 credits	6 credits
Postgraduate Diploma:	18 credits		6 credits

9. **Assessment**

    Each module will carry 100 marks and will be assessed as follows (unless otherwise specified):

    Assessment will be based on a written examination of 3 hours and continuous assessment carrying a range of 10% to 30% of total marks. Continuous assessment may be based on laboratory works, and/or assignments and should include at least one class test.

    A minimum of at least 30% should be attained in each of Continuous Assessment and Written Examination, with an overall total of 40% for a candidate to pass a module.

    Submission Deadlines for MSc Project

    First Draft: End of July in the Final Year.
    Final Copy: Last working day of August in the Final Year.

10. **Plan of Study**

    Students are required to submit at the end of Semester 1 a Plan of Study for their whole Programme of Studies, indicating the list of elective modules and in which semester each of them will be taken.

    The University reserves the right not to offer a given elective module if the critical number of students is not attained and/or for reasons of resource constraints.

11. **Important Note**

    The rules as stipulated in this Programme Structure and Outline Syllabus will replace all other rules and regulations.

12. **List of Modules**

Code	Module Name	Hrs/Wk L+P	Credits
CORE MODULES			
CSE 6101	Software Requirements Engineering and Research Methods	3+0	3
CSE 6102	Advanced Distributed Systems	2+2	3
CSE 6103	Data Security	3+0	3
CSE 6201	Advanced Networking and Data Communication	2+2	3
Distributed Systems & Multimedia Stream			
CSE 6202	Middleware Technologies	2+2	3
CSE 6204	Systems Support for Multimedia	3+0	3
Software Engineering Stream			
CSE 6203	Principles of Software Project Management	3+0	3
CSE 6205	Software Reliability and Testing	3+0	3
PROJECT			
CSE 6000	Project	-	12
ELECTIVES			
Distributed Systems & Multimedia Stream			
CSE 6010	Pattern Recognition	2+2	3
CSE 6012	Multimedia Data Storage	3+0	3
CSE 6014	Multimedia Software Development	2+2	3
CSE 6016	Mobile and Ubiquitous Computing	3+0	3
CSE 6018	Instructional Systems	3+0	3
Software Engineering Stream			
CSE 6011	Software Quality Management	3+0	3
CSE 6013	Systems Modelling	3+0	3
CSE 6015	Real-time Systems	3+0	3
CSE 6016	Mobile and Ubiquitous Computing	3+0	3
CSE 6017	Parallel Processing	3+0	3
CSE 6018	Instructional Systems	3+0	3

13. Programme Plan - MSc Computer Science with specialisation in either Distributed Systems & Multimedia or Software Engineering

YEAR 1

Semester 1 Code	Module Name	Hrs/Wk L+P	Credits	Semester 2 Code	Module Name	Hrs/Wk L+P	Credits
CORE				**CORE**			
CSE 6101	Software Requirements Engineering and Research Methods	3+0	3	CSE 6201	Advanced Networking and Data Communication	2+2	3
CSE 6102	Advanced Distributed Systems	2+2	3		Core based upon field of specialisation		3
CSE 6103	Data Security	3+0	3		Core based upon field of specialisation		3

YEAR 2

Semester 1 Code	Module Name	Hrs/Wk L+P	Credits	Semester 2 Code	Module Name	Hrs/Wk L+P	Credits
CORE				**CORE**			
CSE 6000	Project	-	-	CSE 6000	Project	-	12
ELECTIVES							
	Elective based upon field of specialisation		3				
	Elective based upon field of specialisation		3				

Note 1: A limited number of seats will be available for each stream.

Note 2: Students will opt for a field of specialisation as from the second semester. Once a stream has been selected, students will not be allowed to change stream up to the completion of the Programme of Studies.

Note 3: Students are required to register at the Faculty for modules that they intend to follow in a given semester on a date specified by the Faculty. However, students will be allowed to withdraw from a module without penalty within 4 weeks from the first day of the semester.

