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Information/Action

Professional Services Committee

Initial Accreditation and Program Approval

Executive Summary: This agenda item presents proposals submitted by institutions of higher education for subject matter program approval, as well as a proposal submitted by a local education agency for approval of a guidelines-based Alternative Professional Clear Administrative Services Credential program. The agenda item provides background information about the subject matter standards and an overview of the process for reviewing proposals. As requested by the Commission at its August 2005 meeting, this agenda item also includes additional information about two subject matter programs approved by the Commission at that meeting.

Recommended Action: That the Commission act on the Single Subject Matter Preparation Programs in Mathematics and Science: Physics and the guidelines-based program for the Professional Clear Administrative Services Credential.

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Strategic Plan Goal: 1
Promote educational excellence through the preparation and certification of professional educators

- Sustain high quality standards for the preparation of professional educators.
- Assess and monitor the efficacy of the Accreditation System, Examination System, and State and Federal Funded Programs.

Initial Accreditation and Program Approval

Introduction

This agenda item presents proposals submitted by local education agencies and institutions of higher education for single subject matter preparation program approval and guidelines-based Alternative Professional Clear Administrative Services Credential program approval. The agenda item provides background information about the subject matter standards, an overview of the process for reviewing proposals, information about the program proposals, and supporting documentation. This agenda item also includes additional information about two subject matter programs approved by the Commission at its August 2005 meeting.

Education Code §44259 charges the Commission with the responsibility for ensuring that subject matter standards and examinations are aligned with the state content and performance standards for pupils. Education Code §44311 requires the Commission to evaluate any subject matter program offered by an accredited institution on the basis of standards of quality and effectiveness adopted by the Commission. In carrying out these responsibilities, the Commission grants approval to subject matter programs. For the October meeting of the Commission, two subject matter preparation programs are presented for consideration. One guidelines-based program for the Professional Administrative Services Credential is presented for consideration. When the Commission adopted the standards and the guidelines for the Professional Administrative Services Credential program, it required that the guidelines-based programs be approved by the Commission.

I. Subject Matter Preparation Programs

Background

Since its beginning in 1970, the Commission has required the subject matter preparation of teachers to be connected to the curriculum taught in public schools. Through a series of reforms, the Commission has continued to "raise the bar" in how those relationships are to be demonstrated in single subject matter programs. In the 1990s, as the State began raising standards for students in kindergarten through twelfth grade and focusing school curriculum on those standards, policy makers turned to strengthening teacher credentialing requirements to ensure that California teachers would be prepared to help their students meet the new standards. A Commission agenda report in May 2004 provided a historical discussion about Commission-approved subject matter programs (http://www.ctc.ca.gov/commission/agendas/2004-05/may-2004-6A.pdf).

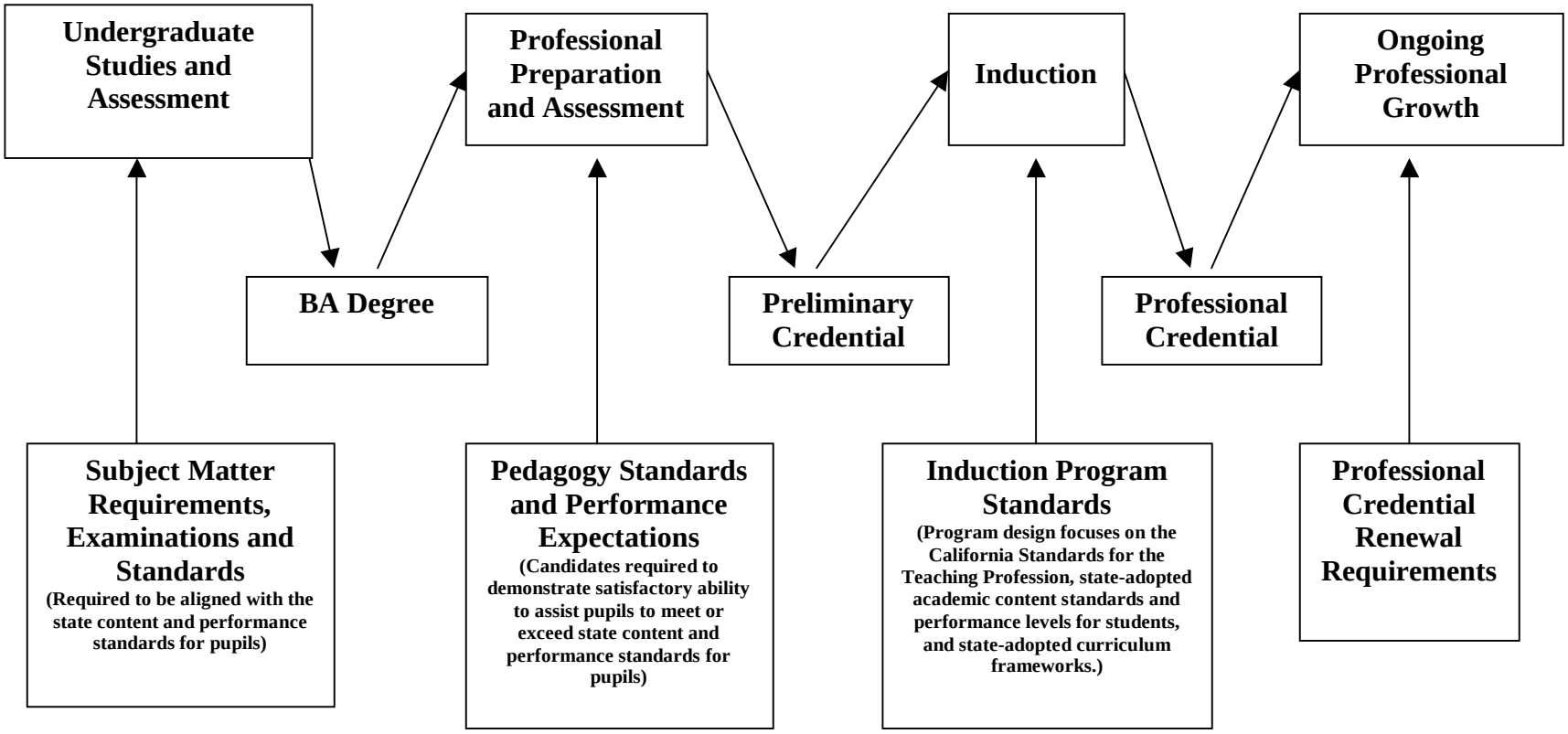
SB 1422 and SB 2042 Teaching Credential Reforms: From 1994-1997, the Commission sponsored a comprehensive review of the requirements for earning and renewing multiple and

single subject teaching credentials, pursuant to SB 1422 (Bergeson, Chap. 1245, Stats, 1992). The SB 1422 Advisory Panel appointed by the Commission examined all facets of the existing credentialing system and developed a series of recommendations aimed at improving the recruitment, preparation, induction and ongoing development of teachers. The Commission received the SB 1422 Advisory Panel report in August 1997. Many of these recommendations were included in the omnibus legislation SB 2042 (Alpert, Mazzoni, Chap. 548, Stats. 1998) that was signed into law in September 1998.

SB 2042 amended Education Code Section 44259 for both multiple and single subject matter programs to require the Commission to ensure "that subject matter program standards and examinations are aligned with the state content and performance standards for pupils." This new mandate more explicitly related the subject matter knowledge required of all prospective teachers directly to what is taught in the K-12 curriculum for each subject matter area. In addition, SB 2042 required professional preparation programs to ensure that each candidate "recommended for a credential or certificate has demonstrated satisfactory ability to assist pupils to meet or exceed state content and performance standards for pupils."

A unique feature of SB 2042 (Education Code Section 44259) was the mandate to develop three sets of program standards simultaneously (Elementary Subject Matter Preparation, Professional Teacher Preparation, and Professional Teacher Induction) so that the three sets of standards would be coherent, would build upon and reinforce each other, and would provide a logical and seamless transition for teacher candidates throughout their subject matter preparation, their pedagogical preparation, and their induction in their first two years of teaching. Thus, for the first time, each phase of teacher education became part of a coherent Learning to Teach system driven by the State's K-12 academic content standards. Following is a diagram that shows the relationships between the components of that system. (Figure 1)

Figure 1: Relationship between the State Student Content and Performance Standards for Pupils and California's Learning to Teach System for the Multiple and Single Subject Credential



Development of Subject Matter Requirements, Examinations and Program Standards: From 1998 to 2001, the 2042 Advisory Committee met to develop recommendations for new standards for the subject matter preparation of multiple subject credential candidates, for the professional preparation of multiple and single subject credential candidates, and for professional teacher induction. To continue implementation of the provisions of SB 2042, the Commission began the work of developing new examinations and revising the single subject matter standards. The work (starting in 2001) was divided into three phases. Phase One included the subject areas of English, Math, Science, and Social Science. Phase Two (starting in 2003) included the subject areas of Music, Art, Physical Education, and Languages Other Than English. Phase Three (starting in 2004) included the subject areas of Home Economics, Agriculture, Business, Health, and Industrial and Technology Education. When the Commission adopts the standards for the Phase Three subject areas, the credential reforms mandated by SB 2042 will be complete.

When developing examinations and standards, the Commission is required to work with education experts for professional advising (Education Code 44225, 44288). Pursuant to Commission policy, the Executive Director of the Commission appointed subject matter panels in each of the single subject areas to advise Commission staff and the examination contractor on the development of new subject matter requirements, program standards, and examinations for these subject areas. Panel members were selected to ensure diverse representation of race, gender, region, and educational entities. The panels consisted of:

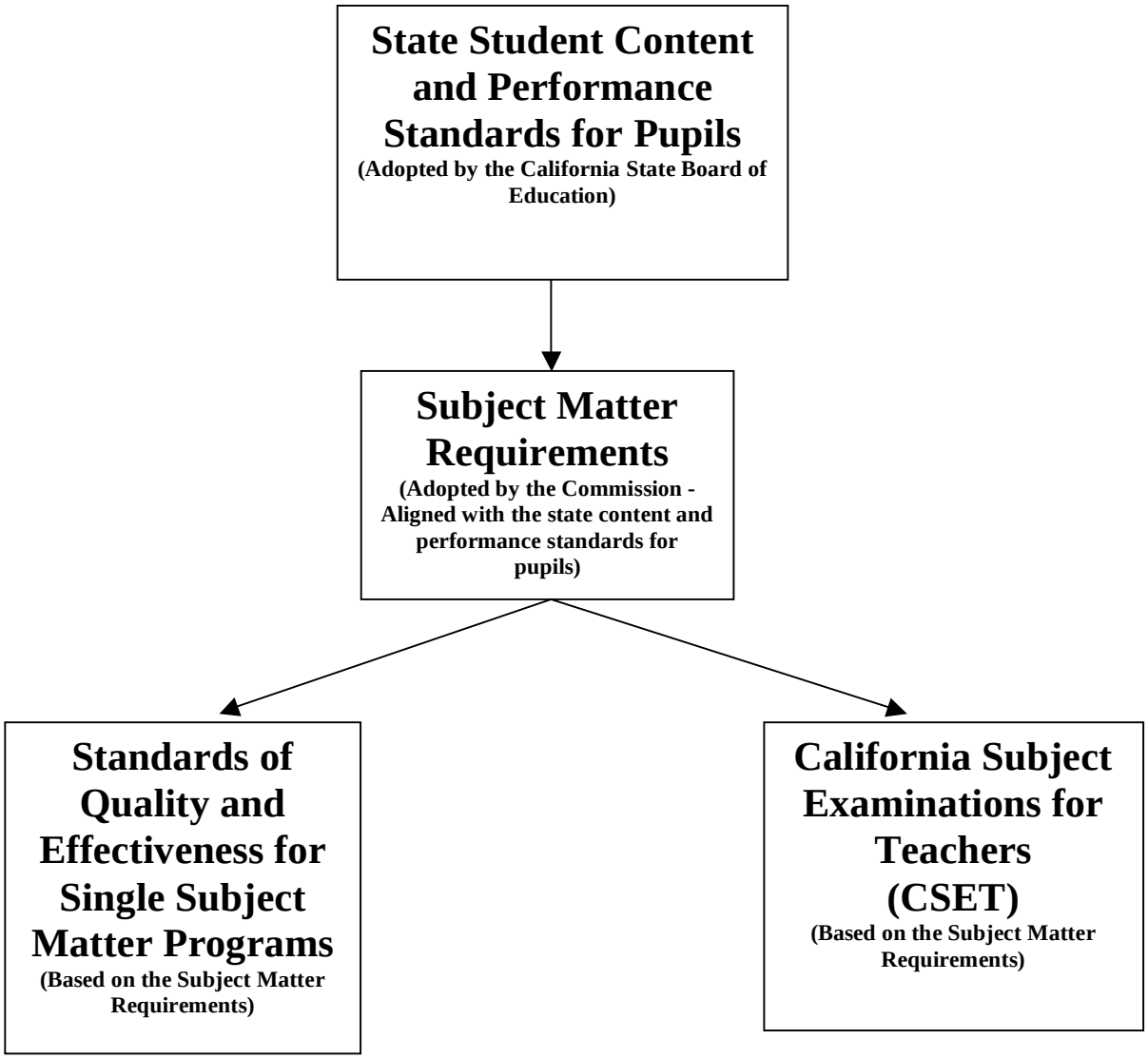
- K-12 Classroom teachers of the subject area,
- Subject area specialists from school districts, county offices of education, and post-secondary institutions,
- Professors in the subject area teaching in subject matter preparation programs,
- Teacher educators,
- Members of relevant professional organizations, and
- Members of other relevant committees and advisory panels.

Under the guidance of Commission staff and the contractor, the panels followed the same general pattern for their work on each phase of the reform. The advisory panels were charged with; (a) developing subject matter requirements (SMRs) that were aligned with the appropriate K-12 academic content standards and curriculum frameworks, (b) using the SMRs to develop new subject matter examinations, and (c) using the SMRs to develop new standards of quality and effectiveness for undergraduate subject matter programs. In this way, the Commission could be assured that its program standards and assessments were aligned with the State's K-12 academic content standards. The SMRs are the subject-specific knowledge, skills and abilities in each subject matter area needed by beginning teachers.

The SMRs specify the content that is to be taught in Commission-approved subject matter programs and tested on the subject matter examinations. It was of critical importance that these SMRs be aligned with the state content and performance standards for pupils. The panels began by drafting content domains for the SMRs that were based on the K-12 student content standards. To show this alignment and to ensure that the SMRs did indeed cover each standard, the K-12 content standards were mapped onto each subdomain of the SMRs. After undergoing an alignment and congruence study, a field review, and panel revisions, the SMRs were brought to

the Commission for approval. Alignment notations to the K-12 standards were placed at the end of each content domain. (See Appendix A for examples of SMRs) Following is a diagram that shows how the state student content standards are related to the Commission's SMRs, examinations and standards. (Figure 2)

Figure 2 – Relationship between State Student Content Standards for Pupils and Commission Subject Matter Requirements, Examinations and Standards



Each panel used the following resource documents in their work. The K-12 Student Academic Content Standards and Frameworks were the *primary* resource used in developing the SMRs and program standards.

- The K-12 Student Academic Content Standards and Frameworks that have been approved by the California State Board of Education.
- The previous Commission-approved Standards of Quality and Effectiveness for Subject Matter Programs.
- The Standards of Program Quality and Effectiveness for the Subject Matter Requirements for the Multiple Subject Teaching Credential
- The Standards for Quality and Effectiveness for Professional Teacher Preparation Programs (SB 2042 Standards).
- Other state and national publications and research articles from the professional literature in a particular subject area.

The State Board of Education-adopted K-12 student academic content standards and frameworks were the seminal documents that guided the panels and the examination contractor, as mandated by SB 2042. However, the panels also used the other resource documents in their work. These documents helped panels establish SMRs that extend the knowledge required by the academic content standards. The panels developed a consistent set of content domains, which became the outline for the SMRs. Although the panels found much of the K-12 student content standards and framework to be consistent with the previous single subject matter standards, they identified important changes that needed to be made to the standards.

Because the Single Subject Credential is a K-12 credential, Standards of Quality and Effectiveness for the Subject Matter Requirement for the Multiple Subject Credential were included as a source document for review. The panel compared the multiple subject content specifications and standards to ensure accurate articulation of the subject matter. The multiple subject standards organization was adopted by the panels to ensure consistency between the sets of standards. Where the panels found parallels in content, the panels adopted some of the multiple subject language. The panels also considered the possibilities of primary and secondary teaching assignments for the single subject credentials with regard to subject matter content. In all resource documents, content for grades six through twelve was particularly noted by the panels, taking into consideration middle grades curriculum, as well as high school curriculum.

For each phase, the Commission adopted SMRs prior to adopting the program standards. This enabled the advisory panels to use the adopted SMRs to develop the subject matter examinations and to develop the program standards in each content area. The panels drafted standards by consensus through democratic dialogue. For the Phase One subject areas (English, Math, Science and Social Science), the Commission adopted the new program standards in January 2003. The new subject matter examinations (CSET) were put in place beginning in January 2003. For the Phase Two subject areas (Music, Art, Physical Education, and Languages Other Than English), the Commission adopted the new program standards in May 2004. The second set of new subject matter examinations were administered beginning fall 2004. For the Phase Three subject areas (Home Economics, Agriculture, Business, Health, and Industrial and Technology Education), the new subject matter requirements were adopted by the Commission in January 2005. The corresponding new program standards are going through the final

development phase and will be presented to the Commission in January 2006. The new Phase Three subject matter examinations will administered for the first time in fall 2005.

Through these standards, all programs are required to offer an undergraduate curriculum to prospective teachers that reflects and builds on the state-adopted content standards for California public schools K-12 and curriculum frameworks for California public schools. The standards further require programs to demonstrate that the program philosophy, design, and intended outcomes are consistent with the content of the State-adopted academic content standards for K-12 students and curriculum frameworks for California public schools. The statement of program philosophy submitted by institutions must show a clear understanding of the preparation that prospective teachers need in order to be effective in delivering academic content to all students in California schools. In addition, the standards require all single subject matter program proposals to demonstrate how the program sponsor works cooperatively with community colleges to ensure that subject matter coursework at feeder campuses is aligned with the relevant portions of the state-adopted academic content standards for California public schools K-12.

The standards include additional requirements to ensure that bachelors degree programs in the specific subject areas are aligned with the content standards and provide opportunities to study and learn advanced concepts that incorporate the curriculum framework. For example, Standard 11 of the Mathematics Subject Matter Program Standards requires programs to assure that each prospective teacher studies and learns advanced mathematics that "incorporates the *Mathematics Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1997)* and the *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999)*" and requires the curriculum of the program to address the *Subject Matter Requirements for Mathematics* adopted by the Commission.

At the time the Commission adopts the program standards, it also adopts the preconditions and an implementation plan that includes a calendar for the submission of new program proposals and the process for review of the proposals. Institutions and staff then follow the adopted implementation plan to transition to the new program standards.

Subject Matter Program Review Procedures

The Commission has historically maintained a practice of helping institutions be successful in meeting its standards. Accordingly, the procedures focus on technical assistance and rigorous review that includes opportunities for sponsors to revise their proposals in response to questions and concerns identified by reviewers. Following are the general procedures for the review of new subject matter programs:

1. Technical Assistance – After the Commission adopts a set of new program standards, Commission staff members provide technical assistance to sponsors wishing to submit responses to the new standards. The technical assistance may take several forms. Staff members may arrange meetings of prospective sponsors to discuss the standards and how to respond to them. Staff members respond to questions from sponsors in e-mails and telephone calls. Occasionally, staff members will provide an informal review of one or

more written responses to standards. Finally, technical assistance materials are provided on the Commission's website.

2. Preconditions Review – After the program proposal is received, Commission staff members review the sponsor's response to the preconditions. The preconditions are based on state laws and Commission policies and do not involve issues of program quality but do address minimum unit and content area requirements. Staff reviews the proposed program to determine that it complies with the requirements of state laws and Commission policies. If the preconditions response is incomplete, the sponsor is requested to provide specific information necessary for compliance with the preconditions. The sponsor may submit the information requested or resubmit the entire proposal with the inclusion of the requested information.

3. Program Review – In addition to the preconditions review, subject matter experts review the program sponsor's responses to each of the subject matter program standards. Unlike the preconditions, the standards address issues of program quality and effectiveness. Each response to the standards is reviewed by content experts drawn from K-12 or postsecondary education to determine the sufficiency of the responses. Reviewers are trained in the standards and the review process and then assigned proposals to review. The training includes analysis of whether the program document and supporting evidence cover all of the subject matter requirements adequately and appropriately to meet the standards. To make this determination, reviewers examine the narrative response to the standards. This is followed by a review of the supporting documentation, including, but not limited to course descriptions, syllabi, lists of textbooks and assigned reading, and additional course materials. If this examination does not conclusively show that the program meets all standards and subject matter requirements, the sponsor is asked to submit additional evidence which may include a matrix mapping the courses to the subject matter requirements which are aligned with the K-12 student content standards. At least two reviewers must come to agreement that a program meets the standards. The program is not submitted to the Commission for approval until the reviewers are satisfied that the program proposal meets <u>all</u> of the Commission's program standards and subject matter requirements.

