Basic educational courses which are taught on a department:

- mathematical analysis 1 and 2 semesters;
- analytical geometry is 1 semester;
- linear algebra is 1 semester;
- entering into information technologies – 2 semester;
- vectorial and tensor analysis – 3 semester;
- differential and integral equalizations and variation calculation – 3 semester;
- informatics and programming – 3 semester;
- complex analysis – 4 semester;
- theory of chances and mathematical statistics – 4 semester;
- mathematical design – 4 semester;
- methods of mathematical physics – 5 semester.

Programs of basic educational courses.

"**Mathematical analysis"**

Border of sequence.

Axioms of material numbers. Existence of exact overhead and lower verges at limited a plural. Granicya of sequence. Basic theorems about sequences which meet: about the unicity of границі, about a maximum transition in inequalities, about three sequences, about narrow-mindedness. Infinitely small and infinitely large a sequence, connection between them. Theorems about properties infinitely small sequences and границь sequences, related to the arithmetic operations. Monotonous sequences. Theorem about сходимости of the limited monotonous sequence. Number of e. Lemma about the inlaid intervals. Subsequences. Theorem about existence of consilient subsequence in the limited sequence. Fundamental sequences. A criterion is Cauchies.

Border and continuity of functions.

Concept of границі function. Theorem about the equivalence of determinations of limit of function for Cauchies and on Heine. Arithmetic operations above functions which have eventual границю. A criterion is Cauchies of existence eventual galley proof. Continuity of function. Classification of points of break. Arithmetic operations by functions. Continuity of difficult function. Continuity of elementary functions: to the rational shot of R(x), trigonometric functions *of* sin *x, cos x.* and by him reverse arcsin *x, arccos x* ., экспонента eh, *logarithm of* ln *x, function* of degree of x.*a First* remarkable границя. Second remarkable границя. Comparison of functions and o-символіка. Theorems about equivalent functions. Main part of function. Comparison is endless small and infinitely large functions. Basic theorems about continuous functions: theorem of Bol'cano-koshi; theorem of Weierstrass. Basic theorems about continuous functions: even continuity and theorem of Kantora; theorem about continuity of reverse function; theorem about the maintainance of sign of continuous function.

Differentiation of functions.

Concept of derivate and differential, connection between them. Geometrical maintenance. Connection between дифференцируемостью and continuity. Rules are calculations of derivate and differential, related to the arithmetic operations. Derivate of difficult and reverse functions.

Table of derivative elementary functions. A function and its derivate is self-reactance set. Derivates and differentials of higher orders. Invariantist' of form of the first differential. Governed calculation of derivative higher orders, additions and increases related to the operations (linearness, formula of Leybnicya). Basic theorems about differentiation of function: Farm, Rollya, Lagrange, Cauchies. Rule of Lopitalya (opening of vagueness). Formula of Teylora (with a remaining member in form Peano and Lagrange). Formulas of Teylora for elementary functions *eh, sin x, cos x, ln(1+x) (1+x)a.* Asymptotes of the graph of function. Criterion of monotony of function in terms of 1 to the derivate. Necessary and sufficient terms of экстремума in terms of 1 to the derivate. Sufficient condition of экстремума in terms of 2 derivates. Criterion of bulge in terms of 1 and 2 to the derivate.

Imaginaries, polynomials, rational shots.

Axiomatic introduction of imaginaries. Arithmetic operations above imaginaries in form algebra. Numbers and properties of operation of complex connection are complex united. Module and argument of imaginary. Operations of increase and distributing of imaginaries are in a trigonometric form. Drew out roots of n-го degree from an imaginary. Sequences of imaginaries and their limit. Determination of functions *of ez, ln z, zw, sin z, cos z, sh z, ch z* . Native polynomials. Theorem of Bezu. Decomposition of polynomials on multipliers. Properties of roots of polynomials with actual coefficients. Decomposition of polynomial with actual coefficients on multipliers. Decomposition of the proper rational fraction in the sum of the simplest.

Indefinite integral.

Determination of indefinite integral (primitive). Theorem about primitive functions. Table of indefinite integrals. Governed integration: linearness, integration by installments, replacement of variables under a sign an indefinite integral. Examples of application of rules of integration. Integration of rational shot.

An integral and his application is certain.

