

## Upper Division Courses

**108. Experimentation and Investigation Techniques in Science.** Practical research activities in selected areas of science. Application of science skills and knowledge to problems. (Prereq: Instructor consent. CR/NC grading. 3 units)

**125. Selected Science Forum Topics.** Selected scientific knowledge applied to modern problems in society such as space program, pollution, energy crisis, life issues. (3 units)

## Physical Science

### Lower Division Courses

**10. Introductory Physical Science.** Static and current electricity, magnetism and electromagnetism: elements, compounds, and chemical change; architecture of atoms and atomic energy; nature of matter and physical change; mechanics of force and motion. (Lecture 2 hrs/lab 3 hrs. 3 units)

**15. Molecules in Action.** Energy, the nature of matter, historic and contemporary perspective of human impact on environment. Scientific principles applied in familiar situations. (3 units)

**\*20. Principles of Physical Science.** Earth science topics for nonscience majors. Aspects of geology, astronomy, light, meteorology, and heat. (Lecture 2 hrs/lab 3 hrs. 3 units)

**30. Physical Science.** Laws and principles of physics and chemistry applied to functions of the human body. Includes measurement, metric system, mechanics, electricity, atomic structure, inorganic and organic chemistry. (Lecture 2 hrs/lab 3 hrs. 3 units)

### Upper Division Courses

**101. Foundations of Physical Science.** Tracing the development of such generalizations as Newton's laws of motion and gravitation, thermodynamics, electromagnetism, principles of physical geology, and recent advances in nuclear physics. Not for science majors. (3 units)

**180. Individual Studies.** Work, under guidance, in special fields. (Prereq: Instructor consent. CR/NC grading. Repeatable for credit. 1-4 units)

## Mathematics and Computer Science Department

### Curricula Offered:

- BA—Mathematics
  - Concentrations—
    - Computer Science
    - Statistics
- Minor—Mathematics
- Credential—Single Subject Instruction

Office: MacQuarrie Hall

Phone: 277-2411

Professor MITCHEM (Chair), Professors BILLIK, BRADSHAW, BURKE, BYRD, DOLBY, EDGAR, FEINSTEIN, FELDMAN, FITTING, GILES, LANGE, LARSEN, LOVAGLIA, POST,

\* Fulfills General Education.

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PRESTON, PRUITT, SMART, STERN, SWANN, THORO, WREDE; Associate Professors AGOSTON, BEESON, BLOCKUS, DAY, GRAVES, JACKSON, KELLUM, PETERSON, PHILLIPS, POSNER, SCHMEICHEL, SCHWEITZER, SILLS, SMORYNSKI, WEDDINGTON; Assistant Professors ANDERSON, FLOYD, FOSTER, GOLDSTON, HAYES, KOCAK, KUBELKA, PEARCE, PENCE, PFIEFER, NARODITSKY, SENGUPTA, SIMONS, SMITH.

The goals of the Mathematics and Computer Science Department directly related to its degree programs and course offerings are the following:

1. The preparation of students for positions in the private and public sectors through the B.A. concentrations in statistics and computer science.
2. The preparation of students for further graduate study.
3. The training of secondary and junior college teachers through the B.A. and M.A. programs and the selection and supervision of student teachers.
4. The granting of minors to accompany all university majors and teaching credentials.
5. Offering General Education courses and service courses for science, engineering, business, social science, and elementary education programs.

In essence, the Mathematics and Computer Science Department provides a vigorous intellectual center for the mathematical life of the University.

### Honors Program in Mathematics

The requirements for mathematics majors to graduate with departmental honors are: (1) at least a 3.0 G.P.A. overall, (2) at least a 3.5 G.P.A. in mathematics, and (3) completion of at least one Honors Seminar and recommendation of that instructor.

The Department also may offer a lower division honors program extending over a period of four semesters.

### B.A. Mathematics

The B.A. Degree in Mathematics is recommended for students who plan to become teachers or plan further study in mathematics. The program is sufficiently flexible so that applied mathematics can be emphasized in preparation for industrial work. A degree in mathematics is also excellent preparation for graduate work in numerous other disciplines.

