Component Specification

Maths for Information Technology

 NFQ Level 5

5N18396

1. Component Details

Title	Maths for Information Technology
Teideal as Gaeilge	Mata le haghaidh Teicneolaíocht Faisnéise
Award Class	Minor
Code	5N18396
Level	5
Credit Value	15
Purpose	The purpose of this award is to certify relevant knowledge, skill and competence to apply a broad range of mathematical skills and tools to a wide variety of contexts especially in software development and/or working with computer systems and networks.
Units	The Learning Outcomes are grouped into the following units: 0 Basic arithmetic and algebra 2 Set Theory and Boolean Logic 3 Functions and Calculus 4 Geometry and Trigonometry 5 Probability and Statistics 6 Algorithms and Computations
Learning Outcomes	Learners will be able to: 0 Basic arithmetic and algebra

0.1   Master the operations of addition, multiplication, subtraction and division in the N, Z, Q, R, domains including the rules of indices and logarithms.

0.2   Solve practical problems by choosing the correct formulae to calculate the area and perimeter of a square, rectangle, triangle, and circle.

0.3   Solve practical problems by choosing the correct formulae, to calculate the volume/capacity and surface area of a cube, cylinder, cone, and sphere.

0.4   Demonstrate a fundamental understanding of binary numbers. Perform binary arithmetic. Be familiar with hexadecimal notation. Convert from binary and hexadecimal to base 10 and base 10 to binary and hexadecima.

0.5   Distinguish between an expression and an equation.

0.6   Evaluate, expand and simplify algebraic expressions.

0.7   Transpose formulae and perform arithmetic operations on polynomials and rational algebraic expressions.

0.8   Multiply linear expressions to produce quadratics and cubics.

0.9   Reduce quadratic expressions to products of linear expressions through the use of inspection to determine the factors. Use this to solve quadratic equations.

0.10 Solve quadratic equations with real and complex roots by factorisation or formula.

0.11 Solve linear inequalities.

0.12 Find a solution, if it exists, for simultaneous linear equations with 2 and 3 unknowns and interpret the results.

2   Set Theory and Boolean Logic

2.1   Demonstrate a fundamental understanding of the language of set theory including:

      universal set, subsets, sets N, Z, Q, R, C and ø, finite and infinite sets, and cardinal number

      of a set.

2.2   Use the basic operations on sets including union, intersection, complement, symmetric

      difference, Cartesian product, and power set.

2.3	Use Venn diagrams of two and three sets to represent relationships between sets.
2.4	Define and apply the truth tables for (N)AND, NOT, (N)OR and XOR.
2.5	Use truth tables to establish logical equivalences, for example De Morgan's Laws.
3	Functions and Calculus
3.1	Recognise that a function assigns a single output to every input, understand the concept of an inverse function and be able to compute it in simple algebraic cases.
3.2	Graph linear, quadratic and cubic functions and use these graphs to solve equations $f(x)=0$, $f(x)=k$, and $f(x)=g(x)$.
3.3	Define and graph simple and trigonometric functions.
3.4	Complete the square for a quadratic function and hence determine its roots and vertex.
3.5	Investigate the concept of the limit of a function and compute the limits of linear, quadratic and quotient functions, and understand the idea of a continuous function.
3.6	Understand how a derivative arises as a limit from looking for tangent lines or rates of change.
3.7	Use the sum, product and quotient formulas for differentiation and the chain rule to differentiate simple functions that are a composition of several functions.
4	Geometry and Trigonometry
4.1	Work with linear equations of the form $ax + by + c = 0$.
4.2	Solve problems involving slope of a line to include investigating parallel and perpendicular lines.
4.3	Solve problems involving midpoint and length of a line segment.
4.4	Apply the Pythagorean Theorem.

4.5 Demonstrate understanding of the concepts of degree and radian measure.

4.6 Define sin (θ), cos (θ), tan (θ), using right angled triangles and using the unit circle having

regard to amplitude, phase and period.

