Programmatic Review of the School of Science 2016

Phase 2: Programme Review

PROGRAMME PANEL REPORT

SCHOOL: School of Science
DEPARTMENT: Department of Computer Science
DATE: March 30 – 31st 2017

PROGRAMMES AND MODULES SUBMITTED FOR REVIEW

Major Awards

Higher Diploma in Cloud Computing
Higher Diploma in Cloud and mobile software development
Master of Science in Cloud computing
Master of Science in Software Design & Architecture (New)

New Modules on the Information Security programmes

Scripting for Sys Automation
Online Fraud Analytics
Software Vulnerabilities

Master of Science in Software Development (legacy)

PROGRAMME REVIEW PANEL MEMBERSHIP

Mr. Fintan Ronan, Director, Software Engineering, DELL EMC Converged Platforms & Solutions Division
Mr. Robert Boyle, X-Force Exchange Development Manager, IBM Security
Mr. Nigel Whyte, Head Dept. of Computing, IT Carlow

Prof. Ger Kelly, Head Department of Mechanical Biomedical and Manufacturing Engineering, Cork

Institute of Technology

PROGRAMME REPRESENTATION

Core Programme Staff

Mr Tim Horgan, Head of Department
Ms Oonagh O'Brien, Assistant Lecturer
Dr Ted Scully, Lecturer
Mr Gerard McSweeney, Lecturer
Ms. Meadbh O'Connor, Assistant Lecturer
Mr Eoin O'Regan, Assistant Lecturer
Mr Larkin Cunningham, Assistant Lecturer
Dr Aisling O'Driscoll, Lecturer
Dr Olivia Brickley, Lecturer
Dr Paul Davern, Assistant Lecturer
Mr Pat McCarthy, Lecturer
Mr Karl Grabe, Lecturer
Prof Paul Walsh, Lecturer
Dr Donna O Shea, Lecturer
Dr John Creagh, Lecturer
Dr Sean McSweeney, Assistant Lecturer
Dr Paul Davern, Assistant Lecturer
Dr Laura Climent, Assistant Lecturer
Dr Ignatio Castineiras, Assistant Lecturer
Dr Alejandro Arbelaez, Assistant Lecturer

Learner Representatives

1.   Ray O'Leary, MScCC
2.   David Foley, MScCC
3.   Daryl Peters, MScSD
4.   Lesley Power, HDipC&M

Graduates

1.   Kenneth Moore, MScCC
2.   Geoff Wales, HDipC&M
3.   Kevin Gartland, HDipCC
4.   John O'Brien, MScCC
5.   Damian Chapman, MScSD

External Stakeholders

1.   Thomas Kelly, MScCC
2.   Eugene Bell, MScCC

PROGRAMME SUMMARY AND MAJOR CHANGES PROPOSED

1. HIGHER DIPLOMA IN CLOUD COMPUTING & HIGHER DIPLOMA HIGHER DIPLOMA IN CLOUD AND MOBILE SOFTWARE DEVELOPMENT

1.1. **Overview of the HDip programmes**

Both of these programmes are funded by the HEA under the Government's ICT Skills Action Plan 2014 – 2018 and are 60 credit, two semester (30 credits per semester), at level on the NFQ. The demand for ICT skills in Ireland continues to exceed domestic supply. ICT companies are currently utilising inward migration to address this gap and while inward migration will continue to be an important source of skilled professionals into the near future, the need to boost the domestic supply of high-level ICT skills remains an important part of a sustainable ICT industry in Ireland.

Furthermore, the successful exploitation of the opportunities offered by new products and technologies in the ICT sector will require a broad base of skilled people here. In order to ensure that one of Ireland's most important resources, its labour force, is appropriately skilled, CIT along with a number of higher education providers are offering a selection of Level 8 Conversion Programmes which provide graduates from other skills areas with the opportunity to upskill or reskill through a HDip Conversion programme in core computing/programming skills. Both programmes share a common semester 1.

On successful completion of the Higher Diploma programme there is a progression pathway available to enable students to enter the MSc in Cloud Computing taught Masters programme.