	Semester Units
General Education (total University requirement 48 units) ..	39
Of the 48 units required by the University, 3 units in quantitative reasoning and 6 units in laboratory science (physical science) are met by completing mathematics requirements, and 39 are met by other General Education courses.	
Physical Education .....	2
Requirements in the Major.....	37-41
Math 30 (or 20), 31 (or 21), 32.....	10-14
Upper division mathematics, to include Math 112A or 115; Math 131A or 112B; 6 units from Math 127, 128, 129A and 129B, and not to include Math 106 and certain special courses, such as institute courses, not listed in this catalog .....	27
Supporting Courses Required.....	6-8
One year of calculus-based physics. On prior approval this may be replaced by 6 units of upper division mathematics related courses from other departments. However, the student must then complete the regular General Education Science program.	
Electives .....	34-40
Total Units Required for Degree .....	124

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## B.A.—Mathematics

### Concentration in Computer Science

The Concentration in Computer Science provides a solid background for employment in the computer science field. Graduates typically accept positions as programmer/analysts in government or industry. This option also prepares students for graduate study in computer science.

	<i>Semester Units</i>
General Education (total University requirement 48 units) ..	39
Of the 48 units required by the University, 3 units in quantitative reasoning and 6 units in laboratory science (physical science) are met by completing mathematics requirements and 39 are met by other General Education courses.	
Physical Education ..	2
Requirements for the Major ..	43-48
Math 30 (or 20), 31 (or 21), 32, 45 ..	13-17
Upper division mathematics to include Math 113, 115, or 116; Math 129A; Math 131A or 112B; Math 142 ..	
	12
Two of the following groupings ..	10-11
Math 144P and 145; Math 140 and 147; Math 144F and one of Math 143C, 143M; Math 144L and one of Math 156, 171.	
Eight additional units of upper division courses from the Department of Mathematics and Computer Science, not to include Math 106 and certain special courses not listed in this catalog.	
	8
Supporting Courses Required ..	6-8
One year of calculus-based physics. On prior approval this may be replaced by 6 units of upper division mathematics related courses from other departments. However, the student must complete the regular General Education Science program.	
Electives ..	27-34
Additional courses in the Department of Mathematics and Computer Science are strongly encouraged.	
Total Units Required for Degree ..	124

The computing facilities at SJSU include three timesharing systems; a CDC Cyber 730/760 running the Network Operating System, a PDP 11/70 running DEC's RSTS/E operating system, and a PDP 11/45 running UNIX.

The Department of Mathematics and Computer Science has two microcomputer laboratories for students. These labs are supplied with 22 North Star advantages running CP/M, 5 Apples, and an assortment of 10 other machines.

## B.A.—Mathematics

### Concentration in Statistics

The Concentration in Statistics provides not only the basis for an entry level position in government or industry, but also a fine preparation for the student interested in advanced study in statistics, probability, or many other fields.

	<i>Semester Units</i>
General Education (total University requirement 48 units) ..	39
Of the 48 units required by the University, 3 units in quantitative reasoning and 6 units in laboratory science (physical science) are met by completing mathematics requirements and 39 are met by other General Education courses.	

Physical Education ..	2
Requirements for the Major ..	37-41
Math 30 (or 20), 31 (or 21), 32 (Math 44 or 45 strongly recommended.) ..	
	10-14
Upper division mathematics, to include Math 129A; 131A or 112B; 142; and one of 113, 115 or 116. Math 161, 162, 163 and 164. Three additional units of upper division courses from the Department of Mathematics and Computer Science not to include Math 106 and certain special courses such as institute courses not listed in this catalog ..	
	27
Supporting Courses Required ..	6-8
One year of calculus-based physics. On prior approval this may be replaced by 6 units of upper division mathematics related courses from other departments. However, the student must then complete the regular General Education Science Program.	
Electives ..	34-40
Total Units Required for Degree ..	124

## Minor—Mathematics

	<i>Semester Units</i>
Minor Requirements ..	18
Math 31 (or 21)† or their equivalent (3-5); upper division mathematics (9); other mathematics electives, upper division or lower division (4-6).	

(The following courses may not be counted toward the minor in mathematics: Math 106 and certain special courses such as institute courses not listed in this catalog.)

Students who hold a Single Subject Instruction Credential in a field other than Mathematics should contact a Mathematics and Computer Science Department teaching minor advisor for information concerning a "Dixon Act" minor (Supplementary Authorizations) in Mathematics.

## Restriction on Enrollment for Credit

Enrollment for credit in Math 5, 7, 8, 10, 12, 70, 71, and 106 will not be allowed for student who have received credit in Math 20, 21, 29, 30, 31, 32, unless the particular course in question must be taken in order to fulfill major, minor or credential requirements.

