	Application Development, Software Development, Cloud Computing, Mobile Cloud Gaming and Computing Infrastructure. In addition, as a result of the most recent Springboard call for tenders, an additional elective module – Domain Skills for Computing – has been included in the schedule. This module has been designed to accommodate localised requirements of specific companies or sectors who may wish to offer the programme in-house or to recruit candidates with a specific skillset.

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Report of the Programme Evaluation Panel

Provider's Name:	National College of Ireland
Address:	Mayor Square
	IFSC
	Dublin 1
QA procedures agreed on:	2006
QA procedures reviewed on:	2010
Programme submitted for approval*:	**Leading to the award of:**
1. Higher Diploma in Science in Computing	Higher Diploma in Science
2.	
3.	
4.	
5.	
Date submitted to QQI:	11th April 2016
Date of Evaluation:	16 May 2016
Date of Report:	16 May 2016

Membership of the Programme Evaluation Panel:

Role	Name	Area of Expertise	QQI Peer Review Reference Listing
Chairperson	Dr Joseph Ryan	Registrar, Athlone Institute of Technology	
External Specialist	Prof Christian Horn	Dundalk Institute of Technology	
External Specialist	Dr Liam Noonan	Limerick Institute of Technology	
Industry/Employer Perspective	Mr Derek Harnett	Intel	
Rapporteur	Dr Maurice FitzGerald	National College of Ireland	

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1 Profile of provider:

The National College of Ireland (NCI) has an immensely proud history as a third level educational institution. Established by the Jesuit order in 1951 as the Catholic Workers College it quickly gained recognition for excellence in its subject fields, particularly human resource management and industrial relations, and for the provision of high quality educational opportunities for employees entering third level education. In the late 1990's the College became the National College of Ireland and entered a new phase of its development expanding its part-time provision to a number of off-campus locations throughout the country and extending its full-time undergraduate programmes to include accountancy, finance and informatics. In 2002 the College moved from its original site in Ranelagh to a new 'State of the Art' purpose built premises in Dublin's International Financial Services Centre.

NCI's educational philosophy and operational structure embody participation, collaboration and applied problem solving strategies. These are enabled by a faculty whose qualifications and professional experience help integrate academic theory with current practical application. The College assesses both the quality of its academic programmes and the academic achievement of its students and utilises the results of these assessments to improve academic and institutional quality.

The primary focus of NCI is on maintaining a centre of excellence that is centered on the changing needs of today's learner. National College of Ireland provides a broad range of high-quality education programmes for today's knowledge-based society.

In line with its mission of widening access to education, the College places a strong emphasis on the needs of the learner, bringing a unique student-centered approach to all aspects of its teaching and research. National College of Ireland provides a range of learning options that extend beyond traditional classroom dynamics, including distance learning and internet-based learning programmes.

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2 Context of validation

The Higher Diploma in Science in Computing was first validated in 2013 with 5 elective streams. The programme has run with 2 cohorts annually, mainly populated by learners who are eligible for Springboard/ICT funding from the HEA.
In order to accommodate the evolving nature of the Computing discipline, the College wishes to introduce three additional elective streams to the programme.

- Internet of Things, (Group Elective 6)
- Cyber Security, (Group Elective 7)
- Software Quality and Testing. (Group Elective 8)

These specialisations complement the existing programme and the suite of specialisations already validated in the area of Mobile Application Development, Software Development, Cloud Computing, Mobile Cloud Gaming and Computing Infrastructure.

In addition, as a result of the most recent Springboard call for tenders, an additional elective module – Domain Skills – has been included in the schedule. This module has been designed to accommodate localised requirements of specific companies or sectors who may wish to offer the programme in-house or to recruit candidates with a specific skillset.
In accordance with QQI Criteria and Policy for Validation, these amendments have been proposed to be considered under differential validation. The report below therefore reflects the consideration of the panel on those elements of the programme that have been amended.

3 Planning:

Programme development since agreement of QA procedures / the last review

The College has developed a significant number of programmes since its last institutional review culminating in 2015 with a complete programmatic review of its portfolio across the Business, Computing and Education subject areas.

3.1 Purpose of the award

Does the proposed programme address a clear market demand? Yes✓ No

The ***IoT*** elective group comprises a suite of modules which enables the learners to obtain specialised knowledge and technical skills in the area of Internet of Things. In particular, the IoT principles module imparts knowledge of underlining technologies, and the potential impacts of the many machine to one human paradigm. This core theoretical basis is augmented by Fundamentals of Mobile Communication module. IoT is inherently a physical computing domain, as such IoT Software Development serves as the primary practical module for the stream. Therein, the learner will gain experience in building reusable and bespoke IoT software. It was a natural fit to incorporate the existing Multimedia and Mobile Application Development module in the curriculum. Mobile phones, tablets, and wearables are key candidates for M2M communication with constrained devices. The judicious use of multimedia is key to providing a fluid interaction experience for the user.

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The ***Cyber Security*** elective group comprises a suite of modules that enables the learners to obtain specialised knowledge and technical skills in the area of Cyber Security. In particular, the learners would first get grounding in the key concepts from the Security area (e.g. Security principles module) and practical experience in Cyber Security by developing secure applications (e.g. Secure Programming module) and by identifying malware, attacks, issues and discrepancies (Digital Forensics module and Penetration Testing module).