4.7 Work with trigonometric ratios in root form.

4.8 Solve problems involving the area of a triangle using the formula area = ½ab sin Θ.

4.9 Solve practical problems using trigonometric formulae and terminology, including the sine,

cosine and tangent ratios for right angled triangles.

4.10 Solve practical problems using the Sine Rule and Cosine Rule.

5 Probability and Statistics

5.1 List outcomes of an experiment.

5.2 Apply the fundamental principle of counting.

5.3 Count the arrangements of n distinct objects (n!).

5.4 Count the number of ways of arranging r objects from n distinct objects.

5.5 Count the number of ways of selecting r objects from n distinct objects.

5.6 Recognise that probability is a measure on a scale of 0-1 of how likely an event is to occur.

5.7 Understand the concepts and be able to calculate probabilities by counting equally likely

outcomes.

5.8 Understand the concepts and be able to calculate compound probabilities of independent

events and of mutually exclusive events describing data graphically and numerically.

5.9 Understand the different types of data: categorical: nominal or ordinal numerical: discrete

or continuous.

5.10 Demonstrate an understanding of the relative effectiveness of different displays in

representing the findings of a statistical investigation (pie charts, histograms, stem and leaf

plots).

5.11   Use frequency tables and histograms to display data.

5.12   Understand and be able to compute:-

☐ mean, median, mode to measure central tendency

☐ range and standard deviation to measure variability

5.13   Discuss the limitations or merits of mean, median and mode for measuring central

tendency with symmetric data and with skewed data.

6   Algorithms and Computations

6.1   Explain the concept of an algorithm.

6.2   Relate the concept of an algorithm to that of a mathematical function acting on a domain

of possible inputs.

6.3   Manipulate lists and arrays including addition and multiplication.

6.4   Use the mathematical notations involved in using lists and arrays including the index,

sigma and pi notation.

6.5   Apply lists and arrays to simple problems such as shopping lists and prices.

6.6   Describe the divide and conquer approach to solving problems.

6.7   Use algorithms/functions for carrying out simple operations on one dimensional arrays by

iterating over an index.

6.8   Use algorithms for simple computational problems using recursion including linear search

and binary search; and sort techniques including bubble sort, insertion sort, selection sort

and shell sort.

Assessment

General Information   Details of FET assessment requirements are set out in Assessment Guidelines for Providers.

All FET assessment is criterion referenced. Successful achievement of the award is based on learners attaining the required standards of knowledge, skill or competence.

The techniques set out below are considered the optimum approach to assessment for this component. In exceptional circumstances providers may identify alternative assessment techniques through the provider's application for programme validation which are **reliable** and **valid** but which are more appropriate to their context.

Assessment of a number of components may be integrated across programmes for delivery, provided that the learning outcomes of each minor award are assessed.

Group or team work may form part of the assessment, provided each learner's achievement is separately assessed.

All providers are required to submit an assessment plan as part of their application for programme validation. Assessment Plans will include information relating to scheduling and integration of assessment. See current FET validation guidelines at www.qqi.ie.

Assessment Techniques
In order to demonstrate that they have reached the standards of knowledge, skill and competence identified in all the learning outcomes, learners are required to complete the assessment(s) below.

The assessor is responsible for devising assessment instruments (e.g. project and assignment briefs, examination papers), assessment criteria and mark sheets, consistent with the techniques identified below and FETAC's assessment requirements.

Programme validation will require providers to map each learning outcome to its associated assessment technique. See current FET validation guidelines at www.qqi.ie.

All learning outcomes **must** be assessed and achieved

Assignment   100%

Description

Assignment

An assignment is an exercise carried out in response to a brief with specific guidelines as to what should be included. An assignment is usually of short duration and may be carried out over a specified period of time.

Recognition of Prior Learning (RPL)	Learners may be assessed on the basis of their prior knowledge and experience. Providers must be specifically quality assured to assess learners by this means. To do so they must complete B10, see Provider's Quality Assurance Guidelines and be included on the Register of RPL approved providers. See RPL Guidelines at www.fetac.ie for further information and registration details.