4. Subject Matter Program Approval – The programs that are deemed by the reviewers to have met all standards and subject matter requirements are submitted to the Commission for approval. After subject matter program approval is granted, the institution may advertise that fact. Graduates of a Commission-approved single subject matter preparation program meet the Commission's subject matter program requirement and are not required to take the subject matter examination (CSET).

Fiscal Considerations of the Subject Matter Program Review Process

The costs of reviewing a prospective subject matter program for initial approval vary. Before a proposal is submitted for review, there may be consultation with one or more Commission staff members. Typically, the consultation could be one to two hours in length. Once the proposal is submitted, staff review is conducted to see if it is complete, if responses to the required

preconditions and standards are satisfactory, and if appropriate supporting evidence is included. If the response is incomplete, the prospective sponsor is notified and given the opportunity to submit additional information. Depending on the thoroughness of the submission, the preconditions review could take as little as one hour of staff time. The full review of a program proposal could take from four to eight hours to review the responses to the standards per reviewer. Again, if the response to the preconditions or standards is deficient, the time necessary to complete the review could increase. Each review requires at least two volunteer reviewers to reach consensus about the response of the program sponsor. Reviewers communicate by a secure web-based communication system or telephone about the results of their individual reviews and come to agreement about the specific review. If reviewers cannot agree upon the program report, another reviewer and/or staff interact with the original reviewers to come to agreement about the response.

Subject Matter Programs Submitted for Consideration

Two programs proposals are submitted for consideration of Initial Subject Matter Preparation Program Approval. Each program was systematically reviewed by subject matter review panels in accordance with the Commission's adopted standards of quality and effectiveness for subject matter programs for the appropriate subject matter area: The *Mathematics Teacher Preparation in California: Standards of Quality and Effectiveness for Subject Matter Programs* and the *Science Teacher Preparation in California: Standards of Quality and Effectiveness for Subject Matter Programs* adopted by the Commission in 2003 (Subject Matter Requirements are included in Appendix A.) Findings were recorded and program sponsors were given opportunities to amend and revise proposals in order to meet the program standards. Following is information about the two programs being submitted.

Request for Initial Subject Matter Preparation Program Approval from University of San Diego in Mathematics

Information from Standard 1 – (The following information was excerpted from the institutional response to Program Standard 1 that asks the institution to describe how its program philosophy and design is related to the Commission's standards and how it reflects and builds on the State-adopted academic content standards for K-12 students and the curriculum frameworks for California public schools.) The development of the Mathematics Single Subject Credential Program at USD was guided by the university's mission statement, the goals of the Department of Mathematics and Computer Science for the mathematics major, and the department's statement on teacher preparation, with attention to the Mathematics Content Standards for California Public Schools, K-12 and the Mathematics Framework for California Public Schools. The required mathematics content courses in the program have been selected so that students take academic courses that cover the content in all of the mathematics subject matter domains commonly taught in K-12 schools: algebra, geometry, number theory, probability and statistics, calculus and the history of mathematics. The required and elective extended studies courses contribute to the students' understanding of the different branches of mathematics, related disciplines and mathematics education. The newly developed capstone course, Math 405 (Advanced Perspectives on Secondary School Mathematics) has been designed to increase

students' understanding of the connections between the branches of mathematics and the connections between higher mathematics and secondary school mathematics.

Course work includes concepts and problem solving within mathematical domains, such as calculus and geometry, as well as the role of mathematical reasoning and proof and the mathematical applications in the development of mathematics and its role in society. The program recognizes that future teachers of mathematics need to develop a profound understanding of secondary school mathematics and be able to understand how mathematics on that level is related to higher and lower level mathematics. The program develops their ability to communicate that understanding and to use appropriate technology.

The coursework requirements for the program are summarized in Appendix B and a matrix chart is included that shows where the domains of the Mathematics Subject Matter Requirements are addressed in the program.

Results of the Review – The review panel has conducted a thorough examination and analysis of the program document and supporting evidence provided by the program sponsor, including the course descriptions, syllabi, and materials and determined that the proposed program meets the subject matter standards and subject matter requirements which are aligned with the K-12 student content standards. During this process the sponsor responded to all of the reviewer's questions and concerns by providing additional information, evidence and changes to the program to insure that of the standards and requirements were fully met.

Request for Initial Subject Matter Preparation Program Approval from California State University, Chico in Science: Physics

Information from Standard 1 – (The following information was excerpted from the institutional response to Program Standard 1 that asks the institution to describe how its program philosophy and design is related to the Commission's standards and how it reflects and builds on the State-adopted academic content standards for K-12 students and the curriculum frameworks for California public schools.) The Academic Content Standards for K-12 students and Curriculum Frameworks for California public schools center on Glenn T. Seaborg's definition of science: "Science is an organized body of knowledge and a method of proceeding to an extension of this knowledge by hypothesis and experiment." The purpose of the General Physics degree at California State University, Chico is to train students in three general areas: 1) the fundamental principles of science across the disciplines of science, 2)In-depth understanding of the principles of physics and a second science and 3) the process of science, that is, how basic principles are elucidated and evaluated. Thus, the program emphasizes theory and practice across the science disciplines.

To accomplish the first purpose of the program, introductory sequences in physics, chemistry, geoscience and biology are required. These are followed by in-depth courses in physics and a second science chosen by the student. In the introductory sequences in physics, chemistry, geoscience and biology, the fundamental laws of nature and how they relate to the individual disciplines in science are presented. The chemistry classes investigate the principles of atomic

structure, chemical bonding, stoichiometry, the periodic table, gases, solids, liquids, solutions and equilibrium. The geoscience courses provide students with a well-rounded exploration of the current scientific understanding of Earth and the cosmos. Students study the composition, active processes, and evolution of a wide variety of systems: the earth's interior and surface, the oceans, the atmosphere, the biosphere and space. In the biological sciences, the introductory sequence emphasizes the common elements of life: ecology, evolution, molecular biology, and genetics.

All of the introductory courses save one include weekly laboratory work. In these settings the third purpose of the program is addressed, the process of science. Here students learn and practice the methods of scientific inquiry that cultivate curiosity, skepticism, objectivity, and observation. Thus, students acquire the skills and habits of mind that will not only enable them to teach science effectively, but also to continue learning about science long after their graduation from college. These qualities are essential for teachers of today's rapidly expanding and evolving body of scientific knowledge and are qualities that can be used to teach science effectively among diverse groups of students. In summary, these introductory courses model multiple instructional strategies, such as direct instruction, teacher modeling and demonstration, and investigation and experimentation, which are the most effective techniques for teaching science and are the methods advocated by the California Science Framework.

In-depth knowledge of physics is accomplished by an additional year of study in modern physics, a semester of advanced laboratory, a seminar course on current topics, a semester of observation and practice in physics teaching in a local high school physics classroom and two elective advanced physics courses.

The advanced laboratory course develops high level skills in the practice of science using state-of-the-art technologies and demands substantial amounts of technical writing. The seminar course requires students to complete a one-hour presentation to faculty and students on a topic of their choosing. This is a capstone experience requiring students to analyze complex discipline-based issues and synthesize information from multiple sources and perspectives. These courses develop the skills in written and oral communication required for the teaching profession.

In-depth knowledge of a second science chosen by the student is also required by the General Physics degree. This is accomplished through twelve additional units of coursework in the second science.

The coursework requirements for the program are summarized in Appendix B and a matrix chart is included that shows where the domains of the Science: Physics Subject Matter Requirements are addressed in the program.

Results of the Review – The review panel has conducted a thorough examination and analysis of the program document and supporting evidence provided by the program sponsor, including the course descriptions, syllabi, and materials and determined that the proposed program meets the subject matter standards and subject matter requirements which are aligned with the K-12 student content standards. During this process the sponsor responded to all of the reviewer's

questions and concerns by providing additional information, evidence and changes to the program to insure that of the standards and requirements were fully met.

II. Guidelines-Based Programs for the Alternative Professional Clear Administrative Services Credential

Background

California's school administrator credential structure consists of two levels of certification. The first level, the Preliminary Administrative Services Credential, requires the candidate to verify three years of successful school experience, possess a teaching credential or other services credential (e.g., counseling credential), and to complete a Commission-accredited formal administrator preparation program or to verify administrative knowledge by passing a Commission-adopted examination. The Preliminary Administrative Credential is valid for five years. During this first five years of service, the administrator is required to complete advanced certification requirements in order to qualify for the permanent California administrator license, the Professional Clear Administrative Services Credential.

In response to concerns stated in the field about the effectiveness and utility of programs leading to the professional clear credential, the Commission reviewed program standards and requirements in 2001 and 2002 and solicited input from California administrators about their experiences in completing credential requirements. From this information the Commission concluded that there needed to be greater flexibility in options and requirements for new administrators to obtain the professional clear credential. The Commission also determined that one or more options needed to emphasize mentoring from an experienced administrator rather than formal preparation in order to make the advanced preparation experience most effective for new administrators. Consequently the Commission acted to establish a variety of options from which a new administrator could select to meet requirements for the professional clear credential.

Guidelines-based professional clear administrative services credential programs are one of five options provided to new school administrators for meeting requirements for the Professional Clear Administrative Services Credential. The Commission established this option in November, 2003, as the last of several measures aimed at reforming advanced California school administrator preparation. The other four options available under current law are:

1. ***Completion of a standards-based professional clear administrative services credential program*** – These programs are offered by colleges, universities and county offices of education. Such programs consist of a combination of coursework and fieldwork experiences and are reviewed under the Commission's formal program accreditation process. Virtually all administrators completed this route after the state instituted a two-level administrative credential structure and prior to the Commission's most recent reform efforts.

2. ***Demonstrated mastery of fieldwork performance standards –*** This option is an extension of the authority of the standards-based programs described above, allowing institutions with those programs to assess program candidates on their current administrative performance, and to clear any or all program coursework requirements based on the findings of that assessment. This option is intended to allow institutions to abbreviate programs for some candidates based on a determination that a candidate has already been able to demonstrate competence in one or more aspects of the professional clear credential program. Only those aspects in which the candidate has demonstrated competence are to be cleared under this option, and all of the other program requirements must be completed before the candidate is to be recommended for the professional clear credential.

3. ***Completion of the AB 75 Principal Training Program offered by a state-approved provider –*** The Commission acted to recognize completion of all three modules of the Principal Training Program as an option for meeting the advanced preparation requirement for the professional clear credential. These programs are reviewed and approved by the State Board of Education with assistance by staff of the California Department of Education. Due to a requirement for some administrators to complete this program, as well as the availability of state funds to cover administrators' costs for participation in many cases, this has become a popular option for meeting requirements for the professional clear credential.

4. ***Passage of a national administrator performance assessment adopted by the Commission*** – Legislation reflecting the Commission's policy for administrator preparation reform included establishing an examination option for meeting requirements for the professional clear credential. At the time this legislation passed, Commission staff had identified a portfolio-based assessment being developed based on national administrator performance standards that are closely aligned with California's administrator performance standards, and had intended to propose that assessment to the Commission for possible adoption to serve as this option. Due to a dispute over ownership of the portfolio assessment among the entities involved in its development it has not yet become available for use. Staff has not found an acceptable alternative, so this option is not currently available.

The fifth option, guidelines-based professional clear administrative services credential programs, focuses on providing individualized support, mentoring and assistance to new administrators. These programs are required to initially assess candidates on their early administrative performance, thereby identifying relative strengths and weaknesses and establishing appropriate professional development goals. Based on the initial assessment the candidate, program faculty and an experienced administrator who will serve as the candidate's mentor develop a mentoring plan that defines the focus, goals, mode and frequency of mentoring activities and may identify specific professional development activities that the candidate will complete over the course of the program. Program guidelines for this option require that candidates receive a minimum of two years of mentoring prior to being recommended for the professional clear credential. The candidate's administrative performance and progress toward program goals must be assessed on multiple occasions, and the mentoring plan may be amended over time to reflect changing candidate needs and/or job responsibilities. The program design must also include a summative assessment through which the candidate must be judged to have attained a level of administrative

competence meriting recommendation for the Professional Clear Administrative Services Credential. Programs approved under this option are granted authority to recommend program candidates for the credential based on a positive summative assessment.

Guidelines-based Program Review Procedures

The Commission's adoption of program guidelines to govern program review and approval represents a departure from the Commission's conventional program approval process. Under the conventional process, programs are proposed and reviewed according to formal program standards, preconditions, and the Common Standards adopted by the Commission, and the decision on program accreditation rests with the Committee on Accreditation. Due to the alternative approach of guidelines-based programs, the Commission opted to institute a different program approval process. At its November 2003 meeting, concurrent with adoption of the guidelines that govern these programs, the Commission adopted the following process for review and approval of guidelines-based professional clear administrative services credential programs.

1. An entity interested in sponsoring a program prepares a program proposal that addresses each of the Guidelines for Alternative Professional Clear Administrative Services Credential Programs, and the related expectations.

2. Before the proposed program is submitted to the Commission, it receives written approval by the individual or group responsible for governance of the entity sponsoring the program. The written approval accompanies the program proposal when the proposal is submitted to the Commission for review and approval.

3. Commission staff reviews the proposed program to determine whether the proposal complies with the Commission's adopted guidelines and expectations for such programs, and may request additional information or clarification from the program sponsor to be satisfied that all guidelines and expectations are met.

4. Upon a finding that the proposed program meets all program guidelines and expectations, staff recommends program approval to the Commission and places the proposed program on the appropriate agenda for formal approval.

5. Once formally approved, the program may be implemented by the program sponsor, and an individual identified as having completed the approved program will be recognized as having completed the requirements for the Professional Clear Administrative Services Credential. The program sponsor will complete a program completion verification document produced by the Commission, and provide this document to the administrator completing the program for use in applying for the Professional Clear Administrative Services Credential.

Based on this program review structure, Commission staff has previously reviewed seven guidelines-based professional clear administrative services credential programs and the Commission has formally approved those programs, which are now in operation. This item

presents one additional proposed guidelines-based program. Staff has reviewed the proposal and has found that the program proposal has received appropriate endorsement from the sponsoring agency's governance, and that the program as proposed meets the Commission's guidelines for such programs. A brief description of the program follows.

Guidelines-based Program Submitted for Consideration

There is one program proposal submitted for consideration of Alternative Professional Clear Administrative Services Credential Program Approval. The program was reviewed according to the *Program Provider Guidelines for Alternative Professional Clear Administrative Services Credential Programs* adopted by the Commission in 2004. (Appendix C)

Los Angeles Unified School District Alternative Professional Clear Administrative Services Credential Program

This proposal is being submitted by the LAUSD Administrative Academy which has been involved in administrator leadership training since 1999. New administrators in the Los Angeles Unified School District (LAUSD) currently receive their Tier II administrator training through a collaborative program based at a local university or completion of the Principal Training Program (AB75). The district will now be sponsoring its own program. This program proposal indicates that administrators involved in the new program will be using *the California Professional Standards for Educational Leaders* (CPSEL) to frame the curriculum, seminars, coaching and a final project. In addition, all new LAUSD administrators are required to complete the LAUSD Administrative Academy's New Administrator Program (NAP). The NAP will be the core curriculum for the program. An Individual Induction Plan will be used as the basis for school/site leadership development and is aligned with District initiatives and school/site needs. Each seminar is supported by specific CPSEL themes that refine the participant's leadership actions based on their IIP.

The design of the proposed program follows the general model set forth in the Commission's guidelines. Specific components include:

- New Administrator Program (NAP) Attendance
  The NAP requires all new administrators participate in a three day Induction session.

- CPSEL Assessment/Induction Plan Development
  Each Tier II candidate will develop an Individual Induction Plan using the CPSEL Self-Assessment on Leadership Standards. Throughout the program, participants refine and personalize their Plan and align their leadership actions with the CPSEL themes. A support administrator will coach participants in leadership actions.

- Eight CPSEL Leadership Seminars-Mentoring and Professional Development
  The state guidelines for Tier II programs require a mentor/coach component. Each participant will be assigned to a cohort that is facilitated by an LAUSD Support

Administrator. The Support Administrators are current District Administrators that will be selected based on their leadership and coaching experiences. Support Administrators will provide specialized Individual Induction Plan coaching. Additionally, Support Administrators will facilitate leadership seminars using the CPSEL document and coaching protocols.

Each leadership seminar will be based on one of the six CPSEL themes. The curriculum, agendas, and materials will be provided by the Administrative Academy. Seminar sessions also provide opportunities for individualized coaching by Support Administrators. Tier II participants benchmark their learning after each seminar, which will lead to their final project.

CPSEL Standards are:

Standard 1- Vision of Learning that is Shared and Supported by the School Community

Standard 2- School Culture and Instructional Program

Standard 3- Management of the Organization, Operations and Resources for a Safe and Effective Learning Environment

Standard 4- Promoting the Success of All Students by Collaborating with Families and Community Members

Standard 5- Promoting the Success of All Students by Modeling a Personal Code of Ethics and Developing a Professional Leadership Capacity

Standard 6- Promoting the Success of all Students by Understanding and Responding to, and Influencing the Larger Political, Social, Economic, Legal and Cultural Context.

- CPSEL Exit Interview/Final Project
  The final project will focus on specific leadership needs that were identified in the Individual Induction Plan. This project will be aligned to and support existing District, school/site needs and initiatives through coaching, implementing the Individual Induction Plan, and enhancing leadership skills.

LAUSD Local Districts will submit recommendations for the Support Administrators. Potential Support Administrators will go through a selection and interview process. A Support Administrator will be responsible for attending coaching meetings, facilitating Tier II seminars, collaborating with the Administrative Academy, providing coaching support for 15 participants, and verifying course completion for each credential candidate.

This proposal includes appropriate program documents and forms to be used for assessing the candidate, the mentor, and the program. The proposal complies with requirements in the guidelines for both internal and statewide program review of program quality that both inform the program about ways in which the program may be further refined, and assist staff in determining whether continued program approval is merited.

Review of Guidelines-based Proposals

Results of the Review – Los Angeles Unified School District has submitted complete responses to the Commission's *Guidelines for Alternative Professional Clear Administrative Services Credential Programs.* Based on the initial program proposal and additional information provided in response to staff questions and concerns, staff has concluded the program meets the Commission's Guidelines. Therefore, the staff brings the program to the Commission for consideration.

III. Additional Information about Two Programs Approved at the August 2005 Commission Meeting

Additional information about the Single Subject English program from California State University, Northridge and the Mathematics program from University of California, Irvine is presented in Appendix D

IV. Options and Considerations

Subject Matter Preparation Program Approval

The Commission has the option to grant or deny initial approval of the Single Subject Matter Preparation Programs at the following institutions:

University of San Diego
Mathematics
California State University, Chico
Science: Physics

Based on the satisfactory review of responses to Preconditions and Standards for the Single Subject Matter Preparation Programs, both programs meet the requirements for approval. Granting initial program approval to the institutions will allow the institutions to begin offering the programs to meet the subject matter requirements for the Single Subject Credential.

Guidelines for Alternative Professional Clear Administrative Services Program Approval

The Commission has the option to grant or deny initial program approval to the Guidelines-based Alternative Professional Clear Administrative Services Credential program for the following program sponsor:

Los Angeles Unified School District

Based on the satisfactory review of responses to Guidelines the program meets the requirements for approval. Granting program approval will allow the program sponsor to begin offering the programs to meet the requirements for the Professional Clear Administrative Services Credential.

Appendix A

Subject Matter Requirements for Prospective Teachers of Mathematics[1]

Part I: Content Domains for Subject Matter Understanding and Skill in Mathematics

Domain 1. Algebra

Candidates demonstrate an understanding of the foundations of the algebra contained in the Mathematics Content Standards for California Public Schools (1997) as outlined in the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) from an advanced standpoint. To ensure a rigorous view of algebra and its underlying structures, candidates have a deep conceptual knowledge. They are skilled at symbolic reasoning and use algebraic skills and concepts to model a variety of problem-solving situations. They understand the power of mathematical abstraction and symbolism.

