O‘ZBEKISTON RESPUBLIKASI
OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

SAMARQAND DAVLAT ARXITEKTURA – QURILISH UNIVERSITETI

“KELISHILGAN”
o‘quv ishlari bo‘yicha
prorektor _____
M.T.Shodmonquloy
Ro‘yxatga olindi: №24/a
«___» avgust 2024 yil

“TASDIQLAYMAN”
Rektor _____
Ch.J. Turkyilmaz
«__» avgust 2024 yil

MATEMATIKA 2

FAN DASTURI

Bilim sohasi: 700 000 – Muhandislik ishlov berish va qurilish sohalari
1000 000 – Xizmatlar

Ta’lim sohasi: 710000 – Muhandislik ishi
720000 – Ishlab chiqarish va ishlov berish sohalari
730000 – Arxitektura va qurilish
1020000 – Gigiyena va ishlab chiqarishda mehnat muhofazasi

Ta’lim yo‘nalishi: 60710500 – Elektr muhandisligi;
60711800 - Atrof-muhit muhandisligi;
60712300 – Mexanika muhandisligi;
60721500 - Geodeziya va geoinformatika;
60721700 - Kadastr
60730300 - Qurilish muhandisligi;
61020200 - Mehnat muhofazasi va texnika xavfsizligi.

Samarqand – 2024

Kurs ma'lumotlari
Course Information Form

Modul kodi **Code** MAT1040	**O'quv yili** 2024-2025	**Semestr** 2	**ECTS – Kreditlar** 2-semestr - 6			
Modul turi Majburiy	**Ta'lim tili** O'zbek/rus		**Auditoriya soatlari**			Mustaqil ta'lim (soat/hafta) Independent Education (hour/week)
Fan nomi Title	**Jami yuklama**		**Ma'ruza (soat/hafta)** Lecture (hour/week)	**Amaliyot (soat/hafta)** Practical (hour/week)	**Laboratoriya (soat/hafta)** Laboratory (hour/week)	
Matematika 2 Mathematics 2	2-semestr -180		2-semestr -3	2-semestr -2		2-semestr -7

Dastlabki shart Prerequisite	**Yo'q** None

Semestr Semestr	**Bahorgi** Spring

Kurs tili Course language	**O'zbek, Ingliz, Rus** Uzbek, English, Russian
O'quv kursi Level of Course	**Birinchi kurs** First Cycle
Ta'lim yo'nalishlari Course type	60710500 – Elektr muhandisligi; 60721500 - Geodeziya va geoinformatika; 60721700 – Kadastr; 61020200 - Mehnat muhofazasi va texnika xavfsizligi; 60712300 – Mexanika muhandisligi; 60730300 - Qurilish muhandisligi; 60711800 - Atrof-muhit muhandisligi.
Kurs toifasi Course Category	**Asosiy** Core Courses
Dars shakli Mode of Delivery	**An'anaviy (Yuzma – yuz muloqot)** Face – to - face

Ma'sul kafedra Owner academic unit	**Ijtimoiy va tabiiy fanlar kafedrasi** Department of social and natural sciences
Kursga ma'sul Cours Coordinator	Mamasoliyev Qazoqboy
O'qituvchilar Instructor(s)	Mardonov Baxodir, Xudoyarov Ulug'bek, Qulmirzayeva Gulrabo, Shodiyev Kamoliddin
Yordamchilar Asistant(s)	Tuyg'unov Javlonbek, Quljanov Javlon, Vahobov Mexroj

