001-2-4060: Partial Differential Equations in Continuum Transport Processes (3 credits)

Weekly Lecture Hours	Exercise	Laboratory	Field Trip
3			

Lecturer: **Ido Regev**

*Course description and objective***:**
The goal will be to learn how to derive and solve mathematical models that describe transport phenomena. We will learn different transport models as well as various analytical and numerical solution methods.

Course prerequisites:
Calculus, linear algebra and ordinary differential equations

Course structure:
The course will be taught weekly in 3 hours lectures.
The course is designed for M.Sc. and Ph.D. students.

Assessment of students and structure of final grade:
Homework submission   25%
Final project   75%

Detailed description of course units:

1. Review of ordinary differential Equations

2. Systems of ordinary differential equations

3. Gradients and fluxes – Fourier's law and Fick's law

4. Deriving the heat/diffusion equation

5. Separation of variables

6. The wave equation

7. Solution methods for the wave equation

8. Dimensional analysis

9. Self-similar solutions

10. Numerical analysis of partial differential equations

Suggested text books:

Olver, Peter J. "Introduction to partial differential equations", springer, 2014.

Holmes, Mark H. "Introduction to the foundations of applied mathematics", Vol. 56. Springer Science & Business Media, 2009.

King, Andy C. et al. "Differential equations: linear, nonlinear, ordinary, partial", Cambridge University Press, 2003.

Cleve Moler, Numerical Computing with MATLAB (https://www.mathworks.com/moler.html)

Gilbert Strang, Computational Science and Engineering, Vol. 1. Wellesley: Wellesley-Cambridge Press, 2007.