

## Syllabus

**I. Course Name:** Explicit and Approximate Solutions to the Boltzmann Equation

**II. Course description and objective**

The course is devoted to the search of the general form of Maxwellian solutions of the nonlinear integro-differential Boltzmann and Bryan-Pidduck kinetic equations . Some approximate (bimodal and multi-modal) solutions of these equations are also built.

**III. Elective**

**IV. Master Program, 3th Term, 52 Class Hours, 5 Credits**

**V. Course content**

Chapter 1 Bimodal distributions

Section 1. Tamm-Mott-Smith distribution.

Section 2. «Uniform-integral» deviation and its minimization.

Section 3. Bimodal distributions with global modes

Section 4. «Gain» and «loss» terms of collision integral.

Section 5. Some elements of distribution theory.

Section 6. Search of the low-temperature limit.

Section 7. One-dimensional case.

Section 8. Three-dimensional case, solution of the system of differential equation.

Section 9. Classification of bimodal solutions.

Section 10. Physical sense of the explicit approximate solutions.

Section 11. Interaction between spiral flows in rarefied gas .

Chapter 2. Three-modal approximate solutions

Section 1. «Pure-integral» deviation.

Section 2. Three-modal distributions and the system of differential equations for them.

Section 3. Minimization of the «pure» deviation.

Section 4. Search of the «plato-like» coefficient functions.

Section 5. Interaction between «eddy-like» flows

**VI. Pre-taken courses**

Mathematical Analysis, Functional Analysis, Ordinary and Partial Differential Equations,  
Distribution Theory.

**VII. Form of the final test:** examination (four-level evaluation scale)

**VIII. Teaching materials and reference books**

1. Больцман Л. Лекции по теории газов. – М.: Гостехиздат, 1956.
2. Карлеман Т. Математические задачи кинетической теории газов – М.: ИЛ, 1960.
3. Чепмен С., Каулинг Т. Математическая теория неоднородных газов. – М.: ИЛ, 1960.
4. Коган М. Н. Динамика разреженного газа. – М.: Наука, 1967.
5. Черчиньяни К. Теория и приложения уравнения Больцмана. – М.: Мир, 1978.
6. Петрина Д. Я., Герасименко В.И., Малышев П. В. Математические основы классической статистической механики. – К.: Наукова думка, 1985.

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