California State University San Marcos • NEW COURSE • FORM C MATH 698

ORIGINATOR'S SECTION:

1. College:

☐ CHABSS ☐ CoBA
☐ CoEHHS ☒ CSM

Desired Term and Year of Implementation (e.g., Fall 2008):

Fall 2017

2.Course is to be considered for G.E.? (If yes, also fill out appropriate GE form*) ☐ Yes ☒ No

3. Course will be a variable-topics (generic) course? ☐ Yes ☒ No
("generic" is a placeholder for topics)

4. Course abbreviation and Number:* MATH 698

5. Title: (Titles using jargon, slang, copyrighted names, trade names, or any non-essential punctuation may not be used.)
Preparation for Graduate Comprehensive Examination

6. Abbreviated Title for PeopleSoft:
(no more than 25 characters, including spaces)
Prep for Graduate Exam

7. Number of Units: 3

8. Catalog Description: (Not to exceed 80 words; language should conform to catalog copy. Please consult the catalog for models of style and format; include all necessary information regarding consent for enrollment, pre- and/or corequisites, repeated enrollment, crosslisting, as detailed below. Such information does not count toward the 80-word limit.)

Independent research and preparation for taking the Master of Science in Mathematics Comprehensive Examination. Graded Credit/No Credit. May be repeated for credit, but students may enroll in only one section per semester and a maximum of three (3) units will be counted toward the Master of Science in Mathematics degree. Enrollment restricted to students with graduate student standing in mathematics that have advanced to candidacy under the Comprehensive Exam Option and requires the approval of the Graduate Coordinator.

9. Why is this course being proposed?

See attached P-2 Form and memo.

10. Mode of Instruction*

For definitions of the Course Classification Numbers: http://www.csusm.edu/academic_programs/curriculumscheduling/catalogcurricula/DOCUMENTS/Curricular_Forms_Tab/Instructional%20Mode%20Conventions.pdf

Type of Instruction	Number of Credit Units	Instructional Mode (Course Classification Number)
Lecture		
Activity	3	24
Lab		

11. Grading Method:*
☐ Normal (N) (Allows Letter Grade +/-, and Credit/No Credit)
☐ Normal Plus Report-in-Progress (NP) (Allows Letter Grade +/-, Credit/No Credit, and Report-in-Progress)
☒ Credit/No Credit Only (C)
☐ Credit/No Credit or Report-in-Progress Only (CP)

12. If the (NP) or (CP) grading system was selected, please explain the need for this grade option.
The comprehensive exam is judged as pass or fail, rather than as a letter grade.

13. Course Requires Consent for Enrollment? ☒ Yes ☐ No

☐ Faculty ☐ Credential Analyst ☐ Dean ☒ Program/Department - Director/Chair

14. Course Can be Taken for Credit More than Once? ☒ Yes ☐ No
If yes, how many times? 3 (including first offering)

15. Is Course Crosslisted: ☐ Yes ☒ No

If yes, indicate which course and check "yes" in item #22 below.

16. Prerequisite(s): ☒ Yes ☐ No Enrollment restricted to students with graduate student standing in mathematics that have advanced to candidacy under the Comprehensive Exam Option.

17. Corequisite(s): ☐ Yes ☒ No

* If Originator is uncertain of this entry, please consult with Program/Department Director/Chair.

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BY:

18. Documentation attached: Other:
☐ Syllabus ☒ Detailed Course Outline
AND a Sample Exam Composition and Sample Study Guide

19. If this course has been offered as a topic, please enter topic abbreviation, number, and suffix:*

20. How often will this course be offered once established?* As needed.

PROGRAM DIRECTOR/CHAIR - COLLEGE CURRICULUM COMMITTEE SECTION:
(Mandatory information – all items in this section must be completed.)

21. Does this course fulfill a requirement for any major (i.e., core course or elective for a major, majors in other departments, minors in other departments)? ☐ Yes ☒ No

If yes, please specify:

22. Does this course impact other discipline(s)? (If there is any uncertainty as to whether a particular discipline is affected, check "yes" and obtain signature.) ☐ Yes ☒ No

If yes, obtain signature(s). Any objections should be stated in writing and attached to this form.

