

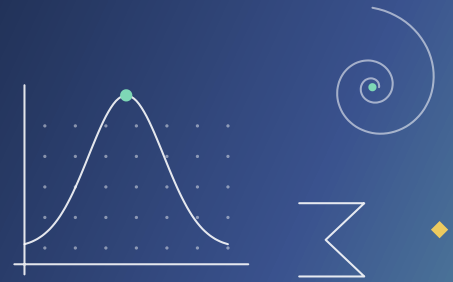
Module code

SPM-2204

Type of module

Undergraduate: Mathematical Sciences – Major Core

Number Theory and Algebra



Modular credits

4

Total student
engagement

56 hours

Prerequisite

**SPM-2202 Linear
Algebra and its
Applications**

Anti-requisite

None

Aims

To develop students' ability to analyse and apply fundamental properties of natural numbers and core algebraic structures in solving mathematical problems, while cultivating logical reasoning, precision, and intellectual integrity in mathematical practice.

Module learning outcomes (MLO)

On successful completion of this module, a student will be expected to be able to:

MLO 1

Apply the Euclidean and division algorithms to compute the greatest common divisor (gcd) and solve basic number-theoretic problems.

MLO 2

Apply modular arithmetic, including the Chinese Remainder Theorem, to solve linear congruences.

MLO 3

Apply the Fundamental Theorem of Arithmetic, Fermat's Little and Euler's Theorems to critically evaluate the role of number theory in cryptographic systems.

MLO 4

Analyse the structure and properties of groups, semigroups, rings, and fields through examples and problem-solving.

MLO 5

Synthesise algebraic structures and their properties to prove theorems and solve advanced problems.

Module contents

Method of mathematical induction. Division and Euclidean algorithm.

Greatest common divisor and least common multiple. Primes and Fundamental Theorem of arithmetics.

Congruences and modular arithmetics. Structure of $\mathbb{Z}_n$.

Solving linear congruences. Chinese Remainder Theorem.

Fermat Little Theorem. Euler generalization. Public key cryptography.

Permutations. Order and sign. Cycle decomposition.

Definition and examples of groups. Semi-groups. Rings and fields.

Basic properties of groups. Order of an element. Subgroups. Cyclic groups. Generating sets.

Cosets. Lagrange Theorem. Fermat and Euler Theorems. Homomorphisms. Normal subgroups.

Assessment

60% **40%**

Examination

Coursework



■ Examination — 60% ■ Class tests — 30% ■ Assignment — 5% ■ Tutorial participation — 5%

Formative assessment

Weekly discussion
and feedback

Summative assessment

COMPONENT	WEIGHTING
Examination	60%
Coursework	40%
Individual	40%
Class tests	30%
Assignment	5%
Tutorial participation	5%

Graduate attributes and skills

Programme learning objectives (PLO) addressed

- | | |
|--|---|
| 1 PLO 1 (Core Mathematical Knowledge) | 2 PLO 2 (Analytical Problem-Solving) |
| 4 PLO 4 (Mathematical Communication) | 6 PLO 6 (Adaptability and Lifelong Learning) |

Sustainability concept addressed

- 4** SDG 4 Quality Education

Digital skills/software used (not limited to)

- Organisational tools (e.g. Outlook calendar, CANVAS)
- Mathematical and computational software (e.g. Microsoft Excel, MATLAB)

Micro-credentialling option

No

Stackable towards GenBESTARI Undergraduate Degree
Programme or other relevant Lifelong Learning
Programmes

No

Document details

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