Determination of integral of Riemann. Formula of Newton-Leybnica. The condition of integrating of .Суми and integrals of Darboux is needed. Criteria of integrating of functions: in the terms of sums of Darboux, vibrations. Properties of integral of Riemann. Theorems about middle. Properties of integrals with a variable high bound. Geometrical applications of integral of Riemann: area of curvilinear trapezoid, curvilinear sector, volume of body (in particular, bodies of rotation). Geometrical applications of integral of Riemann: length of curve, area of surface of rotation. Physical additions of integral of Riemann: center of weight of flat curve, plates. Theorems of Gul'dina. Unown integrals on an unlimited interval: determination, criterion of сходимости Cauchies, sign of comparison, absolutely and de bene esse consilient integrals. Unown integrals from an unlimited function: determination, criterion of сходимости Cauchies, sign of comparison, absolutely and de bene esse consilient integrals.

Differentiation of functions a few the variables.

Granicya of sequence of vectors in *Rm*. Theorem about the equivalence of сходимости on a norm and on co-ordinates. Theorems about границі: about unity of границі, narrow-mindedness, criteria Cauchies, Arithmetic operations. Plurals of points are in Rm: internal, maximum, external points; opened, plurals are reserved; areas. Granicya of function a few the variables. Theorem about the equivalence of determinations of границі for Cauchies and on Heine. Continuous functions and their properties: arithmetic operations, difficult function, theorems about continuous functions (Bol'cano-koshi, Weierstrass, Kantora). Derivates and differentials of

a 1 order: partial derivates, derivates to direction, differential; connection between existence of derivate and differential and continuity. Gradient. Geometrical and physical maintenance. Properties of the differentiated functions, related to the arithmetic operations. Derivates and differentials of difficult functions. Invariantist' of form of the first differential. Derivates and differentials of a 1 order are a vector of function. Matrix of Jacobi. Derivate and differential of difficult function. Derivates and differentials of higher order. Theorem about the mixed derivate. Formula of Teylora for functions a few the variables. Ekstremumy of functions a few the variables. Necessary and sufficient terms. Local экстремум is conditional.

Multiple integrals.

Measure of Zhordana of plurals from *R2*. Criterion of measurableness. Properties of measurable plurals. Integral of Riemann as measure of Zhordana of plurals from *R2*. Determination of double integral. Sumy and integrals of Darboux. Their properties. Criteria of integrating of functions: in the terms of sums of Darboux, vibrations. Properties of double integral. Integrating of continuous functions. Theorem about середє. Report of double integral to repeated. Replacement of variables is in a double integral. Geometrical maintenance of якобіана. Passing to the arctic co-ordinates. Measure of Zhordana of plurals from *R3*. Criterion of measurableness. Properties of measurable plurals. A double integral as measure of Zhordana is multiplied from *R3*. Determination of triple integral. Sumy and integrals of Darboux. Their properties. Criteria of integrating of functions are in the terms of sums of Darboux and vibrations. Properties of triple integral. Integrating of continuous functions. Theorem about middle. Report of triple integral to repeated. Replacement of variables is in a triple integral. Geometrical maintenance of якобіана. Passing to the spherical and cylinder co-ordinates.

Curvilinear and superficial integrals.

Smooth curve. Tangent direct and normal plane. Length of curve. Curvilinear integrals on length, report to the certain integral, property.

Orientation of curve. Curvilinear integrals on co-ordinates, report to the certain integral, property. Curvilinear integrals on co-ordinates from a complete differential. Proceeding in primitive. Smooth surface. Tangent plane and нормаль to the surface. Area of smooth surface. Superficial integrals on an area, report to the double integral, property. Orientation of surface. Superficial integrals on co-ordinates, report to the double integral, property.

Theme 7. Numerical rows (6 hours).

Numerical rows. The condition of сходимости is needed. A criterion is Cauchies of сходимости of numerical rows. Signs of comparison of сходимости of rows with positive members (in a general and maximum form). Integral sign of сходимости of rows. Signs of D'Alembert and Cauchies of сходимости of rows. The sign of Leybnica сходимость of rows. Absolutely consilient numerical rows. Basic property. Arithmetic operations above absolutely meet rows. De bene esse consilient numerical rows.

Theme 10. Functional rows (12 hours).

Functional sequences, поточечна and even сходимость. A criterion is Cauchies of even сходимости. Theorem about continuity, integrating and диференційованість границі of functional sequence. Functional rows. Potochechna and even сходимость. A criterion is Cauchies of even сходимости of row. Sign of Weierstrass. Theorems about continuity, integrating and диференційованість sums of functional row. Rows of degrees. First theorem of

Abel. Theorem about existence of radius of сходимости. Formulas of D'Alembert and Cauchies for the radius of сходимости of row of degree. Rows of degrees on actual wasp. Pochlenne differentiation and integration. Row of Teylora. Sufficient sign of сходимости of row of Teylora. Rows of Teylora functions *eh, cos x, sin x*. Concept of functions *of ez, cos z, sin z.* Rows of Teylora functions *of ln(1+x) (1+x)a.* Properties of the trigonometric system of functions. Coefficients of evenly consilient trigonometric row (coefficients of Fur'e) are Theorem of Riemann. Integral presentation of *n-oї*of partial sum of row of Fur'e. Kernel of Dirichlet and his properties. Theorem about поточечну сходимости of row of Fur'e. Rows of Fur'e of pair and odd functions. Decomposition of functions in a row on ***Cos*** and ***Sin***.

