MAT 18-C Mathematical Thinking
Development of quantitative thinking and problem solving abilities through a selection of mathematical topics: logic and reasoning; numbers, functions, and modeling; combinatorics and probability; growth and change. Other topics may include geometry, statistics, game theory, and graph theory. Through their engagement in problem solving, students develop an appreciation of the intellectual scope of mathematics and its connections with other disciplines.
Prerequisite: MAP 103 or level 2+ or higher on the mathematics placement examination
Prerequisite must be met within one year of beginning this course.
3 credits

MAT 1C-C Calculus I
The differential calculus and integral calculus, emphasizing conceptual understanding, computations, and applications, for students who have the necessary background from 12th-year high school mathematics. Differentiation of elementary algebraic, trigonometric, exponential, and logarithmic functions; graphing; modeling and maximization; the Rieman integral; and the fundamental theorem. May not be taken for credit in addition to MAT 125 or 141 or AMS 151.
Prerequisite: B or higher in MAT 122, or level 5 on the mathematics placement examination. May not be taken for credit in addition to MAT 125 or 141 or AMS 151.
Advisory Prerequisite: C or higher in MAT 122
Advisory Corequisite: MAT 125 or 131 or AMS 151
1 credit

MAT 12C-C Calculus I
A continuation of MAT 126, covering improper integrals and the hospital's rule, complex numbers, sequences, series, Taylor series, differential equations, and modeling. May not be taken for credit in addition to MAT 132 or 142 or AMS 161.
Prerequisite: C or higher in MAT 126 or level 8 on the mathematics placement examination
3 credits

MAT 130 Functions
Inverse functions, exponential and logarithmic functions, radian measure of angles and trigonometric functions. Open to prospective students in engineering, physical sciences, and mathematics who need to bridge the gap between MAT 122 and 125 or MAT 131 or AMS 151. May not be taken for credit in addition to MAT 123.
Advisory Prerequisite: C or higher in MAT 122
Advisory Corequisite: MAT 125 or 131 or AMS 151
1 credit

MAT 131-C Calculus II
The differential calculus and integral calculus, emphasizing conceptual understanding, computations, and applications, for students who have the necessary background from 12th-year high school mathematics. Differentiation of elementary algebraic, trigonometric, exponential, and logarithmic functions; graphing; modeling and maximization; the Riemann integral; and the fundamental theorem. May not be taken for credit in addition to MAT 125 or 141 or AMS 151.
Prerequisite: B or higher in MAT 123, or level 5 on the mathematics placement examination, or B or higher in MAT 122 and coregistration in MAT 130
3 credits

MAT 132-C Calculus II
A continuation of MAT 131, covering symbolic and numeric methods of integration; area under a curve; volume; applications such as work and probability; improper integrals and the hospital's rule, complex numbers, sequences, series, Taylor series, differential equations, and modeling. May not be taken for credit in addition to MAT 126 or 127 or 132 or AMS 161.
Prerequisite: C or higher in AMS 151 or MAT 131 or 141, or level 7 on the mathematics placement examination
3 credits

MAT 141-C Honors Calculus I
The topics of MAT 151 treated with additional attention to the underlying theory as a means of understanding why the processes of calculus work. May not be taken for credit in addition to MAT 125 or 131.
Advisory Prerequisite: Permission of instructor and MSRC Undergraduate Programs Director
Advisory Corequisite: MAT 125 or 131 or AMS 151
1 credit

MAT 142 Honors Calculus II
A continuation of MAT 141 in the same spirit, covering the topics of MAT 132. May not be taken for credit in addition to MAT 126 or 127 or 132 or AMS 161.
Prerequisite: Level 5 on the mathematics placement examination; priority given to students in the University's honors programs
1 credit

MAT 160 Mathematical Problems and Games
Intended for students interested in sharpening their problem-solving skills and in developing their ability to express mathematical ideas.
1 credit, S/U grading

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MAT 203 Calculus III with Applications
Vector algebra in two and three dimensions, multivari- ate differential and integral calculus, optimization, vector calculus including the theorems of Green, Gauss, and Stokes. Applications to economics, engineering, and all sciences, with emphasis on numerical and graphical solutions, use of graphing calculators or computers. May not be taken for credit in addition to AMS 281 or MAT 205.
Prerequisites: C or higher in MAT 127 or 132 or 142 or AMS 161 or level 9 on the mathematics placement examination. 3 credits

MAT 205 Calculus III
Vector algebra, multivariate differential and integral calculus, divergence and curl, line and surface integra-als, theorems of Green, Gauss, and Stokes. More theoretical than MAT 203 with applications to the physical sciences. Not for credit in addition to AMS 261 or MAT 203.
Prerequisites: C or higher in MAT 127 or 132 or 142 or AMS 161 or level 9 on the mathematics placement examination. 4 credits

