

**CSU Channel Islands
Pilot Conversion Form
Program to be Converted:
Master of Science in Mathematics
October 20, 2010**

CSU Degree Program Proposal Template

**1. Program Type
(Please retain any from the list below that apply—then delete the others)**

√ [Pilot Conversion](#)

2. CPEC COVER PAGE (required for graduate programs only)

The California Post-Secondary Education Commission now requires for each graduate program proposed, a table of contents cover page that lists the following review criteria and that identifies the page numbers on which those criteria are addressed in the proposal. The criteria include:

- **Student demand.....7**
This can be demonstrated with surveys of student intention to enroll in the program. Include current and projected enrollments of related existing programs at the proposing campus or feeder institutions.
- **Societal Needs.....13**
The proposal should establish that there will be sufficient employment opportunities for graduates of the proposed program. Workforce demand projections can be helpful in establishing the balance between graduates and employment opportunities. Letters from regional employers are helpful, as well. Workforce data are available at: http://www.calstate.edu/app/workforce_data.shtml
- **Appropriateness to Institutional and Segmental Mission.....3,4**
Describe how the proposed degree program fits with the campus, school/college, and departmental missions.
- **Number of Existing and Proposed Programs in the Field.....13**
Demonstrate how the proposed program differs from or is similar to existing programs in the state.
- **Total Costs for the Program.....16, 19**
Are there sufficient funds available to support the resources that are required in order to initiate and maintain the program, including: the number of new faculty required; equipment; library resources; and classroom, office, and laboratory facilities. Identify the source of the funds required to support the program, both initially and in the long run.
- **Maintenance and Improvement of Quality.....7**
Submit formal assessment plans that address program goals and student learning outcomes. Goals should be measurable; plans should be manageable, and data should be meaningful.

Goals should be related to institutional and program mission, and to the curriculum. See the CSU assessment site for further information:

<http://www.calstate.edu/acadaff/sloa/index.shtml>

• **Advancement of Knowledge13**

Describe how the program will contribute to the growth and development of intellectual and creative scholarship.

3. Program Identification

a. Campus: CSU Channel Islands

b. Full and exact degree designation and title (e.g. Master of Science in Genetic Counseling, Bachelor of Arts with a Major in History).

Master of Science in Mathematics

c. **Total number of Units Required.** A justification is required later in the proposal for any proposed undergraduate program requiring more than 120 semester units, 180 quarter units.

32 Semester Units

d. Date the Board of Trustees approved adding this program projection to the campus Academic Plan.

March 2005

e. Term and academic year of intended implementation (e.g. Fall 2007).

Fall 2005

f. Name of the department(s), division, or other unit of the campus that would offer the proposed degree major program. Please identify the unit that will have primary responsibility.

Academic Affairs/Extended University/Mathematics

g. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.

Ivona Grzegorzcyk, Professor of Mathematics and Chair
Jorge Garcia, Associate Professor of Mathematics
Jesse Elliott, Associate Professor of Mathematics
Peter Smith, Professor of Computer Science
William Wolfe, Professor of Computer Science and Chair
Geoff Dougherty, Professor of Physics

h. Statement from the appropriate campus administrative authority that the addition of this program supports the campus mission and will not impede the successful operation and growth of existing academic programs. (CPEC “**Appropriateness to Institutional and Segmental Mission**”)

See attachment A – Provost Statement of Support

- i. Any other campus approval documents that may apply (e.g. curriculum committee approvals).

See attachment A – MS Math Long Form sigs (approval dates included)

- j. Please specify whether this proposed program is subject to WASC Substantive Change review.

The MS in Mathematics is not subject to WASC Substantive Change review. CSU Channel Islands received its initial WASC accreditation in July 2007, subsequent to the implementation of the MS in Mathematics and thereby approving this program and its other initial undergraduate and graduate degrees.

- k. **Optional: Proposed Classification of Instructional Programs (CIP) Code and CSU Degree Program Code**

Campuses are invited to suggest one CSU degree program code and one corresponding CIP code. If an appropriate CSU code does not appear on the systemwide list at:

http://www.calstate.edu/app/documents/HEGIS-CIP2000_102406.xls , you can search CIP 2000 at <http://nces.ed.gov/pubs2002/cip2000/> to identify the code that best matches the proposed degree program. The Classification of Instructional Programs (CIP) is a National Center for Education Statistics (NCES) publication that provides a numerical classification and standard terminology for secondary and postsecondary instructional programs. The CSU degree program code (based on old HEGIS codes) and CIP code will be assigned when the program is approved by the Chancellor.

Program Code: 17011 as assigned by the Chancellor’s Office October 21, 2006

4. Program Overview and Rationale

- a. Rationale, including a brief description of the program, its purpose and strengths, fit with institutional mission, and a justification for offering the program at this time. The rationale may explain the relationship among the program philosophy, design, target population, and any distinctive pedagogical methods. (**CPEC “Appropriateness to Institutional and Segmental Mission”**)

With the rapid development of high-tech and computational sciences in the entire world, the need for graduate programs in computational sciences is acute. There is a global shortage of people with advanced mathematical, computational, and computer skills throughout the industry, especially in the greater Los Angeles area, and Ventura county. The MS program in Mathematics is broad in scope: the applications include Bioinformatics, Actuarial Sciences, Cryptography, Security, Image Recognition, Artificial Intelligence, and Mathematics Education.