Note 4: An elective will be provided only if sufficient number of students have opted for it and depending on availability of resource persons.

14.   Outline Syllabus

CSE 6010 - PATTERN RECOGNITION (L/P - 3.0)
Introduction to Pattern Recognition, Bayesian decision theory, error probability, Parametric estimation and supervised learning, Maximum likelihood estimation, Linear discriminant functions, Nonparametric methods, Feature selection and extraction, Feature extraction for representation, Feature extraction for classification, Unsupervised learning and clustering, Object recognition, Syntactic Classification of data; Neural and evolutionary classification.

CSE 6011 - SOFTWARE QUALITY MANAGEMENT (L - 3.0)
Software Quality Factors, Metrics & Models, Estimation Techniques, Benchmarking, Quality Assurance Activities, Measurement Tracking, Statistical Quality Assurance, Data Quality Control, ISO Standards Requirements & Certification, TickIt, Quality Ethics.

CSE 6012 - MULTIMEDIA DATA STORAGE (L - 3.0)
Multimedia Data Representation, Multimedia Data Classification, Modelling Multimedia Databases, Object Oriented Multimedia Databases, Multimedia Database Indexing and Retrieval, Image Retrieval, Colour, Texture and Shape for Image Retrieval, Content-Based Retrieval: CB Video Retrieval, CB Image Retrieval, Architectures for Multimedia Databases, Multimedia Storage Management.

CSE 6013 - SYSTEMS MODELLING (L - 3.0)
Queuing Network Modelling; Workload characterization; Analytic Techniques; Performance bounds; Representing Specific Subsystems; Scheduling; Parameterisation; Evolving systems; Perspective: Networks, OS, Database concurrency.

CSE 6014 - MULTIMEDIA SOFTWARE DEVELOPMENT (L/P - 3.0)
Introduction to multimedia, issues in Multimedia Applications Design, Multimedia Data Representations, Audio and Video Compression, Multimedia Network Communications, QoS issues for multimedia transmission, Resource Management.

CSE 6015 - REAL-TIME SYSTEMS (L - 3.0)
Introduction to real-time systems: examples, hard v/s soft, reference model; Static Scheduling; Dynamic Scheduling; Scheduling of Periodic and Sporadic Tasks; Dealing with complexities arising in real systems; Pre-emptive and Non-pre-emptive Systems; Resource Sharing; Servers: Deferrable servers, Sporadic servers, Constant utilization and total bandwidth servers.

CSE 6016 - MOBILE AND UBIQUITOUS COMPUTING (L - 3.0)
Network and Transport Protocols for Wireless Networks, Mobile IP and Variants of TCP; Distributed Systems Platforms for Mobile Computing, Proxy Based Architectures, Service Discovery, Interaction Platforms; Local and Wide Area Technologies (Bluetooth, 802.11, GSM); File Systems Support for Mobile Computing; Developments in Context-aware and Ubiquitous Computing; Smart Embedded Devices, Information Appliances and Wearable Computers; Sensing and Context Acquisition in Ubiquitous Computing; New Trends in Networking and Communications, Proximity-Based Networking, Communication Protocols for Wireless Sensor Networks; Human Interaction in Ubiquitous Computing Environments, Tangible User Interfaces, Ambient Displays and Augmented Reality Interfaces; Privacy and Security.

CSE 6017 - PARALLEL PROCESSING (L - 3.0)
Load Balancing and Task Scheduling, Static and Dynamic Task, Task Graphs, Communication Delay, Algorithms for Task Assignment, Static and Dynamic Load Balancing, Optimal Static Algorithm, Binary Dissection Method, Greedy Algorithm, Dimension Exchange, Scattered Decomposition, Minimisation of a Hamiltonian (Energy Function), Formulation of Objective Function (E), Simulated Annealing, Starting Temperature (Tstart), Complexity of Basic Communication Structures, K-port Communication, Spanning Trees, Single/Multi Node Broadcast, Single/Multi Node Scatter, Parallel Sorting Algorithms, Matrix Multiplication (Fox's Algorithm).