Fanni o'qitishdan maqsad Course objectives	Talabaga qator va qatorlar haqida batafsil ma'lumot berish va ko'p o'zgaruvchili funksiyalar uchun limit, uzluksizlik, xususiy hosila, karrali integral tushunchalarini qo'llash ko'nikmasini berish. To inform the student about series and series in detail and to provide the ability to use the concepts of limit, continuity, partial derivative, double integral in multivariable functions
Fanning mazmuni Course content	Cheksiz sonli ketma-ketliklar. Cheksiz ketma-ketliklar, ketma-ketlikning yaqinlashishi va uzoqlashishi. Monoton chegaralgan ketma-ketlik va uning limiti. Ketma-ketlik limitini hisoblash, ketma-ketliklar uchun sendvich (siqilish) teoremasi, uzluksiz funktsiyalar ketma-ketligi haqidagi teorema. Ba'zi xususiy limitlar, rekursiv ketma-ketliklar. Cheksiz sonli qatorlar. Sonli qator, xususiy yig'indilar, qatorning yaqinlashishi va uzoqlashishi. Geometrik qator. Qatorlarning ba'zi

	xossalari. Qator yaqinlashishining zaruriy sharti. Garmonik qator. Musbat hadli qatorlarning yaqinlashish alomatlari: taqqoslash, Dalamber, Koshining radikal va integral alomatlari. Ishorasi navbatlashuvchi va ishorasi o'zgaruvchi qatorlar. Leybnits teoremasi. Absolyut va shartli yaqinlashish. Funksional qator. Darajali qator. Darajali qatorlar xossalari, hadma-had differensiallash va integrallash. Darajali qatorning yaqinlashish radiusi va yaqinlashish sohasi. Teylor va Makloren qatorlari. Teylor qatorining qo'llanilishi. Elementar bo'lmagan integrallarni hisoblash, arktangens, limitni hisoblash. Parametrik tenglamalar va qutb koordinatalari.Tekis egri chiziqni parametrlash, parametrik tenglamalar, parametrik tenglamasi bilan berilgan egri chiziqlar ustida amallar: hosilasi, parametric tenglama bilan berilgan egri chiziq uzunligi. Tekislikda koordinatalar: qutb koordinatalarida chiziq tenglamalari, qutb va dekart koordinatalari orasidagi munosabat, qutb koordinatalarida yuza va chiziq uzunligini hisoblash. Vektorlar. Uch o'lchamli koordinatalar sistemasi, vektorlar, to'g'ri ko'paytma, ikki vektor orasidagi burchak, perpendikulyar vektorlar, vektor ko'paytma, fazodagi parallel vektorlar. Chiziqlar va tekisliklar: fazodagi chiziqlar, chiziqning vektor tenglamasi, chiziqning parametrik tenglamalari. Fazodagi tekislik, kesishish chiziqlari, vektor qiymatli funksiyalar: fazodagi egri chiziq va urinma, limit va uzluksizlik, hosilalar, tezlik vektori, tezlanish vektori, hosil qilish qoidalari, fazoda egri chiziq yoyi uzunligi. Bir necha o'zgaruvchi funksiyasining differensial hisobi. Bir necha o'zgaruvchining funksiyasi, uning limiti, uzluksizligi. Xususiy hosilalar va to'la differrensial. To'la differensiallarning tatbiqlari. Ikki o'zgaruvchining funktsiyasini chiziqlilashtirish. Murakkab funksiyani differensiallash (zanjir qoidasi). Oshkormas funksiyalarni differensiallash. Yuqori tartibli xususiy hosilalar va differensiallar. Yo'nalishli bo'yicha hosila va gradient vektori. Tekislikda yo'nalish bo'yicha hosila va uni hisoblash, talqini. Gradient. Sath chiziqlari va sirtlari. Sirtga o'tkazilgan urinma tekislik va normal tenglamalari. Ikki o'zgaruvchi funksiyasining ekstremumi (lokal ekstremumi). Ekstremumning zaruriy sharti, kritik va egar nuqtalar. Lokal ekstremumning yetarli sharti (ikkinchi hosila yordamida tekshirish). Shartli ekstremum. Ikki o'zgaruvchi funksiyasining eng katta va eng kichik qiymatlari. Karrali integrallar. To'g'ri to'rtburchakli soha bo'yicha ikki karrali(ikki o'lchovli) integral, ikki karrali integral hajm sifatida. Karrali integralni hisoblash: Fubini teoremasi(birinchi shakli). Umumiy soha bo'yicha ikki karrali integral. Ikki sirt orasidagi hajm (Fubini teoremasi, umumiy hol). Integrallash chegaralarini topish: vertikal va gorizontal kesmalar usullari. Ikki karrali integralning xossalari. O'rta qiymat haqidagi teorema. Qutb koordinatalarida ikki karrali integral: integrallash chegaralarini topish, dekart koordinatalaridan qutb koordinatalariga o'tish. Yuzani ikki karrali integral yordamida hisoblash. Ikkita sirt orasidagi jism hajmini qutb koordinatalarida hisoblash. Karrali integralda o'zgaruvchini almashtirish. Uch karrali integral: uch karrali integralning ta'rifi, xossalari, hisoblanishi, tadbiqlari. Infinite Sequences: Convergence and Divergence, Convergence and Divergence of Sequences, Calculation of Limits of Sequences, Sandwich (Compression) Theorem for Sequences, Continuous Function Theorem of Sequences, Frequent Limits, Recursive Sequences, Bounded Monotone Sequences, Monotone Sequence Theorem. Infinite Series: Geometric Series , For Divergent Series n. Term Test, Combining Series, Adding or Deleting Terms, Convergence Tests for Positive Term Series: Integral Test, p Series, Harmonic Series, Comparison Test, Limit Comparison Test, Ratio Test, Root Test. Alternating Series: Alternating Harmonic Series, Alternating Series Test (Leibniz Test), Absolute and Conditional Convergence. Power Series: Radius of Convergence of a Power Series, Operations in Power Series, Series Product Theorem for Power Series, Term Term Derivative