MAT 211 Introduction to Linear Algebra
Introduction to the theory of linear algebra with some applications; vectors, vector spaces, bases and dimen- sion, applications to geometry, linear transformations and rank, eigenvalues and eigenvectors, determinants and inner products. May not be taken for credit in addition to AMS 201 or MAT 205.
Prerequisites: C or higher in MAT 127 or 132 or 142 or AMS 161 or level 9 on the mathematics placement examination.
Pre-or Corequisite: MAT 211 or AMS 210
3 credits

MAT 310 Linear Algebra
Finite dimensional vector spaces, linear maps, dual spaces, bilinear functions, inner products. Additional topics such as canonical forms, multilinear algebra, numerical linear algebra.
Prerequisites: C or higher in MAT 211 or 305 or AMS 210; C or higher in MAT 200 or permission of instructor.
3 credits

MAT 311 Number Theory
Congruences, quadratic residues, quadratic forms, continued fractions, Diophantine equations, numer- ber-theoretical functions, and properties of prime numbers.
Prerequisites: C or higher in MAT 312 or 313 or 318; C or higher in MAT 200 or permission of instructor.
3 credits

MAT 312 Applied Algebra
Topics in algebra: groups, informal set theory, rela- tions, homomorphisms. Applications: error correcting codes, Burnside’s theorem, computational complexity, Chinese remainder theorem. This course is offered as both AMS 351 and MAT 312.
Prerequisites: C or higher in MAT 211 or MAT 211 Advisory Prerequisite: MAT 200 or CSE 113
3 credits

MAT 313 Abstract Algebra
Groups and rings together with their homomorphisms and quotient structures. Unique factorization, poly- nomials, and fields.
Prerequisites: C or higher in MAT 310 or 312 or 318; C or higher in MAT 200 or permission of instructor.
3 credits

MAT 316 Invitation to Modern Mathematics
Mathematical reasoning and the process of mathe- matical research. The power and range of modern mathematics are discussed in detail through a few key theorems in algebra, analysis, geometry, and topology together with some applications.
Prerequisites: MAT 211 or MAT 210; MAT 203 or 205 or AMS 201; MAT 200 or permission of instructor.
3 credits

MAT 318 Classical Algebra
Re-examines algebra from an historical perspective: the Hungarian-Arabic number system, mathematics in ancient Egypt and China; the Greek contribution (unique factorization, Euclidean division algorithm, polynomials); unsolvability of the three great prob- lems (trisecting the angle, squaring the circle, solving quintics); modern perspectives.
Prerequisites: C or higher in the following: MAT 125 or 131 or 141 or AMS 151; MAT 211 or MAT 210; MAT 200 or permission of instructor.
Advisory Prerequisite: MAT 125 or 131
3 credits

MAT 319 Foundations of Analysis
A careful study of the theory underlying topics in one-variable calculus, with an emphasis on those topics arising in high school calculus. The real number sys- tem, limits, functions and sequences, Differentiations, integration, and the fundamental the- orem. Infinite series.
Prerequisites: C or higher in MAT 200 or permission of instructor; C or higher in one of the following: MAT 205, 205, 211, AMS 261, or A- or higher in MAT 127, 132, 142, or AMS 161.
3 credits

MAT 320 Introduction to Analysis
Prerequisites: C or higher in MAT 200 or permission of instructor; C or higher in one of the following: MAT 203, 205, 211, AMS 261, or A- or higher in MAT 127, 132, 142, or AMS 161.
3 credits

MAT 322 Analysis in Several Dimensions
Continuity, differentiation, and integration in Euclidean n-space. Differentiable maps, Implicit and inverse function theorems. Differential forms and the general Stokes’s theorem.
Prerequisites: C or higher in MAT 202, 205, or AMS 261; C or higher in MAT 211 or AMS 210; B or higher in MAT 320
Advisory Pre- or Corequisite: MAT 310
3 credits

MAT 324 Real Analysis
Prerequisites: C or higher in MAT 205 or AMS 261; B or higher in MAT 320
3 credits

MAT 331 Computer-Assisted Mathematical Problem Solving
Exploration of the use of the computer as a tool to gain insight into complex mathematical problems through a project-oriented approach. Students learn both the relevant mathematical concepts and ways that the computer can be used (and sometimes misused) to understand them. The particular problems may vary by semester; past topics have included cryptography, fractals and recursion, modeling the flight of a glider, curve fitting, the Brachistochrone, and computer graphics. No previous experience with computers is required.
Prerequisite: C or higher in MAT 203 or 205 or AMS 261.
3 credits

MAT 336-H History of Mathematics
A survey of the history of mathematics from the beginnings through the 19th century, with special attention to primary sources and to the interactions between culture and mathematics. Emphasis on top- ics germane to the high school curriculum. Mesopotamian, Egyptian, and Greek mathematics; non-European mathematics; early Renaissance math- ematics; the birth and flowering of calculus; the beginnings of probability theory; and the origin of non-Euclidean geometrics and the modern concept of number.
Prerequisite: MAT 200 or AMS 301
3 credits

MAT 341 Applied Real Analysis
Partial differential equations of mathematical physics: the heat, wave, and Laplace equations. Solutions by techniques such as separation of variables using orthogonal functions (e.g., Fourier series, Bessel functions, Legendre polynomials). D’Alembert solu- tion of the wave equation.
Prerequisites: C or higher in the following: MAT 203 or 205 or AMS 261; MAT 303 or 305 or AMS 361
Advisory Prerequisite: MAT 200
3 credits

MAT 342 Applied Complex Analysis
Functions of a complex variable, calculus of residues including evaluation of real integrals, power and Laurent series, conformal mappings and applications, Laplace and Cauchy-Riemann equations, the Dirichlet and Neumann problems, and the Laplace and Hilbert transforms and their applications to ordinary and par- tial differential equations.
Prerequisites: C or higher in the following: MAT 203 or 205 or AMS 261; MAT 303 or 305 or AMS 361
Advisory Prerequisite: MAT 200
3 credits

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MAT 351 Differential Equations: Dynamics and Chaos
A study of the long-term behavior of solutions to ordinary differential equations or of iterated mappings, emphasizing the distinction between stability on the one hand and sensitive dependence and chaotic behavior on the other. The course describes examples of chaotic behavior and of fractal attractors, and develops some mathematical tools for understanding them. Pre-requisites: C or higher in the following: MAT 203 or 205 or AMS 261; MAT 303 or 305 or AMS 361; MAT 301 D.E.C. 3 credits

MAT 360 Geometric Structures
Formal geometries and models. Topics selected from projective, affine, Euclidean, and non-Euclidean geometries. Pre- or Corequisites: C or higher in the following: MAT 203 or 205 or AMS 261; MAT 201 or AMS 210; MAT 200 or permission of instructor 3 credits

MAT 362 Differential Geometry of Surfaces
The local and global geometry of surfaces; geodesics, parallel transport, curvature, isometries, the Gauss map, the Gauss-Bonnet theorem. Prerequisite: C or higher in MAT 319 or 320 or 364 3 credits

MAT 364 Topology and Geometry
A broadly based introduction to topology and geometry, the mathematical theories of shape, form, and rigid structure. Topics include intuitive knot theory, lattices and tilings, non-Euclidean geometry, smooth curves and surfaces in Euclidean 3-space, open sets and continuity, combinatorial and algebraic invariants of spaces, higher dimensional spaces. Prerequisites: MAT 203 or 205 or AMS 261. Advisory Prerequisite: MAT 319 or 320 3 credits

MAT 371 Logic
A survey of theological foundations of mathematics: development of propositional calculus and quantification theory, the notions of a proof and of a model, the completeness theorem, Godel’s incompleteness theorem. This course is offered as both CSE 371 and MAT 371. Pre- or Corequisites: MAT 200 or CSE 213 3 credits

MAT 373 Analysis of Algorithms
Mathematical analysis of a variety of computer algorithms including searching, sorting, matrix multiplication, fast Fourier transform, and graph algorithms. Time and space complexity. Upper-bound, lower-bound, and average-case analysis. Introduction to NP completeness. Some machine computation is required for the implementation and comparison of algorithms. This course is offered as AMS 373, CSE 373, and MAT 373. Prerequisites: MAT 211 or AMS 210; CSE 214 3 credits

MAT 401 Seminar in Mathematics
Discussions of a specific area of interest in mathematics. The work of each semester covers a different area of mathematics. May be repeated as topic changes. Prerequisites will be announced with the topic each time the course is offered. Prerequisites: U3 or U4 standing; additional prerequisites announced with topic 3 credits

MAT 402 Seminar in Mathematics
Discussions of a specific area of interest in mathematics. The work of each semester covers a different area of mathematics. May be repeated as topic changes. Prerequisites will be announced with the topic each time the course is offered. Prerequisites: U3 or U4 standing; additional prerequisites announced with topic 3 credits