Discipline _____ Signature _____ Date _____ Support _____ Oppose

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SIGNATURES : (COLLEGE LEVEL) :

Prof. Amber Puha 12/20/16
1. Originator (please print or type name) Date

Prof. Wayne Aitken 12/20/16
2. Program Director/Chair Date

2/28/17
3. College Curriculum Committee Date

2/23/17
4. College Dean (or Designee) Date

(UNIVERSITY LEVEL)

5. UCC Committee Chair Date

6. Vice President for Academic Affairs (or Designee) Date

7. President (or Designee) Date

Office of Academic Programs PS Banner Catalog Revised 3/28/2007

* If Originator is uncertain of this entry, please consult with Program/Department Director/Chair. Revised page ✓

California State University
SAN MARCOS

College of Science
& Mathematics

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MEMORANDUM

DATE: February 2, 2017

TO: CSM Curriculum Committee and UCC

FROM: Prof. Amber Puha
Graduate Coordinator
Department of Mathematics

SUBJECT: Math 698 C Form

When a student advances to candidacy under the comprehensive exam option, the coursework taken to date is reviewed by the Graduate Coordinator. Based on that, a Comprehensive Examination Committee with expertise relative to the student's coursework is formed. That committee selects the courses to be tested. Six courses are tested in all, with Math 430 and Math 470 (Foundations of Analysis and Abstract Algebra) always included in the exam so that graduates must demonstrate sufficient expertise in these two fundamental areas of mathematics. The other four courses are determined by the committee based on a combination of the coursework completed, the student's preferences, and the availability of faculty instructing those courses to prepare an exam syllabus or exam study guide and to write and grade that portion of the exam (e.g., those on sabbatical aren't generally asked to serve). The Graduate Coordinator notifies the student of the committee members, committee chair, and courses to be tested. The student then receives an exam syllabus or study guide for each course to be tested from the faculty member writing and grading the questions on that subject on the exam. In addition to a Course Outline, we have included a sample exam composition (see recent email to Jason Swalwell) and an exam study guide for one of the courses to be tested for illustrative purposes.

Enclosures (5): P-2 form & Explanatory Memo, Catalogue Copy, C Form, Sample Exam Subject Content, Sample Course Study Guide, Course Outline

Math 698 -- **Preparation for Graduate Comprehensive Examination**
COURSE OUTLINE

Course Description: Independent research and preparation for taking the Master of Science in Mathematics Comprehensive Examination. *Graded Credit/No Credit. May be repeated for credit, but students may enroll in only one section per semester and a maximum of three (3) units will be counted toward the Master of Science in Mathematics degree. Enrollment restricted to students with graduate student standing in mathematics that have advanced to candidacy under the Comprehensive Exam Option and requires the approval of the Graduate Coordinator.*

Student Learning Outcomes: Students will

- Demonstrate mastery of the following two foundational areas of mathematics:
  - Analysis (PSLO 1)
  - Abstract Algebra (PSLO 2)
- Demonstrate mastery of the subject matter of the four additional 500-level mathematics courses to be tested as determined by the Comprehensive Examination Committee.
- Develop and write mathematics proofs in advanced areas of mathematics (PSLO 4)
- Develop and analyze mathematical models and algorithms, as appropriate to the courses tested (PSLO 5)
- Note: PSLO 3 is evaluated within the Graduate Writing Assessment Requirement, prior to advancement to candidacy

Activities: Students are to study independently, but student may arrange to meet with their Comprehensive Exam Committee Chair or any member of the Comprehensive Exam Committee as desired to discuss the material to be tested or to ask questions.

Textbook: Students will reference the textbooks from the six courses to be tested.

Study Guides/Exam Syllabi: Students will be provided with a Study Guide or Exam Syllabus for each course to be tested by the faculty member writing and grading the exam questions pertaining to that course.

Grading Scheme: Students earning a 70% or better on the exam will be awarded a grade of CR.

From: **A. Puha** apuha@csusm.edu
Subject: Comprehensive Exam Committee
Date: November 22, 2016 at 4:04 PM
To: Jason Swalwell swalw001@cougars.csusm.edu
Cc: Mike Picollelli mpicollelli@csusm.edu

Dear Jason,

Dr. Picollelli will chair your comprehensive exam committee. Dr. Whittlesey and Dr. Aitken will be the additional members.