## Lower Division Courses

**4. Mathematics for the Non-Scientist.** For those anxious about mathematics. Introduces set theory, linear equations, statistics, and mathematical modeling in various non-science disciplines. (Units completed do not carry graduation credit. CR/NC grading. 3 units)

**5. Introductory Algebra.** Sets, numbers, and relations; equations in one and two variables; systems of linear equations; polynomials, factors, and rational expressions; quadratic functions and simple geometric concepts. (Units completed do not carry graduation credit. CR/NC grading. 4 units)

**7. Intermediate Algebra.** Review of Math 5. Systems of equations, determinants, quadratic relations, complex numbers, exponents and logarithms, polynomial functions. (Pre-req: Math 5 or one year of high school algebra or instructor consent. 4 units)

† Math 30 does not have to be taken if a grade of "B" or better is received in Math 71.

**8. College Algebra and Trigonometry.** Polynomial, rational, exponential, logarithmic, circular, and trigonometric functions; multiple angle formulas and other trigonometric identities; complex numbers and systems of equations. (Prereq: Two years of algebra and one year of geometry in high school or Math 7 or instructor consent. 3 units)

**\*10. Mathematics for General Education.** Methods of proof. Probability and statistics, problem solving, applications to scheduling and apportionment, population studies, theory of games, polyhedra and networks, graph theory, linear programming. (Prereq: One year of high school algebra or Math 5 and satisfaction of ELM requirement. 3 units)

**\*12. Number Systems.** The structure of the real number system, numeration systems, elementary number theory, and problem solving techniques needed for elementary mathematical applications. (Prereq: One year each of high school algebra and high school geometry, or instructor consent and satisfaction of ELM requirement. 3 Units)

**\*20. Analytic Geometry and Calculus I.** The content of Math 30 together with the first half of Math 29. Topics include coordinate systems, the line, conic sections, limits, differentiation, integration, and applications. (Prereq: Math 8 or satisfactory score on Calculus Placement Exam, or instructor consent. 5 units)

**21. Analytic Geometry and Calculus II.** The content of Math 31 together with the second half of Math 29. (Prereq: Math 30 or 20 or 40, or a grade of A or B in 71, or instructor consent. 5 units)

**\*29. Analytic Geometry.** Coordinate systems, the straight line and conic sections, higher plane curves, parametric equations, vector algebra, solid analytic geometry. (Prereq: Math 8 or equiv. or instructor consent. 4 units)

**\*30. Calculus I.** Introduction to calculus. Includes limits, continuity, differentiation, integration, and applications. (Prereq: Math 29, or satisfactory score on the Calculus Placement Exam, or instructor consent. 3 units)

**31. Calculus II.** Differentiation and integration of transcendental functions. Applications of the derivative and integral. (Prereq: Math 30 or 20 or 40, or a grade of A or B in 71, or instructor consent. 3 units)

**32. Calculus III.** Partial derivatives, multiple integrals, infinite series, and vector calculus. (Prereq: Math 31 or 21, or instructor consent. 4 units)

**\*39. Modern Mathematical Techniques.** Mathematics of counting, discrete probability, vectors and matrices, systems of linear inequalities, Markov chains, difference equations. (Prereq: 3 years of high school mathematics, including trigonometry, or instructor consent. 4 units)

**40. Calculus for the Biological Sciences.** Introduction to calculus, emphasizing life science applications. Includes differentiation, integration, and introduction to differential equations. (Prereq: Math 39 or instructor consent. 3 units)

**\*44. Introductory Programming in BASIC.** Computer programming and problem solving using the BASIC language. Algorithms and mathematical models, searching and sorting, other non-numeric applications, extensive programming experience. (Prereq: Trigonometry, or Math 10 or 12 or 70, or instructor consent. 3 units)

\* Fulfills General Education.