1.1 Algebraic Structures

a. Know why the real and complex numbers are each a field, and that particular rings are not fields (e.g., integers, polynomial rings, matrix rings)
b. Apply basic properties of real and complex numbers in constructing mathematical arguments (e.g., if $a < b$ and $c < 0$, then $ac > bc$)
c. Know that the rational numbers and real numbers can be ordered and that the complex numbers cannot be ordered, but that any polynomial equation with real coefficients can be solved in the complex field

(Mathematics Content Standards for California Public Schools, Grade 6, Number Sense: 1.0, 2.0; Grade 7, Algebra and Functions: 1.0; Algebra I: 1.0, 3.0-7.0, 9.0-15.0, 24.0, 25.0; Geometry: 1.0, 17.0; Algebra II: 1.0-8.0, 11.0, 24.0, 25.0; Trigonometry: 17.0; Mathematical Analysis: 2.0; Linear Algebra: 9.0, 11.0)

1.2 Polynomial Equations and Inequalities

a. Know why graphs of linear inequalities are half planes and be able to apply this fact (e.g., linear programming)
b. Prove and use the following:
   - The Rational Root Theorem for polynomials with integer coefficients
   - The Factor Theorem
   - The Conjugate Roots Theorem for polynomial equations with real coefficients
   - The Quadratic Formula for real and complex quadratic polynomials
   - The Binomial Theorem
c. Analyze and solve polynomial equations with real coefficients using the Fundamental Theorem of Algebra

(Mathematics Content Standards for California Public Schools, Grade 7, Algebra and Functions: 2.0-4.0; Algebra I: 1.0, 2.0, 4.0-10.0, 12.0-15.0, 17.0-23.0; Algebra II: 2.0-11.0, 16.0, 17.0; Trigonometry: 17.0, 18.0; Mathematical Analysis: 4.0, 6.0)

1.3 Functions

a. Analyze and prove general properties of functions (i.e., domain and range, one-to-one, onto, inverses, composition, and differences between relations and functions)
b. Analyze properties of polynomial, rational, radical, and absolute value functions in a variety of ways (e.g., graphing, solving problems)
c. Analyze properties of exponential and logarithmic functions in a variety of ways (e.g., graphing, solving problems)

(Mathematics Content Standards for California Public Schools, Grade 6, Algebra and Functions: 1.0; Grade 7, Number Sense: 1.0, 2.0; Algebra and Functions: 3.0; Algebra I: 3.0-6.0, 10.0, 13.0, 15.0-18.0, 21.0-23.0; Algebra II: 1.0-4.0, 6.0-17.0, 24.0, 25.0; Trigonometry: 2.0, 4.0-8.0, 19.0; Mathematical Analysis: 6.0, 7.0; Calculus: 9.0)

1.4 Linear Algebra

a. Understand and apply the geometric interpretation and basic operations of vectors in two and three dimensions, including their scalar multiples and scalar (dot) and cross products
b. Prove the basic properties of vectors (e.g., perpendicular vectors have zero dot product)
c. Understand and apply the basic properties and operations of matrices and determinants (e.g., to determine the solvability of linear systems of equations)

(Mathematics Content Standards for California Public Schools, Algebra I: 9.0; Algebra II: 2.0; Mathematical Analysis: 1.0; Linear Algebra: 1.0-12.0)

Domain 2. Geometry

Candidates demonstrate an understanding of the foundations of the geometry contained in the Mathematics Content Standards for California Public Schools (1997) as outlined in the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) from an advanced standpoint. To ensure a rigorous view of geometry and its underlying structures, candidates have a deep conceptual knowledge. They demonstrate an understanding of axiomatic systems and different forms of logical arguments. Candidates understand, apply, and prove theorems relating to a variety of topics in two- and three-dimensional geometry, including coordinate, synthetic, non-Euclidean, and transformational geometry.

2.1 Parallelism

a. Know the Parallel Postulate and its implications, and justify its equivalents (e.g., the Alternate Interior Angle Theorem, the angle sum of every triangle is 180 degrees)
b. Know that variants of the Parallel Postulate produce non-Euclidean geometries (e.g., spherical, hyperbolic)

(Mathematics Content Standards for California Public Schools, Algebra I: 8.0, 24.0; Geometry: 1.0-3.0, 7.0, 13.0)

2.2 Plane Euclidean Geometry

a. Prove theorems and solve problems involving similarity and congruence

b. Understand, apply, and justify properties of triangles (e.g., the Exterior Angle Theorem, concurrence theorems, trigonometric ratios, Triangle Inequality, Law of Sines, Law of Cosines, the Pythagorean Theorem and its converse)
c. Understand, apply, and justify properties of polygons and circles from an advanced standpoint (e.g., derive the area formulas for regular polygons and circles from the area of a triangle)
d. Justify and perform the classical constructions (e.g., angle bisector, perpendicular bisector, replicating shapes, regular n-gons for n equal to 3, 4, 5, 6, and 8)
e. Use techniques in coordinate geometry to prove geometric theorems

(Mathematics Content Standards for California Public Schools, Grade 6, Algebra and Functions: 2.0, 3.0; Measurement and Geometry: 2.0; Grade 7, Measurement and Geometry: 1.0-3.0; Algebra I: 8.0, 24.0; Geometry: 1.0-6.0, 8.0-16.0, 18.0-21.0; Algebra II: 16.0, 17.0; Trigonometry: 12.0-14.0, 18.0, 19.0; Mathematical Analysis: 5.0)

2.3 Three-Dimensional Geometry

a. Demonstrate an understanding of parallelism and perpendicularity of lines and planes in three dimensions
b. Understand, apply, and justify properties of three-dimensional objects from an advanced standpoint (e.g., derive the volume and surface area formulas for prisms, pyramids, cones, cylinders, and spheres)

(Mathematics Content Standards for California Public Schools, Grade 6, Measurement and Geometry: 1.0; Grade 7, Measurement and Geometry: 2.0; Algebra I: 24.0; Geometry: 2.0, 3.0, 12.0, 17.0; Mathematical Analysis: 5.0)

2.4 Transformational Geometry

a. Demonstrate an understanding of the basic properties of isometries in two- and three-dimensional space (e.g., rotation, translation, reflection)
b. Understand and prove the basic properties of dilations (e.g., similarity transformations or change of scale)

(Mathematics Content Standards for California Public Schools, Geometry: 11.0, 22.0)

Domain 3. Number Theory

Candidates demonstrate an understanding of the number theory and a command of the number sense contained in the Mathematics Content Standards for California Public Schools (1997) as outlined in the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) from an advanced standpoint. To ensure a rigorous view of number theory and its underlying structures, candidates have a deep conceptual knowledge. They prove and use properties of natural numbers. They formulate conjectures about the natural numbers using inductive reasoning, and verify conjectures with proofs.

3.1 Natural Numbers

a. Prove and use basic properties of natural numbers (e.g., properties of divisibility)
b. Use the Principle of Mathematical Induction to prove results in number theory

c. Know and apply the Euclidean Algorithm
d. Apply the Fundamental Theorem of Arithmetic (e.g., find the greatest common factor and the least common multiple, show that every fraction is equivalent to a unique fraction where the numerator and denominator are relatively prime, prove that the square root of any number, not a perfect square number, is irrational)

(Mathematics Content Standards for California Public Schools, Grade 6, Number Sense: 2.0; Grade 7, Number Sense: 1.0; Algebra I: 1.0, 2.0, 12.0, 24.0, 25.0; Geometry: 1.0; Algebra II: 21.0, 23.0, 25.0; Mathematical Analysis: 3.0)

Domain 4. Probability and Statistics

Candidates demonstrate an understanding of the statistics and probability distributions for advanced placement statistics contained in the Mathematics Content Standards for California Public Schools (1997) as outlined in the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) from an advanced standpoint. To ensure a rigorous view of probability and statistics and their underlying structures, candidates have a deep conceptual knowledge. They solve problems and make inferences using statistics and probability distributions.

4.1 Probability

a. Prove and apply basic principles of permutations and combinations
b. Illustrate finite probability using a variety of examples and models (e.g., the fundamental counting principles)
c. Use and explain the concept of conditional probability
d. Interpret the probability of an outcome
e. Use normal, binomial, and exponential distributions to solve and interpret probability problems

(Mathematics Content Standards for California Public Schools, Grade 6, Statistics, Data Analysis, and Probability: 3.0; Algebra II: 18.0-20.0; Probability and Statistics: 1.0-4.0; Advanced Probability and Statistics: 1.0-4.0, 7.0, 9.0, 17.0, 18.0)

4.2 Statistics

a. Compute and interpret the mean, median, and mode of both discrete and continuous distributions
b. Compute and interpret quartiles, range, variance, and standard deviation of both discrete and continuous distributions
c. Select and evaluate sampling methods appropriate to a task (e.g., random, systematic, cluster, convenience sampling) and display the results
d. Know the method of least squares and apply it to linear regression and correlation
e. Know and apply the chi-square test

(Mathematics Content Standards for California Public Schools, Grade 6, Statistics, Data Analysis, and Probability: 1.0, 2.0; Grade 7, Statistics, Data Analysis, and Probability: 1.0; Probability and Statistics: 5.0-7.0; Advanced Probability and Statistics: 4.0-6.0, 8.0, 10.0-13.0, 15.0-17.0, 19.0)

Domain 5. Calculus *(This domain does not apply to requirements for the Foundational-level Credential.)*

Candidates demonstrate an understanding of the trigonometry and calculus contained in the Mathematics Content Standards for California Public Schools (1997) as outlined in the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) from an advanced standpoint. To ensure a rigorous view of trigonometry and calculus and their underlying structures, candidates have a deep conceptual knowledge. They apply the concepts of trigonometry and calculus to solving problems in real-world situations.

5.1 Trigonometry

a. Prove that the Pythagorean Theorem is equivalent to the trigonometric identity $\sin^2 x + \cos^2 x = 1$ and that this identity leads to $1 + \tan^2 x = \sec^2 x$ and $1 + \cot^2 x = \csc^2 x$
b. Prove the sine, cosine, and tangent sum formulas for all real values, and derive special applications of the sum formulas (e.g., double angle, half angle)
c. Analyze properties of trigonometric functions in a variety of ways (e.g., graphing and solving problems)
d. Know and apply the definitions and properties of inverse trigonometric functions (i.e., arcsin, arccos, and arctan)
e. Understand and apply polar representations of complex numbers (e.g., DeMoivre's Theorem)

(Mathematics Content Standards for California Public Schools, Algebra I: 24.0; Geometry: 3.0, 14.0, 18.0, 19.0; Algebra II: 24.0, 25.0; Trigonometry: 1.0-6.0, 8.0-11.0, 19.0; Mathematical Analysis: 1.0, 2.0; Calculus: 18.0, 20.0)

5.2 Limits and Continuity

a. Derive basic properties of limits and continuity, including the Sum, Difference, Product, Constant Multiple, and Quotient Rules, using the formal definition of a limit
b. Show that a polynomial function is continuous at a point
c. Know and apply the Intermediate Value Theorem, using the geometric implications of continuity

(Mathematics Content Standards for California Public Schools, Algebra I: 24.0; Geometry: 3.0; Algebra II: 1.0, 15.0; Mathematical Analysis: 8.0; Calculus: 1.0-4.0)

5.3 Derivatives and Applications

a. Derive the rules of differentiation for polynomial, trigonometric, and logarithmic functions using the formal definition of derivative
b. Interpret the concept of derivative geometrically, numerically, and analytically (i.e., slope of the tangent, limit of difference quotients, extrema, Newton's method, and instantaneous rate of change)
c. Interpret both continuous and differentiable functions geometrically and analytically and apply Rolle's Theorem, the Mean Value Theorem, and L'Hopital's rule
d. Use the derivative to solve rectilinear motion, related rate, and optimization problems
e. Use the derivative to analyze functions and planar curves (e.g., maxima, minima, inflection points, concavity)

f. Solve separable first-order differential equations and apply them to growth and decay problems

(Mathematics Content Standards for California Public Schools, Algebra I: 5.0-8.0, 10.0, 11.0, 13.0, 21.0, 23.0; Geometry: 3.0; Algebra II: 1.0, 9.0, 10.0, 12.0, 15.0; Trigonometry: 7.0, 15.0-19.0; Mathematical Analysis: 5.0, 7.0; Calculus: 1.0, 4.0-12.0, 27.0)

5.4 Integrals and Applications

a. Derive definite integrals of standard algebraic functions using the formal definition of integral
b. Interpret the concept of a definite integral geometrically, numerically, and analytically (e.g., limit of Riemann sums)
c. Prove the Fundamental Theorem of Calculus, and use it to interpret definite integrals as antiderivatives
d. Apply the concept of integrals to compute the length of curves and the areas and volumes of geometric figures

(Mathematics Content Standards for California Public Schools, Algebra I: 24.0; Geometry: 9.0; Calculus: 13.0-23.0)

5.5 Sequences and Series

a. Derive and apply the formulas for the sums of finite arithmetic series and finite and infinite geometric series (e.g., express repeating decimals as a rational number)
b. Determine convergence of a given sequence or series using standard techniques (e.g., Ratio, Comparison, Integral Tests)
c. Calculate Taylor series and Taylor polynomials of basic functions

(Mathematics Content Standards for California Public Schools, Algebra I: 24.0, 25.0; Algebra II: 21.0-23.0; Mathematical Analysis: 8.0; Calculus: 23.0-26.0)

Domain 6. History of Mathematics ***(This domain does not apply to requirements for the Foundational-level Credential.)***

Candidates understand the chronological and topical development of mathematics and the contributions of historical figures of various times and cultures. Candidates know important mathematical discoveries and their impact on human society and thought. These discoveries form a historical context for the content contained in the Mathematics Content Standards for California Public Schools (1997) as outlined in the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999; e.g., numeration systems, algebra, geometry, calculus).

6.1 Chronological and Topical Development of Mathematics

a. Demonstrate understanding of the development of mathematics, its cultural connections, and its contributions to society
b. Demonstrate understanding of the historical development of mathematics, including the contributions of diverse populations as determined by race, ethnicity, culture, geography, and gender

Part II: Subject Matter Skills and Abilities Applicable to the Content Domains in Mathematics

(All elements of Part II apply to both the Single Subject Credential in Mathematics and the Single Subject Credential in Foundational Mathematics.)

Candidates for Single Subject Teaching Credentials in mathematics use inductive and deductive reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they use counterexamples, construct proofs using contradictions, and create multiple representations of the same concept. They know the interconnections among mathematical ideas, and use techniques and concepts from different domains and sub-domains to model the same problem. They explain mathematical interconnections with other disciplines. They are able to communicate their mathematical thinking clearly and coherently to others, orally, graphically, and in writing, through the use of precise language and symbols.

Candidates solve routine and complex problems by drawing from a variety of strategies while demonstrating an attitude of persistence and reflection in their approaches. They analyze problems through pattern recognition and the use of analogies. They formulate and prove conjectures, and test conclusions for reasonableness and accuracy. They use counterexamples to disprove conjectures.

Candidates select and use different representational systems (e.g., coordinates, graphs). They understand the usefulness of transformations and symmetry to help analyze and simplify problems. They make mathematical models to analyze mathematical structures in real contexts. They use spatial reasoning to model and solve problems that cross disciplines.

(Mathematics Content Standards for California Public Schools, Grade 6, Mathematical Reasoning: 1.0-3.0; Grade 7, Mathematical Reasoning: 1.0-3.0)

Subject Matter Requirements for Prospective Teachers General Science

Part I: Content Domains for Subject Matter Understanding and Skill in General Science

Domain 1. Astronomy

Candidates demonstrate an understanding of the foundations of the astronomy contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of astronomy and its underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand that knowledge of the structure and composition of the universe can be learned from studying stars and galaxies and their evolution. They recognize that objects in the sky move in regular and predictable patterns. Candidates explain how and why the moon's appearance changes during the four-week lunar cycle. They understand how telescopes magnify the appearance of distant objects in the sky, including the moon and the planets. They realize that the solar system consists of planets and other bodies that orbit the sun in predictable paths.

1.1 Astronomy

a. Describe the chemical composition and physical structure of the universe
b. Describe the structure of the solar system and its place in the Milky Way galaxy
c. Distinguish between stars and planets
d. Recognize that stars vary in color, size, and luminosity
e. Describe a simple model of how fusion in stars produces heavier elements and results in the production of energy, including light
f. Describe the regular and predictable patterns of stars and planets in time and location
g. Explain and predict changes in the moon's appearance (phases)
h. Describe the use of astronomical instruments in collecting data, and use astronomical units and light years to describe distances

(Science Content Standards for California Public Schools, Grades 3:4a-e; Grade 5: 5a-c; Grade 6: 7a; Grade 7: 6d, 7a; Grade 8:4a-e; Grades 9-12, Earth Sciences: 1a, 1e, 1g, 2a, 2c, 2e-f)

Domain 2. Dynamic Processes of the Earth (Geodynamics)

Candidates demonstrate an understanding of the foundations of the geodynamics contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of geodynamics and its underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand that Earth's features can be explained by a variety of dynamic processes that have occurred in the past and continue to occur. They understand that plate tectonics account for most of the important features of Earth's surface

and major geologic events. Candidates explain how surficial processes and agents such as waves, wind, water, and ice are slowly modifying Earth's land surface. They understand how weathering, transport, and deposition of sediment are related to this reshaping. Candidates are familiar with evidence from rocks that allows us to understand geologic history and the evolution of life on Earth. They can use observed properties of rocks and minerals to determine their processes of formation. Candidates understand that most of the energy on the Earth comes from the sun. They know that energy from the sun heats Earth unevenly, causing air movements that result in changing weather patterns. They use their understanding of heat to explain the many phenomena on Earth's surface that are affected by the transfer of energy through radiation and convection.

2.1 Tectonic Processes and Features

a. Diagram the features that provide evidence for plate tectonics
b. Summarize the thermal processes driving plate movement
c. Explain how density and buoyancy are related to plate tectonics
d. Describe types of plate boundaries
e. Relate the causes of volcanoes, earthquakes, and earth resources to tectonic processes
f. Summarize earthquake processes in terms of epicenter, focal mechanism, distance, and materials, and the role various factors play in the amount of damage caused by an earthquake

(Science Content Standards for California Public Schools, Grade 6: 1a-g; Grade 8: 4a-e; Grades 9-12, Earth Sciences: 1e, 1g, 2c, 3b, 3d)

2.2 Rock Formation

a. Diagram and explain the rock cycle
b. Describe relative and absolute dating techniques, including how half-lives are used in radiometric dating

(Science Content Standards for California Public Schools, Grade 4: 4a; Grade 7: 3c, 4a–e; Grades 9-12, Chemistry: 11f)

2.3 Shaping Earth's Surface: Surficial Processes and Features

a. Describe the dynamic processes of erosion, deposition, and transport
b. Describe coastal processes including beach erosion and natural hazards
c. Describe the effects of natural hazards, including earthquakes, volcanic eruptions, landslides, and floods, on natural and human-made habitats and environmental and human responses to those events

(Science Content Standards for California Public Schools, Grade 4: 5c; Grade 6: 1e, 1f, 2a–d)

2.4 Energy in the Earth System

a. Diagram the water cycle and describe interrelationships of surface and sub-surface reservoirs
b. Explain daily and seasonal changes in the sky (i.e., the sun's position and the intensity and duration of sunlight)
c. Analyze the uneven heating of Earth by the sun

d. Discuss the effects of air movements on weather
e. Describe the energy transfer processes of convection, conduction, and radiation in relation to the atmosphere/ocean and Earth's interior structure
f. Interpret weather maps to predict weather patterns

(Science Content Standards for California Public Schools, Grade 3: 4e; Grade 5: 3a-d, 4a-e; Grade 6: 4a-e; Grades 9-12, Earth Sciences: 5a-b)

Domain 3. Earth Resources

Candidates demonstrate an understanding of the Earth resources contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of Earth resources and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates know there are many different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable. They realize that sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. Candidates understand that the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process. They know the natural origin of the materials used to make common objects.

3.1 Earth Resources

a. Describe a variety of energy resources, including fossil fuels, nuclear fuels, solar, and biomass
b. Recognize earth materials as resources (e.g., rocks, minerals, soils, and water)
c. Identify resources as renewable vs. nonrenewable
d. Compare extraction and recycling in relation to energy, cost, and demand
e. Explain sustainable uses of resources with respect to utility, cost, human population, and environmental consequences

(Science Content Standards for California Public Schools, Grade 2: 3e; Grade 6: 6a-c; Grades 9-12, Earth Sciences: 9a, 9c)

Domain 4. Ecology

Candidates demonstrate an understanding of the foundations of the ecology contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of ecology and its underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand how organisms in ecosystems exchange energy and nutrients among themselves and with the environment. They can identify factors that affect organisms within an ecosystem, including natural hazards and human activity.

4.1 Ecology

a. Explain energy flow and nutrient cycling through ecosystems (e.g., food chain, food web)
b. Explain matter transfer (e.g., biogeochemical cycles) in ecosystems
c. Distinguish between abiotic and biotic factors in an ecosystem
d. Compare the roles of photosynthesis and respiration in an ecosystem
e. Describe interrelationships within and among ecosystems (e.g., predator/prey)
f. Identify and explain factors that affect population types and size (e.g., competition for resources, niche, habitats, species and population interactions, abiotic factors)

(Science Content Standards for California Public Schools, Grade 4: 2a-c, 3a-c; Grade 5: 2f-g; Grade 6: 5a-e)

Domain 5. Genetics and Evolution

Candidates demonstrate an understanding of the foundations of the genetics and evolution contained in the Science Content Standards for California Public Schools Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of genetics and evolution and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand that a typical cell of any organism contains genetic instructions that specify its traits. They can explain how biological evolution accounts for the diversity of species that developed through gradual processes over many generations. Candidates can describe evidence used to explain the evolution of life on Earth.

