



# Course Syllabus

## 1. Course Title:

Advanced Problems of Mathematical Physics

## 2. Academic Level:

Master

## 3. ECTS Credits:

5 ECTS

## 4. Semester:

2, spring semester

## 5. School/Department:

Institute of Mathematics, Mechanics, and Computer Science named after I.I. Vorovich

## 6. Location:

8-A Milchakova St., Rostov-on-Don

## 7. Instructor:

Assoc. Prof. Svetlana Revina, email: [svrevina@sfedu.ru](mailto:svrevina@sfedu.ru)

## 8. Language of Instruction:

English

## 9. Course Description:

This course is devoted to modern applications of mathematical physics, namely the mathematical description of physical, biological, social and other processes using the apparatus of reaction-diffusion equations.

## 10. Course Aims:

To develop students' competencies related to scientific research in the field of mathematical physics and its applications to mathematical modeling.

## 11. Specific entry requirements (if any):

BSc. courses of analysis, linear algebra, ODE, PDE, calculus, scientific computing (Maple, Matlab)

### **12. Course Content:**

Parabolic Equations in Biology. Methods of Population Dynamics. Non-spatial models of population dynamics. Fisher's equation. An invariant region. Convergence towards equilibrium. Decay of derivatives. Travelling waves: definition and examples. Turing instability.

### **13. Intended Learning Outcomes:**

On successful completion of the course, students are expected to be able to: apply the methods of mathematical physics to research activity.

### **14. Learning and Teaching Methods:**

Lectures, laboratory and pre-laboratory work, self-study with writing a report

### **15. Methods of Assessment/Final assessment information:**

Exam

### **16. Reading List:**

[1] Perthame B. Parabolic Equations in Biology. Springer, 2015. - 204 p.

[2] Kuttler K. Reaction-Diffusion equations with applications. 2011. - 105 p.

[3] Tveito A. Winther R. Introduction to Partial Differential Equations: a Computational Approach. Springer, 1998. - 409 p.

[4] Revina S.V., Lysenko S.A. Sufficient Turing instability conditions for the Schnakenberg system // Vestnik Udmurtskogo Universiteta. Matematika. Mekhanika. Komp'yuternye Nauki. 2021. V. 31. № 3, pp. 424-442. DOI: 10.35634/vm210306.