The Program is of interest to students with undergraduate degrees in mathematical sciences, computer science, engineering, and others with strong computational backgrounds. The program is and will continue to be of service to graduates holding computational degrees, especially for professionals working in local high-tech and computational industries, as well

as military personnel. We have letters from local industries in support of the program (see Appendix C).

MS Mathematics students and graduates have found employment in local high-tech, information systems, and computational industries; business, finance, educational institutions, and the military. We expect future graduates to continue to find employment in these fields as well as in local and federal government. Some students have used the program as a jumping off point for Ph.D. study in the mathematical sciences; current students have similar plans.

The curriculum contains up-to-date technical, theoretical and intellectual achievements in the field of Mathematics. It includes modern computer applications in developing fields such as statistical analysis, artificial intelligence, pattern recognition, computer graphics and mathematics education. This degree program is a result of cooperation between Mathematics and Computer Science faculty. Many of the courses are shared with the MS in Computer Science program; the curriculum for those focusing on applications is also enriched through offerings taught by Physics faculty. Both Computer Science and Physics faculty serve as thesis/ project advisors on demand. The requirement of a graduate thesis or project ensures that each graduate has demonstrated attainment of expertise in a particular area or application of mathematics.

- b. Proposed catalog description, including program description, degree requirements, and admission requirements. For master's degrees, please also include catalog copy describing the culminating experience requirement(s).

Our MS in Mathematics program is interdisciplinary and innovative in nature, and offers a flexible schedule with highly qualified faculty. It is designed to address the global need for people with advanced mathematical, computational, and computer skills throughout the industry, high-tech, and educational systems. Students will acquire a strong background in mathematics, and computer software, as well as the skills to conduct independent applied research or develop independent projects. The program will stress interdisciplinary applications, for example in Actuarial Sciences, Cryptography, Security, Image Recognition, Artificial Intelligence, and Mathematics Education, and will give students a valuable opportunity to gain teaching experience on the university level. Students' specializations depend on the final project/ thesis and the electives chosen under the supervision a Mathematics advisor. An individual study plan can be designed to meet entry requirements for Ph.D. programs in Mathematical Sciences.

Admission Requirements

1. Application. Apply to both the University and the Mathematics Program. Forms are available at the Extended Education Office and on-line at <http://math.csuci.edu/>.
2. Recommendation. At least two letters of recommendations from academia or professional supervisors.
3. Subject Matter Preparation. Applicants are expected to hold BS degree in mathematics. However students with other degrees (or equivalent coursework) maybe considered and admitted conditionally (subject to completing relevant undergraduate mathematics courses).
4. GPA of 3.0 in Mathematical Sciences. If applicant does not have the required GPA, conditional admission maybe available on a limited bases.
5. GRE (general and mathematics) scores are recommended, but not required.

Requirements for the Master of Science in Mathematics – (32 units)

Core Courses – 11 units

Choose three courses from the following list: At least two courses must be in Mathematics:

Core Courses – 11 units

MATH	510	Probabilistic Methods and Measure Theory	3
MATH	511	Functional Analysis	3
MATH	513	Advanced Algebra	3
COMP	510	Algorithms	3
COMP	569	Artificial Intelligence	3
PHYS	510	Advanced Image Analysis Techniques	3

And required two units of:

MATH	599	Graduate Seminar	1
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Masters Thesis or Masters Project Emphasis – 6 units

MATH	597	Master Thesis	3
or			
MATH	598	Master Project	3

Graduate Writing Assessment Requirement

Writing proficiency prior to the awarding of the degree is demonstrated by successful completion of at least two credits of MATH 597 (Masters Thesis) or MATH 598 (Masters Project) with a grade of B or higher.

Electives – 15 units*

Choose five electives from the following list (at least three courses in mathematics):

MATH..	555	Actuarial Sciences	3
MATH .	565	Research in Mathematics Education	3
MATH..	570	Combinatorics	3
MATH..	581	Mathematical Methods in Artificial Intelligence (COMP)	3
MATH..	582	Number Theory and Cryptography	3
MATH..	584	Algebraic Geometry and Coding Theory	3
MATH..	587	Markov Chains and Markov Processes	3
MATH..	588	Stochastic Analysis	3
PHYS....	546	Pattern Recognition	3
COMP ..	520	Advanced Database Systems	3
COMP ..	524	Security	3
COMP ..	529	Network Computing	3
COMP ..	549	Human-Computer Interaction	3
COMP ..	550	Advanced Software Engineering	3
COMP ..	569	Artificial Intelligence	3
COMP ..	571	Biologically Inspired Computing	3
COMP ..	572	Neural Networks	3
COMP ..	575	Multi-Agent Systems	3
COMP ..	578	Data Mining	3

*other graduate or junior/senior courses from related disciplines may be included with advisor's approval.

5. Curriculum

- a. Goals for the (1) program and (2) [student learning outcomes](#). Program goals are very broad statements about what the program is intended to achieve, including what kinds of graduates will be produced. Student learning outcomes are more specific statements that are related to

the program goals but that more narrowly identify what students will know and be able to do upon successful completion of the program.

