Code # SM04 (2014)

**New/Special Course Proposal-Bulletin Change Transmittal Form**

**Undergraduate Curriculum Council** - Print 1 copy for signatures and save 1 electronic copy.

**Graduate Council** - Print 1 copy for signatures and send 1 electronic copy to [mmcginnis@astate.edu](mailto:mmcginnis@astate.edu)

|  |
| --- |
| **New Course or**  **Special Course (Check one box)**  *Please complete the following and attach a copy of the catalogue page(s) showing what changes are necessary.* |

|  |  |
| --- | --- |
| Hung-Chi Su 10/24/2014 **Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **COPE Chair (if applicable)** |
| Debra Ingram Enter date… **Department Chair:** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **General Education Committee Chair (If applicable)** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date… **College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Undergraduate Curriculum Council Chair** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date… **College Dean** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Graduate Curriculum Committee Chair** |
|  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Vice Chancellor for Academic Affairs** |

1. Proposed Course Prefix and Number (For variable credit courses, indicate variable range.)

CS 2913

2. Course Title – if title is more than 30 characters (including spaces), provide short title to be used on transcripts. Title cannot have any symbols (e.g. slash, colon, semi-colon, apostrophe, dash, and parenthesis). Please indicate if this course will have variable titles (e.g. independent study, thesis, special topics).

Discrete Structures

3. Will this course be lecture only, lab only, lecture and lab, activity, dissertation, experiential learning, independent study, internship, performance, practicum, recitation, seminar, special problems, special topics, studio problems, student exchange, occupational learning credit, or course for fee purpose only (e.g. an exam)? Please choose one.

lecture only

4. What is the grade type (i.e. standard letter, credit/no credit, pass/fail, no grade, developmental)?

standard letter

5. Is this course dual listed (undergraduate/graduate)?

no

6. Is this course cross listed? (If it is, all course entries must be identical including course descriptions. It is important to check the course description of an existing course when adding a new cross listed course.)

no

7. Brief course description (40 words or fewer) as it should appear in the bulletin.

Core elements of computer science including algorithms and their analysis, propositional logic, predicate logic, sets, functions and relations, combinatorics, mathematical induction, recursion, matrices, graphs, trees, and Boolean logic. Concepts are expressed graphically, numerically, symbolically, and in writing..

8. Indicate all prerequisites and if this course is restricted to a specific major, which major. (If a student does not have the prerequisites or does not have the appropriate major, the student will not be allowed to register).

a. Are there any prerequisites?

yes: CS1114 or 2114, and MATH 1023 or 1054 or 2204..

b. Why?

The material covered by the course requires some experience in computer programming as well as mathematical facility.

9. Course frequency(e.g. Fall, Spring, Summer). Not applicable to Graduate courses.

Fall, Spring

10. Contact Person (Name, Email Address, Phone Number)

Hung-Chi Su, [suh@astate.edu](mailto:suh@astate.edu), 972.3978

11. Proposed Starting Term/Year

Spring 2015

12. Is this course in support of a new program?   
  
No

If yes, what program?

Enter text...

13. Does this course replace a course being deleted?   
  
No

If yes, what course?

Enter text...

Has this course number been used in the past?   
  
No

*Submit Course Deletion Proposal-Bulletin Change Transmittal Form.*

14. Does this course affect another program?   
  
Yes.  Computer science students will take this course instead of MATH 2183, Discrete Structures.  The Department of Computer Science and the Department of Mathematics and Statistics are collaborating on this curriculum change.  MATH 2183 will still be required by BS and BSE Mathematics majors.  CS 2913 will be required by BS and BA Computer Science majors (assuming the Fall 2014 pilot is successful).  Having separate courses in discrete mathematics for mathematics and computer science majors will allow both programs to deliver content that better prepares students to successfully complete the degree.  The Curriculum Committees of both departments support this change.

If yes, provide contact information from the Dean, Department Head, and/or Program Director whose area this affects.

Enter text...

