

# **The list of the exam questions for the theory module on Computations in Physics**

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1. Classification of PDE
2. Finite difference method for the Dirichlet boundary value problem. Iteration method for rectangular domain in 2D case.
3. Finite difference method for the Dirichlet boundary value problem. Reduction to a system of linear algebraic equations for rectangular domain (2D case with  $2 \times 3$  grid).
4. Ritz and Galerkin methods (general theory). Reduction to a system of linear algebraic equations.
5. Finite element method (Poisson equation for 1D case).
6. Finite difference method for the heat transfer equation.
7. Stability analysis for the heat transfer equation for explicit scheme.
8. Stability analysis for the heat transfer equation for implicit scheme.
9. Crank-Nicolson method for the heat transfer equation, stability and error analysis.
10. Error estimates for the explicit method for the heat transfer equation.
11. Finite difference method for the wave equation.
12. Stability analysis for the finite difference method for the wave equation.
13. The method of finite difference in the frequency domain. Examples.
14. Classification of integral equations. Fredholm integral equations. Iteration method.
15. Method of boundary integral equations for Helmholtz equation (2D case).  
Single and double layer potentials. Method of moments (MOM). Scattering from PEC cylinder.