The ***Software Quality and Testing*** elective group comprises a suite of modules which enables the learners to obtain specialised knowledge and technical skills in the area of Software Quality and Testing. The modules for this stream were designed and developed based on Industry feedback given by SQS, an international Software Quality and Testing provider and trainer, and Irish Software Association. The modules were developed over a series of discussions, and are designed to meet the industry needs of project management, Quality and Testing theory and practical software testing.

3.2 Avoidance of duplication

Has the Programme Development Team identified the availability of similar programmes locally, regionally, nationally?

Yes✓ No

Comment: None

3.3 Stakeholder consultation

Was the level of stakeholder engagement satisfactory? Yes✓ No

Comment: None

Support for the programme (industry/business/community) Yes✓ No

The programme is satisfied that the rationale for the amendments made have included appropriate consultation. The programme information would benefit from an articulation of the expected role that graduates would undertake for each of the streams added to the programme – particularly in relation to ensuring that the scope of the role is clearly identified. This is particularly true of the Cybersecurity stream.

3.4 Efficient and effective use of resources

Does the proposed programme represent both efficient and effective use of the provider's resources?

Yes✓ No

Comment: None

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3.5 Resource development over last 5 years (or in direct support of this programme)

Specific Comments:

Staff: The panel is satisfied that there are appropriate staff employed to deliver this programme.

Accommodation: The panel is satisfied that the College's accommodation is appropriate to this programme.
Information technology: The panel is satisfied that the College's ICT infrastructure is appropriate to this programme.

Library: The panel is satisfied that the College's Library & Information Service is appropriate to this programme.

Administration: The panel is satisfied that there are appropriate administrative and programme administration structures appropriate to this programme.

Publicity/public information: The panel is satisfied that appropriate marketing and public information materials are available

3.6 Planned development over the coming 5 years?

Have the QQI award standards been explicitly referred to in the programme and does the programme meet those standards at the specified level?

Yes✓ No

Comment: None

Has the Provider complied with Protection for Enrolled Learner requirements?

Yes✓ No

The panel understands that PEL requirements for any learners recruited under HEA labour activation schemes will be provided by the HEA. Otherwise PEL will be provided under an arrangement with HECA which is currently being finalised and will be made available to QQI prior to the enrolment of any learner.

3.7 Access

Is the expected minimum and maximum number of all learners entering the programme explicitly stated?

Yes✓ No

Comment: None

Have any/all prerequisite knowledge, skills or competence or any other specific entry requirement been articulated?

Yes✓ No

Comment: None

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4 Quality Assurance

4.1 Application of agreed quality assurance procedures for development of programmes

Were the agreed quality assurance procedures for programme development followed?

Yes✓ No

Comment: None

Has the programme team demonstrated how programme delivery will be monitored in accordance with agreed QA procedures?

Yes✓ No

Comment: None

Are programme management arrangements adequate and coherent?

Yes✓ No

Comment: None

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5 Programme structure and content

Is the programme structure well designed, coherent and fit for its stated purpose?

Yes✓ No

The panel is satisfied that the programme structure has not been affected by the amendments proposed for the programme.

5.1 Programme learning outcomes

Do the programme learning outcomes comply with national standards for the level of award proposed?

Yes✓ No

While the programme learning outcomes have been previously reviewed, the panel requires that the programme learning outcomes are extracted from the mapping table. An exercise should be undertaken to ensure that the taxonomy used is consistently appropriate to the level of the programme and that they can be appropriately assessed at a modular level

Are module descriptions adequate and relevant? Yes✓ No

Comment: None

Are modules relevant and current? Yes✓ No

Comment: None

Does the combination of modules chosen have the coherence to support the proposed award?

Yes✓ No

The panel is satisfied that the coherence of the programme has not been affected by the amendments proposed.

5.2 Learning Modes

Can the teaching and learning strategies proposed support achievement of the required learning outcomes?

Yes✓ No

Comment: None

Are the delivery mechanisms proposed adequate to the needs of the programme and the proposed learner cohorts?

Yes✓ No

Comment: None

5.3 Assessment strategies

Are assessment processes and methods adequately described? Yes✓ No

Are these strategies appropriate to this type of award, in terms of type, frequency and volume?

Yes✓ No

The panel would like to see more detail at a modular level to ensure that it is clear what is expected of the learner and that the assessment is at the appropriate level.

Is assessment explicitly linked with intended learning outcomes? Yes✓ No

Comment: None

Does the assessment strategy underpin the achievement of the relevant standard of knowledge, skill and competence?

Yes✓ No

Comment: None

5.4 Duration

What is the intended duration of the Programme?

One calendar year

What is the lifespan of the programme (e.g. single cohort intake to satisfy limited local demand; multiple intakes over the following 5 years etc.?)

This programme has consistently recruited since 2010.

Does the Panel believe this to be realistic? Yes✓ No

The panel notes that this programme has consistently attracted Springboard and ICT funding.

Are there flexible modes of participation? Yes✓ No

Comment: None

5.5 Credits

Is credit allocation in accordance with national and international guidelines?

