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MATH35082

Symmetry in Nature

Unit code:	MATH35082
Credit Rating:	10
Unit level:	Level 3
Teaching period(s):	Semester 2
Offered by	School of Mathematics
Available as a free choice unit?:	N

Requisites

Prerequisite

- [MATH20201 - Algebraic Structures 1](#) (Compulsory)

Additional Requirements

MATH35082 pre-requisites

Aims

To develop an understanding of symmetry as it arises in nature, and to develop the mathematical techniques for its study through the action of groups.

Assessment methods

- Other - 20%
- Written exam - 80%

Assessment Further Information

Coursework (worth 20%) set around the middle of the semester.

End of semester examination (worth 80%)

Learning outcomes

On successfully completing the course, the student will be able to:

- understand and analyze symmetry from a mathematical perspective
- apply the orbit-stabilizer theorem
- analyze the influence of symmetry on symmetric systems
- explain and predict spontaneous symmetry breaking phenomena

Syllabus

1. What is symmetry? Examples. Groups of transformations. Orbits and stabilizers.
2. Symmetry in geometry: Example classification of triangles
3. Classification: of symmetry groups in 2 and 3 dimensions
4. Symmetry of lattices: (frieze patterns, wallpaper groups and crystals)
5. Symmetry and ODEs: symmetric and nonsymmetric solutions; spontaneous symmetry breaking
6. Spatiotemporal symmetry: (eg, animal gaits)
7. Symmetry and PDEs: pattern formation and more spatiotemporal symmetry

Recommended reading

General:

I.N. Stewart, *Symmetry, a very short introduction*, Oxford (2013)

H. Weyl *Symmetry*, Princeton Science Library (1952)

Advanced:

M. Golubitsky & I. Stewart, *The Symmetry Perspective*, Birkhauser Verlag (2002)

R. Hoyle, *Pattern Formation*, CUP (2006)

Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and provide feedback on their understanding.

Study hours

- Lectures - 22 hours
- Tutorials - 11 hours

- Independent study hours - 67 hours

Teaching staff

James Montaldi - Unit coordinator