Program Goals:

1. Provide students with the opportunity to earn a Master degree in Computer Science or Mathematics from the California State University.
2. Prepare students for employment in a variety of highly sophisticated and complex high-tech and bio-tech industries, businesses, education systems, military and local and federal government
3. Prepare students for further study in graduate or professional schools.
4. Equip students with the depth, flexibility and mathematical skills that apply to variety of fields and offer various career opportunities, including consulting, scientific and technical positions in business and industry, research and development, national and industrial security or teaching positions.
5. Offer all CSUCI students the opportunity to broaden their knowledge and learn mathematical skills and computer technology that can be applied to various professional and personal situations.

Student Learning Objectives

Students graduating from the Mathematics program will be able to:

1. Demonstrate critical thinking, problem solving, and advanced mathematical skills by identifying, evaluating, analyzing, synthesizing and presenting fundamental and advanced mathematical and computer science issues and their applications.
 2. Demonstrate the knowledge of current mathematical theories and broad technology use in industry, including a working knowledge of software development techniques in an industrial setting.
 3. Be knowledgeable of emerging new technologies and industrial practices connected to the computer industry and demonstrate understanding of computing technologies in society.
 4. Demonstrate cooperation skills by working effectively with others in interdisciplinary group settings – both inside and outside the classroom.
 5. Demonstrate independent working and thinking skills by completing a graduate project and/or master thesis.
 6. Demonstrate a sense of exploration that enables them to pursue rewarding careers in high-tech industries, bio-tech industries, businesses, education systems, military and local and federal government.
 7. Demonstrate flexibility, transferability and adaptability of their life-learning skills that are so important in the quickly changing national and international economies.
- b. Plans for assessing program goals and student learning outcomes. Some planners find it helpful to develop matrices in which student learning outcomes and required courses are mapped, indicating where content related to the learning outcomes is introduced, reinforced, and practiced at an advanced level in required courses. (**CPEC “Maintenance and Improvement of Quality”**)

As the matrix below indicates, when and in which aspects of the program students receive introduction to, reinforcement of, and the opportunity to practice each learning outcome at an advanced level depend heavily on individual student’s course selection. Nonetheless, by the time students have completed six credits of Math 597 (Masters Thesis) or Math 598 (Masters Project), along with a seminar presentation and defense of their theses/ projects, they have demonstrated mastery of learning outcomes 1, 5, 6, and 7 at an advanced level. Learning

outcome 4 is typically achieved through activities surrounding the coursework. Learning outcomes 3 and 4 do not apply to all students; they do apply to those seeking positions post-degree in industry. These students are advised to take courses in which they are exposed to, practice, and master these outcomes; they are also encouraged to pursue thesis/ project experiences that allow them to further develop their expertise in mathematical technology and computing.

Student Learning Outcomes vis-à-vis Program Components

	Core Courses	Seminar	Electives	Masters Thesis/ Project
SLO 1	I, R, A (d)	I	I, R, A (d)	R, A
SLO 2	I (d), R (d), A (d)	I	I (d), R (d), A (d)	R (d), A (d)
SLO 3	I (d), R (d), A (d)		I (d), R (d), A (d)	R (d), A (d)
SLO 4	I, R, A (d)	I	I, R, A (d)	R (d), A (d)
SLO 5	I (d)		I (d)	R, A
SLO 6	I (d), R (d), A (d)	I, R	I (d), R (d), A (d)	R, A
SLO 7	I (d), R (d), A (d)		I (d), R (d), A (d)	R, A

Codes: I – introduced; R – reinforced; A – practiced at advanced level; (d) – depending on choice of classes within category

- c. Total number of units required for the major; total number of units required to graduate.
32 Semester Units are required for the MS in Mathematics.
- d. Include a justification for any baccalaureate program that requires more than 120-semester units or 180-quarter units. *Not Applicable.*
- e. If any formal options, concentrations, or special emphases are planned under the proposed major, identify and explain fully. Optional: You may propose a CSU degree program code and CIP code for each concentration that you would like to report separately from the major program, if the option is approximately equivalent to a degree currently listed on the CSU application-booklet degree program table. If you do not find an appropriate CSU degree program code at: http://www.calstate.edu/app/documents/HEGIS-CIP2000_102406.xls , you can search CIP 2000 at <http://nces.ed.gov/pubs2002/cip2000/> to help identify the code that best matches the proposed curriculum. *Not Applicable.*
- f. A list of all courses *required* for the major, specifying catalog number, *title*, units of credit, and prerequisites or co-requisites (thereby ensuring that there are no “hidden” prerequisites that would drive the total units required to graduate beyond the total reported in 4c above).

Requirements for the Master of Science in Mathematics – (32 units)

Core Courses – 11 units

Choose three courses from the following list: At least two courses must be in Mathematics:

Core Courses – 11 units

MATH	510	Probabilistic Methods and Measure Theory	3
MATH	511	Functional Analysis	3
MATH	513	Advanced Algebra	3
COMP	510	Algorithms	3
COMP	569	Artificial Intelligence	3
PHYS	510	Advanced Image Analysis Techniques	3

And required two units of:

MATH 599	Graduate Seminar	1
Masters Thesis or Masters Project Emphasis – 6 units		
MATH 597	Master Thesis	3
or		
MATH 598	Master Project	3

MATH 510 PROBABILISTIC METHODS AND MEASURE THEORY (3)

Three hours lecture per week

Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Introduction to probabilistic methods. Topic include: sigma algebras, measures, integrals, Lebesgue measure, main convergence results and the change of variable results for integrals. Probabilistic methods in computational sciences are studied.

