REPUBLIC OF UZBEKISTAN

MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATIONS

FERGANA STATE TECHNICAL UNIVERSITY

Methematics (1,2,3)

MODULE HANDBOOK

Field of knowledge:	700000	- Engineering and construction industries
Field of Education:	730 000	- Architecture and construction
Educational Program:	60730300	- Civil Engineering

Fergana 2025

Module title	***Methematics (1,2,3)***
Code (if available)	*Math1M16, Math2M26, Math3M36*
Semester(s) of module teaching	*1,2,3*
Responsible for the module	*Mirzakarimov Ergashboy Mirzaboyevich, Associate Professor, Department of "Higher Mathematics"* *Rasulov Rashidjon Gayratjon ugli, Associate Professor, Department of "Higher Mathematics"*
Language of instruction	*Uzbek*
Connection to the curriculum	*Compulsory*
Teaching methods	*lecture, practical training, independent study.*
Study load (including classroom and independent study hours)	*Total hours: 540 hours* *Auditorium hours: 216 hours* *lecture – 96 hours, practical training-120 hours, Independent study – 324 hours.*
Credit units	***18***
Required and recommended prior knowledge for studying the module	*Physics. Geodetic measurements, mechanics, thermal engineering*
Module objectives/intended learning outcomes	***Purpose of the module:*** *In the construction of buildings and structures, mathematics plays an important role in the calculation of structures, optimization of material consumption, and design processes. This program is aimed at a deep assimilation of the necessary mathematical knowledge and methods for civil engineers.* *The professional level of the trained specialist depends on their ability to apply modern mathematical methods to practical problems, the level of use of information technologies for constructing and obtaining a solution algorithm.* *Based on this, the purpose of this "Mathematics" course is the formation of a scientific worldview and mathematical thinking and algorithmic thinking, the construction of a mathematical model of technical processes, the creation of optimal methods for its solution, as well as the formation of skills in decision-making based on the solution.* ***The task of the discipline*** *- is to provide students with knowledge of the theory of mathematics, to teach them to apply the acquired knowledge in practice, to build a mathematical model of technical (practical) problems, to create a solution algorithm, to be able to apply information technologies to solve problems, to analyze solutions and draw conclusions based on them, and to form the ability to make decisions.* *The following requirements are set for students' knowledge, skills, and abilities in the subject.* ***Student needs to know:*** *• abstract logical thinking, ability to analyze the process and make correct decisions using induction and deduction methods in solving practical problems.* *• finding and analyzing the analytical relationship between variables based on discrete data.* *• ability to visualize the applications of mastered*

	mathematical concepts from a technical point of view. *• ability to construct and solve a simple mathematical model of non-standard technical problems in their professional activity and analyze the solution.* *• ability to build a mathematical model of simple technical processes and find and analyze its solution using software tools.* *• statistical processing of quantitative data and determination of their statistical estimates* *• calculation of the stability of structures* *• analysis of the construction plan and sections.* *• building frame modeling* *• deformation of materials* *• curvilinear structures* *• optimization of architecture and structures* *• calculation of the center of gravity, area, and volume of structures* *• stress-affect models of building materials* *• strength of materials, safety coefficients* *• forecasting construction costs*
Content	*Module 1. Fundamentals of elementary mathematics. The subject of science and its role in the development of technology. Rules for performing arithmetic and algebraic operations. Fractions, operations on fractions. Percentages. Calculation of complex percentages. Elements of combinatorics. Solving equations and inequalities. Elementary functions.* *Module 2. Elements of linear algebra. Calculating the stability of structures, matrices, systems of equations.* *Basic concepts about matrices. Linear operations on matrices. Algorithm for multiplying a matrix by a matrix. Transpose of a matrix and its properties. Determinant of a square matrix. Properties of the determinant. Minor and algebraic complement. Inverse matrix. Algorithm for calculating the inverse matrix. Recommendations for solving practical problems.* *Basic concepts about a system of linear algebraic equations. Solving a system of n equations in n unknowns using Cramer's rule and the inverse matrix (n=2,3) Algorithm for solving a system of linear algebraic equations using the Gauss method. Working in the Maple program. System of homogeneous linear algebraic equations. Construction of a fundamental solution.* *Module 3. Vector algebra and analytical geometry. Building plans, spatial location, calculation of angles and distances* *Simple problems of analytical geometry. Vector. Linear operations on vectors. Collinear and coplanar vectors. Basis vectors. Propagation of vectors by basis. Scalar product of two vectors. Vector product of two vectors and its geometric meaning. Mixed product of three vectors and its geometric interpretation (global and local coordinates).* *Equations of a straight line on the plane: a) equation with angular coefficients; b) equation of a straight line passing through a given point and two given points; c) normal equation of a straight line; d) conditions of angle, parallelism and perpendicularity between two straight lines; e) distance from a point to a straight line (geodesic directions).* *Canonical equations of second-order curves. Drawing circles,*

	ellipses, hyperbolas, and parabolas in Maple. *General equation of a plane, canonical equation, normal equation. Angle between two planes. Distance from a point to a plane. Equations of a straight line in space. Plane and straight line location.* *Module 4. Differential calculus of a function of one variable. Curved constructions, load distribution, optimal forms (extremum problems)* *1. Functions, limits, continuity* *2. Differentiation and its applications in geodesy (curves, gradients)* *3. Optimization problems (least squares method)* *Sets and operations on them. Methods of function assignment. Sequence and its limit. Basic theorems about limits.* *First and second remarkable limits. Continuity of a function at a point. Basic elementary functions. Classification of points of discontinuity. Properties of a continuous function at a section.* *Derivative of a function. Its meaning. Basic rules for derivation. Derivative of an inverse and complex function. Derivative of parametric and non-obvious functions.* *Differential of a function. Its application to approximate calculus. Derivatives of higher order. Basic theorems about differentiable functions. (Role, Lagrange, Cauchy theorems)* *Growth and decrease of a function. Checking a function for an extremum. Function Determining the concavity and convexity of the graph of a function, function graph, asymptotes. Constructing a function graph. Methods of interpolating a function.* *Applications of differential calculus of a function of one variable.* *Module 5. Integral calculus of a function of one variable.* *(Volume of building materials, center of gravity, moments of inertia)* - *Definite and indefinite integrals (calculation of surface, volume and area)* - *Differential equations (geodesic motion models)* *Definition and properties of the elementary function and indefinite integral. Integral table. Integration methods: direct integration; substitution (replacement of variables) and integration by parts.* *Integration of some functions involving square roots. Integration of a rational function by expanding rational fractions into simplest fractions.* *Integration of trigonometric functions. Integration of irrational functions.* *Definite integral, its geometric meaning and properties. Newton-Leibniz formula. Calculating the definite integral using change of variable and integration by parts.* *Calculating the surface area of a sphere in the Cartesian and polar coordinate system. Calculating the arc length of a curve in the Cartesian coordinate system. Calculating the volume of a circular body. Application of the definite integral to solving practical problems. Improper integrals of infinite and continuous functions.* *Methods for approximating the definite integral. (Right rectangle, trapezoid and Simpson's method). Calculating definite*

	integrals in the Maple program. *Module 6. Functions of several variables.* *Definition, domain, graph of a function of several variables*
Forms of assessment	*oral, presentation, written work, practical assignments, and final exams.*
Requirements for study and assessment	*To successfully complete the module, the student must attend classes and achieve the minimum scores in the current, intermediate and final assessments.*
Bibliography	*Main literature* *1. Allyn J.Washington, Richard S. Evans "Basic Technical Mathematics with Calculus" 11th edition. | Boston : Pearson, [2018] | Includes indexes.* *2. Sh.R.Khurramov "Higher Mathematics" textbook Tashkent 2018* *3. A. P. Matelenok "Higher Mathematics" Novopolotsk Polotsk State University 2020* *4. A.Abdurazakov, A.Fozilov, K .Radjapov, A. Shayev, N.Mirzamahmudova, N.Mahmudova "Higher Mathematics" textbook, Fergana 2021.* *Additional literature* *1. B.A.Abdurakhmonov, Sh.R.Khurramov "Higher Mathematics" textbook 2 volumes. Tashkent 2018.* *2. K.A. Kurganov, Yu.Kh. Eshkabilov, R.R. Kucharov "Higher Mathematics" textbook, Tashkent 2019.* *3. A. Abdurazakov, A. Fozilov, K. Radjabov, N. Mahmudova, N. Mirzamahmudova "Higher Mathematics" textbook, Fergana 2019.* *4. Narimov Sh. Eshmamatova D.B. "Higher Mathematics" textbook, part 1. Tashkent 2020.* *5. Mirzakarimov E.M. Solving Higher Mathematics Problems Using Maple. Part 1, 2, 3, T: "Sparks of Literature", 2014, 2015* *6. Information sources:* *http://e/.tfi.uz/pdf/omsh uzk.pdf* *http:///.tfi.uz/pdf/omsh uz1.pdf* *http://www.mcce.ru,* *http://lib.mexmat.ru* *http:// www.a-geometry.narod.ru* *http://allmath.ru/highermath/mathanalis*
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