SNAPSHOT OF UNIVERSITY OF CALIFORNIA
"A-G" APPROVAL PROCESS FOR CTE COURSES

California is often regarded as a leading state in the area of career and technical education (CTE). With extensive support from the executive and legislative branches, a history of innovative career academies, a set of established CTE standards and framework, and involved higher education and business communities, CTE is a significant element of California's college- and career-ready (and broader education) reform efforts.

The role of the higher education community, and the University of California system in particular, makes California stand out as a leader in the integration of CTE and academics. California is the only state in the country with a truly statewide system in place for higher education to validate locally- and state-developed high school CTE courses as acceptably meeting high school academic graduation requirements as well as postsecondary admission requirements (otherwise known as the "a-g" curriculum) for the two public, four-year systems of higher education in the state.

About the "A-G" Curriculum

The "a-g" curriculum is the set of required courses for admissions to any institution within the University of California System and the California State University System. While there is no "a-g" diploma, a number of districts – such as San Jose Unified, San Francisco Unified and Los Angeles Unified – have set policies making the college- and career-ready curriculum the default graduation requirements. Currently, about a third of all high school graduates in California complete the" a-g" curriculum.

	SUBJECT	# OF COURSES REQUIRED	REQUIRED COURSES (Or Equivalent)
A	History/Social Studies	2 years	U.S. History and/or Civics and World History, Cultures and Geography
B	English	4 years	Approved courses
C	Mathematics	3 years	Algebra I, Geometry and Intermediate Algebra
D	Laboratory Science	2 years	Biology, Chemistry and/or Physics
E	Language Other than English	2 years	In same language
F	Visual/Performing Arts	1 year	From Dance, Drama/Theater, Music, or Visual Art
G	College-prep elective	1 year	Additional academic course in any of the above subjects

Background

In 1999, the Governor's School-to-Career Advisory Council began the "a-g" Interactive Guide Project to better connect high school and higher education. The "a-g" Guide Project was originally designed to make the "a-g" course approval process more transparent and efficient by clarifying criteria and offering a variety of tools, resources and assistance to California high school educators who wanted their courses to be approved as meeting "a-g" curriculum. Ten years later, the project has proved its value and has been embraced by the state's secondary schools, Department of Education and full UC System.

The "a-g" Guide Project has also provided an opportunity for CTE courses to be validated as offering students more options to complete college-prep courses. For example, since the 2001-02 year, the number of CTE courses accepted for "a-g" approval has increased from 258 to over 9,000, a number fully expected to climb in the future. Pursuant to pro-CTE legislation, the University has developed model uniform academic standards for career technical education courses to provide more guidance to teachers who want their CTE courses approved by UC.

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Over the long range, the plan is to continue to grow and expand upon the Guide Project website by adding new resources in support of the review process. In addition, the University is utilizing a multi-pronged approach to more fully integrate academically rigorous career technical education into the classroom. This three-part strategy includes:

1. Expanding the availability of academically rigorous CTE curriculum by developing industry-specific model courses for statewide use that meet "a-g" subject requirements;
2. Providing workshops, web-based tools and other forms of assistance, such as the Curriculum Integration Program, to those seeking help related to the development and submission of courses for "a-g" approval, and,
3. Ensuring fast and consistent approvals of academically-rich CTE courses so that more CTE classes meet the approval of UC for its "a-g" requirements in all academic subject areas.

The Approval Process

Each year, the University of California System solicits lists of courses from district and school administrators to identify the menu of courses that could be used to meet the System's (as well as California State University systems') admissions requirements – or the "a-g" curriculum. Specifically, University of California admissions staff and subject matter experts review all submissions and approve the courses as an "a-g" subject area course, an "a-g" subject area "honors" course, or an "a-g" academic elective course, taking into consideration (but not limited to):[1]

- The academic rigor of the courses
- Any (and the level of any) pre-requisites
- The level of student work required
- How the subject specific questions were assessed
- The depth of the key assignments
- The instructional materials utilized

Courses may be rejected for various reasons including a lack insufficient academic content, too narrow of a focus or a lack of depth, too much of a focus on career-related skills rather than the academics behind those skills, or lack of sufficient pre-requisites. Once a course is approved, however, it is added to a districts' course list and available to schools throughout the state for use.

Looking Ahead

Over 9,000 CTE courses currently count towards "a-g," yet many of these courses fall under either the "d"- Laboratory Science, "f"- Visual & Performing Arts or "g"- College Prep Elective subject areas. Since certain CTE pathways more easily align with specific subject areas, it has been challenging for educators to find and develop linkages with other disciplines, such as English and math. For this reason, the UC System recently launched the UC Curriculum Integration (UCCI) Institute. The goals of this professional development institute are to engage high school teachers to develop innovative model course outlines that integrate career and technical education (CTE) with the "a-g" curriculum for use statewide, and to develop a cadre of expert teachers and administrators to further the development of these courses. The focus of the first institute, held in May 2010, was on mathematics and finance and business. Once the courses developed through the UCCI Institute are completed and approved, they will be made available for any high school to add on their own "a-g" course list and teach at their school.[2]

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[1] See http://www.ucop.edu/a-gGuide/ag/a-g/a-g_reqs.html for clarity on what UC is looking for in each of the main subject areas in the a-g curriculum.