5.1 Genetics and Evolution

a. Explain the inheritance of traits which are determined by one or more genes, including dominance, recessiveness, sex linkage, phenotypes, genotypes, and incomplete dominance
b. Solve problems that illustrate monohybrid and dihybrid crosses
c. Compare sexual and asexual reproduction
d. Explain how the coding of DNA (deoxyribonucleic acid) controls the expression of traits by genes
e. Define mutations and explain their causes
f. Explain the process of DNA replication
g. Describe evidence, past and present, that supports the theory of evolution, including diagramming relationships that demonstrate shared characteristics of fossil and living organisms
h. Explain the theory of natural selection, including adaptation, speciation, and extinction
i. List major events that affected the evolution of life on Earth (e.g., climate changes, asteroid impacts)

(Science Content Standards for California Public Schools, Grade 7: 2a-e, 3a-e; Grades 9-12, Biology/Life Sciences: 4c, 7c, 8a)

Domain 6. Molecular Biology and Biochemistry

Candidates demonstrate an understanding of the foundations of the molecular biology and biochemistry contained in the Science Content Standards for California Public Schools Kindergarten Through Grade Twelve (1998) (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of molecular biology and biochemistry and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand and apply the principles of chemistry that underlie the functioning of biological systems. They describe the properties of biochemical compounds that make them essential to life.

6.1 Biology and Biochemistry

a. Demonstrate understanding that a small subset of elements (C, H, O, N, P, S) makes up most of the chemical compounds in living organisms by combining in many ways
b. Recognize and differentiate the structure and function of molecules in living organisms, including carbohydrates, lipids, proteins, and nucleic acids
c. Describe the process of protein synthesis, including transcription and translation
d. Compare anaerobic and aerobic respiration
e. Describe the process of photosynthesis

(Science Content Standards for California Public Schools, Grade 5: 2f-g; Grade 6: 5a; Grade 8: 6b-c; Grades 9-12, Biology/Life Sciences: 1d, 1f, 1g, 1h, 4a, Chemistry: 10c)

Domain 7. Cell and Organismal Biology

Candidates demonstrate an understanding of the foundations of the cell and organismal biology contained in the Science Content Standards for California Public Schools Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of cell and organismal biology and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand that all living organisms are composed of cells and explain important cellular processes. They describe and give examples of how the anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. Candidates demonstrate understanding of physical principles that underlie biological structures and functions. They apply these principles to important biological systems.

7.1 Cell and Organismal Biology

a. Describe organelles and explain their function in the cell
b. Relate the structure of organelles and cells to their functions
c. Identify and contrast animal and plant cells
d. Explain the conversion, flow, and storage of energy of the cell
e. Identify the function and explain the importance of mitosis and meiosis as processes of cellular and organismal reproduction
f. Compare single-celled and multicellular organisms, noting the role of cell differentiation in the development of multicellular organisms

g. Describe the levels of organization (e.g., cells, tissues, organs, systems, organisms) in plants and animals
h. Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems
i. Explain the major structures and their functions in vascular and nonvascular plants
j. Describe the life processes of various plant groups, including, but not limited to, reproduction, photosynthesis, respiration, and transpiration
k. Explain the reproductive processes in flowering plants

(Science Content Standards for California Public Schools, Grade 3: 1b, 1c; Grade 5: 2a, 2e; Grade 7: 1a-f, 5a-g, 6d, 6h-j)

Domain 8. Waves

Candidates demonstrate an understanding of the foundations of waves as contained in the Science Content Standards for California Public Schools Kindergarten Through Grade Twelve (1998) and outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of waves and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand that all waves have a common set of characteristic properties. They apply their knowledge of these properties to describe and predict the behavior of waves, including light waves, sound waves, and seismic waves. Candidates apply the simple principles of optics to explain how various lenses work.

8.1 Waves

a. Compare the characteristics of sound, light, and seismic waves (e.g., transverse/longitudinal, travel through various media, relative speed)
b. Explain that energy is transferred by waves without mass transfer and provide examples
c. Explain how lenses are used in simple optical systems, including the camera, telescope, microscope, and the eye
d. Explain and apply the laws of reflection and refraction
e. Compare transmission, reflection, and absorption of light in matter

(Science Content Standards for California Public Schools, Grade 3: 1d, 2a-d, 4c; Grade 6: 3a; Grade 7: 6a, 6c-g; Grades 9-12, Physics: 4a-b, 4d, 4f)

Domain 9. Forces and Motion

Candidates demonstrate an understanding of the foundations of forces and motion as contained in the Science Content Standards for California Public Schools Kindergarten Through Grade Twelve (1998) and outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of forces and motion and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates describe the motion of an object and understand the relationships among its velocity, speed, distance, time, and acceleration. They understand the relationship among force, mass, and acceleration. Candidates use Newton's laws to predict the motion of objects.

9.1 **Forces and Motion**

a. Discuss and apply Newton's laws (i.e., first, second, third, and law of universal gravitation)
b. Define pressure and relate it to fluid flow and buoyancy (e.g., heart valves, atmospheric pressure)
c. Describe the relationships among position, distance, displacement, speed, velocity, acceleration, and time, and perform simple calculations using these variables for both linear and circular motion
d. Identify the separate forces that act on a body (e.g., gravity, pressure, tension/compression, normal force, friction) and describe the net force on the body
e. Construct and analyze simple vector and graphical representations of motion and forces (e.g., distance, speed, time)
f. Identify fundamental forces, including gravity, nuclear forces, and electromagnetic forces (magnetic and electric), and explain their roles in nature, such as the role of gravity in maintaining the structure of the universe
g. Explain and calculate mechanical advantages for levers, pulleys, and inclined planes

(Science Content Standards for California Public Schools, Grade 7: 6h-j; Grade 8: 1a-f, 2a-g)

Domain 10. Electricity and Magnetism

Candidates demonstrate an understanding of the foundations of the electricity and magnetism contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of electricity and magnetism and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand that electric and magnetic phenomena are related. They use knowledge of electricity and magnetism to explain many practical applications.

10.1 Electricity and Magnetism

a. Describe and provide examples of electrostatic and magnetostatic phenomena
b. Predict charges or poles based on attraction/repulsion observations
c. Build a simple compass and use it to determine direction of magnetic fields, including the Earth's magnetic field
d. Relate electric currents to magnetic fields and describe the application of these relationships, such as in electromagnets, electric current generators, motors, and transformers
e. Design and interpret simple series and parallel circuits
f. Define and calculate power, voltage differences, current, and resistance in simple circuits

(Science Content Standards for California Public Schools, Grade 4: 1a-g; Grade 9-12, Physics: 5a-c)

Domain 11. Heat Transfer and Thermodynamics

Candidates demonstrate an understanding of the foundations of heat transfer and thermodynamics as contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) and outlined in the Science Framework for

California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of heat transfer and thermodynamics and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates explain how heat flows in a predictable manner. They understand that energy cannot be created or destroyed, although in many processes energy is transferred to the environment as heat. Candidates apply their knowledge to explain how many phenomena on Earth's surface are affected by the transfer of energy through radiation and convection currents.

11.1 Heat Transfer and Thermodynamics

a. Know the principle of conservation of energy and apply it to energy transfers
b. Discuss how the transfer of energy as heat is related to changes in temperature
c. Diagram the direction of heat flow in a system
d. Describe the methods of heat transfer by conduction, convection, and radiation, and provide examples for each
e. Explain how chemical energy in fuel is transformed to heat
f. Design and explain experiments to induce a physical change such as freezing, melting, or boiling
g. Distinguish between physical and chemical changes and provide examples of each

(Science Content Standards for California Public Schools, Grade 6: 3a-d, 4d; Grade 8: 3b, 3d-e, 5c-d; Grade 9-12, Physics: 3a-c, Chemistry: 7a-c)

Domain 12. Structure and Properties of Matter

Candidates demonstrate an understanding of the structure and properties of matter contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of matter and its underlying structures, candidates have a deep conceptual knowledge of the content area. Candidates know that more than 100 elements of matter exist, each with distinct properties and a distinct atomic structure. They describe both macroscopic and microscopic properties of matter including intermolecular and intramolecular forces. They know that the organization of the periodic table is based on the properties of the elements and reflects the structure of atoms. Candidates understand how the periodic table is constructed and the periodic trends in chemical and physical properties that can be seen in the table. They recognize chemical reactions as processes that involve the rearrangement of electrons to break and form bonds with different atomic partners. Candidates demonstrate understanding of the principles of chemistry that underlie the functioning of biological systems.

12.1 Structure and Properties of Matter

a. Identify, describe, and diagram the basic components within an atom (i.e., proton, neutron, and electron)
b. Know that isotopes of any element have different numbers of neutrons but the same number of protons, and that some isotopes are radioactive
c. Differentiate between atoms, molecules, elements, and compounds
d. Compare and contrast states of matter and describe the role energy plays in the conversion from one state to another

e. Discuss the physical properties of matter including structure, melting point, boiling point, hardness, density, and conductivity
f. Recognize that all chemical substances are characterized by a unique set of physical properties
g. Define and calculate density, and predict whether an object will sink or float in a fluid
h. Explain that chemical changes in materials result in the formation of a new substance corresponding to the rearrangement of the atoms in molecules
i. Explain and apply principles of conservation of matter to chemical reactions, including balancing chemical equations
j. Distinguish among acidic, basic, and neutral solutions by their observable properties
k. Describe the construction and organization of the periodic table
l. Based on position in the periodic table, predict which elements have characteristics of metals, semi-metals, non-metals, and inert gases
m. Explain chemical reactivity using position on the periodic table
n. Predict and explain chemical bonding using elements' positions in the periodic table
o. Recognize that inorganic and organic compounds (e.g., water, salt, carbohydrates, lipids, proteins, nucleic acids) are essential to processes within living systems
p. Explain the central role of carbon in living system chemistry

(Science Content Standards for California Public Schools, Grade 8: 3a-c, 5a-e, 6a, 6c, 7a-c, 8a-d; Grades 9-12, Chemistry: 7b, 11c)

Physics Subject Matter Requirements

Part I: Content Domains for Subject Matter Understanding and Skill in Physics

Domain 1. Motion and Forces

Candidates demonstrate an understanding of the foundations of motion and forces as contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) and outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of motion and forces and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates demonstrate an understanding of motion and the relationship of force to motion. Candidates use analytical, numerical, and graphical methods in problem-solving.

1.1 Motion and Forces

a. Solve problems using Newton's Second Law (e.g., problems involving time, velocity, and space-dependent forces)
b. Construct appropriate free-body diagrams of many-body problems (e.g., two or more coupled masses)
c. Solve periodic motion problems
d. Solve 2-dimensional problems involving vector analysis of motion and forces, including projectile motion, uniform circular motion, and statics
e. Generate and understand functional relationships of graphs showing distance, velocity, and acceleration versus time
f. Recognize relationships among variables for linear motion and rotational motion
g. Solve problems involving linear and rotational motion in term of forces and torques

(Science Content Standards for California Public Schools, Grades 9-12, Physics: 1a-m)

Domain 2. Conservation of Energy and Momentum

Candidates demonstrate an understanding of the conservation of energy and momentum contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) and outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of conservation of energy and momentum and of their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates demonstrate an understanding of the principles of conservation of energy and momentum. They apply this understanding to predict and describe the movement of objects.

2.1 Conservation of Energy and Momentum

a. Use conservation of energy to characterize kinetic-potential energy systems such as oscillating systems (pendula and springs), projectile motion, and roller coasters
b. Analyze elastic and inelastic collisions and solve for unknown values
c. Solve problems involving linear and rotational motion in terms of conservation of momentum and energy

d. Recognize relationships between energy/momentum conservation principles and Newton's Laws
e. Examine the impact of friction on conservation principles
f. Interpret force-versus-time and force-versus-distance graphs to find, for example, work done or impulse on a system

(Science Content Standards for California Public Schools, Grades 9-12, Physics: 2a-h)

Domain 3. Heat and Thermodynamics

Candidates demonstrate an understanding of the foundations of heat and thermodynamics as contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) and outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of heat and thermodynamics and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates demonstrate understanding of the laws of thermodynamics and the thermodynamic properties of materials.

3.1 Heat and Thermodynamics

a. Solve problems involving the laws of thermodynamics using the relationships among work, heat flow, energy, and entropy
b. Define and correctly apply thermodynamic properties of materials such as specific heat (heat capacity), heats of fusion, heat of vaporization, thermal conductivity, and thermal expansion to solve problems
c. Solve problems for ideal gas systems
d. Solve problems involving cyclic processes, including calculations of work done, heat gain/loss, , and entropy change
e. Interpret graphs showing phase changes and graphs of cyclic processes
f. Describe a plasma, state its characteristic properties, and contrast it with an ideal gas

(Science Content Standards for California Public Schools, Grades 9-12, Physics: 3a-g)

Domain 4. Waves

Candidates demonstrate an understanding of the foundations of waves as contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) and outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of waves and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates can describe waves and their characteristic properties and understand that these properties do not depend on the type of wave. They use their knowledge of waves and wave properties to predict wave behavior under various conditions. Candidates are familiar with the electromagnetic spectrum.

4.1 Waves and Their Characteristic Properties

a. Relate wave propagation to properties of materials (e.g., predict wave speed from density and tension)

b. Describe, distinguish, and solve both conceptual and numerical problems involving interference, diffraction, refraction, reflection, Doppler effect, polarization, dispersion, and scattering

(Science Content Standards for California Public Schools, Grades 9-12, Physics: 4a-f)

Domain 5. Electromagnetism

Candidates demonstrate an understanding of the foundations of electromagnetism contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of electromagnetism and its underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates understand the relationship between electric and magnetic phenomena and can apply their knowledge to real-life examples. They can solve calculus-based problems using the quantitative and vector relationships among charges, currents, forces, and fields.

5.1 Electric and Magnetic Phenomena

a. Analyze electric and magnetic forces, charges, and fields using Coulomb's law, the Lorentz force, and the right-hand rule
b. Apply energy principles to analyze problems in electricity, magnetism, and circuit theory involving capacitors, resistors, and inductors
c. Calculate power, voltage changes, current, and resistance in multiloop circuits involving capacitors, resistors, and inductors
d. Interpret and design mixed series and parallel circuits involving capacitors, resistors, and inductors
e. Solve problems involving the relationships between electric and magnetic phenomena
f. Explain properties of transistors, diodes, and semiconductors

(Science Content Standards for California Public Schools, Grades 9-12, Physics: 5a-o)

Domain 6. Quantum Mechanics and the Standard Model of Particles

Candidates demonstrate an understanding of the foundations of quantum mechanics and the standard model of particles contained in the Science Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1998) as outlined in the Science Framework for California Public Schools: Kindergarten Through Grade Twelve (2002) from an advanced standpoint. To ensure a rigorous view of quantum mechanics and the standard model of particles and their underlying structures, candidates have a deep conceptual knowledge of the subject matter. Candidates are familiar with the standard model of particles and the four fundamental forces of nature. They recognize the assumptions and principles of early quantum mechanics.

6.1 Quantum Mechanics and the Standard Model

a. Distinguish the four fundamental forces of nature, describe their ranges, and identify their force carriers
b. Evaluate the assumptions and relevance of the Bohr model of the atom

(Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 1i)

Subject Matter Requirements For Prospective English Teachers

Content Domains for Subject Matter Understanding and Skill in English

More than ever before, teachers of English in California's middle and high schools must deliver a complex and dynamic curriculum to students of every socioeconomic, linguistic and cultural background. Furthermore, society is increasingly technologically and media oriented. The Reading/Language Arts Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) forms the basis for the preparation of English teachers, who must equip their students to meet the challenges of this changing world. In this context, new paradigms and models are required for teaching English/Language Arts. Multiple forms of literacy demand a broad theoretical knowledge of language and literacy acquisition, while new information technologies require an emphasis on critical analysis of both print and non-print texts.

Candidates for Single Subject Teaching Credentials in English have a broad knowledge of literature, language and linguistics, rhetoric and composition, and communication studies. Candidates must be able to read and write well for a variety of purposes and communicate effectively within a variety of rhetorical contexts. In addition, candidates must have experience in theater arts, public speaking, journalism, textual analysis of nonfiction and electronic media, and production of technologically enhanced documents. This broad scope of background and skills ensures a greater degree of success in English/Language Arts classrooms for California's public school children.

Domain 1. Literature and Textual Analysis

Candidates demonstrate knowledge of the foundations and contexts of the literature and textual analysis contained in the English-Language Arts Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1997) as outlined in the Reading/Language Arts Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) at a post secondary level of rigor. Candidates have both broad and deep conceptual knowledge of the subject matter. The candidate's preparation should include breadth of knowledge in literature, literary analysis and criticism, as well as non-literary text analysis. Literary analysis presumes in-depth exploration of the relationship between form and content. The curriculum should embrace representative selections from different literary traditions and major works from diverse cultures. Advanced study of multicultural writers is also fundamental preparation for teaching these works. Shakespeare remains integral to the secondary school curriculum; advanced study of his work is, therefore, essential to future secondary teachers. Candidates must be enthusiastic readers and writers, who know and apply effective reading strategies and compose thoughtful, well-crafted responses to literary and non-literary texts. Candidates will be able to:

1.1 Literary Analysis

a. Recognize, compare, and evaluate different literary traditions to include:
   - American (inclusive of cultural pluralism)
   - British (inclusive of cultural pluralism)

- World literature and literature in translation (inclusive of cross-cultural literature)
- Mythology and oral tradition

b. Trace development of major literary movements in historical periods (e.g., Homeric Greece, medieval, neoclassic, romantic, modern)

c. Describe the salient features of adolescent/Young Adult literature

d. Analyze and interpret major works by representative writers in historical, aesthetic, political, and philosophical contexts

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 2.4; Grades 11-12, Reading: 2.2, 3.5-7)

1.2 Literary Elements

a. Distinguish salient features of genres (e.g., short stories, non-fiction, drama, poetry, and novel)

b. Define and analyze basic elements of literature (e.g., plot, setting, character, point of view, theme, narrative structure, figurative language, tone, diction, and style)

c. Articulate the relationship between the expressed purposes and the characteristics of different forms of dramatic literature (e.g., comedy, tragedy, drama, and dramatic monologue)

d. Develop critical thinking and analytic skill through close reading of texts

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 1.1-2, 2.1, 2.4, 2.6, 2.8, 3.0; Grade 7, Reading: 1.1, 2.4, 3.1-5; Grade 8, Reading: 1.1, 2.7, 3.0; Grades 9-10, Reading: 1.1, 2.8, 3.1-4, 3.7-10; Grades 11-12, Reading: 2.2, 3.1-4)

1.3 Literary Criticism

a. Research and apply criticism of major texts and authors using print and/or electronic resources

b. Research and apply various approaches to interpreting literature (e.g., aesthetic, historical, political, philosophical)

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 2.1-2, 2.6-8, 3.6; Grade 7, Reading: 2.1, 2.4, 2.6, 3.0; Grade 8, Reading: 2.2, 2.6, 3.0; Grades 9-10, Reading: 2.2, 2.4, 2.8, 3.5-7, 3.11-12, Writing 1.6-7; Grades 11-12, Reading: 2.2, 2.4, 3.8-9, Writing 1.6-7)

1.4 Analysis of Non-Literary Texts

a. Compare various features of print and visual media (e.g., film, television, Internet)

b. Evaluate structure and content of a variety of consumer, workplace, and public documents

c. Interpret individual works in their cultural, social, and political contexts

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 2.0, 3.0; Grade 7, Reading: 2.1-5, 2.2, 3.0; Grade 8, Reading: 2.1-7,

3.0; Grades 9-10, Reading: 2.1, 2.2, 2.4-7, 3.0; Grades 11-12, Reading: 2.1-3, 2.6, 3.0)

Domain 2. Language, Linguistics, and Literacy

Candidates demonstrate knowledge of the foundations and contexts of the language, linguistics, and literacy contained in the English-Language Arts Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1997) as outlined in the Reading/Language Arts Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) at a post secondary level of rigor. Candidates have both broad and deep conceptual knowledge of the subject matter. Many California students, coming from a variety of linguistic and sociocultural backgrounds, face specific challenges in mastering the English language. The diversity of this population requires the candidate to understand the principles of language acquisition and development. Candidates must become knowledgeable about the nature of human language, language variation, and historical and cultural perspectives on the development of English. In addition, candidates must acquire a complex understanding of the development of English literacy among both native and non-native speakers. Candidates will be able to:

2.1 Human Language Structures

a. Recognize the nature of human language, differences among languages, the universality of linguistic structures, and change across time, locale, and communities
b. Demonstrate knowledge of word analysis, including sound patterns (phonology) and inflection, derivation, compounding, roots and affixes (morphology)
c. Demonstrate knowledge of sentence structures (syntax), word and sentence meanings (semantics), and language function in communicative context (pragmatics)
d. Use appropriate print and electronic sources to research etymologies; recognize conventions of English orthography and changes in word meaning and pronunciation

