Prerequisites for Partial Differential Equations I

- **Analysis I - III**
- **Linear Algebra I and II**

You have to be familiar with at least the following material listed below:

Analysis I (selection of topics):

- Sequences and series
- Convergence
- Functions on the real line
- Limits, continuity and differentiability and associated theorems (e.g. intermediate value theorem, mean value theorem, chain rule)
- Integral on the real line

Analysis II (selection of topics):

- Geometry and topology of Euclidean space and metric spaces (convergence, open, closed and compact sets etc.)
- Functions of several variables (continuity, partial derivatives, total derivatives, chain rule etc.)
- Inverse and implicit function theorems
- Extrema and associated derivative criteria
- Lagrange multipliers

Analysis III (selection of topics)

- Multidimensional integrals
- Divergence theorem
- Integration by parts
- Green's first and second formula
- Fubini's theorem
- Change of variable formula
- Integration in polar coordinates
- Differentiation und the integral sign (that is w.r.t. a parameter)

German textbooks:

- Otto Forster, Analysis I – III

English textbooks:

- Analysis I: Abbott, Understanding Analysis, M. Spivak, Calculus (at least 2nd edition)
- Analysis II: M. Spivak, Calculus on manifolds, W. Fleming, Functions of several variables
- Analysis III: W. Fleming, Functions of several variables

Linear Algebra I and II (selection of topics)

- Vectorspaces
- Linear independence
- Bases
- Linear systems of equations
- Finding coordinates of vectors w.r.t. an arbitrary basis
- Linear transformations and their associated matrices w.r.t. given bases
- Inverse linear maps resp. inverse matrix
- Adjoint linear map resp. transpose matrix
- Determinants
- Various equivalent criteria for linear independence using for instance the Gramian matrix
- Eigenvalues and eigenvectors
- Inner product spaces
- Orthogonality
- Gram-Schmidt orthonormalization
- Symmetric matrices (self-adjoint linear transformations)
- Diagonalization of symmetric matrices

English textbooks:

- S. Lang, Linear Algebra
- G. Strang, Linear Algebra and its applications

German textbook:

- Fischer, Linear Algebra