**The program of the final exam for the discipline   
"Selected problems of complex plasma physics"**

**a) Topics of the course "Selected problems of complex plasma physics", submitted for the exam. 1 block:**

1. Wrte down the basic concepts about Nonideal Plasma. Interparticle interactions and criteria of nonideality. [1,4,5].
2. Describe screening of charged particle’s field in plasma. Quantum effects in interparticle interactions. Consider both quantum and screening effects. [1,4,5].
3. Give an explanation of “Charge-atom” interactions in nonideal plasma. The screening and quantum effects in charge-atom interactions. [1,6,8].
4. Characterize the influence neutral and compound particles in plasma. The range of existence and the classification of states of nonideal plasma. [1,4,5].
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6. Describe screening of charged particle’s field in plasma. Quantum effects in interparticle interactions. Consider both quantum and screening effects. [1,4,5].
7. Give an explanation of “Charge-atom” interactions in nonideal plasma. The screening and quantum effects in charge-atom interactions. [1,6,8].
8. Characterize the influence neutral and compound particles in plasma. The range of existence and the classification of states of nonideal plasma. [1,4,5].

2nd block:

1. Write down main forces acting on dust particles in plasma. The gravitational force, the neutral drag force, the thermophoretic force, the electrostatic force, Ion drag force. [1, 4, 5].
2. Describe electrical methods of nonideal plasma generation. [1,5].
3. Give the examples of dynamic methods of nonideal plasma generation. Describe them. [1,7].
4. Describe thermodynamic properties of nonideal plasmas. Consider the model of one component plasma [1,6].
5. Write down main forces acting on dust particles in plasma. The gravitational force, the neutral drag force, the thermophoretic force, the electrostatic force, Ion drag force. [1, 4, 5].
6. Describe electrical methods of nonideal plasma generation. [1,5].
7. Give the examples of dynamic methods of nonideal plasma generation. Describe them. [1,7].
8. Describe thermodynamic properties of nonideal plasmas. Consider the model of one component plasma [1,6].

3rd block:

1. Explain the process charging of dust particles in plasmas. Four mechanisms. [1,6,8].
2. Write down some peculiarities of dusty plasma. OML theory. [1.8].
3. Explain the model of multi component plasma [1,6].
4. Explain ionization equilibrium. The Saha equation. [1,7].
5. Explain the process charging of dust particles in plasmas. Four mechanisms. [1,6,8].
6. Write down some peculiarities of dusty plasma. OML theory. [1.8].
7. Explain the model of multi component plasma [1,6].
8. Explain ionization equilibrium. The Saha equation. [1,7].

**Subjects of examination tasks for the 3rd block:**

1. The potential interaction of particles and bring them into a dimensionless form. A dimensionless view of potential interaction. A dimensionless view of the Debye-Huckel potential and its graphic image. A dimensionless view of the Deutch potential and its graphic image. A dimensionless view of the Coulomb potential and its graphic image [2,3].
2. Tokamak the plasma Debye radius and the Langmuir plasma frequency of the plasma. The ionospheric plasma the Debye radius of the plasma and the Langmuir plasma frequency  [2,3].
3. The method of obtaining dusty plasma in a magnetic field. The movement of dust particles in an external magnetic field in experimental condition. The method of obtaining dusty plasma in a magnetic field in experimental condition. The movement of dust particles in an external magnetic field [2,3].
4. The experimental setup of the installation "Coulomb crystal". The experimental setup of the installation "Coulomb crystal". The experimental setup for obtaining glow discharge dusty plasma. The generation of dusty plasma in a gas discharge. The experimental methods of generating dusty plasma [2,3,9,10].
5. The main ideas of the experiment "Coulomb crystal".The mechanism of magnetic traps to hold the Coulomb crystal. The time of flight and velocity of diamagnetic particles in the experiment "Coulomb crystal". The oscillations of a Coulomb crystal in an external magnetic field [2,3,9,10].

**b)** As a result of passing the exam on the subject "Selected problems of complex plasma physics" the student will be able to:

* to summarize the basis theoretical methods at investigation of ionization equilibrium and properties for complex plasmas;
* to classify a fundamental problem in complex plasma physics and it applied;
* to explain modern problems in physics of complex plasmas;
* to describe plasma and corresponding apply necessary method of calculations;
* to evaluate the model of interaction between particles, with take into account different effects (screening effects, quantum mechanical effects diffraction and symmetry, degeneration and etc.);
* to explain derived knowledge for analyze of concrete physical phenomena;
* to predict derived results in respect to real plasmas medium;

to calculate a properties of complex plasmas.

**c) Evaluation criterion:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Score | Criterion | The first block | The second block | The third blocks |
| Exelent (90-100%) | The answer is complete or the problem was solved completely  The material is correct  The creative abilities demonstrated | 30-33 | 30-33 | 30-34 |
| Good  (75-89%) | The answer is correct but not complete or there some insignificant mistakes in problem solution  There is a logical construction in answer | 25-29 | 25-29 | 26-29 |
| Satisfied (50-74%) | The answer is not complete and there are some mistakes in formulas and logical consequences. For practical part – the solution of problem is not complete | 17-24 | 17-24 | 17-25 |
| Not satisfied (0-49%) | There are crude mistakes or problem was not been solved. There are grammatical, terminological mistakes and no logic in construction of answer | 0-16 | 0-16 | 0-16 |

**d) Literature:**

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4. Baimbetov F.B., Ramazanov T.S. Mathematical simulation in nonideal plasma physics. Almaty. Scinse. 1994.-212 P. (Monograph).
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11. B.M. Smirnov, Physics of atom and ion (Moscow, Nauka 1986).
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