Yes✓ No

Comment: None

Considering the level, outcomes and volume of each module, is the number of credits attached to each appropriate?

Yes✓ No

Comment: None

Considering the stated objective of the programme is the number of credits attached to the award appropriate?

Yes✓ No

Comment: None

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5.6 NFQ Level

Is the proposed level of the programme in accordance with institutional policy/national norms?

Yes✓ No

Comment: None

5.7 Programme titles and award

Is the title consistent with national policy, is it informative and is it fit for purpose?

Yes✓ No

Comment: None

5.8 Transfer and Progression

Has the Programme Development Team identified realistic transfer and progression opportunities/possibilities that learners may avail of following achievement of this award?

Yes✓ No

Comment: None

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6 Module Titles, Content and Assessment Strategy

6.1 Domain Skills

Is the title informative and is it fit for purpose? Yes✓ No

The panel recommends that as this concept is being introduced across a number of programmes, the title of the module should related at minimum to the subject area e.g. Domain Skills for Web Technologies.

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The parameters for the assessment of this module should be reviewed to ensure that it is scalable and that consistency can be achieved.

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.2 Internet of Things (IoT) Stream

The panel accepts the inclusion of this stream/group elective

6.2.1 IoT Principles

Is the title informative and is it fit for purpose? Yes✓ No

Comment: None

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

The panel reviewed a similar descriptor for another programme evaluated on the day and recommends that this descriptor should become the baseline descriptor for this module. In particular, references to the societal impacts of IoT are not viewed as being of a critical nature and the emphasis should be placed on enabling technologies. In order to facilitate

the evolving nature of this subject matter, a placeholder should be set in the module descriptor for 'emerging trends.'

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used.

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.2.2 IoT Software Development

Is the title informative and is it fit for purpose? Yes✓ No

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

The panel and the programme team had significant discussion over the programming language in use for this suite of modules. The panel is of the view that learners should be exposed to C++ to enable the learners to benefit from this

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

The assessment strategy for the module should be made more specific rather than an outline of what may be used Yes✓ No

.

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.2.3 Fundamentals of Mobile Communication

Is the title informative and is it fit for purpose? Yes✓ No

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.2.4 Multimedia and Mobile Application Development

Is the title informative and is it fit for purpose? Yes✓ No

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.3 Cybersecurity Stream

The panel accepts the inclusion of this stream/group elective

6.3.1 Security Principles

Is the title informative and is it fit for purpose? Yes✓No

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.3.2 Secure Programming

Is the title informative and is it fit for purpose? Yes No✓
The panel is of the view that this module should be sufficient distinguished from the module delivered on the honours degree due to the differences of the cohorts taking the module. The module may be better titled as Principles of Secure Programming.

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Learners should be exposed to C++ programming in order to benefit most from taking this stream.

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.3.3 Penetration Testing

Is the title informative and is it fit for purpose? Yes✓No

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.3.4 Digital Forensics

Is the title informative and is it fit for purpose? Yes✓No

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.4 Software Quality and Testing Stream

The panel accepts the inclusion of this stream

6.4.1 Business Analysis & Problem Solving Techniques

Is the title informative and is it fit for purpose? Yes✓ No

The panel notes that the module presented) has been updated and presented as part of another submission. (Business Analysis & Communication) Clarity is required on the module being delivered on this programme.

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.4.2 Fundamentals of Software Quality and Testing

Is the title informative and is it fit for purpose? Yes✓No

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

Comment: None

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

The assessment strategy for the module should be made more specific rather than an outline of what may be used

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

Comment: None

6.4.3 Practical Software Testing

Is the title informative and is it fit for purpose? Yes✓No

The panel recommends that Applied Software Testing may be a more appropriate title

Are the specific learning outcomes a) properly stated, b) sufficient and c) achievable?

Yes✓ No

The taxonomy used for the module learning outcomes should be reviewed to ensure that they are appropriate to the level and can be appropriately assessed

Is the content sufficiently informative and is it fit for purpose? Yes✓ No

The curriculum for this module should be expanded to ensure that all stakeholders understand what is expected.

Does the Assessment Strategy align sufficiently with the intended learning outcomes?

Yes✓ No

Is the required reading and supplementary reading appropriate, current and realistic?

Yes✓ No

A review of the booklist should be undertaken to ensure the most current editions are cited.

7 Specific Issues to be addressed by the provider

7.1 Conditions of Approval:

C1. Programme learning outcomes should be separately listed in the documentation. An exercise should be undertaken to ensure that the taxonomy used for these outcomes is consistently appropriate to the level of the programme and their articulation allows the module to be appropriately assessed.

C2. Module learning outcomes need to be written using a suitable taxonomy (i.e. the verbs employed must be appropriate to their level)

C3. In turn, there needs to be real alignment and clarity on the one hand regarding how module learning outcomes are assessed and, on the other, that there is appropriately detailed and varied assessment (and reassessment) strategies at module level (as well as across programmes as a whole).

C4. The assessment approach for the *Domain Skills* module should be reviewed to ensure that it is scalable and standards are consistent.

C5. The '*Secure Programming'* module should be clearly identified as being an introductory module and differentiated from the similar module on the BSc Hons in Computing.