Theme 11. Integrals which depend on a parameter. (10 hours).

Own integrals, which depend on a parameter, property (continuity, integrating, диференційованість). Unown integrals which depend on a parameter. Even сходимость. A criterion is Cauchies. Sign of Weierstrass. Properties of unown integrals dependency upon a parameter (continuity, integrating, диференційованість). To Euler integrals. Integral of Fur'e. Theorem about поточечну сходимости. Integral of Fur'e of pair and odd functions. ***Cos-*** and ***Sin-перетворення***of Fur'e. Complex form of integral of Fur'e (transformation of Fur'e). Properties of transformation of Fur'e.

"**Analytical geometry "**

Geometrical vectors and linear actions above them. Linear space of vectors. Scalar work of two vectors. Determinants 2, 3 to the order. Vectorial work of two vectors. Work of three vectors is mixed. Double vectorial work of three vectors.

General equalization of line. Canonical equalization of line. Equalization of line which passes through two fixed points. Equalization of line in segments on axes. Self-reactance equalization of line. Corner between two by lines. Rationed equalization. Geometrical maintenance of coefficients is in the rationed equalization of line. Distance from a point to to to the line. Pinches of lines.

General equalization of plane. Self-reactance equalization, equalization in segments on axes. Corner between two planes. Rationed equalization of plane. Geometrical maintenance of coefficients is in the rationed equalization of plane. Distance from a point to the plane. Bunch and copula of planes.

Canonical equalization, line, as line of crossing of two planes. Distance from a point to to to the line.
Ellipse. Hyperbola. Parabola. Canonical equalization. Property Direktorial'ni. Equalization in the arctic system of co-ordinates. Kasatel'nye. Optical properties. Research of curve the second order.
Classification of surfaces the second order. Research of surfaces the second order to on by their canonical equalization.

"**Linear algebra "**

Linear space. Arcwise dependent (independent) the system of vectors. Complete (incomplete) systems. Base. Dimension of linear space. Isomorphousness of linear spaces. Subspace*:* Crossing and sum of subspaces.

Matrices and determinants. Actions above columns and lines; grade of matrix. Systems of linear homogeneous (неоднородных) equalizations. Theorem of Kronekera-kapelli. Method of Gaus. Determinants n of th order of determination, properties. Minori. Additions of algebra.
Linear operators are in the completely-measured spaces: determination, matrix of linear operator, is in the set base. Work of operators and proper matrices. Kernel and appearance of operator. Method of Gaus. Transformation of matrix of linear operator in transition to the new base. Spectral theory of operators. Characteristic polynomial of linear operator. Own vectors, own numbers. Diagonalizuemiy operator. Zhordanova form.
Euclid space. Ortogonal. A base is orthogonalized. Algorithm of Gramme-Shmidta. Spectral theory. Conjugating, самспрягающие operators. Unitary operator. Bilinear and quadratic forms. Bringing a quadratic form over to the sum of squares. Law of inertia of quadratic forms. Classification of quadratic forms. Criterion of Silvester знакосталісті of quadratic form.

" **Entering into information technologies "**

Theme 1. Operating system of WINDOWS. Chart of work of user from WINDOWS. Objects. Standard elements of WINDOWS: windows, types of menu, panel, button. Technology of the use of manipulator is a mouse. Facilities of start of приложень . Base operations above documents. Triad of tools. Compatible work of приложень: buffer of exchange, technology of OLE. Acquaintance from приложенням "Explorer".

Theme 2. Word processor of MS WORD. Features of fonts are in WINDOWS. Possibilities of MS WORD. Creation, load, maintainance of documents. Elements of window of WORD. Basic operations with a text. Basic elements to the document: characters, indentions, structure of page. Possibilities which are contained in the Main menu item [Format], for formatting of characters and indentions. Columns, lists. Znoski, running headlines, pagination. Forming and editing of maintenance a document. "Drawing panel". Insertion of pictures, OLE-механізм. Objects of WORD-ART. Editor of formulas. Tables. Creation, formatting, editing of tables. Difficult tables.