MATH 511 FUNCTIONAL ANALYSIS (3)

Three hours lecture per week

Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Topics include: metric spaces, function spaces, normed vector spaces, linear operators. Banach spaces, Hilbert space, Spectral theory, and fundamental theorems in functional analysis. Applications in various fields including computer science, bioinformatics, and statistical analysis.

MATH 513 ADVANCED ALGEBRA (3)

Three hours lecture per week

Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Topics include: Techniques of Group Theory, Rings Fields, Modules, Galois Theory, Algebraic Number Theory, Algebraic Geometry, Techniques of Linear Algebra, Noncommutative Algebra, and Homological Algebra.

MATH 599 GRADUATE SEMINAR (1)

Three hours lecture per week

Prerequisite: Graduate standing in MS Math or MS Computer Science, or Consent of Instructor

Oral presentations of current work in mathematics by local and outside speakers; student thesis and project presentations. Repeatable up to 2 units.

COMP 510 ALGORITHMS (3)

Three hours lecture per week

Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Design strategies for algorithms and data structures. Theoretical limits to space and time requirements. Time/space trade-offs. Categories of problems and algorithms. Applications to business, bioinformatics, engineering, telecommunications and other disciplines. Open problems in the field.

COMP 569 ARTIFICIAL INTELLIGENCE (3)

Three hours of lecture in the lab per week

Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
The course covers the many aspects of how human intelligence might be encoded in computer programs and mechanisms such as robots. This includes topics in Natural Language Processing, Computer Vision, Expert Systems, and Automated Problem Solving.

PHYS 510 ADVANCED IMAGE ANALYSIS TECHNIQUES (3)

Three hours of lecture in the lab per week
Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Image processing course in the fundamentals of 2-D digital signal processing with emphasis in image processing techniques, image filtering design and applications. Programming exercises in Matlab (or Octave) will be used to implement the various processes, and their performance on synthetic and real images will be studied. Applications in medicine, robotics, consumer electronics and communications.

MATH 597 MASTER THESIS (1-6)

Three hours lecture per week
Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Supervised research in mathematical sciences or applications. Required to present research at Graduate Seminar.

MATH 598 MASTER PROJECT (1-6)

Three hours lecture per week
Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Supervised industrial, educational or scientific project involving use of advanced mathematical methods. Required to present projects at the Graduate Seminar.

MATH 599 GRADUATE SEMINAR (1)

Three hours lecture per week
Prerequisite: Admission to the Computer Science or Mathematics Graduate Program
Oral presentations of current advancements in the field, reports on students' research, master thesis, and projects. Repeatable.

Graduate Writing Assessment Requirement

Writing proficiency prior to the awarding of the degree is demonstrated by successful completion of at least two credits of MATH 597 (Masters Thesis) or MATH 598 (Masters Project) with a grade of B or higher.

- g. List of *elective* courses that can be used to satisfy requirements for the major, specifying catalog number, title, units of credit, and prerequisites or co-requisites. Include proposed catalog descriptions of all new courses. For graduate program proposals, identify whether each course is a graduate or undergraduate offering.

Note: All courses are graduate level courses.

Electives – 15 units*

Choose five electives from the following list (at least three courses in mathematics):

MATH.. 555	Actuarial Sciences	3
MATH . 565	Research in Mathematics Education	3
MATH.. 570	Combinatorics	3
MATH.. 581	Mathematical Methods in Artificial Intelligence (COMP)	3
MATH.. 582	Number Theory and Cryptography	3
MATH.. 584	Algebraic Geometry and Coding Theory	3
MATH.. 587	Markov Chains and Markov Processes	3
MATH.. 588	Stochastic Analysis	3
MATH.. 590	Special Topics	3
PHYS.... 546	Pattern Recognition	3

COMP .. 520	Advanced Database Systems	3
COMP .. 524	Security	3
COMP .. 529	Network Computing	3
COMP .. 549	Human-Computer Interaction	3
COMP .. 550	Advanced Software Engineering	3
COMP .. 569	Artificial Intelligence	3
COMP .. 571	Biologically Inspired Computing	3
COMP .. 572	Neural Networks	3
COMP .. 575	Multi-Agent Systems	3
COMP .. 578	Data Mining	3

*other graduate or junior/senior courses from related disciplines may be included with advisor's approval.

Note: With regard to Sections 4f and 4g, a proposed program should take advantage of courses already offered in other departments when subject matter would have considerable overlapping content.

- h. List of any new courses that are: (1) needed to initiate the program and (2) needed during the first two years after implementation. Only include proposed catalog descriptions for new courses. For graduate program proposals, identify whether each course is a graduate-level or undergraduate-level offering. *Not Applicable*.
- i. Attach a proposed course-offering plan for the first three years of program implementation, indicating, where possible, likely faculty teaching assignments. *Not Applicable*.
- j. For master's degree proposals, include evidence that program requirements conform to the minimum requirements for the culminating experience, as specified in [Section 40510](#) of [Title 5 of the California Code of Regulations](#).

MS Mathematics satisfies the culminating experience by requiring students to integrate MATH 597 (Master Thesis) and MATH 598 (Master Project) for 6 units.

- k. Admission criteria, including prerequisite coursework.

Admission Requirements

1. Application. Apply to both the University and the Mathematics Program. Forms are available at the Extended Education Office and on-line at <http://math.csuci.edu/>.
2. Recommendation. At least two letters of recommendations from academia or professional supervisors.
3. Subject Matter Preparation. Applicants are expected to hold BS degree in mathematics. However students with other degrees (or equivalent coursework) maybe considered and admitted conditionally (subject to completing relevant undergraduate mathematics courses).
4. GPA of 3.0 in Mathematical Sciences. If applicant does not have the required GPA, conditional admission maybe available on a limited bases.
5. GRE (general and mathematics) scores are recommended, but not required.