	Theorem, Term by Term Integration Theorem, Taylor and Maclaurin Series, n. The Taylor Polynomial of Order. Applications of the Taylor Series: Computing Non-Elementary Integrals, Arctangents, Calculating Limits in Uncertainty. Parametric Equations and Polar Coordinates: Parametrizing Planar Curves, Parametric Equations, Calculation with Parametric Curves: Derivative, Length of Parametrically Defined Curve. Polar Coordinates: Polar Equations, Relation Between Polar and Cartesian Coordinates, Polar and Cartesian Coordinates), Areas and Lengths in Polar Coordinates, Area in Plane, Length of Polar Curve. Vectors: Three-Dimensional Coordinate Systems, Vectors, Dot Product, Angle Between Two Vectors, Perpendicular Vectors, Vector Product, Parallel Vectors, Lines and Planes in Space: Mixed Derivative Theorem, Higher Order Partial Derivatives, Differentiability, Chain Rule: Functions of Two Variables, Chain Rule for Functions Containing Two Independent Variables, Functions of Three Variables, Chain Rule for Functions with Three Arguments, Chain Rule for Two Independent Variables and Three Intermediate Variables . Revisiting the Closed Derivative. Directional Derivatives and Gradient Vector: Directional Derivatives in the Plane, Directional Derivative Interpretation, Computation and Gradients, Tangents of Level Curves and Gradients, Functions of Three Variables. Tangent Planes and Differentials: Tangent Plane of a Surface, Normal Line of a Surface. Linearizing a Function of Two Variables, Differentials, Extreme Values: Local Extreme Values, Necessary Conditions for Local Extreme Values, Critical and Saddle Points, Second Derivative Test for Local Extreme Values. Multiple Integrals: Double Integrals on Rectangles, Double Integrals as Volumes, Calculation of Double Integrals: Fubini's Theorem(The First Shape), Double Integrals over General Regions, Double Integrals over Non-Rectangular Bounded Regions, Volumes between two surfaces , Fubini's Theorem (More Comprehensive Figure). Finding the Limits of Integration: Using Vertical Sections, Using Horizontal Sections, Properties of Double Integrals, Area Calculation in Double Integrals, Mean Value Theorem. Double Integrals in Polar Form: Finding the limits of integration, Converting Cartesian Integrals to Polar Integrals. Calculation of volume (volume between two surfaces) with the use of polar coordinates, Variable Transformation in Double Integrals. Triple integral: definition, properties, calculation, applications.
Tavsiya qilingan yoki talab qilinadigan adabiyotlar ro'yxati Recommended Or Required Reading	1. Thomas Calculus (vol. 1) , George B. Thomas , Maurica D. Weir Joel R. Hass, Translation Editor Mustafa Bayram , 2011, Ankara . 2. Salih Çelik and Sultan Çelik, Mathematical Analysis 1, 3rd edition, Birsen Publishing House, 2010 3. Xurramov Sh.R. Oliy matematika. T.: «Tafakkur», 1-jild. 2018. 4. Xurramov Sh.R. Oliy matematika. Misol va masalalar. Nazorat topshiriqlari. 1- qism, 2- qism. T: Fan va texnologiyalar, 2015. 5. Ё.У.Соатов Олий математика. 1- жилд, 3- жилд, Т.: Ўзбекистон, 1992, 1996. 6. Danko P.E., Popov A.G., Kojevnikova T.E. Oliy matematika mashqlar va masasalarda. 1, 2 -qismlar.Toshkent, "O'qituvchi", 2009 y. 7. Mamasoliyev Q. Oliy matematika (Bir o'zgaruvchili funksiya va uning differensial hisobi) [Matn] O'quv qo'llanma/ - Toshkent. "Sahhof", 2021.-264 b. 8. Mamasoliyev Q. Oliy matematika (Bir o'zgaruvchili funksiyaning integral hisobi) [Matn] O'quv qo'llanma/ - Toshkent. "Sahhof", 2022.-228 b.
Tavsiya etilgan qo'shimcha dastur komponentlari Recommended Optional Program Components	Yo'q\ (bor bo'lsa yoziladi) None