1.2. **Educational Aims of the Higher Diploma in Cloud Computing & Higher Diploma in Cloud & Mobile Software Development**

The overall aim is to provide graduates with a Higher Diploma in Science in Cloud Computing or a Higher Diploma in Science in Cloud and Mobile Software Development, where they will be able to combine the transferable skills (independent learning, critical analysis, communications and so forth) that they have obtained as part of their original degree with specific Computing/IT skills in their chosen area of specialisation.

Successful graduates are expected to spend one year obtaining an award which will contain the following stages; (a) Immersion in Computing Knowledge; participants will follow a broad immersive set of modules in the fundamentals of computing, (b) Deepening and specialisation; this element is a focused set of modules and project work designed to bring candidate quickly to the industry entry standard for graduates in the chosen field of specialisation.

1.3. **Major Changes Now Proposed**

The individual modules have been updated to

- Reflect discipline advances in indicative contents
- Refine and update learning outcomes so they better reflect module content

The Data Base Systems module (S1) was changed to Data Management systems following consultation with industry. New 10 credit modules "Computer science project" were added in semester 2 of both programmes. There were no significant changes in assessment strategies. The

intention is to offer the programme in the future, in an online mode only, on a part time delivery basis. The existing cohort will continue to complete the programme in 2017/2018.

2. MASTER OF SCIENCE IN CLOUD COMPUTING

2.1. PROGRAMME SUMMARY

Cloud Computing is considered a relatively new field in Internet computing where novel perspectives in internetworking technologies have emerged. The 60 credit, level 9 MSc in Cloud Computing programme was developed to deal with issues relating to this new paradigm. The recent convergence of cloud with big data has created additional opportunities for IT professionals to gain valuable insights into their business data. Such insights are critical for companies to maintain their competitive edge, increase their revenues and deliver new innovative services and solutions.

The content seeks to reflect current and likely future practice in cloud planning and management, the design and management of virtual environments, data analytics, the consolidation of data centres, security techniques in multi-tenant virtualised environments and related areas that contribute to the building of both private and public cloud environments. The programme team is comprised of a large adjunct faculty from companies such as Dell-Emc, UTRC, Johnson Controls, and VMware.

After completing this programme graduates may wish to continue to PhD level within the Department of Computer Science.

2.2. EDUCATIONAL AIMS OF THE MASTER OF SCIENCE IN CLOUD COMPUTING

This programme aims to provide the graduate with the advanced conceptual understanding, detailed factual knowledge, and specialist technical skills that are required for success in Cloud Computing. Graduates of this programme will be well equipped to meet the challenges associated with the major changes currently occurring in the IT industry. In this context the programme covers both theoretical background and practical design considerations. The content seeks to reflect current and likely future practice in cloud planning and management, the design and management of virtual environments, the consolidation of data centres, security techniques in multi-tenant virtualised environments and related areas that contribute to the building of both private and public cloud environments.

2.3. MAJOR CHANGES NOW PROPOSED

The individual modules have been updated to

- Reflect discipline advances in indicative contents
- Refine and update learning outcomes so they better reflect module content

A New elective module entitled Future Internet was developed as an elective to discuss challenges and driving forces behind the Future Internet and enabling technologies. Scripting for Sys automation represents a name change and update focusing on Python and cloud automation tasks.

There were no significant changes in assessment strategies. The intention is to offer the programme in the future, in an online mode only, on a part time delivery basis. The existing cohort will continue to complete the programme in 2017/2018.

3. MASTER OF SCIENCE IN SOFTWARE DESIGN & ARCHITECTURE (NEW)

3.1. PROGRAMME RATIONALE

The January 2012 Programmatic review panel when reviewing the MSc in Software Development recommended that the indicative content should be reviewed at the earliest opportunity with a significant input from the main software houses in Ireland. This new programme is developed in response to this recommendation. The modules on the programme are entirely new apart from updates to existing research project modules.

3.2. PROGRAMME SUMMARY

Traditionally, software architects were responsible for "the design and technological decisions of the software development process" and defined "systems by applying abstract knowledge and proven methods to a set of technologies with the goal of creating an extendible and maintainable solution". Over the past decade the traditional role of the software architect - changed. Agile development methodologies have meant the adoption of tools and practices that help avoid or decouple up front systems or architectural design. Agile teams focus on small local decisions, restructuring the system through refactoring maintaining the development pace.