**45. Introduction to Computers and Programming.** Problem solving, algorithm development and high level language programming. Basic concepts of structured programming. Designing, coding, debugging, and documentation of programs. Numerous programming assignments. (Prereq: Math 30 (or 20) or concurrent enrollment in Math 30 or instructor consent. 3 units)

**\*70. Finite Mathematics.** Systems of linear equations and inequalities, matrices, set theory, and probability theory, applications to business and to social sciences. (Prereq: High school Algebra II or Math 7, or instructor consent. 3 units)

**\*71. Calculus for Business and Aeronautics.** Functions and graphs, limits, continuity, differentiation, integration, partial differentiation. Emphasis on business and economics applications. (Prereq: Math 70 or 3 years of high school mathematics including trigonometry, or instructor consent. 3 units)

### Upper Division Courses

**104. History of Mathematics.** Mathematical development from earliest times to the 20th Century. (Prereq: Upper division algebra or geometry course, or instructor consent. 3 units)

**106. Intuitive Geometry.** Introductory geometry, measurement, constructions, congruence, coordinate geometry, computer literacy, introduction to statistics and probability, introduction to transformations. (Prereq: Math 12 or instructor consent. 3 units)

**112A. Vector Calculus.** Algebra and calculus of vectors, metric structure of Euclidean space, transformations, vector fields, integration, and applications, introduction to Cartesian tensors. (Prereq: Math 32 or instructor consent. 3 units)

**112B. Advanced Calculus.** Calculus of several variables; Frechet derivative, Jacobian, inverse and implicit function theorems, change of variables in integration and selected topics. (Prereq: Math 112A or instructor consent. 3 units)

**113. Differential Geometry.** Properties of curves and surfaces, Frenet-Serret formulas and the fundamental forms. Study of curves and surfaces in the small by means of differential calculus. (Prereq: Math 32 and 129A or instructor consent. 3 units)

**115. Modern Geometry and Transformations.** Synthetic and analytic theory of projective transformations, similarities, Euclidian motions, inversive geometry. (Prereq: Math 31 (or 21) or instructor consent. 3 units)

**116. Geometry for Computer Graphics.** Two and three dimensional vector geometry, geometric transformations, geometry of curves and surfaces. Applications to algorithms for displaying curves and surfaces (clipping, hidden line and surface removal, intersections), representation of three dimensional objects, digital topology. (Prereq: Math 32, 129A and one of Math 144F, 144P; or instructor consent. 3 units)

**127. Applied Algebra.** Group theory, group codes, Boolean algebras, finite state machines, finite fields, linear finite state machines. (Prereq: Math 129A or instructor consent. 3 units)

**128. Algebraic Structures.** Groups, rings, and fields, their structures and morphisms, including quotient groups, transformation groups, ideals, quotient rings, integral domains, field extensions. (Prereq: Math 129A or instructor consent. 3 units)

\* Fulfills General Education.