[2] For more information see: http://www.ucop.edu/ucci/

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Sample Course Description

A. COVER PAGE

Date of Submission (Please include Month, Day and Year):	**July 20, 2006**

1. Course Title **Multimedia Information Technology**	9. Subject Area ☐ History/Social Science ☐ English [X] Mathematics ☐ Laboratory Science ☐ Language other than English ☐ Visual & Performing Arts ☐ Intro ☐ Advanced ☐ College Prep Elective
2. Transcript Title(s) / Abbreviation(s) Multimedia Information Technology	
3. Transcript Course Code(s) / Number(s) **N/A**	
4. School **San Roque School**	
5. District Private	
6. City **Santa Barbara**	10. Grade Level(s) for which this course is designed ☐ 9 ☐ 10 [X] 11 [X] 12
7. School / District Web Site www.sanroqueschool.com	11. Seeking "Honors" Distinction? ☐ **Yes** [X] **No**
8. School Course List Contact **Name:** XXX **Title/Position:** Assistant to the Director **Phone:** XXX **Ext.** XXX **E-mail:** XXX	12. Unit Value ☐ 0.5 (half year or semester equivalent) [X] 1.0 (one year equivalent) ☐ 2.0 (two year equivalent) ☐ Other: _____

13. Is this an Internet-based course? ☐ Yes [X] No

If "Yes", who is the provider? ☐ *UCCP* ☐ *PASS/Cyber High* ☐ *Other* _____

14. **Complete outlines are not needed for courses that were previously approved by UC. If course was previously approved, indicate in which category it falls.**

- [ ] A course reinstated after removal within 3 years. Year removed from list? _____

    Same course title?   [ ] Yes   [ ] No

    If no, previous course title? _____

- [ ] An identical course approved at another school in same district. Which school? _____

    Same course title?   [ ] Yes   [ ] No

    If no, course title at other school? _____

- [ ] Approved Advanced Placement (AP) or International Baccalaureate (IB) course

- [ ] Approved UC College Prep (UCCP) Online course

- [ ] Year-long VPA course replacing two approved successive semester courses in the same discipline

- [ ] Approved P.A.S.S./Cyber High course

- [ ] Approved ROP/C course. Name of ROP/C? _____

- [ ] Approved CDE Agricultural Education course

- [ ] Other. Explain: _____

15. Is this course modeled after an UC-approved course from another school <u>outside</u> your district?   [X] Yes   [ ] No

If so, which school(s)? _____ Westlake High School, Westlake Village _____

Course title at other school Multimedia Information Technology_____

16. Pre-Requisites

Algebra 2, Geometry

17. Co-Requisites

None

18.   Is this course a resubmission?   [ ] Yes   [X] No

If yes, date(s) of previous submission? _____

Title of previous submission? _____

19. Brief Course Description

This course offers an introduction to concepts used in modern engineering projects while reinforcing and introducing the mathematical content key to these projects. Engineering and design examples are drawn from wireless and telecommunications, the Internet, electronic music, and digital imagery. Math content from Algebra 1, Geometry, and Algebra 2 is reviewed, mastered and applied, while content from Trigonometry, Linear Algebra, Probability and Statistics is introduced and also mastered. Students completing the course will have been exposed to and mastered relevant applications of mathematics, while gaining an understanding of the field of engineering.

B. COURSE CONTENT

Please refer to instructions

20. Course Goals and/or Major Student Outcomes

The student is expected to:
- represent information bearing signals as discrete or continuous graphs, and classify signals as periodic or non-periodic;
- understand the mathematical conditions for when a sequence of numbers is precisely equivalent to information bearing signals;
- analyze sinusoidal signals by comparing amplitudes and frequencies, and apply transformations of functions to write equations of specific signals;
- investigate sums of sinusoids and Fourier series, understand how sums of sinusoids approximate general information bearing signals, and apply this computer generated music;
- use logarithms to compare the relative loudness of speech, music, and other general forms of signals, and compute the signal-to-noise ratio of a signal and apply this to the understanding of real-world data;
- observe the effects of exponential growth in information accuracy as the number of bits used in storing information is increased and apply this to the design of digital information acquisition systems;
- use the fundamental counting principle and combinatorics to enumerate possible outcomes and apply this to network design for applications such as wireless and Internet communications;
- use composition of functions in a graphical representation to predict the effects of various engineering operations such as filtering;
- use measures of central tendency (mean, median) in engineering applications and apply this to improving the quality of digital videos and images;
- perform operations in other bases (binary, hexadecimal) and convert to and from base 10 and apply this to computer based mathematical operations;
- use the correct prefixes for both large and small numbers given in scientific notation (ex. kilo, mega, giga, micro) and apply this to presentations of engineering designs;
- use simple matrix operations in a variety of applications (filtering or extracting information from images, correcting errors in digital messages); and
- use polynomials in a variety of applications including encrypting digital information and predicting technology trends;
- encode and decipher digital messages: zip codes, and UPC symbols using modular arithmetic

21. Course Objectives

- The student is exposed to and displays mastery of high-level mathematical concepts.
- The student applies mathematical knowledge to engineering and technology.
- The student develops an understanding of the engineering design process as well as an awareness of the mathematical foundation necessary for success in engineering.
- The student explores the mathematical connections between humans and technology to enhance the human utility of engineering designs
- The student uses a variety of technology devices and mathematical concepts to design, build, and test engineering concepts.

