MATH 0017 - CONCEPTS OF MATHEMATICS

SECTION A

1. Division: Sciences & Mathematics
2. Subject Code: MATH
3. Course Number: 0017
4. Course Title: CONCEPTS 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		**5. Standard Term Total Semester Hours**	
Lecture/Discussion:	3	Lecture/Discussion:	54
Lab:		Lab:	
Activity:		Activity:	
By Arrangement:		By Arrangement:	
Total Hours per Week:	3	**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.)

Three years of high school mathematics which includes two years of algebra and one year of geometry; or MATH D and B with grades 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:

Exploration of mathematical patterns and relations, formulation of conjectures based on the explorations, proving (or disproving) the conjectures. Includes different problem solving techniques, number theory, probability, statistics, sequences and series, and geometry. Intended for students interested in elementary education.

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.)

For each topic, the students will:
1. develop a strategy for approaching problems with which they are unfamiliar;
2. construct clear and logical solutions or proofs for each problem;
3. evaluate orally presented or written solutions for flaws and/or mistakes and correct these flaws or mistakes.

I. PROBLEM SOLVING TECHNIQUES
A. Examine and organize information in unfamiliar problems as an initial approach to solving;
B. construct tables, graphs, and diagrams and utilize as a problem solving technique;
C. utilize algebraic solutions to presented problems, which include systems of equations in solution;

II. NUMBER THEORY
A. Propose, test, debate, and construct a clear, logical, and sound solution to these problems in groups;
B. Solve other problems using the Euclidean Algorithm;

III. SET THEORY
A. Categorize information in a problem into clear sets, subsets, and complementary sets;
B. calculate the number of elements in intersections and unions of sets using Venn Diagrams;

IV. PROBABILITY AND STATISTICS
A. Propose, test, debate, and construct a solution to the Buffon Needle (Noodle) Problem based on experimental data;
B. Solve problems using counting techniques, which include the use of combinatorics;
C. Select the best solution to a problem using probability and expected values;

V. GEOMETRY AND NETWORKS
A. Propose, test, debate, and construct a solution to the Highway Inspector Problem (an adaptation of Eulerian Networks);
B. Design Eulerian and Hamiltonian networks with given numbers of vertices and test them for transportivity;
C. Propose, test, debate, and construct solutions to open-ended problems involving geometry including Sperner's Lemma;

VI. SEQUENCES AND SERIES
A. 1. Propose, test, debate, and construct a solution to the Handshake Problem and its variations, which includes summation of finite series;
2. Create solutions and verify their validity to infinite sum problems in the form of geometric sequences and series;
B. 1. Predict the entries in a sequence by following the pattern in a sequence;
2. Construct a series that correctly represents information in a problem and find its sum, may be finite or infinite.

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.)

Concepts of Mathematics is a course designed to encourage critical thinking skills in students as they explore various investigation topics and open-ended questions. Students will observe patterns, analyze data, make conjectures about these observations and prove (or disprove) their conjectures. Their process and results will be formally communicated in writing and in oral presentations. This course is also designed to show students the beauty of Mathematics, along with providing them with an opportunity to discover the joy and power of mathematical thinking.

I. Problem Solving Techniques
A. Common approaches to problem solving -
look for a pattern, guess and check, convert to algebra
B. Organization of information -
making tables, draw a diagram, use a graph

II. Number Theory
A. Divisibility, greatest common divisor, division algorithm
B. The Euclidean Algorithm, primes

III. Set Theory
A. Sets, subsets, and complements
B. Venn Diagrams

IV. Probability and Statistics
A. Calculate probabilities with Venn Diagrams, counting techniques, appropriate formulae using experimental techniques
B. Calculate statistics with appropriate formulae and using experimental techniques

V. Geometry and Networks
A. Eulerian paths
B. Hamiltonian paths
C. Networks
D. Sperner's Lemma
E. Geometry - tessellation, polygons, polyhedra

VI. Sequences and Series
A. Use of sequences to represent given problem data
B. Use of series to find sums of given problem data

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. Find an internet discussion of Venn Diagrams and come to class prepared to discuss the logic of the Venn Diagram.

2. Read the homework handouts to determine the questions being asked and the work that will need to be done to accomplish the solution.

3. Read a solution to a problem prepared by another group and analyze that solution for correct logic or implied flaws.

4. Read article "Teaching Mathematics Requires Special Skills" by Debbie Ball (or similar article on same topic). Write journal entry and discuss in class.

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

1. Working in groups, develop a possible solution for the "Highway Inspector" network problem. Test the conjecture for accuracy and write up a clear, logical proof for the solution.

2. Within a group that has discovered a flaw with another group's solution to a problem, write a paper indicating how the solution was in error and a proposal on how to fix that error.

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

1. Geometry Group Project - Polyhedra building/investigation dualism, stellating, truncating, and compounds.

2. Collection and organization of experimental data for Buffon Needle (Noodle) problem.

3. Research historical math approaches to various problems given in class, with use of a library or internet.

4. Research mathematicians past or present and give presentation in class, with use of library or internet.

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:	Ignacio Bello, Jack Britton, Anton Kaul
Title:	Topics in Contemporary Mathematics
Publisher:	Houghton Mifflin
Date of Publication:	2008
Edition:	9th

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:

A complete text is not typically used for the class. A text provides too many solutions to problems which are to be considered by the student. Most work is done from class participation, lecture and class hand-outs.

Example 1: The instructor poses a problem, such as the handshake problem: "If everyone in this room shook hands once with every other person in this room, how many handshakes occur?" The students are given time to work in groups to come up with an answer to the problem. The instructor monitors group progress, interjects hints or ideas as they work, and then asks students to share their solutions with the class at the end. The instructor also attempts to help students generalize their answer to a mathematical formula.

Example 2: Students are required to read materials (text, research documents) before coming to class. The instructor has the students discuss the readings with each other in groups. The instructor then allows time for whole-class question and answer and attempts to highlight the essential concepts from the readings. These readings may then be used by the instructor to launch class activities.

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.)

Example 1. On checking 200 students, it is found that 70 are taking French, 40 are taking German, 75 are taking Spanish, 10 are taking French and German, 30 are taking French and Spanish, 15 are taking German and Spanish, and 70 are taking no language. If it is known that no students are taking all three languages, draw a Venn Diagram to determine the answers to each of the following questions:
a) How many are taking two languages?
b) How many are taking only Spanish?
c) How many are taking Spanish and not French?

Example 2. Construct two networks, each with 5 vertices, such that one of them is traversable exactly once, and the other is not. Explain your answer.

Evaluation: Students will be evaluated using the following criteria: 1) Mathematical correctness of their answer, 2) Mathematical correctness of their solution strategy, and 3) effectiveness at communicating mathematical concepts.

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:

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

Yuba College - Math 15A Concept of Mathematics
CSU Sacramento - Math 17 An Introduction to Exploration, Conjecture, and Proof in Mathematics
San Francisco State University - Math 165 Concepts of the Number System
UC Davis - Math 71A Explorations in Elementary Mathematics

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 satisfies a requirement for Elementary Education majors planning on transferring to the CSU school system. Specifically, it prepares them to take Math 107A at CSUS.

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

This course is transferrable and counts toward the Elementary Education degree in the CSU school stystem.

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

This course connects to the mathematics departments' student learning outcomes of creating and interpreting visual models and representations of mathematics as well as effectively communicating mathematical information, concepts, and processes to others.

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

Standard requirements for typical mathematical courses.

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

None.

SECTION G

1. Maximum Class Size (recommended): 32

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