Templates, their creations and uses. Macro instructions, their creations and uses. Autotext. Autostorage.
Theme 3. Processor of spreadsheets of EXCEL. Structure to the document of EXCEL. Windows of EXCEL. Names of barns. Type of адресів. Types are information. Filling and editing of tables. A search-and-replace is information. Autofillings, his kinds. Registration of tables. Formulas and functions are in barns. Master of functions. Construction of diagrams and graphs of functions by master of diagrams. Lists as bases given. Sorting and filtrations information.
Theme 4. Bases of work with databases in the environment of MS ACCESS. Development of structure of base is information. Key fields. Filling of base. A search is in a base.

"**Vectorial and tensor analysis"**

Elements of differential geometry and its application are in mechanics.

Natural trihedron of curve. Curvature and twisting of curve. Kinematics of solid. Tensor of angulator. Dynamics of solid. Tensor of inertia

Integral theorems of vectorial analysis.

Scalar fields: determination, surfaces of level, derivate to direction, gradient. Vector fields: vectorial lines, vectorial tubes, divergence, rotor. Operator of Gamil'tona, vectorial operations of 1го and 2го order. Formula of Stoksa (formula of Grina, as case of part). Formula of Stoksa.

Invariant determination of rotor, physical maintenance. Formula of Gaussa-ostrogradskogo. Invariant determination of divergence, physical maintenance. Theorems which join to the theorem of Gaussa-ostrogradskogo (about a gradient, divergence, rotor, лапласіан). Physical examples of application of integral theorems: law of Archimedes (gradient), flight of speeds of body of rotation (rotor), stationary equalization of flow of liquid (divergence), stationary equalization of distributing of heat (лапласіан). Potential fields: determination, criterion of potentiality, characteristic property, scalar potential. Field Solenoidal'ni: determination, criterion of соленоідальності, characteristic properties, vectorial potential. Laplacian field. Basic theorem of vectorial analysis: renewal of the field on the set rotor and divergence. Simpler than all the electrostatic field (point charge). Electrostatic field of the charged body. Simpler than all магнитостатичне flight (endless rectilineal explorer with a current). Magnitostatichne flight of explorer with a current. Vectorial operations of the field theory are in curvilinear co-ordinates (gradient, rotor, divergence, лапласіан).

Elements of tensor analysis. Tensors of напруг, deformations, resiliency. Physical maintenance. Law of Hooke. Elements of theory of ortogonal tensors.

"**Differential and integral equalizations and variation calculation"**

Differential equalizations of first-order. A task is Cauchies. Formulation of theorem about existence and unicity of decision of task Cauchies. Elementary integration of equalizations of first-order. Differential equalizations *n* of th order. A task is Cauchies. Theorem about existence and unicity of decision of task Cauchies. Linear equalizations of th order. General properties of decisions. Homogeneous and неоднородные equalizations. Concept about a maximum task for equalization the second order. Function of Grina and its physical maintenance. Systems of differential equalizations. A task is Cauchies. Theorem about existence and unicity of decisions. Method of exceptions. Method of the first integrals. Systems of linear differential equalizations. Concept about firmness and asymptotic firmness. Research of firmness on the first approaching. Method of functions of Lyapunova. Asymptotic decomposition on a small parameter in regular case. Concept about сингулярных indignations.

Integral functional. Differentiation of integral functional. Ekstremumy of functional. Basic lems of variation calculation. Equalization of Euler-Lagrange. Functional which depend on a few functions. System of equalizations of Euler-Lagrange. Variation principle is in classic mechanics.
Metrical spaces. Theorem of Banakha. Proof of theorem about existence and єдиність upshot of task Cauchies. Integral equalizations of Fredholm and Vol'terra of the second family. Theorems about existence and unicity of decisions. Own values and own functions of homogeneous equalization of Fredholm. Theorem of Gilbert-Shmidta. Application of integral equalizations of Fredholm to the decision of maximum tasks

"Informatics and programming"

Theme 1. Entering into programming in the environment of DELHPI.

DELPHI as an environment of creation of WINDOWS-приложень by the language of OBJECT-PASCAL Rapid creation facilities of DELPHI of interface of приложення.

Theme 2. Operators of language of PASCAL. Structure of the program of PASKALYA. Types are certain to PASKALYU.. Constants and variables of their announcement and use. Assignment statement. Built-in functions, examples of their use, are in the linear programs of .Арифметичні expression. Relations, boolean expressions. Priority of implementation of

operations is in expressions. Sostavniy operator. Control structures. The operator of IF THEN ELSE is conditional. Examples of his use are a calculation of cobbed-continuous function. Cyclic programs. The review of cycles of language PASKAL'. Cycle with a parameter. Finding of complete sums, polynomials of Chebisheva, calculations of double sums. Programming of recurrent expressions. Cycles with pre-condition of WHILE DO and from післяумовою REPEAT UNTIL. Finding of unfinished sums with exactness. Finding of границі sequence with exactness. Examples of the programs .