Kursni o'rganish natijalari

Course learning outcomes

1.	Talabalar qator va qatorlarning yaqinlashuvini va darajali qatorlarning yaqinlashuv diapazonini topadilar Students will find the convergence of series and series and the range of convergence of power series.

2.	Talabalar vektor algebrasidan uch o'lchamli fazo va tekislikda foydalanish, tekislik va chiziq tenglamalarini yozish ko'nikmasiga ega bo'ladilar. Students will gain the ability to use vector algebra in three-dimensional space and plane and write plane and line equations.
3.	Talabalar ko'p o'zgaruvchili funksiyalarda limit va uzluksizlik tushunchalarini tushunish, qisman hosilalarni hisoblash, tangens tekisliklarni, yo'nalish hosilalarini va gradientlarni topish ko'nikmasiga ega bo'ladilar. Students will gain the ability to understand the concepts of limit and continuity in multivariable functions, calculate partial derivatives, find tangent planes, directional derivatives and gradients.
4.	Talabalar ikkinchi hosilaviy test yordamida ekstremal masalalarni yechish qobiliyatiga ega bo'ladilar. Students will gain the ability to solve extreme problems with the second derivative test.
5.	Talabalar qo'sh integrallarni yechishadi va maydon va hajmni hisoblash uchun qo'sh integrallardan foydalanadilar. Students will solve double integrals and use double integrals to calculate area and volume.