- l. Criteria for student continuation in the program.

Classification Status

Conditionally Classified

To qualify for admission in conditionally classified graduate standing, a student must:

1. Hold an acceptable baccalaureate degree from an accredited institution.
2. Have attained a grade-point average (GPA) of at least 2.5 (4.0=A) in the last 60 semester units attempted
3. Have been in good standing at the last institution attended
4. Be accepted into a graduate degree curriculum on a conditional basis, subject to the requirement that any deficiencies must be remedied by additional preparation.
5. For students entering the Master of Arts in Education: Educational Leadership Program, if the student is missing one or more of the following requirements, CBEST, advanced technology or special education course.

Classified

A student who meets the minimum requirements for admission as a graduate student, as specified in the preceding paragraph, may be admitted as a fully classified graduate student pursuing an authorized degree curriculum if the appropriate program authorities determine the he or she satisfactorily meets the professional, personal, scholastic, or other standards for admission to the graduate degree curriculum, including qualifying examinations that the appropriate program authorities may prescribe. Only those applicants who show promise of success will be admitted to the graduate curricula, and only those who continue to demonstrate a satisfactory level of scholastic competence shall be eligible to proceed in such curricula.

Advancement to Candidacy

Advancement to candidacy recognizes that the student has demonstrated the ability to operate at and sustain a level of scholarly competence that is satisfactory for successful completion of the degree requirements. The student is then cleared for the final stages of the program, which, in addition to any remaining coursework, may include the thesis, project, or examination. The student may request advancement to candidacy only after a formal program of study (except a required final or 'capstone' course) has been submitted, the graduation writing requirement has been satisfied, and sufficient coursework has been completed to allow the program to make a judgment about the student's potential to complete the program.

- m. For undergraduate programs, planned provisions for articulation of the proposed major with community college programs. Not Applicable.
- n. If there is a [Lower-Division Transfer Pattern](#) (LDTP) for this major, indicate the relationship between the LDTP and the requirements presented in this proposal. Information on LDTP is available at: <http://www.calstate.edu/AcadAff/ldtp.shtml> Not Applicable.
- o. Advising "roadmaps" that have been developed for the major. .

Please see Appendix D for Sample Two-Year Plans (Roadmaps) and the Course Prerequisites Flow Chart

- p. Provision for meeting accreditation requirements, if applicable, and anticipated date of accreditation request (including the WASC Substantive Change process).

Accreditation Note:

Master's degree program proposals

If subject to accreditation, establishment of a master's degree program should be preceded by national professional accreditation of the corresponding bachelor's degree major program.

Fast-track proposals

Fast-track proposals cannot be subject to specialized accreditation by an agency that is a member of the Association of Specialized and Professional Accreditors unless the proposed program is already offered as an authorized option or concentration that is accredited by an appropriate specialized accrediting agency.

The MS in Mathematics is not subject to WASC Substantive Change review. CSU Channel Islands received its initial WASC accreditation in July 2007, subsequent to the implementation of the MS in Mathematics and thereby approving this program and its other initial undergraduate and graduate degrees.

**6. Need for the Proposed Degree Major Program
(CPEC “Societal Need,” “Number of Existing Programs in the Field,” and “Advancement of the Field”)**

- a. List of other California State University campuses currently offering or projecting the proposed degree major program; list of neighboring institutions, public and private, currently offering the proposed degree major program.

Many other CSU campuses offer a Master of Science in Mathematics. However, the three nearby private institutions (California Lutheran University, Pepperdine University, and Westmont College) do not offer these degrees. The nearest MS Mathematics Programs to CSU Channel Islands are those of CSU Northridge and UC Santa Barbara, each at a distance that makes commuting to these programs a burden for students from our local area.

- b. Differences between the proposed program and programs listed in Section 5a above.

The CSU Channel Islands program will provide an opportunity to earn a MS in Mathematics degree to students in the local service area – and offer all students access to highly desired high-tech and educational positions in a unique program that stresses an interdisciplinary learning approach. Our program features a high degree of interaction with qualified faculty. All students must complete a Master Thesis or Master Project to obtain the degree.

- c. List of other curricula currently offered by the campus that are closely related to the proposed program.

Master in Computer Science Program: all MS MATH courses are electives for the MS in Computer Science degree; all MS COMP classes are electives for the MS in Mathematics degree.

- d. Community participation, if any, in the planning process. This may include prospective employers of graduates.

Individuals in positions of leadership at several local high-tech companies were consulted during the planning process for this program. Please see their letters of support in Appendix C.

- e. Applicable workforce demand projections and other relevant data.

There is a wealth of evidence of the ongoing and growing need for individuals with the training represented by an MS degree in Mathematics in high-tech industry and business. The

following figures and conclusions are from the recent study “Help Wanted: Projections of Jobs and Education Requirements through 2018,” a June 2010 publication of the Georgetown University Center on Education and the Workforce (CEW).