CSE 6018 - INSTRUCTIONAL SYSTEMS (L - 3.0)
Learning theories, instructional design models, cognitive psychology, courseware engineering, emerging learning technologies, ILE, ITS, virtual labs, assessment, implementation.

CSE 6101 - SOFTWARE REQUIREMENTS ENGINEERING AND RESEARCH METHODS (L - 3.0)
Practical Process Improvement, The Requirements Documents, Requirements Elicitation, Requirements Analysis and Negotiation, Describing Requirements, System Modelling, Requirements Validation, Requirements Management, Requirements Engineering for Critical Systems, System Modelling with Structured Methods, Formal Specification, Viewpoints, CMM.

CSE 6102 - ADVANCED DISTRIBUTED SYSTEMS (L/P - 3.0)
System Models, IPC Mechanisms, Remote Invocations, Naming Services, Distributed File Systems, Replications, Shared Data, Distributed Transactions, Case Studies.

CSE 6103 - DATA SECURITY (L - 3.0)
Need for Security, Security Architectures as a Strategic Planning Tool, Risk Analysis, Business Continuity Planning, Security Management, Cryptographic techniques, Key management, Pseudo-randomness, Authentication/Identification Protocols, Challenge/response security, Digital signatures, Public Key infrastructures: Introductory network security concepts, Network management security: Secure protocols: Network defences, Electronic mail security, Wireless security, Mobile communications security, Web Security, Software Protection, Middleware Security.

CSE 6201 - ADVANCED NETWORKING AND DATA COMMUNICATION (L/P - 3.0)
Congestion Control in the Internet, TCP Performance, Router components, packet dropping policies for IP, flow control algorithms, unicast routing in the internet, Inter-domain routing (CIDR, BGP, Policy Routing), introduction to multicast routing in the internet, inter-domain multicast routing, QoS definition and concepts, QoS Architectures, QoS adaptation protocols, Traffic Engineering, overlay, switching techniques and protocols, naming issues and mapping techniques, network and application management, resource management and efficiency issues.

CSE 6202 - MIDDLEWARE TECHNOLOGIES (L/P - 3.0)
Roles of Middleware, Middleware standards, Existing Middleware Technologies, Interfaces and IDLs, Binding, Dynamic Invocation, Interface Repository, Filters, Smart proxies, Practical experience with one middleware.

CSE 6203 - PRINCIPLES OF SOFTWARE PROJECT MANAGEMENT (L - 3.0)
Scope of software project management, Similarities/Differences with other projects, Project-Life Cycle, Project management processes, CMM, Evaluation Techniques, Planning & Programming Techniques, Scheduling Principles, Budgeting, Procurement Strategies, Contract Management, Team Organisation & HRM, Resource Allocation, Risk Management, Controlling and Monitoring software process, Quality Management, Configuration Management, Web-based Project Management, Project Management Software tools.

CSE 6204 - SYSTEMS SUPPORT FOR MULTIMEDIA (L - 3.0)
Real-Time Scheduling, Multimedia File Systems, Real-Time Network protocols, Real-Time Operating Systems, Intra-capsule concurrency, QoS management in Middleware - QoS specifications and representations, QoS Translations, Explicit Bindings, Ongoing research.

CSE 6205 - SOFTWARE RELIABILITY AND TESTING (L - 3.0)
Principles of reliability, errors and faults; error density; error severity, MTTF, MTTR, software reliability models, techniques to improve and predict reliability, The principles of software testing, black box testing, white box testing, unit testing, system testing, and integration testing, testing: formal and informal methods; program analysis: dynamic analysis, static analysis, data flow analysis; selection of test cases; program instrumentation; mutation analysis; and symbolic execution, quality assurance, Cleanroom development.