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 1.1-5; Grades 7-8, Reading: 1.2; Grades 9-10, Reading: 1.1-3)

2.2 Acquisition and Development of Language and Literacy

a. Explain the influences of cognitive, affective, and sociocultural factors on language acquisition and development
b. Explain the influence of a first language on second language development
c. Describe methods and techniques for developing academic literacy (e.g., tapping prior knowledge through semantic mapping, word analogies, and cohesion analysis)

(English-Language Arts Content Standards for California Public Schools, Grades 6-12, Reading: 1.0)

2.3 Literacy Studies

a. Recognize the written and oral conventions of Standard English, and analyze the social implications of mastering them

b. Describe and explain cognitive elements of reading and writing processes (e.g., decoding and encoding, construction of meaning, recognizing and using text conventions of different genres)
c. Explain metacognitive strategies for making sense of text (e.g., pre-reading activities, predicting, questioning, word analysis, and concept formation)

(English-Language Arts Content Standards for California Public Schools, Grades 6-12, Reading: 1.0)

2.4 Grammatical Structures of English

a. Identify methods of sentence construction (e.g., sentence combining with coordinators and subordinators; sentence embedding and expanding with clausal and phrasal modifiers)
b. Analyze parts of speech and their distinctive structures and functions (e.g., noun phrases including count and noncount nouns and the determiner system; prepositions, adjectives, and adverbs; word transformations)
c. Describe the forms and functions of the English verb system (e.g., modals, verb complements, and verbal phrases)

(English-Language Arts Content Standards for California Public Schools, Grade 8, Reading: 1.2)

Domain 3. Composition and Rhetoric

Candidates demonstrate knowledge of the foundations and contexts of the composition and rhetoric contained in the English-Language Arts Content Standards for California Public Schools; Kindergarten Through Grade Twelve (1997) as outlined in the Reading/Language Arts Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) at a post secondary level of rigor. Candidates have both broad and deep conceptual knowledge of the subject matter. Candidates face dynamic challenges in the domains of oral and written communication. They must make appropriate use of current text-production technologies and develop sensitivity to patterns of communication used by different social and cultural groups. Candidates are competent writers and speakers who are able to communicate appropriately in various rhetorical contexts, using effective text structures, word choice, sentence options, standard usage conventions, and advanced research methods as needed. The subject matter preparation program provides opportunities for candidates to develop skills and confidence in public speaking. Candidates will be able to:

3.1 Written Composing Processes (Individual and Collaborative)

a. Reflect on and describe their own writing processes
b. Investigate and apply alternative methods of prewriting, drafting, responding, revising, editing, and evaluating
c. Employ such strategies as graphic organizers, outlines, notes, charts, summaries, or précis to clarify and record meaning
d. Integrate a variety of software applications (e.g., databases, graphics, and spreadsheets) to produce print documents and multi-media presentations

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 2.1-2, 2.4, Writing: 1.4-6; Grade 7, Reading: 2.3-4, Writing: 1.3-4, 1.6-7; Grade 8, Reading: 2.4, Writing: 1.1, 1.4-1.6, Listening and Speaking: 1.4; Grades 9-10, Reading: 2.4, Writing: 1.8-9; Grades 11-12, Writing: 1.4, 1.7-9, Listening and Speaking: 2.4)

3.2 Rhetorical Features of Literary and Non-Literary, Oral and Written Texts

a. Recognize and use a variety of writing applications (e.g., short story, biographical, autobiographical, expository, persuasive, business and technical documents, historical investigation)
b. Demonstrate awareness of audience, purpose, and context
c. Recognize and use various text structures (e.g., narrative and non-narrative organizational patterns)
d. Apply a variety of methods to develop ideas within an essay (e.g., analogy, cause and effect, compare and contrast, definition, illustration, description, hypothesis)
e. Apply critical thinking strategies to evaluate methods of persuasion, including but not limited to:
   - Types of appeal (e.g., appeal to reason, emotion, morality)
   - Types of persuasive speech (e.g., propositions of fact, value, problem, policy)
   - Logical fallacies (e.g., bandwagon, red herring, glittering generalities, ad hominem)
   - Advertising techniques (e.g., Maslow's hierarchy of needs)
   - Logical argument (e.g., inductive/deductive reasoning, syllogisms, analogies)
   - Classical argument (e.g., claim, qualifiers, rules of evidence, warrant)

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 2.1-2, 2.4, 2.6, 2.8, Writing: 1.1-3, 1.6, 2.1-5, Listening and Speaking: 1.8-9; Grade 7, Reading: 1.3, 2.2-3, Writing: 1.1-3, 1.7, 2.1-5, Listening and Speaking: 1.1, 1.3; Grade 8, Reading: 1.3, 2.2, Writing: 1.1-3, 1.52.1-6, Listening and Speaking: 1.8; Grades 9-10, Writing: 1.1-2, 1.4, 1.9, 2.1-6, Listening and Speaking: 1.5, 1.10, 1.13; Grades 11-12, Reading: 1.3, 2.2, 2.4-6, Writing: 1.1-5, 1.9, 2.1-6, Listening and Speaking: 1.4, 1.12-13)

3.3 Rhetorical Effects of Grammatical Elements

a. Employ precise and extensive vocabulary and effective diction to control voice, style, and tone
b. Use clause-joining techniques (e.g., coordinators, subordinators, and punctuation) to express logical connections between ideas
c. Identify and use clausal and phrasal modifiers to control flow, pace, and emphasis (e.g., adjective clauses, appositives, participles and verbal phrases, absolutes)
d. Identify and use devices to control focus in sentence and paragraph (e.g., active and passive voice, expletives, concrete subjects, and transitional phrases)
e. Maintain coherence through use of cohesive devices

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 1.1, Writing: 1.2, 1.6, Written and Oral English Language

Conventions: 1.1-5; Grade 7, Writing: 1.1, 1.7, Written and Oral English Language Conventions: 1.1-7; Grade 8, Writing: 1.2, 1.6, Written and Oral English Language Conventions: 1.1-6, Listening and Speaking: 1.5-6; Grades 9-10, Writing: 1.1-2, 1.6, 1.9, Written and Oral English Language Conventions: 1.1-5; Grades 11-12, Reading: 2.1-2, Writing: 1.2-5, 1.9, Written and Oral English Language Conventions: 1.1-3, Listening and Speaking: 1.5)

3.4 Conventions of Oral and Written Language

a. Apply knowledge of linguistic structure to identify and use the conventions of Standard Edited English
b. Recognize, understand, and use a range of conventions in both spoken and written English, including:
   - Conventions of effective sentence structure (e.g., clear pronoun reference, parallel structure, appropriate verb tense)
   - Preferred usage (e.g., verb/subject agreement, pronoun agreement, idioms)
   - Conventions of pronunciation and intonation
   - Conventional forms of spelling
   - Capitalization and punctuation

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 1.1, Written and Oral English Language Conventions: 1.1-5: Grade 7, Written and Oral English Language Conventions: 1.1-7; Grade 8, Writing: 1.2, Written and Oral English Language Conventions: 1.1-6, Listening and Speaking: 1.6: Grades 9-10, Writing: 1.9, Written and Oral English Language Conventions: 1.9; Grades 11-12, Writing: 1.4, Written and Oral English Language Conventions: 1.1-3, Listening and Speaking: 1.8)

3.5 Research Strategies

a. Develop and apply research questions
b. Demonstrate methods of inquiry and investigation
c. Identify and use multiple resources (e.g., oral, print, electronic; primary and secondary), and critically evaluate the quality of the sources
d. Interpret and apply findings
e. Use professional conventions and ethical standards of citation and attribution
f. Demonstrate effective presentation methods, including multi-media formats

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 1.1, 2.1, 2.3, 2.6-8, Writing: 1.4-5, Listening and Speaking: 1.1-2, 1.6-7, 2.1, 2.3; Grade 7, Reading: 2.2, 2.6, Writing: 1.4-5, Listening and Speaking: 1.2, 1.6-7, 2.1, 2.3; Grade 8, Reading: 2.2, 2.7, Writing: 1.3-6, Listening and Speaking: 1.2-3, 1.6-8, 2.3; Grades 9-10, Reading: 2.2-5, 2.8, Writing: 1.3-8, Listening and Speaking: 1.7, 2.2; Grades 11-12, Writing: 1.4, 1.6-8, Listening and Speaking: 2.4)

Domain 4. Communications: Speech, Media, and Creative Performance

Candidates demonstrate knowledge of the foundations and contexts of the speech, media, and creative performance contained in the English-Language Arts Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1997) as outlined in the Reading/Language Arts Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) at a post secondary level of rigor. Candidates have both broad and deep conceptual knowledge of the subject matter. The Reading/Language Arts Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) puts consistent emphasis on analysis and evaluation of oral and media communication as well as on effective public speaking and performance. The candidate must possess the breadth of knowledge needed to integrate journalism, technological media, speech, dramatic performance, and creative writing into the language arts curriculum, including sensitivity to cultural approaches to communication. The subject matter preparation program should include opportunities for candidates to obtain knowledge and experience in these areas. The candidate skillfully applies the artistic and aesthetic tools and sensitivities required for creative expression. Candidates will be able to:

4.1 Oral Communication Processes

a. Identify features of, and deliver oral performance in, a variety of forms (e.g., impromptu, extemporaneous, persuasive, expository, interpretive, debate)
b. Demonstrate and evaluate individual performance skills (e.g., diction, enunciation, vocal rate, range, pitch, volume, body language, eye contact, and response to audience)
c. Articulate principles of speaker/audience interrelationship (e.g., interpersonal communication, group dynamics, and public address)
d. Identify and demonstrate collaborative communication skills in a variety of roles (e.g., listening supportively, facilitating, synthesizing, and stimulating higher level critical thinking through inquiry)

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 1.1, Listening and Speaking: 1.1-8, 2.0; Grade 7, Listening and Speaking: 1.1-7, 2.0; Grade 8, Listening and Speaking: 1.1-8, 2.0; Grades 9-10, Listening and Speaking: 1.1, 1.3-6, 1.8-13, 2.0; Grades 11-12, Reading: 2.6, Listening and Speaking: 1.4-6, 1.8-13, 2.0)

4.2 Media Analysis and Journalistic Applications

a. Analyze the impact on society of a variety of media forms (e.g., television, advertising, radio, Internet, film)
b. Recognize and evaluate strategies used by the media to inform, persuade, entertain, and transmit culture
c. Identify aesthetic effects of a media presentation
d. Demonstrate effective and creative application of these strategies and techniques to prepare presentations using a variety of media forms and visual aids

(English-Language Arts Content Standards for California Public Schools, Grade 6, Reading: 2.1-2, 2.6, Listening and Speaking: 1.9; Grade 7, Reading: 2.1, Listening and Speaking: 1.8-9; Grade 8, Reading: 2.1, 2.3, Listening and

Speaking: 1.8-9; Grades 9-10, Reading: 2.1, Listening and Speaking: 1.1-2, 1.7, 1.9, 1.14; Grades 11-12, Reading: 2.1, Writing: 2.6, Listening and Speaking: 1.1-4, 1.9, 1.14, 2.4; Visual and Performing Arts Content Standards for California Public Schools, Theatre, Grades 6-12, 5.0: Connections, Relationships, Applications)

4.3 Dramatic Performance

a. Describe and use a range of rehearsal strategies to effectively mount a production (e.g., teambuilding, scheduling, organizing resources, setting priorities, memorization techniques, improvisation, physical and vocal exercises)
b. Employ basic elements of character analysis and approaches to acting, including physical and vocal techniques that reveal character and relationships
c. Demonstrate basic knowledge of the language of visual composition and principles of theatrical design (e.g., set, costume, lighting, sound, and props)
d. Apply fundamentals of stage directing, including conceptualization, blocking (movement patterns), tempo, and dramatic arc (rising and falling action)
e. Demonstrate facility in a variety of oral performance traditions (e.g., storytelling, epic poetry, and recitation)

(English-Language Arts Content Standards for California Public Schools, Grade 6, Listening and Speaking: 2.1, 2.3; Grade 7, Listening and Speaking: 2.1; Grade 8, Listening and Speaking: 1.1, 2.1-2, 2.5; Grades 9-10, Listening and Speaking: 2.1, 2.4; Grades 11-12, Listening and Speaking: 1.7, 1.9-10, 2.5; Visual and Performing Arts Content Standards for California Public Schools, Theatre, Grades 6-12, 1.0: Artistic Perception, 2.0: Creative Expression, 3.0 Historical and Cultural Context, 4.0 Aesthetic Valuing)

4.4 Creative Writing

a. Demonstrate facility in creative composition in a variety of genres (e.g., poetry, stories, plays, and film)
b. Understand and apply processes and techniques that enhance the impact of the creative writing product (e.g., work-shopping, readings, recasting of genre, voice, and perspective)
c. Demonstrate skill in composing creative and aesthetically compelling responses to literature

(English-Language Arts Content Standards for California Public Schools, Grade 6-12, Writing: 2.1)

Appendix B

University of San Diego

Mathematics Subject Matter Preparation Program Requirements

The coursework requirements listed for this program have been found by reviewers to meet the Commission's requirements and the content of the program meets the Commission's standards and subject matter requirements. A matrix chart is also included illustrate for Commissioners where the domains of the Mathematics Subject Matter Requirements are addressed in the program. In the course of the program review, the reviewers examine supporting evidence to determine how and to what extent the domains are covered in the program.

Units Required in the Program The subject matter preparation program in mathematics at the University of San Diego consists of a minimum of 38 semester units of core required courses and 16 semester units of extended studies courses.

Core Requirements The core requirements are listed below, and their relationship to the commonly taught subjects is shown in Table 1 on the next page:

Math 115 (College Algebra) or math placement exam	0-3 units
Math 120 (Introduction to Probability and Statistics)	3 units
Math 150 (Calculus I)	4 units
Math 151 (Calculus II)	4 units
Math 160 (Logic for Mathematics and Computer Science)	3 units
Math 250 (Calculus III)	4 units
Math 320 (Linear Algebra)	3 units
Math 325W (History of Mathematics)	3 units
Math 350 (Probability)	3 units
Math 360 (Advanced Calculus I)	3 units
Math 375 (Algebraic Systems)	3 units
Math 380 (Geometry)	3 units
Math 405 (Advanced Perspective on Secondary School Mathematics)	3 units
Total	38 - 41 units

Extended studies

Math 305 (Seminar in Teaching Mathematics)	2 units
Two upper-division Math electives	6 units
CS 150 (Computer Programming I)	4 units
Physics 270 (Introduction to Mechanics and Wave Motion)	4 units
Total	16 units

The following table shows the six major Content Domains for the Subject Matter Requirements and the courses in which they are covered.

Coverage of the subject matter requirements in courses:

	Algebra	Geometry	Number Theory	Probability & Statistics	Calculus	History Math
Math 120 Intro Prob & Stat				x		x
Math 150 Calculus I	x				x	
Math 151 Calculus II	x	x			x	x
Math 160 Logic Math & CS	x		x	x	x	
Math 250 Calculus III	x	x			x	
Math 320 Linear Algebra	x	x				
Math 325W History of Math						x
Math 350 Probability	x			x		
Math 360 Adv Calculus I	x				x	
Math 375 Algebraic Systems	x		x		x	x
Math 380 Geometry		x				x
Math 405 Adv Perspective	x	x			x	x
Math 305 Seminar						x
Phys270 Mechanics	x					

Throughout the program students are encouraged to see the connections between their current work and secondary mathematics, but this is particularly emphasized in Math 405 (Advanced Perspective on Secondary School Mathematics). Indeed, this has been a special consideration in selecting the textbook for the course. Some other examples of places where the connections between college mathematics and secondary mathematics are particularly emphasized are in Math 305 (Seminar in Teaching Mathematics)

California State University, Chico

Science: Physics Subject Matter Preparation Program Requirements

The coursework requirements listed for this program have been found by reviewers to meet the Commission's requirements and the content of the program meets the Commission's standards and subject matter requirements. A matrix chart is also included illustrate for Commissioners where the domains of the Science: Physics Subject Matter Requirements are addressed in the program. In the course of the program review, the reviewers examine supporting evidence to determine how and to what extent the domains are covered in the program.

The "General Physics" degree is specifically designed to meet the criteria of the California Commission on Teacher Credentialing for students that want to become high school physics teachers.

General Education Requirements: 39 units (university requirement is 48 units)
Including Cultural Diversity Requirements: 6 units
Reduced by three courses required below (Math 7A, Biol 6A and Chem 37)

Lower-Division Requirements: 47 units

CHEM	037	General Chemistry	4 units
CHEM	038	General Chemistry	4 units
BIOL	006A	Biological Principles	4 units
BIOL	006B	Biological Principles	4 units
GEOS	002	Physical Geology	3 units
MATH	007A	Analytic Geometry and Calculus	4 units
MATH	007B	Analytic Geometry and Calculus	4 units
MATH	007C	Analytic Geometry and Calculus	4 units
MATH	007D	Elem Diff Equation/Vector Calc	4 units
PHYS	004A	Mechanics	4 units
PHYS	004B	Electricity and Magnetism	4 units
PHYS	004C	Heat/Wave Motion/Sound/Light	4 units

Upper Division Requirements: 16 units

GEOS	100	Earth Science	3 units
PHYS	200A	Modern Physics I	3 units
PHYS	200B	Modern Physics II	3 units
PHYS	227	Advanced Laboratory	3 units
PHYS	289T	Internship in Physics Teaching	3 units
PHYS	291	Physics Seminar	1 unit

Upper Division Physics Electives: 6 units
6 Units selected from any upper-division course in physics.

Science Breadth Electives: 12 units
12 Units selected from any non-General Education courses in Chemistry (CHEM), Biology (BIOL), or Geoscience (GEOS). All 12 units must be selected from one department.

Breadth of Study Program Matrix

The program addresses the subject matter skills and abilities applicable to the content domains in science listed below:

A-Astronomy
B-Dynamic Processes of the Earth (Geodynamics)
C-Earth Resources
D-Ecology
E-Genetics/Evolution
F-Molecular Biology and Biochemistry
G-Cell and Organismal Biology
H-Waves
I-Forces and Motion
J-Electricity and Magnetism
K-Heat Transfer and Thermodynamics
L-Structure and Properties of Matter

Below is a matrix listing the science breadth courses required for the General Physics degree and the Content Domains for Subject Matter Understanding and Skill in General Science. For each sub-domain, a check mark indicates that the sub-domain is addressed in the course indicated. Evidence is contained in the syllabi for each course that is in Appendix E as well as the course descriptions in Appendix B and Appendix C. In more cases than not, the content is included in more than one course that assures not only complete coverage, but also a chance for the student to integrate their knowledge across science disciplines.