C6. The *Principles of Internet of Things* module should be reviewed to ensure that emphasis is placed on enabling technologies. An emerging technologies section should be included in the module to allow for the rapidly evolving nature of the subject

C7. Clarity is required on the title and descriptor of the module *Business Analysis & Problem Solving* being delivered on this programme

C8. A graduate profile for each of the additional streams should be outlined which clearly identifies the scope of the award for both learner & employer

7.2 Recommendations:

R1. Various typos occur throughout the paperwork but, given the fact that these documents constitute a public record, the many uses to which this paperwork can be used beyond this evaluation panel, etc., these should be eliminated as a matter of course.

R2. Consider the titling of the Domain Skills module so that it accurately reflects its intent when applied across multiple programmes and/or subject domains.

R3. Learners should be exposed to C++ programming where they are taking the Internet of Things or Cybersecurity streams.

R4. Reading lists for all modules should be reviewed to ensure currency and that sufficient supplementary reading is cited.

R5. The title of Practical Software Testing should be reviewed

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8 Overall Result of Evaluation Panel Review:

The Programme is recommended to the Programmes and Awards Executive Committee for approval subject to the provision to QQI of a revised submission document including programme schedule(s), which addresses the conditions and recommendations required in the report and which has been signed off by the Panel Chair if necessary.

This report has been agreed by the Evaluation Panel and is signed on their behalf by the Chair.

Panel Chairperson: Dr Joseph Ryan Date: 1st June 2016

Signed _ Date _

The Report of the External Review Panel contains no assurances, warranties or representations express or implied, regarding the aforesaid issues, or any other issues outside the Terms of Reference.

While QQI has endeavoured to ensure that the information contained in the Report is correct, complete and up-to-date, any reliance placed on such information is strictly at the reader's own risk, and in no event will QQI be liable for any loss or damage (including without limitation, indirect or consequential loss or damage) arising from, or in connection with, the use of the information contained in the Report of the External Evaluation Panel.

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Appendix 1: Staff

Staff Name	Role
Mr Michael Bradford	Lecturer
Dr Dominic Carr	Programme Director & Lecturer
Ms Adrianna Chis	Lecturer
Mr Sam Cogan	Computing Support Tutor
Mr Oisin Creanor	Associate Lecturer
Mr Ron Elliott	Associate Lecturer
Dr Mike Goldrick	Learning Support & Development Officer
Dr Paul Hayes	Lecturer
Dr Arghir Moldovan	Associate Lecturer
Ms Lisa Murphy	Lecturer
Mr Eugene McLaughlin	Associate Lecturer
Dr Eugene O'Loughlin	Lecturer
Ms Sinéad O'Sullivan	Director of Quality Assurance
Dr Pramod Pathak	Dean of the School of Computing
Dr Anu Sahni	Lecturer
Frances Sheridan	Lecturer
Dr Paul Stynes	Vice Dean, Academic Programmes and Research

National College of Ireland

Higher Diploma in Science in Computing
Differential Validation
New Specialisations in Internet of Things, Cyber Security, and Software Quality and Testing

Current QQI Programme Code: PG20837

Programme Team Response
The programme team for the Higher Diploma in Science in Computing programme would like to express their appreciation of the Expert Panel's deliberations and feedback.
The programme presented to the External Panel has undergone a set of considered amendments based on the panel's feedback and the conditions and recommendations relating to the proposed programme as outlined below.

Conditions

Condition	Response
C1. Programme learning outcomes should be separately listed in the documentation. An exercise should be undertaken to ensure that the taxonomy used for these outcomes is consistently appropriate to the level of the programme and their articulation allows the module to be appropriately assessed.	The programme learning outcomes have been listed at the beginning of section 4.2 The minimum intended programme learning outcomes (MIPLO) have been reviewed and the taxonomy used is appropriate for the level 8 as recommended by the QQI award standards for Computing. Table 6 has been revised to map the modules learning outcomes to the MIPLOs.
C2. Module learning outcomes need to be written using a suitable taxonomy (i.e. the verbs employed must be appropriate to their level)	The learning outcomes have been reviewed for all the modules undergoing differential validation to ensure that the taxonomy used is appropriate for the level 8. Next, are presented the modules and the corresponding learning outcomes that have been revised: • IoT Principles: LO1, LO2 • IoT Software Development: LO1, LO2 • Fundamentals of Mobile Communication: removed previously LO3, revised LO1, LO2, LO3, LO4 • Multimedia and Mobile Application Development: LO1, LO2, LO3, LO4 • Security Principles: LO1, LO3, LO4, LO5 • Fundamentals of Secure Programming: LO1, LO2, LO3, LO4 • Penetration Testing: LO1, LO2, LO3 • Digital Forensics: LO1, LO3 • Business Analysis and Communication: LO1, LO2, LO3 • Fundamentals of Software Quality and Testing: combined LO2 and LO3, revised LO1, LO2, LO3, LO4