The 60 credit, level 9 MSc in Software Design & Architecture programme is an advanced industry-focused programme that addresses the skills gap of software developers and/or architect in the face evolving software development practices. It aims to provide students the opportunity for in-depth study of the advanced design and architectural and software development and process skills required for the successful design and development of complex software distributed systems. It provides students with the theoretical and practical knowledge necessary to advance their career in software development as a senior member of the development team or as software architect.

Delivered exclusively online, over a period of 2 years, the programme offers working professionals flexible opportunities to learn more about technological advances in the industry. The programme places a major emphasis on developing higher level software development skills. Students are exposed to current state-of-the art principles, methods and research of software design and architecture.

On successful completion of the MSc in Software Design & Architectures programme, graduates will have acquired advanced knowledge and skills to enable them manage, design and create software and processes that are reliable, robust, secure and scalable.

After completing this programme graduates may wish continue to PhD level within the Department of Computer Science.

3.3. EDUCATIONAL AIMS OF THE MASTER OF SCIENCE IN SOFTWARE DESIGN & ARCHITECTURE

The aim of the MSc in Software Design & Architecture degree is to develop students' knowledge and skills in Software Design & Architecture, Software Development Processes, Analysis and Design of Algorithms, Programming Language Design, Decision Analytics, Software Vulnerabilities, Microservices and Data Analytics.

Students will develop skills in analysing requirements and designing appropriate software solutions; designing and creating complex software systems to solve real-world problems, evaluating and using advanced software environments, design methods and programming languages, and evaluating and responding to recent trends in interoperability and software development.

In addition to the taught modules, students will complete a research project that can be aligned to their own specific research interests.

3.4. MASTER OF SCIENCE IN SOFTWARE DEVELOPMENT (LEGACY)

The New Programme MSc in Software Design & Architecture is to replace the existing programme Master of Science in Software development which has not been presented for re-validation. The documentation supplied does not contain any proposal in connection with this programme.

4. NEW MODULES ON THE INFORMATION SECURITY PROGRAMMES

Three modules which were updated on the 90 credit MSc in Information security and the embedded 60 credit award Postgraduate Diploma in Science in Information security were reviewed by the panel. These were Scripting for Sys Automation, Online Fraud Analytics, and Software Vulnerabilities.

A. PANEL FINDINGS AND RECOMMENDATIONS

1. OVERALL RECOMMENDATION TO ACADEMIC COUNCIL ON REVALIDATION

Contingent upon confirmation of the successful completion of the internal programme and module moderation process, the Panel **recommends to Academic Council that the programmes and modules listed above be revalidated** for a further five years or until the next Programmatic Review, whichever is sooner, with effect from 1 September 2017.

Other than Registrar's Office approval of the programme and module specifications on conclusion of internal moderation, only one condition is attached to this recommendation. This condition concerns the MSc in Software Design & Architecture. The view of the panel was that entrants should have minimum of 3 years preferably 5 years relevant experience.

2. GENERAL

2.1. **Commendation**: The Panel **commends** the commitment of the academic staff to the Programmatic Review process evidenced by the detailed analysis and reflection underpinning the self-review of their programmes submitted and the professional manner in which they engaged with the review panel throughout the visit. While the quality of documentation on the whole was comprehensive, the justification, rational, and engagement with relevant stakeholder in some instances for some of the changes proposed was not reflected in the documentation itself, but was very evident from the interaction with the programme staff. Performance metrics including student throughput should ideally be included when available.

3. ENTRANT AND GRADUATE PROFILE, AWARD AND PROFESSIONAL ENVIRONMENT

3.1. **Commendation:** For the suite of programmes under review, the panel would like to commend the programme team for the design of their programmes which the panel believe are fit-for-purpose and aligned with the needs of industry. There was clear evidence of engagement with industry though it was not included in the formal documentation. The use of an industry panel to give both programme and module feedback was exemplary.

4. PROGRAMME OPERATION AND PERFORMANCE

4.1. **Commendation:** The panel commends the work of the programme team for the continued support they provide to their students including induction, newsletters and online fora, and to the adjunct faculty via the handbook. The panel notes that the online HDip courses are particularly attractive and empowering to women at home. The panel recommends that at initial inductions it would be beneficial to introduce all module leaders (internal and external) to the incoming students.