“Computer and Mathematical Science occupations are the largest category in the STEM cluster. They accounted for 3.4 million jobs in 2008, or 2.3 percent of all jobs, and will grow to 4.2 million jobs in 2018, or 2.6 percent of the total.” Educational levels for these occupations are currently concentrated in Bachelor’s and Master’s degrees (69 percent); CEW predicts this percentage will increase to 71 percent by 2018. They further predict that 1.5 million positions in this sector will be available by 2018: 798,000 new jobs and 707,000 replacement openings. These figures represent a relatively greater demand than for other occupations for highly skilled individuals to replace retirees. In particular, the number of Mathematical Sciences occupations is expected to grow roughly 20% in the next decade.

- f. If the program was proposed to meet society’s need for the advancement of knowledge, please specify the need and explain how the program meets that need.

Note: Data Sources for Demonstrating Evidence of Need

APP Resources Web <http://www.calstate.edu/app/resources.shtml>

[US Department of Labor, Bureau of Labor Statistics](#)

[California Labor Market Information](#)

[Labor Forecast](#)

7. Student Demand (CPEC “Student Demand”)

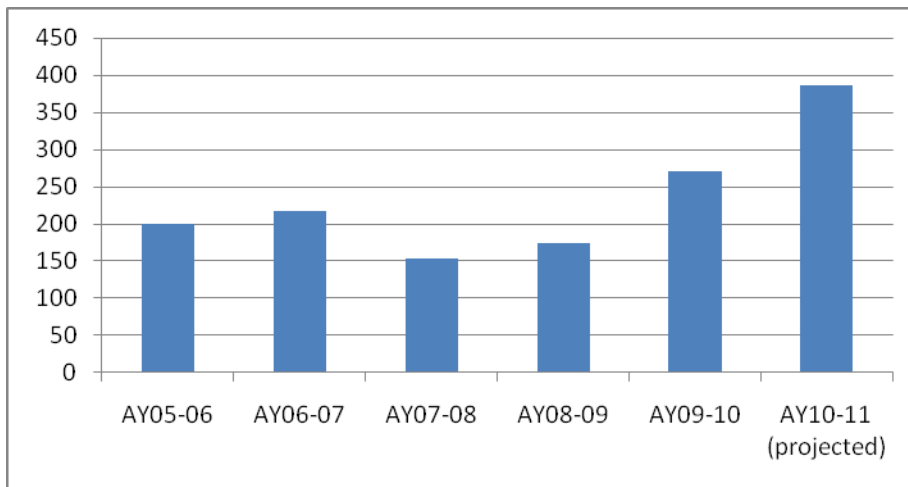
- g. Compelling evidence of student interest in enrolling in the proposed program. Types of evidence vary and may include national, statewide, and professional employment forecasts and surveys; petitions; lists of related associate degree programs at feeder community colleges; reports from community college transfer centers; and enrollments from feeder baccalaureate programs, for example.

The table below is provided by Extended University; see below for discussion.

Semester	# enrolled in degree program	# of MS Math degrees posted
Fall 04	0	
Spring 05	4	
Summer 05	0	
Fall 05	9	
Spring 06	11	
Summer 06	5	
Fall 06	9	
Spring 07	11	
Summer 07	3	2
Fall 07	6	
Spring 08	7	
Summer 08	2	2
Fall 08	12	
Spring 09	11	
Summer 09	3	

Fall 09	16	3
Spring 10	18	degrees still posting when data provided

The chart below indicates the number of student credits taught within the MS Mathematics Program each academic year since the program was initiated. Please note that data provided by Extended University reflects only enrollment of students accepted to the degree program; other area professionals enroll in MS Mathematics courses without intent to pursue the degree. The course enrollment figures thus provide a more accurate picture of the demand for these courses. Enrollment figures by course and by semester are provided in Appendix D.



We have been tracking individual students since the MS Mathematics program was initiated in Fall, 2005. Of the 46 students who were accepted and enrolled, 12 have completed the degree, 4 have left to enroll in Ph.D. programs (without completing the MS degree), 24 are still actively pursuing the MS degree, 4 have definitively dropped out of the program, and 4 are inactive. (Individual data comprising these figures may be found in Appendix D.)

- h. Issues of access considered when planning this program.
- i. For master's degree proposals, the number of declared undergraduate majors and the degree production over the preceding three years for the corresponding baccalaureate program, if there is one.

Number of declared undergraduate majors in Mathematics:

2007	2008	2009
52	52	45

- j. Professional uses of the proposed degree program.

The MS Mathematics Program prepares students for a variety of high-tech industrial positions or advanced mathematics education positions. The degree also prepares students for further graduate education in mathematical and computational fields.

- k. The expected number of majors in the year of initiation and three years and five years thereafter. The expected number of graduates in the year of initiation, and three years and five years thereafter.

See above (g.) for historical figures. A growth rate of 10% per year is expected once enrollment growth at CI is permitted to resume.

8. Existing Support Resources for the Proposed Degree Major Program (CPEC “Total Costs of the Program”)

Note: Sections 7 and 8 should be prepared in consultation with the campus administrators responsible for faculty staffing and instructional facilities allocation and planning. A statement from the responsible administrator(s) should be attached to the proposal assuring that such consultation has taken place.

Extended University is mandated to operate self-supported programs maintained through student fees and other non-State funds. Per EO1000 and a formalized University MOU, Extended University fully reimburses the State for all expenses incurred in the operations of special session degree programs. As such, this program is estimated to have sufficient funds available through student fees to maintain and grow the program in the future (statement from Dean of Extended University attached).