Condition	Response
	• Applied Software Testing: LO1 • Skills of the Computing Domain: LO2 • Cloud Application Development: LO1 • Software Development combined LO1 and LO3 as they were similar, LO6
C3. In turn, there needs to be real alignment and clarity on the one hand regarding how module learning outcomes are assessed and, on the other, that there is appropriately detailed and varied assessment (and reassessment) strategies at module level (as well as across programmes as a whole).	Each module owner has reviewed the *teaching and learning strategy* in order to show specific practice to be applied to each module. The teaching and learning strategy has been revised in the following modules: • IoT Principles • IoT Software Development • Security Principles • Penetration Testing • Digital Forensics • Business Analysis and Communication • Skills for the Computing Domain • Software Development The *assessment strategy* has been updated, where needed, to show the assessment type (e.g. continous assessment, project, final exam), assessment weight, module learning outcomes assessed and the assessment description. The assessment strategy has been revised in the next modules: • IoT Principles • Multimedia and Mobile Application Development • Security Principles • Fundamentals of Secure Programming • Penetration Testing • Digital Forensics • Fundamentals of Software Quality and Testing • Applied Software Testing • Skills for the Computing Domain • Software Development The *reassessment strategy* has been revised in the next modules: • IoT Principles • Multimedia and Mobile Application Development • Business Analysis and Communication • Skills for the Computing Domain

National College of Ireland

Condition	Response
	Detailed *sample assessments* are provided for all the modules. The sample assessments also document the learning outcomes assessed by each sample assessment. • IoT Principles • IoT Software Development • Fundamentals of Mobile Communication • Multimedia and Mobile Application Development • Security Principles • Fundamentals of Secure Programming • Penetration Testing • Digital Forensics • Business Analysis and Communication • Applied Software Testing • Fundamentals of Software Quality and Testing • Skills of the Computing Domain • Cloud Application Development • Software Development
C4. The assessment approach for the *Domain Skills* module should be reviewed to ensure that it is scalable and standards are consistent.	The assessment breakdown has been updated as follows: • 80% - ePortfolio The ePortofolio is composed of a number of suitable content items such as evidence of industry certification, a reflective journal, practical project submission • 20% - Facilitator Review This assessment component is a combined review of student participation by all involved facilitators. NCI faculty are cognizant of issues of scalability around the delivery of this module. The module is elective and will not be offered if scalability issues cannot be addressed

Condition	Response
C5. The '*Secure Programming'* module should be clearly identified as being an introductory module and differentiated from the similar module on the BSc Hons in Computing.	The module has been renamed to "*Fundamentals of Secure Programming*" on the Higher Diploma in Science in Computing (HDCOMP). Furthermore, the module from the BSc Hons in Computing has been renamed to "Secure Application Programming" and focusses on Web Application Security, and thefore it is different from the one taught within HDCOMP. In addition, the Advanced Secure Programming module taught in the BSc Hons in Computing has been revised to ensure that the programming difficulty is higher than the one in the module delivered within HDCOMP. For example, while the Fundamentals of Secure Programming exposes the students to fundamentals topics using a system programming language such as C, or C++, the Advanced Secure Programming module will take an in-depth approach.
C6. The *Principles of Internet of Things* module should be reviewed to ensure that emphasis is placed on enabling technologies. An emerging technologies section should be included in the module to allow for the rapidly evolving nature of the subject	The "Wireless Technologies enabling IoT" section of the IoT module has a new topic on *"Examination of emerging technologies related to, or enabling, IoT"*.
C7. Clarity is required on the title and descriptor of the module *Business Analysis & Problem Solving* being delivered on this programme	The programme team has decided to change the module that is being delivered on the Software Quality and Testing stream from 'Business Analysis and Problem solving' to 'Business Analysis and Communication'. The module 'Business Analysis and Communication' is an updated version of the previous module which is also delivered on another Higher Diploma programme at NCI. The module has been altered to incorporate more communication skills; this update is in alignment with the knowledge and skillset required on the Software Quality and Testing specialisation.
C8. A graduate profile for each of the additional streams should be outlined which clearly identifies the scope of the award for both learner & employer	A graduate profile has been added for each of the new specialiasations in sub-section 3.5 entitled "*Graduate Profile*".

Recommendations

Recommendation	Response
R1. Various typos occur throughout the paperwork but, given the fact that these documents constitute a public record, the many uses to which this paperwork can be used beyond this evaluation panel, etc., these should be eliminated as a matter of course.	The document had been proofread.
R2. Consider the titling of the Domain Skills module so that it accurately reflects its intent when applied across multiple programmes and/or subject domains.	As advised by the validation panel, the module has been renamed to *Domain Skills for Computing*" to reflect its intent for this programme.
R3. Learners should be exposed to C++ programming where they are taking the Internet of Things or Cybersecurity streams.	The following modules within the Internet of Things and Cyber Security streams have been updated to incorporate topics on C++ • IoT Software Development: the sections on o Programming the IoT o Programming a "Thing" • Fundamentals of Secure Programming: the sections on o Introduction and Overview – Systems programming language (e.g. C / C++) o Coding for Security – Mitigation and Prevention
R4. Reading lists for all modules should be reviewed to ensure currency and that sufficient supplementary reading is cited.	Each module owner has reviewed the reading lists to ensure that the appropriate readings are suggested.
R5. The title of Practical Software Testing should be reviewed	The module had been renamed to "*Applied Software Testing*".

Additional Updates

- The module curriculum has been updated for the Applied Software Testing module to provide more details about the topics to be studied.