Grading	Pass	50% - 64%
	Merit	65% - 79%
	Distinction	80% - 100%

Specific Validation Requirements	N/A
Supporting Documentation	1. .
Access	To access programmes leading to this award the learner should have reached the standards of knowledge, skill and competence associated with the preceding level of the National Framework of Qualifications. This may have been achieved through a formal qualification or through relevant life and work experience.
Transfer	Successful completion of this component award enables the learner to transfer to programmes leading to other certificates where this component is a mandatory or an elective requirement.

2. FET Award Standards

QQI award standards are determined within the National Framework of Qualifications (NFQ), http://www.nfq-qqi.com. QQI determines standards for the education and training awards that it makes itself and that are made by providers to whom it has delegated authority to make an award. Providers offering programmes leading to QQI awards **must** have their programme(s) validated in accordance with current validation policy (see www.qqi.ie).

Award standards are designed to be consistent with the NFQ's award classes i.e. major, special purpose, supplemental and minor awards. They are expressed in terms of **learning outcomes** i.e. concise statements of what the learner is expected to know or be able to do in order to achieve a particular award. Learning outcomes for FET awards are contained within the associated specifications:

AWARD CLASS	STANDARDS	AWARDS
Major Award	Certificate Specification	Certificate (Levels 1 to 5) Advanced Certificate (Level 6)

Supplemental Award	Supplemental Specification	Supplemental Certificate (Level 3 to 6)
Special Purpose	Specific Purpose Specification	Specific Purpose Certificate (Levels 3 to 6)
Minor Award	Component Specification	Component Certificate (Levels 1 to 6)

Award standards are thresholds, they describe standards of knowledge, skill or competence to be acquired, and where appropriate, demonstrated, by a learner before an award may be made.

Award standards will be reviewed from time to time as necessary. Minor changes may be made by the QQI executive outside the review cycle where necessary. Changes to standards are published on QQI's website. Providers with validated programmes and providers with delegated authority to make awards are responsible for monitoring relevant standards and making necessary responses to changes.

3. FET Credit

Every FET certificate and component specification includes an FET credit value (Table 1). FET credit is quantified in multiples of 5 FET credits (up to 50 hours of learner effort). Learner effort is based on the time taken by typical learners at the level of the award to achieve the learning outcomes for the award. It includes all learning time involved including: guided learning hours, self-directed learning and assessment.

Table 1: FET Credit Values

NFQ Level	Major Awards Credit Values	Default Credit Values Minor Awards	Other Permitted Minor Award Credit Values	Special Purpose and Supplemental Award Credit Value Ranges
1	20	5	10	
2	30	5	10	
3	60	10	5,20	>5 and<60
4	90	10	5,15,20	>5 and<90
5	120	15	5,10,30	>5 and <120
6	120	15	5,10,30	>5 and <120

Guide to Level

Learning outcomes at this level include a broad range of skills that require some theoretical understanding. The outcomes may relate to engaging in a specific activity, with the capacity to use the instruments and techniques relating to an occupation. They are associated with work being undertaken independently, subject to general direction.

Strand	Sub-strand	Nature of learning
Knowledge	Breadth	Broad range of knowledge
	Kind	Some theoretical concepts and abstract thinking, with significant depth in some areas.
	Range	Demonstrate a broad range of specialised skills and tools

Know How & Skill	Selectivity	Evaluate and use information to plan and develop investigative strategies and to determine solutions to varied unfamiliar problems
Competence	Context	Act in a range of varied and specific contexts, taking responsibility for the nature and quality of outputs; identify and apply skill and knowledge to a wide variety of contexts
	Role	Exercise some initiative and independence in carrying out defined activities; join and function within multiple, complex and heterogeneous groups
	Learning to Learn	Learn to take responsibility for own learning within a managed environment
	Insight	Assume full responsibility for consistency of self- understanding and behaviour

Extract from 'Determinations for the Outline National Framework of Qualifications': NQAI