- a. Faculty who would teach in the program, indicating rank, appointment status, highest degree earned, date and field of highest degree, professional experience, and affiliations with other campus programs. For master’s degrees, include faculty publications or curriculum vitae.

Note: For all proposed graduate degree programs, a minimum of five full-time faculty members with the appropriate terminal degree should be on the program staff.
(Code Memo EP&R 85-20)

Ivona Grzegorzcyk

Professor of Mathematics

PhD in Mathematics, UC Berkeley, 1990

Mathematics faculty at CSU Channel Islands since 2001 (Founding Faculty)

Experience in the areas of algebraic geometry, moduli problems, applied mathematics, mathematics education.

Selected publications:

1. On Newstead's Conjecture on Vector Bundles on Algebraic Curves, *Mathematischen Annalen* 300, 521-541(1994).
2. *Mathematics and Fine Arts*, Kendall/Hunt publishing Co., (2000).
3. Brill-Noether Theory for Stable Vector Bundles, with M. Teixidor i Bigas, in *Moduli Spaces and Vector Bundles*, Cambridge University Press, 2008, arXiv: 0801.4740.

Cynthia Wyels

Professor of Mathematics

PhD in Mathematics, UC Santa Barbara, 1994

Mathematics faculty at CSU Channel Islands since 2005

Experience in the areas of combinatorics, graph theory, mentoring undergraduate and masters-level research.

Selected publications (undergraduate co-authors identified with asterisk):

1. Radio numbers of some generalized prism graphs (with P. Martinez*, J. Ortiz*, M. Tomova), to appear in *Discussiones Mathematicae Graph Theory*.
4. Pebbling graph products (with M. Tomova), to appear in *Ars Combinatoria*.

5. The N-Queens problem on a symmetric Toeplitz matrix (with M. Tomova, Z. Szaniszló), *Discrete Mathematics* 309 (2009), 969 – 974.

Geoffrey Dougherty

Professor of Physics

Ph.D. in Biophysics, University of Keele, 1979

Medical Imaging/Physics faculty at CSU Channel Islands since 2002

Experience in medical imaging, image analysis, and bioengineering.

Selected publications:

1. Textbook – “Digital Image Processing for Medical Applications”, Cambridge University Press, 2009. ISBN-13: 9780521860857. (<http://www.cambridge.org/us/catalogue/catalogue.asp?isbn=9780521860857>)
2. Dougherty, G and Henebry, G. Lacunarity analysis of spatial pattern in CT images of vertebral bone for assessing osteoporosis. *Med. Eng. Phys.*, **2002**, **24**, 129-138.
3. Dougherty, G. and Kawaf Z. The point spread function revisited: image restoration using 2-D convolution. *Radiography*, **2001**, **7**, 255-262.

Jesse Elliot

Associate Professor of Mathematics

PhD in Mathematics, UC Berkeley, 2003

Mathematics faculty at CSU Channel Islands since 2003

Experience in commutative algebra and number theory.

Selected publications:

1. Functorial properties of star operations, *Comm. Alg.* 38 (5) (2010) 1466–1490.
2. Some new approaches to integer-valued polynomial rings, in *Commutative Algebra and its Applications: Proceedings of the Fifth International Fez Conference on Commutative Algebra and Applications*, Eds. Fontana, Kabbaj, Olberding, and Swanson, de Gruyter, New York, 2009.
3. Ring structures on groups of arithmetic functions, *J. Number Theory* 128 (2008) 709–730.

Jorge Garcia

Associate Professor of Mathematics

PhD in Mathematics, U-W Madison, 2002

Mathematics faculty at CSU Channel Islands since 2003

Experience in Stochastic Processes, Large Deviations, Stochastic Integrals, Probability, Markov Processes and Measure Theory.

Selected publications:

1. An Extension of the Contraction Principle, *Journal of Theoretical Probability*, April, 2004
2. A Large Deviation Principle for Stochastic Integrals, *Journal of Theoretical Probability* December, 2007.
3. Limits of Stochastic Integrals, *Advances and Applications in Statistics*, Volume 10, Issue 2 (December 2008)

Kathryn Leonard

Assistant Professor of Mathematics

Ph.D. in Mathematics, Brown University, 2004.

Mathematics faculty at CSU Channel Islands since 2006

Experience in image recognition, shape space, shape modeling, texture analysis.

Selected publications:

1. Efficient representation in spaces of plane curves, *Rend. Linc. Mat. e Appl.*, **20**(1), 2009, 69-93.
2. Efficient shape modeling: epsilon-entropy, adaptive coding, and Blum's medial axis versus the boundary curve, *Int. J. Comp. Vis.*, **74**, 2007, 183 - 199.
3. An efficiency criterion for 2D shape model selection, *IEEE CVPR Proc.*, **1**, 2006, 1289 - 1296.

Geoffrey Buhl

Assistant Professor of Mathematics

Ph.D. in Mathematics, University of California Santa Cruz, 2003

Mathematics faculty at CSU Channel Islands since 2006

Experience in string theory, vertex operator algebras, Möbius vertex algebras, interdisciplinary training in biology and mathematics.

Selected publications:

1. Ordered spanning set for vertex operator algebras, accepted by Moonshine - the First Quarter Century and Beyond conference proceedings.
2. Spanning sets for Möbius vertex algebras satisfying arbitrary difference conditions (with G. Karaali), Journal of Algebra, Vol. 320, Issue 8, 2008.
3. Ordered spanning set for quasimodules for Möbius vertex algebras, Journal of Algebra, Vol. 320, No. 5, 2008.