Walter Balfe
Programme Validation Unit
QQI
Denzille Lane Dublin 2

7 July 2016

Dear Walter,

This is to confirm that I have received and reviewed the amended documentation from National College of Ireland submitted in response to a recent panel for the programmes

HDip in Web Technologies
HDip in Data Analytics
HDip in Computing
Cert in Computing
Cert in Digital Multimedia
BSc (Hons) in Computing

I confirm that in my opinion the amendments made address all the conditions set by the panel and would recommend these programmes to QQI for validation.
The panel report for the BSc (Hons) in Computing contained an error in that Condition 4 and Recommendation 2 did not apply to the programme. The Programme Team has noted this in their response.

Please note that this is reflects my personal opinion, the ultimate decision rests with the chair of the panel.

Best regards

Christian

Christian Horn
Head of Department of Computing Science & Mathematics
Dundalk Institute of Technology
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Skype: Christian.Horn

Walter. Apologies for missing your call.

As you probably gather, I'm away at the moment and without access to these papers. From what I can read, I am satisfied that the college both understands and has set out the intention to meet the significant conditions attaching to this recommendation.

In the absence of any ability to attach an electronic signature to the cover, I trust you can utilise this to affirm my support.

Regards,

Dr Joseph Ryan
Academic Registrar

CERTIFICATE OF VALIDATION

Provider name	National College of Ireland
Date of validation	20 July 2016

	First Intake	**Last Intake**
Enrolment interval	September 2016	September 2020

	Code	**Title**	**Award**
Principal programme		Higher Diploma in Science in Computing	Higher Diploma
Embedded programme			
Embedded programme			

	Name	**Maximum number of learners**	**Minimum number of learners**
Approved centre	National College of Ireland	As per the validated programmes	As per the validated programmes

Target learner groups	As per the validated programmes
Approved countries for provision	Ireland
The teaching and learning modalities	As per the validated programmes
Brief synopsis of the programme (e.g. who it is for, what is it for, what is involved for learners, what it leads to.)	As per the validated programmes
Specifications for teaching staff	As per the validated programmes
Specifications for the ratio of learners to teaching-staff	As per the validated programmes

Programmes being replaced		
Code	**Title**	**Comment**
		N/A

Conditions of validation

The statutory (section 45(3) of the 2012 Act) conditions of validation are that the provider of the programme shall:

a) co-operate with and assist QQI in the performance of QQI's functions in so far as those functions relate to the functions of the provider,
b) establish procedures which are fair and consistent for the assessment of enrolled learners to ensure the standards of knowledge, skill or competence determined by QQI under section 49 (1) are acquired, and where appropriate, demonstrated, by enrolled learners,
c) continue to comply with section 65 of the 2012 Act in respect of arrangements for the protection of enrolled learners, if applicable, and
d) provide to QQI such information as QQI may from time to time require for the purposes of the performance of its functions, including information in respect of completion rates.

Conditions from HET Core Validation Policy and Criteria 2010, Revised 2013

The provider of the programme shall (for each programme):

1. Maintain the status of the programme(s) recognition;
2. Establish, having regard to existing quality assurance procedures, procedures for quality assurance for the purpose of further improving and maintaining the quality of education and training which is provided, organised or procured by that provider as part of the programme(s) concerned, and agree those procedures with QQI;
3. Operate quality assurance procedures agreed with QQI;
4. Implement procedures for the assessment of learners which are consistent with Assessment and Standards, Revised 2013;
5. Implement the procedures described in the document Policies, Actions and Procedures for Access, Transfer and Progression for Learners;
6. Implement any special conditions of validation attached to the relevant awards standards.

Other conditions from HET Core Validation Policy and Criteria 2010, Revised 2013

7. Notify QQI of any change in circumstances affecting the provider which could affect or be perceived to affect the provision of the programme(s). This includes significant changes in corporate or academic governance, ownership, legal status, profile of teaching staff, profile of learners, numbers enrolled, facilities, or resources;
8. Maintain learner data records (personal identification, progression, module marks, stage classification etc.) in order to assist QQI in the performance of its functions;
9. Provide the information required by QQI's award making and monitoring functions, including information in respect of completion rates;
10. Implement the programme in accordance with the **approved programme schedule(s)** (appended) and current assessment strategies;
11. Subject to Section 4.6.1 of *HET Core Validation Policy and Criteria 2010*, Revised 2013, obtain QQI's approval prior to substantially amending the programme's minimum intended learning outcomes, save in the case of incremental enhancements arising from the implementation of findings of the provider's agreed quality assurance procedures;
12. Notify QQI of any information concerning the programme(s), or circumstances that may reasonably be expected to give QQI cause to consider reviewing the programme. Explicitly this includes where another awarding body withdraws or seeks to withdraw validation from the programme(s) and /or any alterations to accreditations (additions or withdrawals) by a professional or regulatory body;
13. Implement the programme(s) as agreed with the resources indicated;
14. Adhere to, and implement the Provider Lifecycle of Engagements.