4.2. **Commendation:** The panel commends the department for being an exemplar of online mode of delivery. Feedback from both existing students and past graduates suggested an understandable sense of isolation while engaging in aspects of the online mode of delivery. The panel **recommends** that the department instigates where possible touch

point communication with the students at say midpoint of semester 1 and encourage face to face communication. The panel further **recommends** the department instigates peer to peer working groups or a buddy system for labs or projects in semester 1 ideally.

4.3. **Recommendation:** The panel notes the importance of ongoing delivery by adjunct faculty. The panel **recommends** that the programme teams continues to develop processes to ensure the adjunct faculty are briefed on all aspects of CIT Marks and standards and that regular reviews of module delivery are undertaken with the adjunct faculty. The panel notes that there was evidence at both the staff and student sessions of informal student feedback being considered.

4.4. **Recommendation:** The panel notes that there was evidence at both the staff and student sessions of informal student feedback being considered. The panel **recommends** that the department should seek to develop a more formal structure to capture and act on student feedback. The panel further recommends that the department should be more proactive in sourcing student representation on course boards.

4.5. **Recommendation:** The panel **recommends** that an assessment matrix describing the nature and timing of assessments across all modules in a given semester be available to students at the start of the semester.

5. PROPOSED NEW PROGRAMME MSC IN SOFTWARE DESIGN AND ARCHITECTURE

5.1. **Commendation:** The panel commends the programme team on the design of the above programme. The panel **recommends** the name be changed to MSc in Software Architecture and Design.

5.2. **Recommendation:** The panel recommends that entry requirements are formalised and stated in the programme documentation.

5.3. **Condition:** The view of the panel is that entrants should have a minimum of 3 preferably 5 relevant years industry experience before being admitted to the programme.

6. MODULES

This section presents the findings and recommendations from an indicative review of modules carried out by the members of the Peer Review Panel.

The recommendation of the Panel to revalidate the programmes under review is contingent on the successful completion of the subsequent internal module moderation process carried out by, or on behalf of, the Registrar's Office.

B. PROGRAMME FINALISATION

1. IMPLEMENTATION OF PANEL REQUIREMENTS/RECOMMENDATIONS

The list below indicates the recommendations and on requirement received from the panel.

Section	Feedback	Response
4.2	**Recommendation:** The panel recommends that the department instigate where possible touch point communication with the students at say midpoint of semester 1 and encourage face-to-face communication.	The lecturer is the most appropriate point of contact when the semester is active. At the end of each semester, the programme board agrees, that a formal mechanism for collecting feedback is appropriate. The programme board would like it noted that Face-to-Face communication with students is many cases is not possible given the fact that the programmes are delivered online and the majority of students are based outside the Munster region. The online delivery mechanism used emulates f2f delivery through online tools. Students are encouraged to use their microphones and encouraged to participate actively in class in this environment.
4.2	**Recommendation:** The panel further recommends the department instigate peer-to-peer working groups or a buddy system for labs or projects in semester 1 ideally.	The programme board looked at various modules to see if it is possible to implement this recommendation. Given the nature of the modules it is not possible to implement group work as part of module assessments. For each programme students can post questions regarding their lab work and assignments and exercises via a discussion forum and Google+ community. It is the responsibility of the student to engage in these modules that are delivered virtually in this manner. The programme board will introduce more ice-breakers at the beginning of the semester to facilitate the students to get familiar and comfortable with this environment and discussion forums online.
4.3	**Recommendation:** The panel recommends that the programme teams continues to develop processes to ensure the adjunct faculty are briefed on all aspects of CIT Marks and standards and that regular reviews of	Accepted – we are working with TEL department to implement this.

	module delivery are undertaken with the adjunct faculty.	
4.4	**Recommendation:** The panel recommends that the department should seek to develop a more formal structure to capture and act on student feedback.	Accepted, see response to 4.2.
4.4	**Recommendation:** The panel further recommends that the department should be more proactive in sourcing student representation on course boards.	Accepted.
4.5	**Recommendation:** The panel recommends that an assessment matrix describing the nature and timing of assessments across all modules in a given semester be available to students at the start of the semester.	Accepted.
5.2	**Recommendation:** The panel recommends that entry requirements are formalised and stated in the programme documentation.	Accepted.
5.3	**Requirement:** The view of the panel is that entrants should have a minimum of 3 preferably 5 relevant years industry experience before being admitted to the programme.	The standard entry requirement will state that students should normally have a minimum of 3 years industry experience. In exceptional circumstances, candidates may be considered for entry by the Head of Department who do not meet this criterion. In this case, the candidate will undergo a selection process which may consist of submitting an extended application form detailing their relevant work experience and attending an interview.

