MATH 0018 - THE NATURE OF MATHEMATICS

SECTION A

1. Division: Sciences & Mathematics
2. Subject Code: MATH
3. Course Number: 0018
4. Course Title: THE NATURE OF MATHEMATICS
5. Semester of First Offering: FALL 2013

SECTION B General Course Information

1.Units: 3.0 **Variable Units:** N/A
2.This Course is: Degree-Applicable Credit - Transferable
3A. Cross-List: **3B. Formerly:**

Course Format and Duration

4. Standard Term Hours per Week

Lecture/Discussion:	3
Lab:	
Activity:	
By Arrangement:	
Total Hours per Week:	3

5. Standard Term Total Semester Hours

Lecture/Discussion:	54
Lab:	
Activity:	
By Arrangement:	
Total Hours :	54

6. Minimum hours per week of independent work done outside the class: 6

Course Preparation - (Supplemental form B required)

7a. Prerequisite(s): (Course and/or other preparation/experience that is REQUIRED to be completed previous to enrollment in this course.)

Two years of high school algebra or MATH D with grade of "C" or better, or placement by matriculation assessment process

7b. Co-requisite(s): (Courses and/or other preparation that is REQUIRED to be taken concurrently with this course.)

7c. Advisory: (MINIMUM preparation RECOMMENDED in order to be succesful in this course. Also known as "Course Advisory".)

Catalog Description And Other Catalog Information:

8. Repeatability: **Not Repeatable**

Please note: Repeatability does not refer to repeating courses because of substandard grades or a lapse of time since the student took the course. A course may be repeated only if the course content differs each time it is offered and the student who repeats it is gaining an expanded educational experience as stipulated in Title V.

- ☐ Skills or proficiencies are enhanced by supervised repetition and practice within class periods.
- ☐ Active participatory experience in individual study or group assignments is the basic means by which learning objectives are attained.
- ☐ Course content differs each time it is offered.

Explanation for above repeatability selection:

9a. Grading Option: Standard Grade

9b. Catalog Description:

Introduces students to the art and application of mathematics in the world around them. Topics include mathematical modeling, voting and apportionment, and mathematical reasoning with applications chosen from a variety of disciplines. Not recommended for students entering elementary school teaching or business.

Course Outline Information

10. Student Performance Objectives: (Performance objectives for all credit courses must indicate that students will learn critical thinking and will be able to apply concepts at college level.Performance objectives must be related to items listed in Section 11.)

a. Solve college level math problems from a variety of different mathematical subject areas, especially topics not usually covered in a traditional mathematics course.
b. Analyze given information and develop strategies for solving problems involving mathematical and logical reasoning.
c. Recognize and apply the concepts of mathematics as a problem-solving tool in other disciplines and contexts.
d. Utilize linear, quadratic, exponential, and logarithmic equations, systems of equations, and their graphs to analyze mathematical applications from various disciplines.
e. Compare and contrast apportionment methods and voting systems, using an appropriate level of mathematics to support any conclusions.

11. Course Content Outline: (Provides a comprehensive, sequential outline of the course content, including all major subject matter and the specific body of knowledge covered.)

I. Mathematical Modeling
A. Applications of linear and quadratic functions and graphs, using tools such as regression lines, optimization, and linear programming
B. Exponential and logarithmic function applications such as growth and decay problems, logistic equations, business and financial applications, and resource analysis
C. Modeling with other mathematical tools and algorithms: applications such as symmetry, tilings, fair division, group theory, graph theory, and networks

II. Voting and Apportionment
A. Apportionment Methods
B. Voting systems
1. Mathematics of Voting systems
2. Weighted voting systems

III. Mathematical Reasoning: Development of mathematical reasoning through study of topics such as numeric and geometric patterns, sequences, probability and chance, and combinatorics

IV. Other Topics from Higher Mathematics
A. Modular arithmetic and cryptology
B. Topics from pure mathematics such as logic, set theory, game theory, non-Euclidean and fractal geometry, and chaos theory

12. Typical Out-of-Class Assignments: (Credit courses **require** two hours of independent work outside of class for each lecture hour, less lab/activity classes. List type of assignments including library assignments.)

a. Reading Assignments: (Submit at least 2 examples.)

1. Read selections in the textbook concerning the Fibonacci sequence. Come to class prepared to discuss the everyday places we find Fibonacci numbers and why they might occur in nature so frequently.

2. Read (online) about how the Best Picture Oscar winner is chosen, and compare and contrast this method to one of the voting methods studied in class.

b. Writing, Problem Solving or Performance: (Submit at least 2 examples)

1. Create a weighted voting system with 4 members in which 1 person has veto power. Calculate the Banzhaf Power Index for the system using the textbook's "alternative definition". Compare this system to a voting system with 5 members in which one person equals one vote. Calculate the Banzhaf Power Index for this system and use it in your discussion.

2. Use the Division Algorithm to show that the remainder when a number n is divided by m is equal to the position n would be on a mod m clock.

3. Public Key Encryption: Using the 2 public numbers 7 and 143, encode the following string of numbers: "2 83 3 61 38".

4. Write about the relationship between the Fibonacci sequence and the Golden ratio. How are a Fibonacci spiral and a Golden spiral different?

c. Other (Term projects, research papers, porfolios, etc.)