MAT 475 Undergraduate Teaching Practicum
Each student assists in teaching a lower-division mathematics course or works in the Mathematics Learning Center. The student’s work is regularly supervised by a faculty member. In addition, a weekly seminar is conducted. Responsibilities may include preparation of materials for student use and discussions, helping students with problems, and involvement in “alternative” teaching projects. Intended for upper-division students who have excelled in the calculus sequence. May not be used for major credit. Prerequisite: Permission of the director of undergraduate studies 3 credits, S/U grading

MAT 487 Independent Study in Special Topics
A reading course for juniors and seniors. The topics may be chosen by the student with the approval of a supervising member of the faculty, who also takes responsibility for evaluation. A topic that is covered in a course regularly offered by the department is not appropriate for independent study. May be repeated. Prerequisite: Permission of the director of undergraduate studies 0-6 credits

MAT 495 Honors Thesis
The student and a supervising faculty member together choose a topic in mathematics, and the student writes a substantial paper expounding the topic in a new way. Prerequisite: Permission of the director of undergraduate studies 3 credits

MEC Mechanical Engineering

MEC 100 Introduction to Mechanical Engineering
Introduction to the mechanical engineering experience in general and mechanical engineering in particular through lectures by faculty and invited speakers from industry, field trips, films and laboratory demonstrations. Lectures cover creative thinking and problem-solving, design team work, computer utilization, ethics and legal issues, uses of libraries and other sources of information, career opportunities in mechanical engineering and related fields, emerging technologies and the cross-disciplinary nature of engineering. 3 credits

MEC 101 Engineering Computing and Problem Solving I
Computer integrated introduction to engineering design and analysis. The mechanical engineering profession, engineering ethics, and engineering impact on society. Engineering equations, graphs, dimensional analysis, curve fitting, optimization in engineering design. Introduction to vectors and engineering statics, failure, and materials selection. Use of spreadsheets and MATLAB. 2 credits

MEC 102 Engineering Computing and Problem Solving II
Introduction to programming with MATLAB. Control structures, arrays and matrix operations, functions, object-oriented programming, interfacing MATLAB with other languages. Projects include applications in solid mechanics, fluid mechanics, thermodynamics and heat transfer, control theory, and basic design concepts. Emphasizes interpretation of previous analyses in terms of generating results, making quantitative comparisons, and assessing changes that optimize or otherwise maximize the usefulness of the result. 2 credits

MEC 104-E Practical Science of Things
A practical introduction to the science and engineering of objects and phenomena in everyday life. The basic principles that underlie the operation of modern devices such as rollercoasters, balloons, vacuum cleaners, airplanes, bicycles, thermostats, air conditioners, automobiles, and GPS systems are developed by investigating how they work. Issues of design, safety, and environmental impact are also discussed. Prerequisite: Satisfaction of entry skill in mathematics requirement (Skill 1) or satisfactory completion of D.E.C. C 3 credits

MEC 105-E Everyday Science
A practical introduction to the science and engineering of objects and phenomena in everyday life. The basic principles that underlie the operation of modern devices such as rollercoasters, balloons, vacuum cleaners, airplanes, bicycles, thermostats, air conditioners, automobiles, and GPS systems are developed by investigating how they work. Issues of design, safety, and environmental impact are also discussed. Prerequisite: Satisfaction of entry skill in mathematics requirement (Skill 1) or satisfactory completion of D.E.C. C 3 credits

MEC 109 Introduction to Mechanical Engineering
Introduces the basic concepts of nuclear science. Topics include basic atomic structure; isotopes; mass-energy equivalence; binding energy; decay of radionuclides; nuclear reactions; fission and fusion; the interaction of radiation with matter; and biological effects of radiation. Discusses nuclear science concepts in the context of relevant applications such as nuclear medicine and imaging, nuclear power, radioactive waste, food irradiation, and weapons. Not intended for science majors. Prerequisite: MAT 123 or level 4 on the mathematics placement examination 3 credits

MEC 160-E Introductory Nuclear Science and Technology
Introduces the basic concepts of nuclear science. Topics include basic atomic structure; isotopes; mass-energy equivalence; binding energy; decay of radionuclides; nuclear reactions; fission and fusion; the interaction of radiation with matter; and biological effects of radiation. Discusses nuclear science concepts in the context of relevant applications such as nuclear medicine and imaging, nuclear power, radioactive waste, food irradiation, and weapons. Not intended for science majors. Prerequisite: MAT 123 or level 4 on the mathematics placement examination 3 credits

MEC 200 Technical Communication in Mechanical Engineering
Introduction to technical writing and oral communication with topics chosen from mechanical engineering. Includes technical memo and report writing and an introduction to researching sources of information. Emphasizes the development of oral presentation skills. Prerequisite: MEC major; U2 standing 1 credit, S/U grading