F18PA Pure Mathematics A

### COURSE DETAILS
**Course Code:** F18PA  
**Full Course Title:** Pure Mathematics A  
**SCQF Level:** 8  
**SCAF Credits:** 15  
**Available as Elective:** No

### DELIVERY LEVEL
<table>
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<th>Undergraduate:</th>
<th>Yes</th>
<th>Postgraduate Taught:</th>
<th>Yes</th>
<th>Postgraduate Research:</th>
<th>No</th>
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### COURSE AIMS
To offer an introduction to the ideas of number theory and geometry to students specialising in Mathematics.

To exploit technical know-how gained at SCQF level 7 to develop theoretical ideas in a concrete setting.

To offer further insights into Mathematical reasoning and the art of proof.

### LEARNING OUTCOMES – SUBJECT MASTERY
By the end of the course, students should be able to:

- understand the arithmetic and order properties of \( \mathbb{Z} \)
- understand the properties of the divisibility relation on \( \mathbb{Z} \)
- carry out the Euclidean algorithm to find greatest common divisors
- find Pythagorean triples and understand their classification
- understand the Fundamental Theorem of Arithmetic
- find prime numbers using a sieve method
- prove that there are infinitely many primes
- understand qualitative facts about the distribution of primes
- find primes in certain families
- understand congruence as an equivalence relation on \( \mathbb{Z} \)
- solve linear and simultaneous congruences
- understand the properties of Euler's \( \phi \)-function
- understand the notion of a plane isometry or motion and their basic properties
- work with the matrix representation of plane isometries
- classify a given plane isometry

### LEARNING OUTCOMES – PERSONAL ABILITIES
- Demonstrate the ability to learn independently
- Demonstrate knowledge of an area of mathematics.
- Manage time, work to deadlines and prioritise workloads
Communicate mathematical reasoning orally and in writing

Use of mathematical software

**SYLLABUS**


Prime numbers: Factorisation in \( \mathbb{Z} \). Primes and their distribution. Fermat and Mersenne primes.

Pythagorean triples: Classification of Pythagorean triples.

Congruences: Congruence as an equivalence relation. Solution of linear and simultaneous congruences.

Multiplicative functions: Summing over divisors, Euler's totient function, Fermat and Euler theorems, applications to cryptography.

Irrational numbers: Irrational, algebraic and transcendental numbers. Countable sets. Diophantine approximation.

Transformation geometry: Classification of plane isometries and their elementary properties.

**COURSE RELATIONSHIPS**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Level</th>
<th>Title</th>
<th>School</th>
<th>Type</th>
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<tbody>
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<td>F17CC</td>
<td>7</td>
<td>Algebra A</td>
<td>School of Math and Comp Sci.</td>
<td>Pre-Requisite</td>
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**LOCATION AND ASSESSMENT METHODS**

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