COURSE	BIOL 6A	BIOL 6B	CHEM 37	CHEM 38	GEOS 2	GEOS 100	PHYS 4A	PHYS 4B	PHYS 4C
Domain 1.1 Astronomy									
a. Describe the chemical composition and physical structure of the universe						√			
b. Describe the structure of the solar system and its place in the Milky Way galaxy						√			
c. Distinguish between stars and planets						√			
d. Recognize that stars vary in color, size, and luminosity						√			
e. Describe a simple model of how fusion in stars produces heavier elements and results in the production of energy, including light						√			
f. Describe the regular and predictable patterns of stars and planets in time and location						√	√		
g. Explain and predict changes in the moon's appearance (phases)						√			
h. Describe the use of astronomical instruments in collecting data, and use astronomical units and light years to describe distances						√	√	√	√
Domain 2.1 Tectonics									
a. Diagram the features that provide evidence for plate tectonics					√				
b. Summarize the thermal processes driving plate movement					√				
c. Explain how density and buoyancy are related to plate tectonics					√				
d. Describe types of plate boundaries					√				
e. Relate the causes of volcanoes, earthquakes, and earth resources to tectonic processes					√				
f. Summarize earthquake processes					√				
Domain 2.2 Rock Formation									
a. Diagram and explain the rock cycle					√				
b. Describe relative and absolute dating techniques, including how half-lives are used in radiometric dating					√				√
c. Compare uniformitarianism and catastrophism					√				
Domain 2.3 Shaping Earth									
a. Describe the dynamic processes of erosion, deposition, and transport					√				
b. Describe coastal processes including beach erosion and natural hazards					√				
c. Describe the effects of natural hazards					√				
Domain 2.4 Energy & Earth									
a. Diagram the water cycle and describe interrelationships of surface and sub-surface reservoirs					√	√			
b. Explain daily and seasonal changes in the sky						√			
c. Analyze the uneven heating of Earth by the sun						√			
d. Discuss the effects of air movements on weather						√			
e. Describe the energy transfer processes of convection, conduction, and radiation in relation to the atmosphere/ocean and Earth's interior structure						√			
f. Interpret weather maps to predict weather patterns						√			

COURSE	BIOL 6A	BIOL 6B	CHEM 37	CHEM 38	GEOS 2	GEOS 100	PHYS 4A	PHYS 4B	PHYS 4C
Domain 3.1 Earth Resources									
a. Describe a variety of energy resources					√				
b. Recognize earth materials as resources					√				
c. Identify resources as renewable vs. nonrenewable					√				
d. Compare extraction and recycling in relation to energy, cost, and demand					√				
e. Explain sustainable uses of resources with respect to utility, cost, human population, and environmental consequences					√				
Domain 4.1 Ecology									
a. Explain energy flow and nutrient cycling through ecosystems		√							
b. Explain matter transfer		√							
c. Distinguish between abiotic and biotic factors	√								
d. Compare the roles of photosynthesis and respiration	√								
e. Describe interrelationships within and among ecosystems		√							
f. Identify and explain factors that affect population types and size		√							
Domain 5.1 Genetics & Evolut'n									
a. Explain the inheritance of traits	√								
b. Solve problems that illustrate monohybrid and dihybrid crosses	√								
c. Compare sexual and asexual reproduction	√								
d. Explain how the coding of DNA controls the expression of traits	√								
e. Define mutations and explain their causes	√								
f. Explain the process of DNA replication	√								
g. Describe evidence, past and present, that supports the theory of evolution		√							
h. Explain the theory of natural selection		√							
i. List major events that affected the evolution of life on Earth		√							

COURSE	BIOL 6A	BIOL 6B	CHEM 37	CHEM 38	GEOS 2	GEOS 100	PHYS 4A	PHYS 4B	PHYS 4C
Domain 6.1 Bio & Biochem									
a. Demonstrate understanding that a small subset of elements (C, H, O, N, P, S) makes up most of the chemical compounds in living organisms by combining in many ways	√								
b. Recognize and differentiate the structure and function of molecules in living organisms	√								
c. Describe the process of protein synthesis	√								
d. Compare anaerobic and aerobic respiration	√								
e. Describe the process of photosynthesis	√								
Domain 7.1 Cell & Org. Bio.									
a. Describe organelles and explain their function	√								
b. Relate the structure of organelles and cells to their functions	√								
c. Identify and contrast animal and plant cells	√								
d. Explain the conversion, flow, and storage of energy of the cell	√								
e. Identify the function and explain the importance of mitosis and meiosis	√								
f. Compare single-celled and multicellular organisms	√								
g. Describe the levels of organization (e.g., cells, tissues, organs, systems, organisms) in plants and animals		√							
h. Describe the structures and functions of human body systems		√							
i. Explain the major structures and their functions in vascular and nonvascular plants		√							
j. Describe the life processes of various plant groups		√							
k. Explain the reproductive processes in flowering plants		√							
Domain 8.1 Waves									
a. Compare the characteristics of sound, light, and seismic waves					√			√	√
b. Explain that energy is transferred by waves without mass transfer								√	√
c. Explain how lenses are used in simple optical systems									√
d. Explain and apply the laws of reflection and refraction									√
e. Compare transmission, reflection, and absorption of light in matter									√

COURSE	BIOL 6A	BIOL 6B	CHEM 37	CHEM 38	GEOS 2	GEOS 100	PHYS 4A	PHYS 4B	PHYS 4C
Domain 9.1 Forces & Motion									
a. Discuss and apply Newton's laws							√	√	√
b. Define pressure and relate it to fluid flow and buoyancy							√		
c. Describe the relationships among position, distance, displacement, speed, velocity, acceleration, and time							√		
d. Identify the separate forces that act on a body and describe the net force on the body							√	√	√
e. Construct and analyze simple vector and graphical representations of motion and forces							√		
f. Identify fundamental forces, including gravity, nuclear forces, and electromagnetic forces, and explain their roles in nature							√	√	√
g. Explain and calculate mechanical advantages for levers, pulleys, and inclined planes							√		
Domain 10.1 Elec. & Mag.									
a. Describe and provide examples of electrostatic and magnetostatic phenomena								√	
b. Predict charges or poles based on attraction/repulsion observations								√	
c. Build a simple compass and use it to determine direction of magnetic fields								√	
d. Relate electric currents to magnetic fields								√	
e. Design and interpret simple series and parallel circuits								√	
f. Define and calculate power, voltage differences, current, and resistance in simple circuits								√	
Domain 11.1 Heat & Thermo.									
a. Know the principle of conservation of energy and apply it to energy transfers							√	√	√
b. Discuss how the transfer of energy as heat is related to changes in temperature							√		√
c. Diagram the direction of heat flow in a system									√
d. Describe the methods of heat transfer by conduction, convection, and radiation									√
e. Explain how chemical energy in fuel is transformed to heat				√			√		√
f. Design and explain experiments to induce a physical change			√	√					√
g. Distinguish between physical and chemical changes			√	√					√

COURSE	BIOL 6A	BIOL 6B	CHEM 37	CHEM 38	GEOS 2	GEOS 100	PHYS 4A	PHYS 4B	PHYS 4C
Domain 12.1 Matter									
a. Identify, describe, and diagram the basic components within an atom			√						√
b. Know that isotopes of any element have different numbers of neutrons but the same number of protons, and that some isotopes are radioactive			√	√					√
c. Differentiate between atoms, molecules, elements, and compounds			√						
d. Compare and contrast states of matter and describe the role energy plays in the conversion from one state to another			√						
e. Discuss the physical properties of matter including structure, melting point, boiling point, hardness, density, and conductivity			√					√	√
f. Recognize that all chemical substances are characterized by a unique set of physical properties			√	√				√	√
g. Define and calculate density, and predict whether an object will sink or float in a fluid							√		
h. Explain that chemical changes in materials result in the formation of a new substance corresponding to the rearrangement of the atoms in molecules			√	√					
i. Explain and apply principles of conservation of matter to chemical reactions, including balancing chemical equations			√						
j. Distinguish among acidic, basic, and neutral solutions				√					
k. Describe the construction and organization of the periodic table			√						√
l. Based on position in the periodic table, predict which elements have characteristics of metals, semi-metals, non-metals, and inert gases			√						√
m. Explain chemical reactivity using position on the periodic table			√						
n. Predict and explain chemical bonding using elements' positions in the periodic table			√						
o. Recognize that inorganic and organic compounds are essential to processes within living systems	√								
p. Explain the central role of carbon in living system chemistry	√								

Depth of Study Program Matrix

The concentration in physics requires the standard three-semester sequence of 4-unit calculus based lower division courses. These courses cover mechanics (PHYS 4A), electricity and magnetism (PHYS 4B), and sound, thermodynamics, optics and modern physics (PHYS 4C). Upper division requirements include one additional year of modern physics (PHYS 200A & 200B), one semester of laboratory in which modern topics are explored experimentally (PHYS 227), a seminar course in which the student must complete a one-hour presentation (PHYS 291), and two additional courses of the student's choice.

A high level of mathematical skill is required for successful completion of the program. Students are required to complete the standard four-semester sequence of 4-unit calculus courses

concurrently with their physics. Differential and integral calculus are used early. Vector calculus and differential equations are used in upper division courses.

Content Domains: Subject Matter Understanding and Skill in Physics

Domain 1. Motion and Forces
Domain 2. Conservation of Energy and Momentum
Domain 3. Heat and Thermodynamics
Domain 4. Waves
Domain 5. Electromagnetism
Domain 6. Quantum Mechanics and the Standard Model of Particles

The content matrix below summarizes the coverage of each of the six physics content domains by each of the relevant physics courses in the program.

COURSE	PHYS 4A	PHYS 4B	PHYS 4C	PHYS 200A	PHYS 200B	PHYS 227
Domain 1.1 Motion & Forces						
a. Solve problems using Newton's Second Law	√	√	√	√	√	√
b. Construct appropriate free-body diagrams	√	√	√	√	√	√
c. Solve periodic motion problems	√	√	√	√	√	√
d. Solve 2-dimensional problems	√	√	√	√	√	√
e. Generate and understand functional relationships of graphs	√	√	√	√	√	
f. Recognize relationships among variables for linear motion and rotational motion	√	√	√	√	√	√
g. Solve problems involving linear and rotational motion in term of forces and torques	√	√	√	√	√	
Domain 2.1 Conservation of Energy and Momentum						
a. Use conservation of energy to characterize kinetic-potential energy systems such as oscillating systems (pendula and springs), projectile motion, and roller coasters	√					
b. Analyze elastic and inelastic collisions and solve for unknown values	√	√	√	√	√	√
c. Solve problems involving linear and rotational motion in terms of conservation of momentum and energy	√	√	√	√	√	√
d. Recognize relationships between energy/momentum conservation principles and Newton's Laws	√	√	√	√	√	
e. Examine the impact of friction on conservation principles	√					
f. Interpret force-versus-time and force-versus-distance graphs to find, for example, work done or impulse on a system	√	√	√			
Domain 3.1 Heat and Thermodynamics						
a. Solve problems involving the laws of thermodynamics using the relationships among work, heat flow, energy, and entropy			√			
b. Define and correctly apply thermodynamic properties of materials such as specific heat (heat capacity), heats of fusion, heat of vaporization, thermal conductivity, and thermal expansion to solve problems			√			
c. Solve problems for ideal gas systems			√			
d. Solve problems involving cyclic processes, including calculations of work done, heat gain/loss, , and entropy change			√			
e. Interpret graphs showing phase changes and graphs of cyclic processes			√			
f. Describe a plasma, state its characteristic properties, and contrast it with an ideal gas			√	√	√	
Domain 4.1 Waves						
a. Relate wave propagation to properties of materials (e.g., predict wave speed from density and tension)		√	√	√	√	
b. Describe, distinguish, and solve both conceptual and numerical problems involving interference, diffraction, refraction, reflection, Doppler effect, polarization, dispersion, and scattering			√	√	√	√
Domain 5.1 Electric and Magnetic Phenomena						

a. Analyze electric and magnetic forces, charges, and fields using Coulomb's law, the Lorentz force, and the right-hand rule		√		√	√	√
b. Apply energy principles to analyze problems in electricity, magnetism, and circuit theory involving capacitors, resistors, and inductors		√				√
c. Calculate power, voltage changes, current, and resistance in multiloop circuits involving capacitors, resistors, and inductors		√				√
d. Interpret and design mixed series and parallel circuits involving capacitors, resistors, and inductors		√				√
e. Solve problems involving the relationships between electric and magnetic phenomena		√	√	√	√	√
f. Explain properties of transistors, diodes, and semiconductors		√				√
Domain 6.1 Quantum Mechanic and the Standard Model of Particles						
a. Distinguish the four fundamental forces of nature, describe their ranges, and identify their force carriers	√			√	√	
b. Evaluate the assumptions and relevance of the Bohr model of the atom			√	√	√	

Appendix C

Part 6: Program Provider Guidelines for Alternative Professional Clear Administrative Services Credential Programs

Guidelines

and

Related Expectations

Program Provider Guidelines for Alternative Professional Clear Administrative Services Credential Programs

Guideline 1: Program Design and Coordination

The program sponsor identifies the basis upon which decisions will be made in determining developmental objectives for each candidate in the program and for assessing the advancement of each candidate toward those objectives during the course of the program. The program is coordinated effectively, and key program personnel are identified and their responsibilities are clearly defined.

Guideline 1 Expectations:

- The program sponsor identifies general administrator performance expectations for use in identifying each candidate's strengths and weaknesses, setting developmental objectives, and measuring progress. These general expectations may be the California Professional Standards for Educational Leaders or a similar set of administrator performance expectations that focus on instructional leadership.

- The program sponsor provides its general administrator performance expectations to each candidate at the outset of the candidate's participation in the program and explains the performance expectations.

- The program identifies the individual responsible for coordination of the program, key personnel involved in program implementation, and the reporting relationships between the identified personnel. The program identifies the person or entity to whom the authority to certify program completion is designated.

Guideline 2: Evaluation of Program Quality

The program sponsor conducts ongoing evaluation of the quality and effectiveness of the program for the purpose of identifying needs for program improvement and to ensure that the program is providing mentoring, support and assistance of high quality that is targeted to meet individual candidates' needs. The program sponsor maintains records of services provided to candidates, candidate assessments and other documentation of program and candidate activities for use in external program assessment activities to be conducted by the Commission.

Guideline 2 Expectations:

- The program evaluation process includes an opportunity for candidates to provide the program sponsor with their perceptions of the quality of the various aspects of the program, including those areas in which the program successfully provided appropriate mentoring, support and assistance, and those areas in which candidates perceived program deficiencies.

- The program evaluation process includes an opportunity for mentors to provide information on their perceptions of the quality of various aspects of the program, including the appropriateness and sufficiency of mentor training requirements, the effectiveness of criteria for mentor assignment, and the quality of the mentor evaluation process.

- The program sponsor uses information obtained through the program evaluation process to identify areas in need of improvement and takes appropriate actions to improve and ensure program quality.

- The program sponsor maintains records of program policies and procedures, services provided to candidates, candidate assessment data, number of mentors, number of participants, and other data related to the program's value, scope and content.

- The program sponsor consents to providing program information to the Commission upon request and to cooperate with program audit and reporting activities conducted by the Commission.

Guideline 3: Initial Assessment of Candidate Competence

Within the candidate's first 90 days of employment in a position requiring possession of an administrative services credential, the program sponsor initially assesses candidates based on the program's general administrator performance expectations. This initial assessment includes a candidate self-assessment component in which the candidate describes current job responsibilities and challenges, and perceived personal strengths and weaknesses. The results of this initial assessment inform decisions concerning the administrator's needs and developmental objectives to be met during the course of the program. Mentoring, support and assistance activities initially focus on those areas in which the initial assessment indicates additional support is needed for the candidate to be successful in his/her current assignment.

Guideline 3 Expectations:

- The program's initial assessment is designed to measure a candidate's initial level of competence in each of the program's general administrator performance expectations in a way that can be compared to future assessments of candidate competence so that the program sponsor can determine the candidate's progress and increased administrative effectiveness over time.

- The results of the initial assessment are shared with the candidate and individual(s) assigned to provide the candidate with mentoring, support and assistance to ensure that all parties have a clear understanding of the candidate's initial strengths, weaknesses, and areas of focus for the mentoring, support and assistance to be provided to the candidate.

- The program sponsor maintains a record of each candidate's initial assessment results for comparison with subsequent assessments to determine candidate progress over the course of the program.

- The assessment examines candidate competence authentically, systematically and fairly, and takes into account the highly variable nature of administrative responsibilities.

Guideline 4: Individualized Mentoring Plan

The program sponsor establishes a process through which a mentoring plan is created for each administrator served by the program. The plan addresses the mentoring, support and assistance needs of each administrator, and may identify additional learning activities needed for the administrator's professional development. The plan includes developmental objectives that the individual administrator is expected to meet over the course of the program.

Guideline 4 Expectations:

- The program sponsor initially assesses each candidate's strengths and weaknesses based on the program's general administrator performance expectations, and uses the results of this assessment to create an appropriate individualized mentoring plan.

- The candidate's developmental needs and current work context are considered and addressed in the development of the plan.

- The candidate, employer, and a program representative participate in the development of the plan and provide written approval of the initial plan.

- The program sponsor provides an opportunity to review and amend the plan as necessary to meet the administrator's needs or address changes in the administrator's assignment or other aspects of the administrator's work context. The candidate, employer, and a program representative review and approve any changes to the individualized mentoring plan.

Guideline 5: Provision of Mentoring, Support and Assistance

The program sponsor provides mentoring, support and assistance that is designed to meet the individual administrator's needs, and is conducted on a regular, ongoing basis throughout the course of, at minimum, the administrator's first two years of administrative service while possessing the Preliminary Administrative Services Credential.

Guideline 5 Expectations:

- The program sponsor, an employer representative, and the administrator collaborate to identify the mentoring, support and assistance needs of the administrator and appropriate means for providing these services.

- The administrator's individual mentoring plan identifies an administrator meeting the qualifications described in Guideline 6 who will serve as the lead mentor* for the administrator.

- The administrator's individual mentoring plan identifies the frequency of regularly scheduled meetings between the administrator and lead mentor. Communication formats for these meetings may be varied (e.g. phone, e-mail, teleconference) but must allow reasonable access for the administrator to the individual(s) assigned to provide support.

- The program sponsor ensures that the administrator has access to mentoring and support in crises or other sensitive situations that occur at times other than the regularly scheduled meetings between the administrator and lead mentor.

- The program sponsor identifies other individuals, in addition to the lead mentor, who have expertise in specific areas applicable to the administrator's current assignment and who will be available to the administrator as needed to provide additional information and guidance.

- The program sponsor provides a list of additional resources that may assist the administrator in succeeding in the current administrative assignment.

- The program sponsor provides opportunities for communication between administrators served by the program to allow for peer engagement and support.

* "Lead mentor" refers to the individual who will serve in the primary mentoring role for the candidate. These guidelines encourage the use of other qualified individuals to assist in the mentoring role, but require that the program assign a lead mentor to serve as the administrator's primary contact and to lead in the coordination of all mentoring activities.

Guideline 6: Mentor Qualifications and Assignment

The program sponsor establishes specific qualifications for the selection of lead mentors* and criteria to be used in determining the appropriate assignment of lead mentors to individual administrators served by the program. Qualifications for lead mentors include appropriate mentor training and experience. The program sponsor establishes an evaluation process for lead mentors and uses the evaluation results to amend mentor selection qualifications and/or training requirements, and to reassign or replace mentors as needed.

Guideline 6 Expectations:

- The program sponsor creates a list of prospective lead mentors of sufficient number to serve all administrators served by the program. All mentors listed meet the qualifications for lead mentors established by the program sponsor.

- Lead mentor qualifications address the number of years of administrative experience and other teaching and services experience; the level and quality of training in support and mentoring; special skills and/or experiences applicable to administrative responsibilities; and other characteristics conducive to successful mentoring, support and assistance.

- The program sponsor's criteria of assignment of lead mentors to individual administrators consider similarities in their current responsibilities and work contexts; geographic proximity; ease of interaction; and other characteristics likely to result in a positive mentoring relationship.

- The program sponsor creates a mechanism for each administrator in the program to evaluate his/her lead mentor. The evaluation provides information on each lead mentor's strengths and weaknesses, identifies areas in which additional training may be required, and rates the overall performance of the mentor from the perspective of the administrator being mentored.

- The program sponsor uses the results of the lead mentor evaluations to make any necessary changes to lead mentor selection qualifications, amend training requirements, and reassign or replace mentors who receive unsatisfactory evaluations.

* "Lead mentor" refers to the individual who will serve in the primary mentoring role for the candidate. These guidelines encourage the use of other qualified individuals to assist in the mentoring role, but require that the program assign a lead mentor to serve as the administrator's primary contact and to lead in the coordination of all mentoring activities.

Guideline 7: Assessment of Candidate Competence

The program sponsor conducts ongoing assessment of the candidate's competence based on the program's general administrator performance expectations, and provides the results to the candidate and the candidate's lead mentor to be used as an indicator of candidate progress, and to redirect the focus of mentoring, support and assistance, if needed. Prior to certifying that each candidate has completed program requirements, the program sponsor conducts a culminating assessment of the candidate's competence based on the program's general administrator performance expectations and the developmental objectives identified in the candidate's individualized mentoring plan. Through this assessment the program sponsor and the lead mentor verify that the candidate has met the developmental objectives established in the individualized mentoring plan and has reached a level of administrative competence appropriate to merit recommendation for the Professional Clear Administrative Services Credential.

Guideline 7 Expectations:

- Candidates are provided feedback on their progress at multiple points in the program.
- Each candidate's individualized mentoring plan is reviewed periodically on the basis of the assessment results and amended as necessary to respond to changes in the candidate's needs for mentoring, support and assistance.
- The assessment examines candidate competence authentically, systematically and fairly, and takes into account the highly variable nature of administrative responsibilities.
- A culminating assessment forms the basis for certifying that the candidate has successfully completed the program and has reached a level of competence meriting possession of a Professional Clear Administrative Services Credential

Appendix D

Additional Information about Two Programs
Approved at the August 2005 Commission Meeting

English	**California State University, Northridge**
Mathematics	**University of California, Irvine**

California State University, Northridge – English
Catalog Course Descriptions

CORE COURSES:

ENGL 258. MAJOR ENGLISH WRITERS I (3)
Prerequisite: Completion of the lower division writing requirement. A study of works of major English writers from the Middle Ages to Samuel Johnson, with attention to literary movements and backgrounds. Critical writing required. (Available for General Education, Humanities.)

ENGL 259. MAJOR ENGLISH WRITERS II (3)
Prerequisite: Completion of the lower division writing requirement. A study of works of major English writers—from Blake to the present, with attention to literary movements and backgrounds. Critical writing required. (Available for General Education, Humanities.)

ENGL 275. MAJOR AMERICAN WRITERS (3)
Prerequisite: Completion of the lower division writing requirement. Study of the important works of a selected number of American writers from the colonial period to modern times. Critical writing required. (Available for General Education, Humanities.).

ENGL 301. LANGUAGE AND LINGUISTICS (3)
Prerequisite: Completion of the lower division writing requirement. An introduction to linguistic science, its back ground, development, and relation to other fields of study; recent developments in the study of language. (Available for Section C of the Multicultural Requirementfor Credential Candidates.)