You will be tested on Math 430 and Math 470, as is everyone.

You will also be tested on Math 505, 542, 550 and 570.

Dr. Picollelli will be sending the exam study guides to you during week 15. He will also be working with you and the committee to set up three exam dates. These will be during weeks 11-15 of the spring semester.

I will return your advancement form to you tomorrow so that you can collect signatures from the committee members and return it to me.

Best Wishes,
Prof Puha

Professor Amber Puha
Graduate Coordinator
Learning Assistant Program Mathematics Coordinator
Surf Team Faculty Advisor
Department of Mathematics
California State University San Marcos
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Math 542 - Advanced Graph Theory
Study Guide

The material in this course primarily falls into three categories: Basic Concepts, Algorithms and Complexity, and Combinatorial Optimization Problems. The following summarizes the corresponding sections of the textbook and what you should know.

Basic Concepts:

- 1.1: Basic definitions (not SRG)
- 1.2: Trees (up through Theorem 1.2.8)
- 1.3: Euler Tours
- 1.4: Hamiltonian Cycles, TSP
- 1.6: Digraphs, orientability

For this material, you should know all of the given definitions and the proofs of the covered Lemmas, Theorems, and Corollaries, but you will not be tested on the proof of Theorem 1.6.3. (Also, recall that we used the term *balanced* in place of *pseudosymmetric* for digraphs.)

Algorithms and Complexity

- 2.1: Algorithms
- 2.2: Representing graphs
- 2.3: Hierholzer's Algorithm for finding Euler tours
- 2.4: Writing down algorithms
- 2.5: Complexity theory, asymptotic notation
- 2.7: NP-Completeness: SAT, 3-SAT, Hamiltonian Cycle (HC) and TSP are NP-Complete.
- 2.8: Vertex Cover (and Dominating Set) is NP-Complete

First and foremost, you should be comfortable with understanding and describing an algorithm in reasonable pseudocode, similar to what's described in Section 2.4. You should be comfortable with asymptotically estimating the running time under the simplifying assumption that basic operations, like entering a variable into memory or performing an arithmetic operation take a single time step. You should know and understand the definitions of the asymptotic notation $O(\cdot), \Omega(\cdot)$ and $\Theta(\cdot)$, and the covered definition of when a decision problem is in P, in NP, or NP-Complete, as well as how to show a new decision problem lies in P or NP or is NP-Complete.

Combinatorial Optimization:

- 3.1 Shortest paths
- 3.3: Breadth-first search (up to Theorem 3.3.5)
- 3.7: Dijkstra's Algorithm (up to Theorem 3.7.2)
- 4.1 Spanning Trees (Just Lemma 4.1.1)
- 4.3 Minimal spanning trees
- 4.4: MINTREE, Prim's Algorithm, Kruskal's Algorithm (up to Algorithm 4.4.7)

For the preceding sections, you should know the definitions, theorem statements and proofs, as well as how to apply BFS, Dijkstra's Algorithm, and Prim and Kruskal's Algorithms. You will only need to know the statements (and not the proofs) of the correctness and running time of Dijkstra's, Prim's, and Kruskal's algorithms. (That is, you only need to know the statements of Theorems 3.7.2, 4.4.2 (for MINTREE), and 4.4.4.)

- 6.1: Network flows (up to Ford-Fulkerson, Algorithm 6.1.7)
- 6.2: Edmonds-Karp improvement to Ford-Fulkerson (Theorem 6.2.1 - statement only)
- Applications of Max-flow Min-cut, including Hall's Theorem (Section 7.3), Konig's Theorem (Homework 6)

You should know all of the definitions, results, and proofs from Section 6.1 *except* the proof of Max-Flow Min-Cut (Theorem 6.1.6). You should be able to apply Ford and Fulkerson's augmenting path algorithm (using the Edmonds-Karp modification) to find a maximum flow on a given network. You should also be comfortable with modeling another problem as a max-flow min-cut problem, as in the homework.