James Sayre

Visiting Professor in Mathematics

PhD in Biostatistics, University of California, Los Angeles, 1977

Mathematics faculty at CSU Channel Islands since 2006

Experience in statistical analysis, biostatistics, epidemiology, research design and analysis.

Selected publications:

1. Measurement of Retinal Vascular Tortuosity and Its Application to Retinal Pathologies (with Dougherty and Johnson), Medical and Biological Engineering and Computing, 2010.
2. Analysis of Covariance Using an Artificial Neural Network (with Hill and Forsythe), 1995.

Vladimir Makarov

Lecturer in Mathematics

Ph.D. in Computational Biology, Baylor College of Medicine, 1998

Mathematics faculty at CSU Channel Islands since 2006

Experience in bioinformatics, massively parallel computing, computational biology, quantitative analysis.

Selected publications:

1. Peristat: a computer-based perimetry self-test for cost-effective population screening of glaucoma (with Tanchulev, Pham and Minkler), Curr Eye Res, Vol 1, 2005.
2. Computer programs for eukaryotic gene prediction, Briefings in Bioinformatics, Vol 3, 2002.
3. Solvation and Hydration of Proteins and Nucleic Acids: a theoretical vies of simulation and experiment (with Pettitt and Feig), Accounts of Chemical Research, Vol 35, 2002.

Roger Roybal

Lecturer in Mathematics

Ph.D. in Mathematics, University of California Santa Barbara, 2005

Mathematics faculty at CSU Channel Islands since 2005

Experience in operator theory and functional analysis, existence and uniqueness in the multidimensional moment problem, mathematics in music.

Selected publications:

A reproducing kernel condition for indeterminacy in the multidimensional moment problem, Proc. Amer. Math. Soc. 135, 2007.

Brian Sittinger

Lecturer in Mathematics

Ph.D. in Mathematics, University of California Santa Barbara, 2006

Mathematics faculty at CSU Channel Islands since 2007

Experience in number theoretic probabilities, algebraic integers, Riemann zeta function.

Selected publications:

The probability that random algebraic integers are relatively r -prime, Journal of Number Theory **130**, 2010.

Matthew Dirk Wiers

Lecturer in Mathematics and Statistics

MBA in Decision Sciences, Indiana University, 1985

MS in Applied Statistics, The Ohio State University, 1988

Mathematics faculty at CSU Channel Islands since 2003

Experience in generalized linear models, actuarial mathematics, research design and data analysis, and statistical programming.

Selected publications:

1. Measurement of Retinal Vascular Tortuosity and Its Application to Retinal Pathologies (with Dougherty and Johnson), Medical and Biological Engineering and Computing, 2010.
2. Analysis of Covariance Using an Artificial Neural Network (with Hill and Forsythe), 1995.
3. Nonparametric Rank Based Main Effects Test Procedures for the Two-Way Layout (with Wolfe, Dean and Hartlaub), Nonparametric Statistics, 1991.

Extended University fully reimburses the State for faculty teaching in the special session degree program. Faculty members teach either through overload within the 125% parameters or receive course buy-out at a rate set by the V.P. of Finance and Administration. In addition to tenure track staff, the program is supported by part-time faculty hired on a course-by-course contractual basis. As the program grows, additional faculty resources will be funded by student fees.

- b. Space and facilities that would be used in support of the proposed program.

Student fees provide sufficient resources through Extended University to reimburse the State for the use of appropriate classroom space. As the program grows, additional space and facilities will be funded by student fees.

- c. A report provided by the campus Library, detailing resources available to support the program (discussion of subject areas, volume counts, periodical holdings, etc. are appropriate).

The Dean of the Library, Amy Wallace, says that the library collection meets the research needs of students in the MS in Mathematics program. The library subscribes to the major database and online journals collections in the field, including MathSciNet, Wiley Interscience, and Science Direct. In addition, the library provides instruction on how to locate and evaluate research materials to the students in this program. As a result, they make good use of our collections and, when necessary, utilize services such as interlibrary loan.

- d. Existing academic technology, equipment, and other specialized materials currently available.

Student fees provide sufficient resources through Extended University to reimburse the State for the use of needed academic technologies. Additionally, Extended University maintains separate resources for additional technology support. As the program grows, additional technology resources will be funded by student fees.

9. Additional Support Resources Required (CPEC “Total Costs of the Program”)

Note: If additional support resources will be needed to implement and maintain the program, a statement by the responsible administrator(s) should be attached to the proposal assuring that such resources will be provided.

No additional support resources are required for this program.

- a. Any special characteristics of the additional faculty or staff support positions needed to implement the proposed program.
- b. The amount of additional lecture and/or laboratory space required to initiate and to sustain the program over the next five years. Indicate any additional special facilities that will be required. If the space is under construction, what is the projected occupancy date? If the

- space is planned, indicate campus-wide priority of the facility, capital outlay program priority, and projected date of occupancy.
- c. A report written in consultation with the campus librarian, indicating any additional library resources needed. Indicate the commitment of the campus either to purchase or borrow through interlibrary loan these additional resources.
 - d. Additional academic technology, equipment, or specialized materials that will be (1) needed to implement the program and (2) needed during the first two years after initiation. Indicate the source of funds and priority to secure these resource needs.