ENGL 302. INTRODUCTION TO MODERN GRAMMAR (3)
A basic course in grammar, traditional, structural, and transformational; some applications of linguistics to the teaching of English and the language arts are suggested.

ENGL 355. WRITING ABOUT LITERATURE (3)
Prerequisites: Completion of the lower-division writing requirement and two lower-division English courses. Intensive study of the literary genres of poetry, prose fiction, and drama. Emphasis on written analysis of selected works in each genre. Development of criteria for responsible judgment.

ENGL 405. LANGUAGE DIFFERENCES & LANGUAGE CHANGE (3)
Prerequisite: Completion of the lower division writing requirement. A study of how and why language changes, with particular emphasis on the history of English, social and geographical dialects, current English usage, and lexicography. A brief review of phonology and grammar will be included for those students who need it. (Available for Section C of the Multicultural Requirement for Credential
Candidates.)

ENGL 406. ADVANCED EXPOSITORY WRITING FOR TEACHERS (3)
Prerequisite: Completion of the lower division writing requirement. This advanced course in written composition and recent composition theory extends the student's writing skills, explores the kind of writing required of California public school students, and establishes criteria for the evaluation of writing at all levels. All Students are required to attend a technological workshop to complete a series of technological requirements. Prospective teacher candidates must participate in field

experience as part of their understanding of the teaching of writing and language arts in the public school classroom.

ENGL 416. SHAKESPEARE: SELECTED PLAYS (3)
A close study of three to five plays. ENGL 416 and 417 may be taken separately or in any sequence.

ENGL 417. SHAKESPEARE: A SURVEY (3)
A study of eight to fifteen of the major plays. ENGL 3416 and 417may be taken separately or in any sequence.

ENGL 429. LITERATURE FOR ADOLESCENTS (3)
Prerequisite: One lower-division literature course and ENGL 355 or one lower-division literature course and ENGL 305. Critical analysis of selected literary works of interest to adolescents, including works commonly used in secondary schools (grades 7-12); development of principles for the evaluation of literature for adolescents. Prospective teacher candidates must participate in field experience as part of their understanding of the teaching of literature and language arts in the public school classroom.

ENGL 436. MAJOR CRITICAL THEORIES (3)
Study of major texts of literary criticism from Plato to the present. Emphasis on application of critical theories.

THE FOLLOWING IS THE COURSE DESCRIPTION FOR THE SENIOR SEMINAR, ENGLISH 495ESM, REQUIRED BY ALL ENGLISH SUBJECT MATTER STUDENTS:

English 495ESM Senior Seminar for Subject Matter Students
Multimedia Literacy in a Global Context.
(1)Preparatory: Senior Seminar; (2) Preparatory: Senior-standing and either two lower-division courses in literature or 3 units of lower-division literature and English 355
English 495ESM is a capstone course for Single Subject Credential students in English that focuses on literature and literacy in multiple genres (poetry, world short fiction, world mythology, and media literacy). Its multigenre, multimedia, and transnational compass makes it innovative and comprehensive. This course reviews, synthesizes, and builds on students' previous work in the English major in critical theory, literature, expository, and creative writing. Included in this specialized seminar will be advanced technological training with expectations of creative applications. Students will present their final seminar projects publicly as well as produce course portfolios, containing both analytical and creative materials.

COMMUNICATION STUDIES 309, ADVANCED PUBLIC SPEAKING (3)
Prerequisite: COMS 151 or 255.
Application of the principles of audience analysis to the preparation, presentation and evaluation of persuasive messages. (Available for General Education, Basic Subjects.)

THEATER 473/L. DRAMATIC PERFORMANCE IN THE SECONDARY LANGUAGE Arts curriculum and Lab (2/1)
Prerequisite: Junior or Senior-standing. Study and practical application of dramatic performance in secondary education, language and arts curriculum. Introduction to and application of artistic and

aesthetic tools and the sensitivities required for creative expression. Fulfills General Education, Section C.2 requirements for English Subject Matter Program majors only.

LITERATURES OF CULTURAL DIVERSITY (3 UNITS): **ONE OF THE FOLLOWING:**

ENGL 311. HISTORY OF AFRICAN-AMERICAN WRITING (3)
Prerequisite: Completion of the lower-division writing requirement. Preparatory: At least one university-level course in literature. Focus on the development of the major genres in African-American writing from the beginning to the present, relating them to the larger movements in American culture. Critical writing required. (Available for General Education, Section F.3, Comparative Cultural Studies)

ENGL 314. NORTH AMERICAN INDIAN LITERATURE (3)
Preparatory: Completion of the lower-division writing requirement. Survey of North American Indian literatures, including traditional oral forms, autobiographies, and contemporary poetry and prose.

ENGL 368. GAY MALE WRITERS (3)

Preparatory: Completion of lower-division writing requirement. Examines works in British and American literature that: a) were written by gay men, and b) portray the lives of gay individuals. Focusing primarily on texts written since the late 19th century, traces the development of gay male self-representation in poetry, novels, short fiction, drama, and nonfiction.

ENGL 369. LESBIAN WRITERS (3)
Preparatory: Completion of lower-division writing requirement. Primarily focuses on the work of lesbian writers of the 20th century. Using the approaches of current feminist literary theorists, explores the diversity and intersections of lesbian literary traditions. Examines the extent to which lesbian writers have followed and/or altered genre conventions in fiction and poetry.

ENGL 371. ISSUES IN JEWISH-AMERICAN WRITING (3)
Prerequisite: Completion of the lower-division writing requirement. Study of Jewish writing in America as it affects the relationship between Jewish issues and themes and American culture, based on the works of such authors as I. B. Singer, Roth, Bellow, Malamud, Cahan, Paley, Olsen, Shapiro, Ozick, and Potok. Critical writing required. (Available for General Education, Section F.3, Comparative Cultural Studies)

ENGL 431. IMAGES OF WOMEN IN LITERATURE (3)
Preparatory: Completion of 3 units of lower-division literature. Study of the images of women in literature and criticism, primarily by women themselves. Emphasis on the diversity of contemporary portrayals and their traditional backgrounds.

ENGL 433. WOMEN AUTHORS (3)
Preparatory: 6 units of lower-division literature courses or 3 units of lower-division literature and ENGL 355. Study of literature (poetry and prose) by prominent English and American women authors from earliest times to the present.

ENGL 434. 19TH-CENTURY WOMEN NOVELISTS (3)
Preparatory: 6 units of lower-division literature courses or 3 units of lower-division literature and ENGL 355. Study of selected novels by important 19th-century women novelists, both British and American, including such writers as Alcott, Austen, C. Brontë, E. Brontë, Chopin, Eliot, Gaskell, Gilman, and Stowe. Examines both text and context for each novel studied in order to suggest why these women chose to be writers, why they chose the subjects they did, and how their works have been received by readers.

ENGL 487. LATINO/A LITERATURES OF THE AMERICAS (3)
Preparatory: ENGL 275; 436. Study of selected works of Latina and/or Latino writers from both the U.S. and Latin America, as well as of issues raised by critics and theorists in the field. Analysis of primary texts will employ methods of contemporary literary criticism. Topic or theme selected by instructor.

AAS 321. ASIAN AMERICAN FICTION (3)
Prerequisite: Completion of the lower-division writing requirement. Study of Asian American fiction written by Americans of Chinese, Japanese, Korean, Filipino, South Asian, and Southeast Asian ancestry. Regular writing assignments required. (Available for General Education, Section C.1, Humanities)

CHS 380. CHICANA/O LITERATURE (3)
Preparatory: Completion of the lower-division writing requirement.Study of major Chicana/o writers. Includes an analysis of Chicano novels, short stories, theater and poetry. Students develop analytical skills through class discussions, written assignments and readings. (Available for General Education, Section C.1, Humanities)

CHS 381. CONTEMPORARY CHICANA LITERATURE (3)
Preparatory: Completion of the lower-division writing requirement. Introduction to the literature produced by contemporary Chicana writers. Reading and discussion of narrative works, poetry and drama as well as socio-historical criticism, literary theory and biography.Socio-critical and textual analysis. Regular written assignments required. (Available for General Education, Section C.1, Humanities)

PAS 344. LITERATURE OF THE CARIBBEAN AND AFRICAN EXPERIENCE (3)
Prerequisite: Completion of the lower-division writing requirement. Examines the literatures of people in Africa and the Caribbean. Establishes the theoretical, historical, cultural and imagistic framework within which that literature operates. Thematic analysis of the literatures with respect to both their comparative experiences and their specifically different backgrounds. (Available for General Education, Section C.1, Humanities)

PAS 346. CONTEMPORARY BLACK FEMALE WRITERS (3)
Prerequisites: PAS, CHS, or ENGL 155; completion of the lower division writing requirement. Study of selected works by contemporary Black women writers, including Alice Walker, ToniMorrison, Ntozake Shange, and Maya Angelou. Themes explored include correcting the images, movement from masking to selfrevelation, male-female relationships, and search for wholeness. (Available for General Education, Section C.1, Humanities)

EXTENDED STUDY CATALOG COURSE DESCRIPTIONS
(12 units in one of the following options)

Literature Extended Study Option:

ENGL 443. ENGLISH LITERATURE OF THE MIDDLE AGES (3)
Prerequisite: 6 units of lower-division literature courses or 3 units of lower-division literature and ENGL 355. A study of the literature of England to 1500, including *Beowulf* and representative Old English secular and religious poems, and such Middle English authors as Chaucer, Langland, the *Pearl* Poet, Gower, and Malory, and such medieval genres as the romance, the lyric, the ballad, and the drama. Some works will be read in modern English versions.

ENGL 473. AMERICAN LITERATURE: 1607-1860 (3)
Prerequisite: 6 units of lower-division literature courses or 3 units of lower-division literature and ENGL 355. Study of the literature and the culture of the colonial period, the early republic, and the romantic period.

ENGL 418. ENGLISH DRAMA TO 1642 (3)
A study of English drama (exclusive of Shakespeare) from its beginning to the closing of the theaters, including major figures such as Marlowe, Jonson, and Webster.

ENGL 414. CHAUCER (3)
Prerequisite: 6 units of lower-division literature courses or 3 units of lower-division literature and ENGL 355. A study of *The Canterbury Tales* and selected other poems.

Literature of Diversity Extended Study Option:

ENGL 368. GAY MALE WRITERS (3)
Prerequisite: Completion of lower division writing requirement. This course will examine works in British and American literature that: a) were written by gay men, and b) portray the lives of gay individuals. Focusing primarily on texts written since the late nineteenth century, it will trace the development of gay male self-representation in poetry, novels, short fiction, drama, and nonfiction.

ENGL 431. IMAGES OF WOMEN IN LITERATURE (3)
Prerequisite: Completion of 3 units of lower division literature. A study of the images of women in literature and criticism, primarily by women themselves. Emphasis on the diversity of contemporary portrayals and their traditional backgrounds.

AAS 420. ASIAN AMERICAN LITERARY SELFREPRESENTATIONS (3)
Prerequisite: Completion of the lower division writing requirement and AAS 100. Examines self-representations in Asian American literary studies. Addresses how self-representations in Asian American literature commonly work within and across a variety of literary genres. Attention also will be paid to the aesthetic, cultural, socio-historical, and publishing factors that have shaped non-fictional self-representations.

ENGL 314. NORTH AMERICAN INDIAN LITERATURE (3)
Prerequisite: Completion of the lower division writing requirement. A survey of North-American Indian literatures, including traditional oral forms, autobiographies, and contemporary poetry and prose.

Creative Writing Extended Study Option:

ENGL 308. NARRATIVE WRITING (3-3)

Prerequisite: ENGL 208 or demonstrated proficiency. Intensive practice in narrative writing with emphasis on short fiction; analysis and criticism of students' work as well as analysis of selected published writings. May be elected a second time.

ENGL 408. ADVANCED NARRATIVE WRITING (3-3)

Prerequisite: ENGL 308. Continued practice in the writing of prose fiction, with a concentration on experimentation in style and structure. Analysis and criticism of students' work. May be repeated once for credit.

ENGL 464. THEORIES OF POETRY (3)

Intensive study of the theories and craft of poetry.

ENGL 465. THEORIES OF FICTION (3)

Intensive study of the theories and craft of fiction.

Linguistics and Diversity Extended Study Option:

LING 417. LANGUAGE DEVELOPMENT & ACQUISITION (3)

Prerequisites: Upper division standing, and an introduction to the study of language. This course introduces students to the study of language development and acquisition, including such topics as approaches to the development of children's grammars, the development of communicative competence, definitions of bi- and multi-lingualism, relationships between language development and learning to read, issues particular to the multilingual nature of California, and issues related to exceptional language development. The course is required for both ITEP and Linguistics/TESL students, and addresses topics linked to language arts and (T) ESL methodscourses for students preparing to teach.

PAS 395. BILINGUALISM IN THE AFRICAN-AMERICAN COMMUNITY (3)

Prerequisite: Completion of the lower division writing requirement. Explores the genesis of African-American linguistic patterns with a focus on acquisition of Ebonics as a socio-cultural linguistic phenomenon. (Available for Section C of the Multicultural Requirement for Credential Candidates.)

CHS 482. LANGUAGE OF THE BARRIO (3)

Prerequisite: Completion of the lower division writing requirement. An examination of the origin and current features of informal spoken Spanish in the Southwestern U.S. It includes an analysis of common colloquial forms, slang, profanity, and code-switching. The course also addresses English usage among Chicanas/os. (Available for Section C. of the Multicultural requirement for Credential Candidates.)

COMS 356. INTERCULTURAL COMMUNICATION (3)

Prerequisite: Completion of the lower division writing requirement. Cultural factors in interpersonal communication, such as perception, roles, language codes, and non-verbal communication. Students will apply and evaluate theories of intercultural communication. (Available for General Education, Comparative Cultural Studies.)

Communication Studies Extended Study Option:

COMS 301. PERFORMANCE, LANGUAGE, & CULTURAL STUDIES (3)
Study of the complex relationships among culture, language, and performance in communication. Examination of theory, behavior, practice and criticism from aesthetic and sociocultural perspectives, with emphasis on contemporary research in language, culture, and performance studies.

COMS 303. NARRATIVE IN PERFORMANCE (3)
Theory and practice in performing narrative fiction and nonfiction. Analysis of the role of narrative in the communicative life of the individual and society. Solo and group performances.

COMS 304. POETRY IN PERFORMANCE (3)
Theory and practice in performing poetry. Analysis of the role of poetry and poetic language in the communicative life of the individual and society. Solo and group performances.

COMS 360. COMMUNICATION AND THE SEXES (3)
Prerequisite: Completion of the lower-division writing requirement. An examination of the communication styles of males and females in a variety of settings. Emphasis is given to gender-related communication behavior and its implications for the ability to maintain effective personal and professional relationships. Strategies for fostering communication competence will be discussed. (Available for General Education, Applied Arts and Sciences.)

Theatre Extended Studies Option:

TH 111. ACTORS AND ACTING (3)
Introduction to theatre through an emphasis upon its central performer, the actor. Illustrative acting exercises. Not open to theatre majors. (Available for General Education, Humanities.)

TH 310. THEATRE IN PERFORMANCE (3)
Prerequisite: Completion of the Lower Division Writing Requirement. Introduction to the theatre through the experience of attending performances, preparatory lectures, and post- performance discussions and critiques. Critical writing assignments required. Not open to theatre majors. (Available for General Education, Humanities.)

TH 471. ADVANCED CREATIVE DRAMA (3)
Prerequisites: TH 371; consent of instructor. Comparison of theories, philosophies, and approaches to creative drama in a laboratory environment through exploration of, and practical experience with, various age levels. Class meets 6 hours per week.

TH 490. THEATRE PRODUCTION PARTICIPATION (1-2-3)
Participation in various aspects of Theatre CSUN's production program: acting, directing, technical, or managerial assignments. Maximum of 4 units may be earned. Not available for graduate credit.

Department of English **Domain 1: Core Courses**

	258	259	275	311	314	355	368	371	406	416	417	429	433	434	436	495ESM	Comm. 309	TH 479
1.1a	xx	xx	xx	x	x	xx	x		x	xx	xx	xx	xx	(x)	(x)	xx		(x)
1.1b	xx	xx	xx	x	x	xx	x		x	xx	xx	xx	xx	(x)	(x)	xx		
1.1c						(x)						xx						
1.1d	xx	xx	xx	x	x	xx	x	(x)	x	xx	xx	xx	xx	(x)	(x)	xx		(x)
1.2a	x	x	x	(x)	(x)	xx	(x)	(x)	(x)	xx	xx	xx	x	(x)	x	xx		(x)
1.2b	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	x	xx		(x)
1.2c		(x)	(x)	(x)	(x)	xx	(x)	(x)	(x)	xx	xx	xx	(x)	(x)	x	xx		xx
1.2d	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	x	xx	xx	x
1.3a	x	x	x	x	x	xx	x	(x)	xx	xx	xx	xx	(x)	x	x	xx	(x)	(x)
1.3b		x	x	x	x	xx	x	(x)	xx	xx	xx	xx	(x)	x	x	xx		(x)
1.4a				(x)	(x)	x	(x)	(x)	x	xx	xx	xx	x	x	x	xx	x	x
1.4b				(x)	(x)	(x)			xx			x	(x)	(x)	(x)	xx	xx	
1.4c	x	x	x	x	x	x	xx	x	xx	xx	xx	xx	x	x	xx	xx		(x)

Key

xx:	Always
x:	Sometimes
(x):	Partial

Department of English

Domain 2: Core Courses

	2.1a	2.1b	2.1c	2.1d	2.2a	2.2b	2.2c	2.3a	2.3b	2.3c	2.4a	2.4b	2.4c
301	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
302	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
405	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx		xx

Key

xx:	Always
x:	Sometimes
(x):	Partial

Department of English **Domain 3: Core Courses**

	258	259	275	311	355	368	371	406	416	417	429	433	434	436	495ESM	Comm. 309	301	302	405
3.1a	(x)	(x)	(x)	(x)	xx	x	(x)	xx	(x)	(x)	xx	(x)	(x)	xx	xx	x			
3.1b	(x)	(x)	(x)	xx	xx		(x)	xx			xx	(x)	(x)		xx	x			
3.1c	(x)	(x)	(x)	(x)	xx	(x)	(x)	xx	(x)	(x)	xx	(x)	(x)	xx	xx	x			
3.1d	(x)	(x)	(x)	(x)	xx	xx	(x)	xx	(x)	(x)	xx	(x)	(x)	(x)	xx				
3.2a	(x)	(x)	(x)	(x)	xx	(x)	(x)	xx			xx			(x)	xx	x		xx	
3.2b	(x)	(x)	(x)	(x)	xx	(x)	(x)	xx	(x)	(x)	xx	(x)	(x)	xx	xx	xx		xx	
3.2c	x	(x)	(x)		xx	(x)	(x)	xx	(x)	(x)	xx	(x)	(x)		xx	xx		xx	
3.2d	(x)	(x)	x	xx	xx	xx	(x)	xx	x	x	xx	x	x	xx	xx	xx		x	
3.2e	(x)	(x)	(x)	(x)	xx	xx	(x)	xx	(x)	(x)	xx	(x)	(x)	x	xx	xx		x	
3.3a	x	x	x	x	xx	xx	x	xx	x	x	xx	x	x	xx	xx	xx		xx	
3.3b	x	x	x	x	xx	xx	x	xx	x	x	xx	x	x	xx	xx	xx			
3.3c	x	x	x	x	xx	xx	x	xx	x	x	xx	x	x	x	xx	xx			
3.3d	x	x	x	xx	xx	xx	x	xx	x	x	xx	x	x	xx	xx	xx			
3.3e	x	x	x	xx	xx	xx	x	xx	x	x	xx	x	x	xx	xx	xx			
3.4a					xx			xx			xx				xx				
3.4b	x	x	x	xx	xx	xx	x	xx	x	(x)	xx	x	x	xx	xx	xx			
3.5a	(x)		(x)	xx	xx	xx	xx	xx	(x)	(x)	xx	(x)	(x)	xx	xx	x			
3.5b	(x)	(x)	(x)	(x)	xx	xx	xx	xx	(x)	(x)	xx	(x)	(x)	xx	xx	x			
3.5c	(x)	(x)	(x)	(x)	xx	xx	x	xx	(x)	(x)	xx	(x)	x	xx					
3.5d	(x)	(x)	(x)	(x)	xx	xx	xx	xx	(x)	(x)	xx	(x)	(x)	xx	xx	x			
3.5e	x	x	x	x	xx	xx	xx	xx	x	x	xx	x	x	xx	xx	x			
3.5f	(x)	(x)	(x)	(x)	xx	xx	xx	xx	(x)	(x)	xx	(x)	(x)	xx	xx	xx			

Key

xx:	Always
x:	Sometimes
(x):	Partial

	Comm. 309	TH 479	258	275	311	355	368	406	416	417	429	495ESM
4.1a	xx			x	x	xx	x	xx	x	x	xx	xx
4.1b	xx					xx		xx	x	x		x
4.1c	xx					xx		xx			xx	x
4.1d	xx			x		xx	x	xx	xx	xx	xx	x
4.2a	xx					xx		xx	x	x		xx
4.2b	xx					xx		xx	x	x	xx	xx
4.2c	xx						x	xx	x	x		xx
4.2d	x	xx						xx				xx
4.3a		xx						xx	x	x		
4.3b		xx						xx	x	x		
4.3c		xx						xx	x	x		
4.3d		xx							x	x		
4.4a			xx						x	x	xx	xx
4.4b			xx								xx	xx
4.4c			xx								xx	xx

Key

xx:	Always
x:	Sometimes
(x):	Partial

University of California, Irvine – Mathematics

Catalog descriptions of Required Core and Breadth Courses in the Math Subject Matter Preparation Program

Mathematics Courses

Math 2A-B Single-Variable Calculus (4-4). Lecture, three hours; discussion, two hours. 2A: Introduction to derivatives, calculation of derivatives of algebraic functions, and applications of derivatives (approximations, curve plotting, related rates, maxima and minima). Indefinite integrals. Fundamental theorem of calculus. Differentiation and integration of sines and cosines. Prerequisite: pass the UCI Precalculus test, or get a grade of C (2.0) or better in Mathematics 1 or 1B at UCI, no more than one year before the start of the quarter in which Mathematics 2A will be taken. 2B: Definite integrals, their applications (areas, volumes, etc.), and methods of integration. Logarithmic and exponential functions. Polar coordinates. Prerequisite for Mathematics 2B: 2A.