Haftalik mavzular va tegishli tayyorgarlik ishlari

Weekly Subjects and Related Preparation Studies

Hafta Week	**Mavzular** Themes	**Resurslar** Related preparation
1.	Sonli ketma-ketliklar va uning limiti.	1-darslik (X bob)
2.	Sonli qator, musbat hadli sonli qatorlar.	1-darslik (X bob)
3.	Ishorasi o'zgaruvchi sonli qatorlar. Funksional qator.	1-darslik (Xbob)
4.	Darajali qator. Teylor va Makloren qatorlari.	1-darslik (X, XI bob)
5.	2-tartibli chiziqlar. Parametrik tenglamalar va qutb koordinatalari. Uzunlik va yuzani hisoblash.	1-darslik (XI bob)
6.	Vektorlar. Uch o'lchamli koordinatalar sistemasi. Fazoda vektorlar. Tekislik va fazoda to'g'ri chiziq tenglamalari.	1-darslik (XII XIII bob)
7.	Fazoda sirtlar. Vektor qiymatli funksiya va uning limiti, uzluksizli, hosilasi.	1-darslik (XIV bob)
8.	Ko'p o'zgaruvchili funksiya va uning limiti, uzluksizligi.	1-darslik (XIV bob)
9.	Ko'p o'zgaruvchili funksiyasining differensial hisobi.	1-darslik (XIV bob)
10.	Skalyar maydon, yo'nalishli bo'yicha hosila va gradient vektori.	1-darslik (XIV bob)
11.	Ikki o'zgaruvchi funksiyasining ekstremumi.	1-darslik (XIV bob)
12.	Shartli ekstremum. Chegaralangan yopiq sohada ikki o'zgaruvchili funksiyaning eng katta va eng kichik qiymatlari.	1-darslik (XV bob)
13.	Ikki karrali integral va uni dekart koordinatalarida hisoblash.	1-darslik (XVbob)
14.	Ikki karrali integralda o'zgaruvchilarni almashtirish, qutb koordinatalarida ikki karrali integral.	1-darslik (XV bob)
15.	Uch karrali integralva uning tadbiqlari.	1-darslik (XV bob)

Baholash jarayoni

Evaluation System

Mashg'ulot turi Activities	**Soni** Number	**Baholash** Percentage of Grade
Darsga qatnashish Attendance / particition	15	20
Laboratoriya ishi Laboratory		
Amaliy ish (qo'shimcha vazifa) Application		
Kurs ishi Field work		
Maxsus kurs amalyoti (ish joyida) Special course internship (work placement)		
Testlar Quizzes / studio crtics		
Uyga vazifani baholash		

Homework assignments		
Ijodiy ish (taqdimot) Presentations / jury		
Loyiha ishi Project		
Seminar Seminar / workshop		
Oraliq nazorat Mid -Terms	2	30
Yakuniy nazorat Final	1	50
O'zlashtirish ko'rsatgichi Percentage of in – term studies		**50**
Yakuniy imtihon bahosi Percentage of final examination		**50**
Jami Total		**100**

ECTS taqsimoti
ECTS workload table

Topshiriqlar Activities	**Soni** Number	**Davomiyligi (soat)** Duration (hour)	**Umumiy yuklama** Total workload
Mashg'ulot soati Course hours	15	3	45
Laboratoriya ishi Laboratory			
Amaliy ish (qo'shimcha vazifa) application	15	2	30
Kurs ishi/ Field work			
Mustaqil ta'lim Study hours out of class	15	7	105
Maxsus kurs amalyoti (ish joyida) Special course internship (work placement)			
Uyga vazifani baholash Homework assignments			
Testlar / Viktorina Quizzes / studio critics			
Loyiha ishi Project			
Ijodiy ish (taqdimot) Presentations / seminar			
Oraliq nazorat Mid – terms (Examination +Examination prep. Duration)			
Yakuniy nazorat (nazorat va nazoratga tayyorlanish soati) Final (examination +examination prep. Duration)			
Jami yuklama / Total workload			180
Jami yuklama / 30 (soat) Total workload / 30(h)			6
Kredit ECTS credit			6

Qo'shimcha eslatmalar Extra Notes	Yo'q\ (bor bo'lsa yoziladi) None

Fan dasturi Mirozo Ulug'bek nomidagi Samarqand davlat Arxitektura-qurilish universitet kengashining 2024 yil ____-avgustdagi ___-sonli bayonnomasi bilan ma'qullangan.

Kafedra mudiri: **A. T. Quldoshev**

Tuzuvchilar: **Q. Mamasoliyev**
Sh. Zikiryayev