

Information on the written exam

October 26, 2022

Administrative information.

- Last day to register for the exam: 21 December 2022
- Written exam: 14 January 2023 (08:30)
- Last day to register for the re-exam: 19 March 2023
- Re-exam: 03 April 2023 (08:30)
- Grades: U, 3, 4 or 5. Preliminary grading limits: 3: 20-29p, 4: 30-39p and 5: 40-50p.
- A table of Laplace transforms (the one from canvas) will be provided. A personal pocket calculator is allowed.
- The awarded bonus points will be added during the grading process if needed. To facilitate the grading, feel free to indicate in your exam if you should have one or two bonus points.
- If not already done, contact me before the 16th of December via email (with a valid document from FUNKA) if you need more time for the exam.
- The results of your exams will be reported to you via Canvas as soon as possible. Please consider that I will have to correct more than hundred of exams in addition to preparing a new course. It is thus not necessary to send me an email asking for your grades.

Expectations.

- Students are expected to know and be able to apply the main definitions and results (statements and possibly some ideas of the proofs) from the lecture in order to solve various tasks.
- Students should explain, analyse, evaluate, and demonstrate their mastery of the course content.
- The exam may contain multiple choice questions, true and false questions, or open-ended questions.
- The exam may contain industrial tasks (pure and easy computations) and questions assessing students critical thinking skills.
- Please explain all steps in your computations and write the mathematics properly (do not just display randomly equations and hope for someone to find the correct one).
- Please use a proper pen, check that your exam is readable and if possible that your answers are ordered correctly.

- No questions will be answered by the teachers 5 *days before the exam*.
- Being able to do previous exams do not imply success in this year's exam.

Important concepts and results from the lecture. The list below includes relevant concepts and results from the lecture (this does not mean that the other ones may not be used or tested):

- Span. Inner product. Functional spaces. Cauchy–Schwarz inequality.
- Lagrange polynomials. Hat functions. Orthogonal projection.
- Interpolation errors. Quadrature formulas.
- FEM: BVP. Variational formulation. FE problem. Linear system of (differential) equations. Pseudo-code. Error estimates.
- For IVP: Explicit Euler and backward Euler schemes. Crank–Nicolson scheme.
- Heat equation and wave equation in $1d$.
- Definition and properties of Laplace transforms. From the definition, derivation of the Laplace transforms of simple functions like $\sin(at)$ or $\cos(at)$. Applications of the Laplace transforms.
- Derivation of the formulas of the Fourier coefficients. Computation of Fourier coefficients. Bessel's inequality. Parseval's identity. Properties of Fourier series.
- Superposition principle. Separation of variables.

Feel free to post your self-designed exam questions on the Piazza page of the course (using the label exam).

If appropriate, questions or comments on this document should be posted on the **Piazza** page of the course.