Mathematically model the blood lead levels of a 10 year old child over time who is enrolled in a school whose drinking water is contaminated with lead. Use Excel to write an affine difference equation composed of an exponential and linear equation. Complete a project that answers the question, "How does the amount of lead increase in the child's bloodstream and how long does it take the child to become poisoned?"

13. Required Materials:

a. All textbooks, resources and other materials used in this course are college level?

- ☑ Yes
- ☐ No

b. Representative college-level textbooks (for degree applicable courses) or other print materials:

Book 1:

Author:	Peter Tannenbaum
Title:	Excursions in Modern Mathematics
Publisher:	Prentice Hall
Date of Publication:	2009
Edition:	7th

c. Other materials and/or supplies required of students:

14.Check all Instructional methods used to present course content:

- ☑ Lecture
- ☐ Discussion Semminar
- ☐ Lab
- ☐ Directed Study
- ☑ Activity
- ☐ Distance Education (requires supplemental form)
- ☐ Work Experience
- ☐ Tutoring

Other:

Give detailed examples of teaching methodology that relate to the course performance objectives:
1. The instructor will have students cast ballots in a preference election in class. The instructor will guide the class as they build a preference schedule and determine the winning candidate using each of the voting methods learned. They will also determine if there is a Majority Candidate and a Condorcet Candidate.

2. Instructor will present two options for mortgages at different interest rates and terms. The students will use formulas and concepts learned in class to calculate total fees and interest paid over the life of each loan option to determine which option is better.

3. After presentation of the "Seven Bridges of Konigsberg" problem, students will create a graph of the situation and use Euler's Circuit Theorem to determine if there is a solution. After Eulerizing the graph, students will apply Fleury's Algorithm to find a circuit.

15. Methods of Assessing Student Learning
15a. Methods of Evaluation:

- ☑ Essay Exam
- ☑ Objective Exam
- ☑ Projects
- ☑ Class Discussion
- ☑ Reports
- ☑ Problem Solving Exam
- ☐ Skill Demonstration
- ☐ Other

15b. (All courses must provide for measurement of student performance in terms of stated student performance objectives, Area 10, and culminate in a formal recorded grade based on uniform standards. Submit at least 2 examples.)

1. In class, we saw that a regular pentagon cannot tile the plane. Suppose you cut the pentagon in half. Can this new shape tile the plane? Explain your answer. Student performance will be measured on correctness of solution, as well as clarity of written explanation.

2. A five-member committee has the following voting system. The chairperson can pass or block any motion that she supports or opposes, provided that at least one other member is on her side. Show that this voting system is equivalent to the weighted voting system [4:3, 1, 1, 1, 1]. Student performance is graded based on correctness and completeness of solution.

SECTION C

1. Program Information:

- ☑ In an approved program
- ☐ Part of a new program
- ☐ Not part of an approved program

2. TOP Code Information

Program Title: Mathematics, General 170100

3. Course SAM Code:

- ☐ A - Apprenticeship Course
- ☐ B - Advanced Occupational
- ☐ C - Clearly Occupational
- ☐ D - Possibly Occupational
- ☑ E - Non-Occupational

4. Faculty Minimum Qualifications/Degrees:

Mathematics

Comments:

SECTION D

General Education Information:

1. College Associate Degree GE Applicability:
Communication & Analytic Thinking
Math Competency

2. CSU GE Applicability:
B-4 Mathematics/Quantitative Reasoning

3. IGETC Applicability:
2: Mathematical Concepts & Quantitative Reasoning

4. CAN :

5. LDTP:

SECTION E

1. Articulation Information: (Required for Transferable Courses Only)

- ☑ CSU Transferable
- ☑ UC Transferable
- ☐ CSU/UC Major Requirement.

If CSU/UC major requirement, list campus and major. (Note: Must be lower division)

2. List at least one community college and its comparable course. If requesting CSU and/or UC transferability also list a CSU/UC campus and comparable lower division course

Sacramento City College College: MATH 300 Introduction to Mathematical Ideas
CSU East Bay: MATH 1110 The Nature of Mathematics
Cal Poly SLO: Math 112 The Nature of Modern Mathematics
UC Riverside: MATH 15 Contemporary Mathematics for the Humanities, Arts and Social Sciences

SECTION F

Planning and Resources: Please address the areas below:

1. Evidence of Need or Potential: recommendations of advisory committee, connection to existing or planned degrees/certificates, or regional/national developments, transfer university requirements.

This course offers students exposure to the power and beauty of mathematics in their everyday lives. It serves as a transferable math course for students with no subsequent math course requirements.

2. Appropriateness to Mission: connection to basic skills, transfer, career technical education, or lifelong learning; relationship

Transfer level math class, especially relevant for students in Liberal Arts degree programs. Also applicable to the AS degree in Mathematics.

3. Place in Program/Department: relationship to student learning outcomes identified by program, connection to general education, or articulation with other institutions.

All four of the SLO's for the math program are addressed and assessed in this course. The course articulates as a transfer level math class with both CSU and UC systems and meets the general education requirement for mathematics/quantitative reasoning.

4. Availability of Faculty and Facilities: minimum qualifications to teach course, special training for instructors, or long-term physical impact of course.

No special training needed, minimum qualifications for mathematics are sufficient.

5. Potential Impact on Resources: impact on library, computer support, transportation, equipment, or other needs

None anticipated.

SECTION G

1. Maximum Class Size (recommended): 35

2. If recommended class size is not standard, then provide rationale: