

Module code

SPM-3301

Type of module

Undergraduate: Mathematical Sciences – Major Option

Combinatorics and Graph Theory



Modular credits

4

Total student
engagement

56 hours

Prerequisite

**SPM-1201
Mathematical
Methods for the
Sciences**

Anti-requisite

None

Aims

To enable students to formulate and solve complex combinatorial problems, evaluate advanced concepts in graph theory, and construct rigorous proofs using logical reasoning.

Module learning outcomes (MLO)

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

MLO 1

Formulate and solve recurrence relations and apply generating functions to advanced combinatorial problems.

MLO 2

Analyse and evaluate combinatorial problems using binomial, multinomial, and inclusion–exclusion principles.

MLO 3

Interpret and apply advanced concepts in graph theory, including connectivity, trees, Eulerian and Hamiltonian paths, and graph colouring.

MLO 4

Construct and present rigorous mathematical proofs in combinatorics and graph theory.

MLO 5

Demonstrate independent mathematical reasoning and professional responsibility in solving advanced combinatorial and graph-theoretic problems.

Module contents

Counting techniques: Permutations and combinations, combinatorial identities

Binomial and multinomial coefficients: Properties and applications

The principle of inclusion and exclusion: Advanced applications and derangements

Recurrence relations: Linear recurrence relations, solving techniques, applications

Generating functions: Ordinary and exponential generating functions, applications in counting

Graph theory fundamentals: Connectivity, trees, Eulerian and Hamiltonian graphs

Graph algorithms: Shortest paths, spanning trees

Assessment

60%

Examination

40%

Coursework

Examination
60%

Class tests
40%

■ Examination — 60% ■ Class tests — 40%

Formative assessment	Summative assessment	
Weekly discussion and feedback	COMPONENT	WEIGHTING
	Examination	60%
	Coursework	40%
	Individual	40%
	Class tests	40%

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
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Digital skills/software used (not limited to)

- Learning management and collaboration platforms (e.g. Canvas, MS Teams)

Micro-credentialling option No	Stackable towards GenBESTARI Undergraduate Degree Programme or other relevant Lifelong Learning Programmes No
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Document details

Office **ODVCE** Document date **26 June 2026** Status **New** Approval **GBF (12/02/2026)**