2. MODULE AND PROGRAMME MODERATION

In total 25 modules were reviewed across the following programmes:
- MSc Software Architecture & Design
- MSc Cloud Computing
- MSc Information Security
- Postgraduate Diploma Information Security
- Higher Diploma in Cloud Computing
- Higher Diploma in Cloud & Mobile Software Development.

All modules were updated in line with feedback received by the module moderator and are now ready to be approved.

MODULE ID	MODULE NAME
12716	Cloud Strategy Planning & Mngt
8710	Managing Virtual Environments
12596	Data Analytics
12719	Scripting for Sys Automation
12720	Cloud Security
12717	Computing Research and Practice
12430	Future Networks
12964	Cloud Storage Infrastructures
12856	Comp Research Project Implem.
13154	Software Design & Architecture
13158	Software Process Engineering
13179	Scalable Microservices
13180	Declarative & Concurrent Programming
13186	Programming Language Design
13016	Software vulnerabilities
13167	Design Analytics
13174	Analysis & Design of Algorithms
13126	Online Fraud Analytics
12411	Cloud Architecture
12405	Cloud Computing with Python
13137	Network Systems
12593	Cloud Infrastructure
12778	Computer Science Project
12591	Cloud Software Engineering
12554	Data Management Systems

It should be noted that modules in the Higher Diploma in Cloud Computing and Higher Diploma in Cloud & Mobile Software Development share a number of modules in the undergraduate degree

programmes such as BSc (honours) Software Development and BSc (honours) in Information Technology Management. These shared modules are listed below and were also reviewed as part of the programmatic review process.

Module Title
SOFT7004 (id:12784) - Object Oriented Principles
COMP6029 (id:13137) - Network Systems
SOFT7006 (id:12785) - Operating System
SOFT7007 (ID:12786) -Requirements Engineering
SOFT7008 (id:12789) - Server-side Web Development
SOFT7035 (id:7547) - Programming Mobile Devices
COMP8046 (id:10959) - Information Analytics

C. APPENDIX – TIMETABLE OF PHASE 2 MEETINGS

		Panel 1	Panel 2	Panel 3
		Software Development Computer Systems e	IT Management, Information Technology	MSc Cloud, MSc in Software
Day One Thursday March 30th 2017				
11.00 to 11.30 pm	Private Panel Meeting including presentation by Registrar's Office	Council Room, 2nd Floor, Administration Building		
11.30 to 12.00pm	Department Overview Presentation / Discussion			
12.00 to 12.30pm	Departmental Research Overview - Links to Teaching			
12.30 to 1.30 pm	**Private Panel Lunch**	Bistro		
1.30 to 3.00 pm	Meeting with Dept. Teams re Programme Operation and Performance	Boardroom, CREATE	Boardroom, Tourism & Hospitality	Business & Humanities Boardroom
3.00 to 3.30 pm	**Private Panel Meeting (Tea/Coffee)**			
3.30 to 5.00 pm	Meet with Dept. Teams re Proposed Changes to Programme Structures			
5.00 to 5.30 pm	Meet with Recent Graduates			
5.30 to 6.00 pm	Meet with Employers			
8pm	Panel Dinner	Kingsley Hotel		

Day Two Friday March 31st 2017

9.00 to 9.15 am	Private Panel Meeting - emerging themes	Boardroom, CREATE	Boardroom, Tourism & Hospitality	Business & Humanities Boardroom
9.15 to 10.15 am	Meet with Students			
10.15 to 10.45 am	**Private Panel Meeting (Tea/Coffee)**			
10.45 am to 12.30 pm	Meet with Dept. Teams re General Review of Modules			
12.30 to 1.30 pm	**Private Panel Lunch**			
1.30 to 2.30 pm	Sub-panel meetings to draft outline reports			
2.30 to 3.00 pm	Feedback to overall panel - themes	Council Room		