Theme 3. Regular types (arrays). Review of difficult types. Regular types (arrays). Facilities of announcement of arrays. Selection of element from an array. Examples of the programs with unidimensional arrays. Sum of array cells, search of maximal and minimum elements in an array and their indexes, search of element according to the sample in an array. Vector as unidimensional array. Finding of scalar work of vectors. Matrix as двумерный array. Algebra of matrices by a language PASKAL'. Arrays of characters. Type of STRING as an example of dynamic array. Procedures and functions for information of type of STRING

Theme 4. Basic algorithms of search and sorting (4 hours). Linear and binary search. An amount of consilient values is in two well-organized arrays. A compatible value is in three arrays. Task about planes in an array. Sorting algorithms. Puzirkove sorting, sorting, sorting the direct including a simple choice. Sorting of array the elements of which are accepted by three values.

Theme 5. Podprogrammy is in PASKALE. Functions. Governed task and application of functions. Formal and actual parameters, connection between them. Examples of the programs with the use of functions: search of decision of equalization of algebra the method of half-note division, by the methods of chords and касательных.

Procedures. Governed task and application of procedures. Formal and actual parameters. Transmission of parameter to address and by value. Rekursiya. Examples of the use of procedures for the approximate finding of the noted integral by the methods of rectangles, trapezoids and Simpson.

“Complex Analysis”

Imaginaries. Algebra

Elementary functions.

Analytical functions.

Integration.

Rows.

Theory of tailings. Tailings. Finding of integrals by tailings. Lemma of Zhordana. Theorem Cauchies about tailings. Integrals are certain from trigonometric and rational functions. Unown integrals from significant functions. Principle of argument and theorem of Rushe.

Operating calculation.

“Theory of chances and mathematical statistics”

Classic and geometrical probabilities. Algebra of events. Axiomatic construction of theory of chances. Probability and independence is conditional. A formula of complete probability is a that formula of Bayesa. Chart of Bernulli. Maximum theorems of Puassona and Муавра-Лапласа. Casual sizes. Distributing functions. Discrete and absolutely continuous casual sizes. Mathematical hope. Dispersion. Covariance and coefficient of correlation. Inequality of Chebisheva. Law of large numbers. Central maximum theorem. Homogeneous chains of Markov. Ergodicity.

Article of mathematical statistics. Distributing of Gausse, Pearson, Fishera and St'yudenta. Interval evaluation of parameters of normal distribution. Statistical verification of hypotheses. Point estimations. Inequality of Рао-Крамера. Method of maximal plausibility. Linear analysis of regression.

"**Mathematical design"**

Description of the system of Maple 8. Elements of syntax of language of Maple.

Numeral methods for the close untiing of equalizations of algebra: method of half-note division, касательных, итераций and their programmatic realization. Untiing of equalizations is in Maple. Work with rows in Maple: finding of sum of numerical row, decomposition in the row of degree, decomposition of function in the row of Fur'e.

Untiing of tasks of general physics by facilities of Maple: finding of analytical decision of equalizations of motion and his visualization. A decision of task is Cauchies. Construction the field of directions and phase portraits for the system of differential equalizations.

Numeral untiing of differential equalizations in derivative parts with the set initial and maximum conditions in Maple (on the example of design of process of heat-conducting and task about oscillation of string). Method of nets for a close numeral decision

"**Methods of mathematical physics"**

Raising of tasks of mathematical physics. Classification of linear equalizations is in the partial derivates of 2th order. Method of Fur'e and his application for the decision of the unidimensional mixed tasks with homogeneous and неоднородными maximum terms.

Own functions of operator of Laplace are in a rectangle. A decision of tasks of mathematical physics is in rectangular areas. Own functions of operator of Laplace are in a circle. Equalization of Besselya and his decision. Task about oscillation of round membrane. Task about distributing of heat in a homogeneous cylinder.

Polynomials of Legendre as own functions of operator of Laplace. Own functions of operator of Laplace on a single sphere (spherical functions). Stratified functions. Decision of tasks of mathematical physics with the use of spherical and stratified functions.

Tasks with a continuous spectrum, application the integral of Fur'e for the decision of stationary tasks. Operating method of decision of non-standard tasks of mathematical physics. Decision of task Cauchies for equalizations of heat-conducting and vibrations. A method of functions of Grina is in the theory of regional tasks of mathematical physics.