Questions 1
discipline «Nonlinear Automatic Control Systems"

1. Give the basic differences between linear and nonlinear ACS. Give the features of research into the nonlinear ACS.
2. Give the typical nonlinear elements: 2 position relays; give their mathematical description.
3. Give the typical nonlinear elements: 3 position relays; give their mathematical description.
4. Give the typical nonlinear elements: relays with saturation and with insusceptibility zone.
5. Give definition of controllability in linearized ACS. Give the proof of criterion of controllability by R. Kallman.
6. Give the definition of observability in linearized ACS. Give of criterion of observability by R. Kallman; show on an example.
7. Give definition of controllability in linearized ACS; give the criterion of controllability by E. Gilbert.
8. Give definition of observability in linearized ACS; give the criterion of observability by E. Gilbert.
9. List the exact methods of research into nonlinear ACS. Andronov's research method. Give the basic concepts of phase-plane method and its features; show on an example.
10. Receive differential equation of a phase trajectory; show its solution; show on an example.
11. Show the classification of points of stationary of linearized systems on the phase-plane, if roots of characteristic equation are real.
12. Show the classification of points of stationary of linearized systems on the phase-plane, if roots of characteristic equation are complex-conjugate.
13. Show the classification of points of stationary of linearized systems on the phase-plane, if roots of characteristic equation are purely imaginary; show a numerical example.
14. Give the definition of the systems with variable structure (SVS). Give the basic idea of construction of SVS; show on an example.
15. Give the examples "stitching together" of systems with variable structure (SVS).

Questions 2
discipline "Nonlinear Automatic Control Systems"

1. Should show from what structures the system with variable structure (SVS) "is stitched". Show the mode of the movement on degenerate trajectories of systems with variable structure (SVS).

2. Should show from what structures the system with variable structure (SVS) "is stitched". Show the mode of switching of systems with variable structure (SVS).

3. Should show from what structures the system with variable structure (SVS) "is stitched". Show the sliding operation mode of systems with variable structure (SVS).

4. Give definitions and show stability of systems "in small", "in big" and "in general".

5. Give definition and show the examples functions fixed-sign, constant-sign and alternating-sign.

6. Provide a square-law form and show her properties. Give formulating Sylvester's criteria.

7. Give creation the Lyapunov's function for linear systems. Show Lyapunov's matrix equation; formulate Lyapunov's Theorems.

8. Provide Kallman's theorem of stability of systems. Show an example asymptotically steady linear ACS.

9. Provide theorems of a direct (second) method of A.M. Lyapunov of stability "in big" for nonlinear ACS.

10. Show the method of creation of Lyapunov's function for nonlinear ACS, namely Krasovsky's method.

11. Show a method of creation of Lyapunov's function for nonlinear ACS, namely the method of a variable gradient or Schultz-Gibson's method.

12. Show parametric synthesis of nonlinear laws of control of a direct Lyapunov's method (on the example of inclusion 2 the position relay).

13. Give definition of absolute stability (stability "in general"). Show the matrix structural scheme of nonlinear ACS.

14. Give the mathematical description of a nonlinear system to structure to which the research Pópov technique is applicable; show the Pópov's function.

15. Provide the formulating of Pópov's theorem for absolute stability of the nonlinear Automatic Control System.

Subjects of tasks at written examination:

1. Research of system on controllability and observability by R. Kallman's criteria.
2. Research of system on controllability and observability by E. Gilbert's criteria.
3. Application of Andronov ‘s method for research of systems in the phase plane; creation of phase portraits.
4. Research of the system by the second Lyapunov’s method on stability "in big".