Math 2D Multivariable Calculus (4). Differential and integral calculus of real-valued functions of several real variables, including applications. Prerequisites: Mathematics 2A-B. Mathematics 2D and H2D may not both be taken for credit.

Math 2J Infinite Series, Complex Numbers, and Basic Linear Algebra (4). Lecture, three hours; discussion, two hours. Infinite sequences and series; complex numbers; systems of linear algebraic equations, determinants, basic matrix operations, eigenvalues, and eigenvectors. Prerequisites: Mathematics 2A-B. Mathematics 2J and Mathematics 2C may not both be taken for credit.

Math 3A Introduction to Linear Algebra (4). Lecture, three hours; discussion, two hours. Vectors, matrices, linear transformations, dot products, determinants, systems of linear equations, vector spaces, subspaces, dimension. Prerequisites: Mathematics 2A-B; 2C or 2J. Only one course from Mathematics 3A, Mathematics 6C, and Physical Sciences 50A may be taken for credit.

Math 6C Linear Algebra (4). Lecture, three hours; discussion, two hours. Linear equations, vector spaces and subspaces, linear functions and matrices, linear codes, determinants, scalar products. Prerequisite: high school mathematics through trigonometry. Only one course from Mathematics 6C, Mathematics 3A, and Physical Sciences 50A may be taken for credit.

Math 7 Basic Statistics (4). Lecture, three hours; discussion, two hours. Basic inferential statistics including confidence intervals and hypothesis testing on means and proportions, t-distribution, Chi Square, regression and correlation. F-distribution and nonparametric statistics included if time permits. Only one course from Mathematics 7, Mathematics 67, and Biological Sciences 7 may be taken for credit.

Math 13 Introduction to Abstract Mathematics (4). Lecture, three hours; discussion, two hours. The style of precise definition and rigorous proof which is characteristic of modern mathematics. Topics include set theory, equivalence relations, proof by mathematical induction,

and number theory. Students construct original proofs to statements. Strongly recommended for freshman and sophomore Mathematics majors as preparation for upper-division courses such as Mathematics 120 and 140.

Math 67 Introduction to Probability and Statistics for Computer Science (4). Lecture, three hours; discussion, two hours. Introductory course focusing on basic concepts in probability and statistics with discussion of applications to computer science. Prerequisites: Mathematics 2B, 6A, and 6C or 3A. Only one course from Mathematics 7, Mathematics 67, and Biological Sciences 7 may be taken for credit.

Math 120A Introduction to Abstract Algebra: Groups (4). Lecture, three hours; discussion, two hours. Axioms for group theory; permutation groups, matrix groups. Isomorphisms, homomorphisms, quotient groups. Basic structure theorems through Sylow theorems. Special emphasis on students doing proofs. Prerequisite: Mathematics 3A or 6C; Mathematics 13 is strongly recommended.

Math 120B Introduction to Abstract Algebra: Rings and Fields (4). Lecture, three hours; discussion, two hours. Basic properties of rings; ideals, quotient rings; polynomial and matrix rings. Elements of field theory. Prerequisite: Mathematics 120A.

Math 124 Algebra and Some Famous Impossibilities (4). Lecture, three hours. Proof of the impossibility of certain ruler-and-compass constructions (squaring the circle; trisecting angles); nonexistence of analogs to the "quadratic formula" for polynomial equations of degree 5 or higher. The necessary algebra introduced as needed. Prerequisites: Mathematics 3A or 6C; Mathematics 120A. Previous or concurrent enrollment in Mathematics 120B and 121A recommended.

Math 130A Probability and Stochastic Processes (4). Lecture, three hours. Introductory course emphasizing applications. Probability, with focus on continuous distributions.

Math 131A-B-C Mathematical Statistics (4-4-4). Lecture, three hours. Introduction to data analysis. Probability distributions, random variables, moments, estimation. Hypothesis testing and confidence intervals. Random simulations. Simple linear regression. Prerequisites: Mathematics 2A-B; 2C or 2J.

Math 140A-B Elementary Analysis (4-4). Lecture, three hours. Introduction to real analysis, including: the real number system, convergence of sequences, infinite series, differentiation and integration, and sequences of functions. Students are expected to do proofs. Prerequisites: Mathematics 2A-B; 2C or 2J; 2D; Mathematics 13 is strongly recommended.

Math 161 Modern Geometry (4). Lecture, three hours. Euclidean geometry; Hilbert's axioms; absolute geometry; hyperbolic geometry; the Poincare models; geometric transformations. Prerequisites: Mathematics 2A-B; 2C or 2J; 2D; 3A or 6C or 2J; 120A.

Math 180 Introduction to Number Theory (4). Lecture, three hours. The ring of integers. Divisibility. Prime numbers and factorization. Number-theoretic functions such as the Moebius

function and the Euler function. Congruences, Moebius inversion, perfect numbers, diophantine equations, quadratic residues. Other topics as time permits. Prerequisite: Mathematics 2A-B; 2C or 2J.

Math 184 History of Mathematics (4). Lecture, three hours. Topics vary from year to year. Some possible topics: mathematics in ancient times; the development of modern analysis; the evolution of geometric ideas. Students are assigned individual topics for term papers. Prerequisite: Mathematics 2A-B; 2C or 2J; 2D; 3A or 6C or 2J; 2F or 3D; 120A; 140A.

Math 192 Tutoring in Mathematics (2). Enrollment limited to upper-division Mathematics majors. Course is designed for prospective teachers. Through lectures and fieldwork, course identifies the attributes of effective mathematics teaching and the elements of excellent mathematics lessons in the context of teaching a diverse student population with lessons that reflect the Mathematics Standards and Framework of California. This course satisfies no requirements other than contribution to the 180 units required for graduation. Pass/Not Pass only. Prerequisites: Mathematics 2A-B; 2C or 2J; 2D; 3A or 6C or 2J; 13 or 120A or 140A. Must be taken for two consecutive quarters.

Education Courses

Ed 111 Seminar: Analysis of Teaching and Learning in a University Course (2)
This course is pending university approval. The catalog descriptios has not been published yet.

Ed 114 Science Education Teacher Apprentice Field Experience (4). Students assist public school classroom teachers in laboratory demonstrations and experiments, tutoring individuals or small groups. May be taken for credit twice. Same as Physical Sciences 114.

Ed 172B Teaching and Learning Secondary School Mathematics (4) Formerly Education 172F.How children and adolescents learn to understand mathematics. Research on mathematical cognition, particularly on mathematical problem solving and the learning of algebra, geometry, and calculus. Examination of several innovative instructional programs derived from research on mathematics learning.

Chemistry Courses

Chem 1A-B-C General Chemistry (4-4-4); 1A (F, W, Summer), 1B (W, S, Summer), 1C (S, Summer, F). Lecture, three hours; discussion, one hour. Stoichiometry, properties of gases, liquids, solids, and solutions; chemical equilibrium, chemical thermodynamics; atomic and molecular structure; chemical kinetics, periodic properties and descriptive chemistry of the elements. Corequisite: concurrent enrollment in the corresponding laboratory courses. Prerequisite for Chemistry 1A: high school chemistry and one of the following: a passing score on the UCI Chemistry Placement Examination or a grade of C or better in Chemistry 1P; for Chemistry 1B and 1C, a grade of C- or better in all previous courses in the sequence. Chemistry 1A-B-C and Chemistry H2A-B-C may not both be taken for credit. **(II)**
NOTE: The Chemistry Placement Examination, which is to be taken prior to enrollment in Chemistry 1A, assesses the student's preparation for General Chemistry. Students enrolled in the

W-S-Summer/F sequence of Chemistry 1A-B-C must complete Chemistry 1C in the Summer Session to be eligible to enroll in Chemistry 51A or 52A in the subsequent fall quarter.

Chem 1LA General Chemistry Laboratory for Engineering Majors (1) W. Laboratory, four hours. Training and experience in basic laboratory techniques through experiments related to lecture topics in Chemistry 1A. Prerequisite: concurrent enrollment or successful completion of Chemistry 1A. NOTE: Chemistry 1LA is open to Engineering majors only. The Chemistry 1LA-LB sequence satisfies all requirements met by Chemistry 1LB-1LC for non-Engineering majors. It is recommended that students complete Chemistry 1LA-1LB and the corresponding Chemistry 1 segment within the same academic year. **(II)**.

Chem 1LB-LC General Chemistry Laboratory (2-2); 1LB (W, S), 1LC (S, Summer, F). Discussion, one hour; laboratory, four hours. Training and experience in basic laboratory techniques. Chemical practice and principles illustrated through experiments related to lecture topics in Chemistry 1A-B-C. Corequisite for Chemistry 1LB and 1LC: concurrent enrollment in the corresponding segment of Chemistry 1. Prerequisite for Chemistry 1LB: a grade of C- or better in Chemistry 1A or Chemistry 1A and 1LA. Prerequisite for Chemistry 1LC: a grade of C- or better in Chemistry 1B and 1LB. **(II)**

Physics Courses

Physics 7A-B-D-E Classical Physics (4-4-4-4) F, W, S, F; 7A-B-D (S, Summer). Lecture, three hours; discussion, one hour. 7A: Units; vectors; motion; momentum; force. 7B: Energy; rotation and gravity. 7D: Electricity and magnetism. 7E: Fluids; oscillations; waves; optics. Corequisites for 7A-B-D: corresponding quarters of Physics 7LA-LB-LD; Mathematics 2A-B and 2C or 2D. Students may not receive credit for more than one section within each of the following sets of courses: Physics 7A, 1 and 5A; Physics 7B and 5B; Physics 7E and 5B; Physics 7D and 5C. (II)

Physics 7LA-LB-LD Classical Physics Laboratory (1-1-1); 7LA (F, S), 7LB (W, Summer), 7LD (S, Summer). Laboratory, two hours. Experiments related to lecture topics in Physics 7A-B-D. Corequisite: corresponding quarter of Physics 7A-B-D. (II)

Computer Skills Courses

ICS 21 Introduction to Computer Science I (6). First of a three-quarter introductory course. Introduces fundamental concepts related to computer software design and construction. Develops initial design and programming skills using a high-level programming language (primarily C++/Java). Introduces useful computer-based tools for analysis, expression, discovery. **(V)**

ENGR10 Computational Methods in Engineering (4) F, Summer. Procedures and procedure followers, algorithms and flow charts, computer languages, subprograms. Computer macro- and microelements, number systems. Methods of differentiation, integration, curve fitting, list processing. Error analysis. Must qualify in BASIC and FORTRAN at end of course through computer use. Corequisite or prerequisite: Mathematics 2A. Only one course from ENGR10,

CEE10, MAE10, ECE10, and ECE12 may be taken for credit. (Design units: 0). *Not offered every year.*

ECE10 Computational Methods in Electrical and Computer Engineering (4) F, W, Summer. An introduction to computers and structured programming. Binary Data Representation. Hands-on experience with a high-level structured programming language. Introduction to algorithm efficiency. Applications of structured programming in solving engineering problems. Prerequisite or corequisite: Mathematics 2A. Only one course from ECE10, ECE12, CEE10, ENGR10, and MAE10 may be taken for credit. Formerly ECE11. (Design units: 0)

CEE10 Methods I: Computation Methods in Civil and Environmental Engineering (4) F. Introduction to engineering analysis, design, and problem solving from a computational perspective. Fundamentals of computers and structured programming. Develop initial design and programming skills using a high-level programming language (primarily C++ with a brief introduction to FORTRAN). Laboratory sessions. Corequisite or prerequisite: Mathematics 2A. Only one course from CEE10, E10, ECE10, ECE12, and MAE10 may be taken for credit. (Design units: 1)

MAE10 Introduction to Engineering Computations (4) F. Introduction to the solution of engineering problems through the use of the computer. Elementary programming in FORTRAN and Matlab is taught. No previous knowledge of computer programming is assumed. Prerequisite or corequisite: Mathematics 2A. Only one course from Engineering MAE10, CEE10, E10, ECE10, and ECE12 may be taken for credit. (Design units: 1)

Appendix C: Alignment Matrix for SMPP courses and the Math Subject Matter Requirements

			Math SMPP Core Courses											
		Mathematics Subject Matter Requirements	**2A**	**2B**	**2D**	**2J**	**3A**	**6C**	**7**	**13**	**67**	**120A**	**120B**	**124**
Course Titles														
Math 2A: Single Variable Calculus		**Domain 1: Algebra**												
Math 2B: Single Variable Calculus		1.1 (a., b., c.) Algebraic Structures					x	x				x	x	
Math 2D: Multiple Variable Calculus		*1.2 Polynomial Equations and Inequalities:*												
Math 2J: Series, Complex Numbers, & Basic Linear Algebra		1.2a Linear inequalities are half planes; linear programming					x	x						
Math 3A: Intro to Linear Algebra		1.2b Rational Root Theorem		x										
Math 6C: Linear Algebra		1.2b Factor Theorem		x			x	x						
Math 7: Basic Statistics*		1.2b Conjugate Roots Theorem					x	x						
Math 13: Abstract Math		1.2b Quadratic Forumula	x											
Math 67: Intro to Probability & Statistics for Computer Science* **		1.2b Binomial Theorem	x											
Math 120A: Abstract Algebra, Groups		1.2c. Solve polynomial equations w/ fundamental theorem of algebra		x			x	x						
Math 120B: Abstract Algebra, Rings and Fields		*1.3 Functions:*												
Math 124: Famous Impossibilities		1.3a. Analyze & prove general properties of functions	x											
Math 130A: Probability & Stochastic Processes**		1.3b. Analyze properties of polynomial, rationl, radical, & absolute value functions	x											
Math 131A: Mathematical Statistics**		1.3c. Analyze properties of exponential and logarithmic functions	x	x										
Math 131B: Mathematical Statistics*		1.4 Linear Algebra (a.,b.,c.)				x	x	x				x	x	
Math 140A: Elementary Analysis														
Math 180: Intro to Number Theory		**Domain 2: Geometry**												
Math 182: Modern Geometry		*2.1 Parallelism:*												
Math 184: History of Math		2.1a. Parallel Postulate-justify equivalents												
		2.1b. Parallel Postulate-variants produce non-Euclidean geometries												
		2.2 Plane Euclidean Geometry:												
		2.2a. Similarit & congruence												
		2.2b. Properties of triangles	x				x	x						
		2.2c. Properties of polygons & circles		x										
		2.2d. Classical constructions											x	x
		2.2e. Use coordinate geometry to prove geometric theorems	x											
Legend:		*2.3 3-D Geometry:*												
"x" topic is covered in a course		2.3a 3-D Parallelism & perpendicularity	x		x									
* Candidates choose one statistics course. Choices include Math 131B, Math 7, or Math 67.		2.3b. Properties of 3-D objects		x	x									
** Candidates choose one probability course. Choices include Math 130A, Math 131A, or Math 67		*2.4 Transformational Geometry:*												
		2.4a Isometries in 2 & 3-D space												
		2.4b Properties of dilations												

	Math SMPP Core Courses						
Mathematics Subject Matter Requirements	**130A**	**131A**	**131b**	**140A**	**182**	**180**	**184**
Domain 1: Algebra							
1.1 (a., b., c.) Algebraic Structures							
1.2 Polynomial Equations and Inequalities:							
1.2a Linear inequalities are half planes; linear programming							
1.2b Rational Root Theorem							
1.2b Factor Theorem							
1.2b Conjugate Roots Theorem							
1.2b Quadratic Forumula							
1.2b Binomial Theorem							
1.2c. Solve polynomial equations w/ fundamental theorem of algebra							
1.3 Functions:							
1.3a. Analyze & prove general properties of functions				x			
1.3b. Analyze properties of polynomial, rationl, radical, & absolute value functions				x			
1.3c. Analyze properties of exponential and logarithmic functions							
1.4 Linear Algebra (a.,b.,c.)							
Domain 2: Geometry							
2.1 Parallelism:							
2.1a. Parallel Postulate-justify equivalents					x		
2.1b. Parallel Postulate-variants produce non-Euclidean geometries					x		
2.2 Plane Euclidean Geometry:							
2.2a. Similarit & congruence					x		
2.2b. Properties of triangles					x		
2.2c. Properties of polygons & circles							
2.2d. Classical constructions							
2.2e. Use coordinate geometry to prove geometric theorems							
2.3 3-D Geometry:							
2.3a 3-D Parallelism & perpendicularity							
2.3b. Properties of 3-D objects							
2.4 Transformational Geometry:							
2.4a Isometries in 2 & 3-D space					x		
2.4b Properties of dilations					x		

Appendix C: Alignment Matrix for SMPP courses and the Math Subject Matter Requirements

		Mathematics Subject Matter Requirements	2A	2B	2D	2J	3A	6C	7	13	67	120A	120B	124
Course Titles														
Math 2A: Single Variable Calculus		**Domain 3: Number Theory**												
Math 2B: Single Variable Calculus		*3.1 Number Sense:*												
Math 2D: Multiple Variable Calculus		3.1a Basic properties of natural numbers												
Math 2J: Series, Complex Numbers, & Basic Linear Algebra		3.1b Prove results in number theory (w/ Principle of Mathematical Induction)	x											
Math 3A: Intro to Linear Algebra		3.1c Apply Euclidean Algorithm												
Math 6C: Linear Algebra		3.1d Apply fundamental theorem of arithmetic												
Math 7: Basic Statistics*														
Math 13: Abstract Math		**Domain 4: Probability & Statistics**												
Math 67: Intro to Probability & Statistics for Computer Science* **		4.1 Probability*									x			
Math 120A: Abstract Algebra, Groups		4.2 Statistics*							x		x			
Math 120B: Abstract Algebra, Rings and Fields														
Math 124: Famous Impossibilities		**Domain 5: Calculus**												
Math 130A: Probability & Stochastic Processes**		5.1 Trigonomety	x	x	x									
Math 131A: Mathematical Statistics**		5.2 Limits & Continuity	x	x	x									
Math 131B: Mathematical Statistics*		5.3 Derivatives & Applications	x	x	x									
Math 140A: Elementary Analysis		5.4 Integrals & Applications	x	x	x									
Math 180: Intro to Number Theory		5.5 Sequences & Series				x								
Math 182: Modern Geometry														
Math 184: History of Math		**Domain 6: History of Mathematics**												
		History of numeral systems												
		Evolution of symbolic algebra												x
		Development of calculus												
		Proof and axiomatic system								x				x
Legend:														
"x" topic covered in a course														
* Candidates choose one statistics course. Choices include Math 131B, Math 7, or Math 67.														
** Candidates choose one probability course. Choices include Math 130A, Math 131A, or Math 67														

Mathematics Subject Matter Requirements	**130A**	**131A**	**131b**	**140A**	**182**	**180**	**184**
Domain 3: Number Theory							
3.1 Number Sense:							
3.1a Basic properties of natural numbers						x	
3.1b Prove results in number theory (w/ Principle of Mathematical Induction)				x			
3.1c Apply Euclidean Algorithm						x	
3.1d Apply fundamental theorem of arithmetic						x	
Domain 4: Probability & Statistics							
4.1 Probability*	x	x					
4.2 Statistics*			x				
Domain 5: Calculus							
5.1 Trigonomety				x			
5.2 Limits & Continuity				x			
5.3 Derivatives & Applications				x			
5.4 Integrals & Applications				x			
5.5 Sequences & Series							
Domain 6: History of Mathematics							x
History of numeral systems							x
Evolution of symbolic algebra							x
Development of calculus							x
Proof and axiomatic system				x			