- 129A. Linear Algebra I.** Matrices, systems of linear equations, vector spaces, vector geometry, linear transformations. (Prereq: Math 31 (or 21) or instructor consent. 3 units)
- 129B. Linear Algebra II.** Continuation of Math 129A. Linear transformations and matrices, eigenvectors and eigenvalues, decomposition of matrices, inner product spaces, applications. (Prereq: Math 129A or instructor consent. 3 units)
- 131A. Introduction to Analysis.** Properties of real numbers including completeness and compactness. Continuous functions, uniform continuity, the derivative. (Prereq: Math 32 or instructor consent. 3 units)
- 131B. Introduction to Real Variables.** The theory of the Riemann integral, sequences and series of functions, spaces of functions. (Prereq: Math 131A or instructor consent. 3 units)
- 133. Differential Equations.** Ordinary differential equations; numerical solutions. (Prereq: Math 32 or instructor consent. 3 units)
- 140. Assembly Language and Computer Organization.** Number bases, representation of instructions and data, data conversion, stacks and other elementary data structures, subroutines, recursion, coroutines, input/output handling, traps, macros. Considerable assembly language programming. (Prereq: One of Math 144F or 144P or 144L. 3 units)
- 141. Boundary Value Problems.** Partial differential equations of physics and engineering, Fourier series, Legendre polynomials, Bessel functions, orthogonal functions, the Sturm-Liouville equation. (Prereq: Math 133 or instructor consent. 3 units)
- 142. Introduction to Combinatorics.** Sets, permutations, combinations, probability, mathematical induction, counting techniques, generating functions, partitions, recurrence relations, inclusion-exclusion. Polya's theorem and applications to computer science, mathematics, engineering, and physical sciences. (Prereq: Math 32 or 129A or instructor consent. 3 units)
- 143C. Numerical Analysis.** Numerical solutions to equations of one variable, problems in approximation theory, differentiation, integration, and differential equations. Topics include: interpolation, difference equations, interval analysis, and error analysis. (Prereq: Math 32 and 144F, or instructor consent. 3 units)
- 143M. Numerical Analysis.** Numerical solutions to systems of linear equations, linear least squares problems, eigenvalue and eigenvector problems. Methods include Gauss-Jordan elimination, Seidel iteration, QR algorithm and linear optimization. (Prereq: Math 129A and 144F, or instructor consent. 3 units)
- 144F,L,M. Programming Languages.** Technical details of programming languages and computer systems. (F) FORTRAN; (L) LISP; (M) Micro Computer Systems. (Prereq: Math 31 (or 21) and 45, or instructor consent. 2 units each)
- 144P. PASCAL.** User-defined and standard data types including Boolean, integer, real, character, array, string, file, sets, records, pointers. Recursion, procedures, parameters, control structures. Numerous programming assignments. (Prereq: Math 45 or instructor consent. 2 units)
- 145. Advanced Programming.** Major programming projects involving implementation of data structures. Advanced programming techniques, including block-structured programming, top-down design, debugging, testing, error trapping, documentation, text and file manipulation. (Prereq: Math 146. 3 units)
- 146. Introduction to Data Structures.** Theory of algorithms and recursion. Representations of arrays, sets, records lists, queues, stacks, trees, graphs, strings, hashing, searching and sorting, introduction to memory management and files. (Prereq: Math 144P. 3 units)
- 147. Machine Structures.** Abstract machines and realizations of abstract machines, architecture and organization of computers, primitive operations and man-machine interfaces. Extensive assembly language programming. (Prereq: Math 142 and Math 140 (or concurrent enrollment in Math 140) or instructor consent. 3 units)
- 148. Complex Variable.** Analytic functions, complex integration, residues, and power series. (Prereq: Math 32 or instructor consent. 3 units)
- 149. Introduction to Operating Systems.** Fundamentals: Contiguous and non-contiguous memory management; processor scheduling and interrupts; concurrent, mutually exclusive, synchronized, and deadlocked processes; files. Substantial programming project required. (Prereq: Math 147 or instructor consent. 3 units)
- 151. Theory of Numbers.** Divisibility, prime numbers, congruences of first and higher degrees, theorems of Fermat, Euler, and Wilson, quadratic residues. (Prereq: Math 31 (or 21) or instructor consent. 3 units)
- 153. Concepts of Compiler Design.** Theoretical aspects of compiler design, including parsing context free languages, lexical analysis, translation specification, and machine-independent code generation. Programming projects to demonstrate design topics. (Prereq: Math 145 or instructor consent. 3 units)
- 155. Introduction to the Design and Analysis of Algorithms.** Algorithm design, O-notation, recurrence relations, average case behavior, fast Fourier transform, NP-completeness. Analysis of searching, sorting, and graph algorithms. (Prereq: Math 146 and 142 or instructor consent. 3 units)
- 156. Introduction to Artificial Intelligence.** Basic concepts and techniques of artificial intelligence: Problem solving, search strategies, game playing. Topics include natural languages, vision systems, and robotics. (Prereq: Math 144L or instructor consent. 3 units)
- 157. Introduction to Data Base Management Systems.** Concepts and structures for implementation of data base management systems; file and data organization; descriptions, integrity, and reliability of data models; query languages; design strategies. (Prereq: Math 146 or instructor consent. 3 units)
- 161. Applied Statistics.** Data classification, comparability and comparison, bases for analysis in one-way tables, standard comparisons and displays, analysis of n-way tables, transformations, linear and non-linear curve fitting, analysis of variance. (Prereq: Math 31 or instructor consent. 3 units)
- 162. Probability and Computation.** Random sequences, simulations, relative frequencies and probability in the Bernoulli case, use of pseudo-random numbers, probabilistic solutions to computing problems, queueing theory. (Prereq: Math 31 or instructor consent. 3 units)

**163. Introduction to Probability and Statistics.** Probability axioms; random variables; marginal and conditional density and distribution functions; binomial, geometric, Poisson, gamma, and normal probability laws; mathematical expectations, moment generating functions; and limit theorems. (Prereq: Math 32 or instructor consent. 3 units)

**164. Mathematical Statistics.** Sampling distributions, interval estimation, confidence intervals, order statistics, sufficient statistics, the Rao-Blackwell Theorem, completeness, uniqueness, point estimation, maximum likelihood, Bayes' methods, testing hypothesis. (Prereq: Math 163 or instructor consent. 3 units)