22. Course Outline

1**.** The World of Modern Engineering
   a. Digital versus Analog
   b. The Mathematics that Gave Birth to the Digital Age, Base 2
   c. Bits and Bytes
   d. The Mathematics of Moore's Law
   e. The Power of Doubling, Exponential Growth

2. Creating Digital Music
   a. Sounds and Signals
   b. Using Mathematics to Create a Signal: Sine and Cosine Functions
   c. Pitch, Frequency, and Periodic Signals
   d. Making Melodies with Sinusoids
   e. Making Periodic Signals
   f. Converting from Rectangular to Polar Coordinates

3. Making Digital Images
   a. Components of a Digital Imaging System
   b. Bits per Pixel, Pixels in Images: Areas of Quadrilaterals
   c. Sampling and Quantization
   d. Changes in Dimension
   e. Rigid Motion Transformations
   f. Colormaps

4. Math You Can See
   a. Image Improvement Operations
   b. Image Segmentation
   c. Arithmetic Matrix Operations: Adding and Multiplying Matrices
   d. Mapping
   e. Noise Reduction: Finding Median and Mean Values

5. Digitizing the World
   a. From Information to Numbers
   b. Binary Numbers
   c. The Decibel Scale
   d. Using Logarithms

6. Coding Information for Storage and Secrecy
   a. Compression Ratio
   b. Using Relative Frequency to Compress Information
   c. Arithmetic and Geometric Series
   d. Password, Access, Codes and PIN's: The Fundamental Counting Principal
   e. Rotational Encoding
   f. Permutation Encoding
   g. The Exclusive-OR Operation and Cryptography
   h. Random Number Generators

7. Communicating with Ones and Zeros
   a. Operation of a Simple Communication System

b.   Coordination between Sender and Receiver
c.   Binary Representation for Each Character
d.   Serial Binary Representation for Each Character
e.   Binary Data Streams

8. Networks
   a.   Network Basics/ Graph Theory
   b.   The Mathematics of Complete Graphs: Full Mesh Networks
   c.   The Mathematics of Spanning Trees: Central Relay-Point Networks
   d.   Reducing the Cost of a Network Routing versus Switching
   e.   The Building of the Internet
   f.   Domain Names in Binary Form

23. Texts & Supplemental Instructional Materials

Engineering Our Digital Future
Geoffrey C. Orsak, **Southern Methodist University**
Sally L. Wood, **Santa Clara Univeristy**
Scott C. Douglas, **Southern Methodist University**
David C. Munson, Jr., **University of Illinois**
John R. Treichler, **Applied Signal Technology**
Ravindra Athale, **DARPA**
Mark A. Yoder, **Rose-Hulman Institute of Technology**
© 2004, 528 pp., cloth
Published by Prentice Hall
ISBN: 0-13-035482-1

Supplements:

Engineering Our Digital Future Lab Manual

Algebra 2
© 2003 Glencoe/McGraw-Hill
ISBN: 0-07-827999-2

Advanced Mathematical Concepts, Precalculus with Applications
© 1994 Glencoe/McGraw-Hill
ISBN: 0-02-824286-6

24. Key Assignments

- Regular Homework
- Student based projects to be discussed at the beginning of the year
  - Examples may include producing a DVD of student work
  - Creating a student music piece
  - Projects integrating math content and real life applications
- Four interdisciplinary projects assigned yearly

25. Instructional Methods and/or Strategies

- Direct Instruction: lecture, reading, in-class research, problem sets, presentations, and guest speakers
- Instructional Materials; textbook; experts from the field, and electronic media
- Hands-On Inquiry
- Self-directed, cooperative, and collaborative learning projects
- Instruction adaptable to levels of learning
- Student oral presentations

26. Assessment Methods and/or Tools

Evaluation of student performance is based on individual abilities, interests, and talents. A combination of methods shall be used to assess student progress. The methods available include but are not limited to the following:
- Regular review of work by the Math teacher
- Portfolios
- Teacher observation
- Student demonstrations
- Student work samples
- Written examinations
- Laboratory projects
- Applied concepts projects

C. HONORS COURSES ONLY

Please refer to instructions

27. Indicate how this honors course is different from the standard course.   N/A

D. OPTIONAL BACKGROUND INFORMATION

Please refer to instructions

28. Context for Course (optional)

29. History of Course Development (optional)