Approved Programme Schedule(s)

Name of Provider	National College of Ireland
Programme Title (i.e. named award)	Higher Diploma in Science in Computing (PG20837)
Award Title QQI named award)	Higher Diploma in Science in Computing
Stage Exit Award Title	
Modes of Delivery (FT/PT/ACCS/BLENDED/OC etc)	Full Time, Blended, OC,

Award Class	Award NQF Level	Award EQF Level	Stage	Stage NQF Level	Stage EQF Level	Stage Credit (ECTS)	Date Effective	ISCED Subject Code
Major	8	6	Award	8		60	September 2016	

Ref	Module Title	Semester	Module Status (M/E)	Module NQF Level	ECTS Credit Number	Total Student Effort: Total Hours	Total Student Effort: Contact Hours	Total Student Effort: Independent Learning	Allocation of Marks: CA %	Allocation of Marks: Project %	Allocation of Marks: Final %	Allocation of Marks: Total %
	Object Oriented Software Engineering	1	M	8	5	125	36	89	0%	60%	40%	100%
	Software Development	1	M	8	10	250	48	202	50%	0%	50%	100%
	Web Design	1	M	8	5	125	36	89	40%	60%	0%	100%
	Computer Architecture Operating Systems and Networks	1	M	8	5	125	36	89	50%	0%	50%	100%
	Introduction to Databases	1	M	8	5	125	36	89	50%	0%	50%	100%
	Cloud Gaming	*2*	*GE1*	*8*	*5*	*125*	*36*	*89*	*0%*	*40%*	*60%*	*100%*
	Graphics and Animation for Devices	*2*	*GE1*	*8*	*5*	*125*	*36*	*89*	*60%*	*40%*	*0%*	*100%*
	Mobile Game Development	*2*	*GE1*	*8*	*5*	*125*	*36*	*89*	*40%*	*60%*	*0%*	*100%*
	Server Side Development	*2*	*GE1A*	*8*	*5*	*125*	*36*	*89*	*0%*	*60%*	*40%*	*100%*
	Fundamentals of Mobile Communication	2	GE2	8	5	125	36	89	40%	0%	60%	100%
	Multimedia and Mobile Application Development	2	GE2	8	5	125	36	89	60%	40%	0%	100%
	Advanced Mobile Application Development	2	GE2	8	5	125	36	89	60%	40%	0%	100%
	Server Side Development	2	GE2A	8	5	125	36	89	0%	60%	40%	100%
	Advanced Programming	*2*	*GE3*	*8*	*5*	*125*	*48*	*77*	*50%*	*0%*	*50%*	*100%*

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Modes of Delivery (FT/PT/ACCS/BLENDED/OC etc)	Full Time, Blended, OC,

Award Class	Award NQF Level	Award EQF Level	Stage	Stage NQF Level	Stage EQF Level	Stage Credit (ECTS)	Date Effective	ISCED Subject Code
Major	8	6	Award	8		60	September 2016	

Ref	Module Title	Semester	Module Status (M/E)	NQF Level	ECTS Credit Number	Total Student Effort: Total Hours	Total Student Effort: Contact Hours	Total Student Effort: Independent Learning	Allocation of Marks: CA %	Allocation of Marks: Project %	Allocation of Marks: Final %	Allocation of Marks: Total %
	Data Structures and Algorithms	*2*	*GE3*	*8*	*5*	*125*	*48*	*77*	*50%*	*0%*	*50%*	*100%*
	Web Services and API Development	*2*	*GE3*	*8*	*5*	*125*	*36*	*89*	*75%*	*0%*	*25%*	*100%*
	Server Side Development	*2*	*GE3A*	*8*	*5*	*125*	36	*89*	*0%*	*60%*	*40%*	*100%*
	Data Storage and Management	2	GE4	8	5	125	36	89	50%	50%	0%	100%
	Infrastructure Management	2	GE4	8	5	125	36	89	35%	35%	30%	100%
	Virtualisation	2	GE4	8	5	125	36	89	35%	35%	30%	100%
	Practical Operating Systems	2	GE4A	8	5	125	36	89	50%	0%	50%	100%
	Cloud Application Development	*2*	*GE5*	*8*	*5*	*125*	36	*89*	*0%*	*100%*	*0%*	*100%*
	Cloud Computing in Business	*2*	*GE5*	*8*	*5*	*125*	36	*89*	*0%*	*50%*	*50%*	*100%*
	Web Services and API Development	*2*	*GE5*	*8*	*5*	*125*	*36*	*89*	*75%*	*0%*	*25%*	*100%*
	Practical Operating Systems	*2*	*GE5A*	*8*	*5*	*125*	36	*89*	*50%*	*0%*	*50%*	*100%*
	IoT Principles	*2*	*GE6*	*8*	*5*	*125*	*36*	*89*	*40%*	*0%*	*60%*	*100%*
	IoT Software Development	*2*	*GE6*	*8*	*5*	*125*	*36*	*89*	*60%*	*40%*	*0%*	*100%*
	Fundamentals of Mobile Communication	*2*	*GE6*	*8*	*5*	*125*	*36*	*89*	*40%*	*0%*	*60%*	*100%*
	Multimedia and Mobile Application Development	*2*	*GE6A*	*8*	*5*	*125*	*36*	*89*	*60%*	*40%*	*0%*	*100%*

Name of Provider	National College of Ireland
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Stage Exit Award Title	
Modes of Delivery (FT/PT/ACCS/BLENDED/OC etc)	Full Time, Blended, OC,