**171. Foundations of Mathematics and Computer Science.** Fundamental and unifying principles of logic and computation. Introduction to mathematical logic for the mathematician and computer scientist. (Prereq: Upper division algebra or instructor consent. 3 units)

**175. Introduction to Topology.** Set theory, topological spaces and separation axioms, completeness, compactness, connectedness, functions and continuity, product spaces. (Prereq: Math 131A or instructor consent. 3 units)

**177. Linear and Non-Linear Programming.** Linear inequalities; the simplex method and other algorithms, duality, integer programming, convex programming, quadratic programming, game theory. (Prereq: Math 129A or instructor consent. 3 units)

**179. Introduction to Graph Theory.** Hamiltonian and Eulerian properties, matching, trees, connectivity, coloring problems, and planarity. Emphasis on algorithms and applications, including optimal network flows. (Prereq: Math 129A or 142, or instructor consent. 3 units)

**180. Individual Studies.** Individual study in a specific field. (Prereq: Department chair approval. CR/NC grading. Repeatable for credit. 1-4 units)

**195. Honors Seminar.** Subject matter determined by instructor and departmental honors committee. At least one Honors Seminar is required for graduation with honors in mathematics. (Prereq: Junior standing and instructor consent. 3 units)

## Mathematics Education

**MthEd. 166. Pre-Professional Experience.** Participation in a tutoring program for lower division mathematics students or serving as teacher assistant. Instruction appropriate to tutoring. (CR/NC grading. Repeatable for a maximum of 6 units. 1-3 units)

**MthEd. 184Y. Student Teaching III—Classroom Teaching.** Minimum 80-120 class periods of classroom teaching, laboratory or field teaching in appropriate single subjects, grades K-12, and related teaching activities and seminar. (Prereq: Joint approval of major and education departments. CR/NC grading. 4-6 units)

**MthEd. 184Z. Student Teaching IV—Classroom Teaching.** Same as 184Y, but in a different subject or may be in a different school, and will be at a different grade level. (CR/NC grading. 4-6 units)

**MthEd. 394. Secondary School Mathematics.** The place and function of mathematics in secondary education, improvement and evaluation of instruction, and teaching the subject matter of secondary mathematics. (3 units)

## Meteorology Department

### Curricula Offered:

BS—Meteorology  
Minor—Meteorology

Office: Duncan Hall 620

Phone: 277-2311

Professors RIEGEL (Chair), BORNSTEIN, GOODMAN, LESTER, MACKAY, READ, WANG.

The offerings of the Meteorology Department are directed both to those who plan a career in this field and to those who wish to add a minor in Meteorology to a related major.

### Honors Program

Students may apply through their advisor for the Honors Program in Meteorology after completion of their third year. To be eligible, students must have an overall average of 3.0 and an average of 3.0 in the meteorology courses taken. Under the supervision of a faculty member, a student enrolled in the honors program undertakes a research project, the results of which are published as a thesis. Details about the program can be obtained in the department office.

### B.S.—Meteorology

This four-year program is designed to develop meteorologists who, upon graduation, are ready to begin professional practice in industry or government or to enter graduate programs in atmospheric science.

	<i>Semester Units</i>
General Education (total University requirement 48 units) ..	33
(Of the 48 units required by the University, 15 units are satisfied by completion of the supporting courses for the major and 33 units are met by other General Education courses.)	
Physical Education .....	2
Requirements for the Major .....	51
Metr 50, 60, 61, 100WA, B, 121A,B, 123, 124, 136, 163, 170A,B, 171A,B, plus at least two of the following: 130, 131, 135, 160, 172	
Supporting Courses Required .....	29
Chem 11A (Lecture only, see advisor) .....	4
<sup>1</sup> Math 30, 31, 32, 133 .....	13
<sup>2</sup> Phys 50, 51, 52 .....	12
Electives .....	9
At least three of these elective units are to be selected from upper division courses in Meteorology, Physics, Mathematics, Computers or Chemistry in consultation with the advisor.	
Total Units Required for Degree .....	124

### Minor—Meteorology

	<i>Semester Units</i>
Minor Requirements .....	16
Metr 60, 61, 170A, 170B and upper division electives selected in consultation with a Meteorology Department advisor.	

<sup>1</sup> Those students who are unprepared to begin with Math 30 may substitute Math 20, 21, 32, 133 (17).

<sup>2</sup> Qualified students may substitute Phys 60, 61 (10 units).