Award Class	Award NQF Level	Award EQF Level	Stage	Stage NQF Level	Stage EQF Level	Stage Credit (ECTS)	Date Effective	ISCED Subject Code
Major	8	6	Award	8		60	September 2016	

Ref	Module Title	Semester	Module Status (M/E)	Module NQF Level	ECTS Credit Number	Total Student Effort: Total Hours	Total Student Effort: Contact Hours	Total Student Effort: Independent Learning	Allocation of Marks: CA %	Allocation of Marks: Project %	Allocation of Marks: Final %	Allocation of Marks: Total %
	Security Principles	*2*	*GE7*	*8*	*5*	*125*	*36*	*89*	*50%*	*0%*	*50%*	*100%*
	Fundamentals of Secure Programming	*2*	*GE7*	*8*	*5*	*125*	*36*	*89*	*50%*	*50%*	*0%*	*100%*
	Penetration Testing	*2*	*GE7*	*8*	*5*	*125*	*36*	*89*	*50%*	*0%*	*50%*	*100%*
	Digital Forensics	*2*	*GE7A*	*8*	*5*	*125*	*36*	*89*	*50%*	*0%*	*50%*	*100%*
	Business Analysis and Communication	*2*	*GE8*	*8*	*10*	*250*	*48*	*202*	*50%*	*0%*	*50%*	*100%*
	Fundamentals of Software Quality and Testing	*2*	*GE8*	*8*	*5*	*125*	*36*	*89*	*50%*	*0%*	*50%*	*100%*
	Applied Software Testing	*2*	*GE8A*	*8*	*5*	*125*	*36*	*89*	*50%*	*50%*	*0%*	*100%*
	Domain Skills for Computing	*2*	*GE1B, GE2B, GE3B, GE4B, GE5B, GE6B, GE7B, GE8B*	*8*	*5*	*125*	*36*	*89*	*100%*	*0%*	*0%*	100%
	Project	*2*	*M*	*8*	*10*	*250*	*36*	*214*	*0%*	*100%*	*0%*	*100%*

Special Regulations: Students must choose a Group Elective

Group Elective 1 – Mobile Cloud Gaming (Modules: Cloud Gaming, Graphics and Animation for Devices, Mobile Game Development,

Name of Provider			National College of Ireland						
Programme Title (i.e. named award)			Higher Diploma in Science in Computing (PG20837)						
Award Title QQI named award)			Higher Diploma in Science in Computing						
Stage Exit Award Title									
Modes of Delivery (FT/PT/ACCS/BLENDED/OC etc)			Full Time, Blended, OC,						
Award Class	Award NQF Level	Award EQF Level	Stage	Stage NQF Level	Stage EQF Level	Stage Credit (ECTS)	Date Effective	ISCED Subject Code	
Major	8	6	Award	8		60	September 2016		

Ref	Module Title	Semester	Module Status (M/E)	Module NQF Level	ECTS Credit Number	Total Student Effort: Total Hours	Total Student Effort: Contact Hours	Total Student Effort: Independent Learning	Allocation of Marks: CA %	Allocation of Marks: Project %	Allocation of Marks: Final %	Allocation of Marks: Total %
	Server Side Development (Elective), Domain Skills for Computing (Elective)) OR **Group Elective 2 – Mobile Application Development** (Modules: Fundamentals of Mobile Communication, Advanced Mobile Application Development, Multimedia and Mobile Application Development, Server Side Development (Elective), Domain Skills for Computing (Elective)) OR **Group Elective 3 – Software Development** (Modules: Data Structures and Algorithms, Advanced Programming, Web Services and API Development, Server Side Development(Elective), Domain Skills for Computing (Elective)) OR **Group Elective 4 – Computing Infrastructure** (Modules: Data Storage and Management, Infrastructure Management, Virtualisation, Practical Operating Systems (Elective), Domain Skills for Computing (Elective)) OR **Group Elective 5 – Cloud Computing** (Modules: Cloud Application Development, Cloud Computing in Business, Web Services and API Development, Practical Operating Systems (Elective), Domain Skills for Computing (Elective)) OR **Group Elective 6 – Internet of Things** (Modules: IoT Principles, IoT Software Development, Fundamentals of Mobile Communication, Multimedia and Mobile Application Development (Elective), Domain Skills for Computing (Elective)), OR **Group Elective 7 – Cyber Security** (Modules: Security Principles, Fundamentals of Secure Programming, Penetration Testing, Digital Forensics (Elective), Domain Skills for Computing (Elective)), OR **Group Elective 8 – Software Quality and Testing** (Modules: Business Analysis and Communication, Fundamentals of Software Quality and Testing, Applied Software Testing (Elective), Domain Skills for Computing (Elective)) Each stream/ specialisation has 2 elective modules, which are mutually exclusive: one stream-specific elective module (i.e. GE1A, GE2A, GE3A, GE4A, GE5A, GE6A, GE7A, and GE8A) and the Domain Skills for Computing module (i.e. GE1B, GE2B, GE3B, GE4B, GE5B, GE6B, GE7B, and GE8B) that is elective and available for all 8 streams/specialisations. **The project must be passed**											