15. Justification should include:

a. Academic rationale and goals for the course (skills or level of knowledge students can be expected to attain)

This course provides an introduction to key mathematical concepts used in computing; goals include:  
  
Experience with fundamentals of analysis of algorithms  
Development of a foundation of set theory concepts and notation

Exploration of a variety of mathematical structures with focus on objects, operations, and resulting properties

Development of formal logical reasoning techniques and notation

Facility with the application of logic to analyzing and writing proofs

Development of techniques for counting, permutations and combinations

Development of the concept of relation through various representations (digraphs, matrices, lists)

b. How does the course fit with the mission established by the department for the curriculum? If course is mandated by an accrediting or certifying agency, include the directive.

The course serves as a requirement for the department’s undergraduate degree programs.  
  
ABET, the accrediting agency for computer science programs, includes the following requirement (under Program Criteria / Curriculum): Mathematics: At least one half year that must include discrete mathematics. The additional mathematics might consist of courses in areas such as calculus, linear algebra, numerical methods, probability, statistics, number theory, geometry, or symbolic logic.

c. Student population served.

Undergraduate students majoring in the department’s Bachelor of Science and Bachelor of Arts programs.

d. Rationale for the level of the course (lower, upper, or graduate).

The lower level of the course corresponds to the introductory nature of the fundamental concepts introduced.

16. Outline (The course outline should be topical by weeks and should be sufficient in detail to allow for judgment of the content of the course.)

Functions, Relations and, Sets: 6 hours

- Functions (surjections, injections, inverses, composition)

- Relations (reflexivity, symmetry, transitivity, equivalence relations)

- Sets (Venn diagrams, complements, Cartesian products, power sets)

- Pigeonhole principle

- Cardinality and countability

Basic Logic: 10 hours

- Propositional logic, Logical connectives, Truth tables

- Normal forms (conjunctive and disjunctive), Validity

- Predicate logic & its limitations

- Universal and existential quantification

- Modus ponens and modus tollens

Proof Techniques: 11 hours

- Notions of implication, converse, inverse, contrapositive, negation, and contradiction

- The structure of mathematical proofs, Direct proofs, Proof by counterexample/contraposition/contradiction

- Mathematical induction

- Recursive mathematical definitions

Basics of Counting: 5 hours

- Counting arguments, Sum and product rule, Inclusion-exclusion principle

- Arithmetic and geometric progressions, Fibonacci numbers

- The pigeonhole principle

- Permutations and combinations

- Pascal’s identity, The binomial theorem

- Solving recurrence relations

Graphs and Trees: 4 hours

Trees

Undirected and Directed graphs

Spanning trees/forests

Traversal strategies

Discrete Probability: 6 hours

- Finite probability space, probability measure, events

- Conditional probability, independence, Bayes’ theorem

- Integer random variables, expectation

- Law of large numbers

17. Course requirements (e.g. research papers, projects, interviews, tests, etc.)

Homework will be assigned on a daily basis. Four one-hour exams will be taken throughout the semester, as well as a comprehensive final.

18. Special features (e.g. labs, exhibits, site visitations, etc.)

none

19. Department staffing and classroom/lab resources (Will this require additional faculty, supplies, etc.?)

The department’s course rotation will be adjusted to allow for offerings of this course; no additional faculty or supplies will be necessary.

20. What is the primary intended learning goal for students enrolled in this course?

Upon completion of the course, students will be able to utilize fundamental mathematical concepts in the creation of data structures and algorithms in subsequent computer science courses.

21. Reading and writing requirements:

a. Name of book, author, edition, company and year

Discrete Mathematics and Its Applicatiions; Rosen, Kenneth; 7th ed.; 2011

b. Number of pages of reading required per week:   
  
between 25 and 40

c. Number of pages of writing required over the course of the semester:   
  
3-4 pages of homework per class period, for a total of approximately 140

22. High-Impact Activities (Check all that apply)

Collaborative assignments

Research with a faculty member

Diversity/Global learning experience

Service learning or community learning

Study abroad

Internship

Capstone or senior culminating experience

Other Explain: Enter text...

23. Considering the indicated primary goal (in Box #20), provide up to three outcomes that you expect of students after completion of this course.

**Outcome #1:** (For example, what will students who meet this goal know or be able to do as a result of this course?)

Students will be able to apply basic big-O analysis to computer algorithms as well as data structures.

Learning Activity:(For example, what instructional processes do you plan to use to help students reach this outcome?)

After lecture over the topic and example demonstrations, students will demonstrate examples in class and in homework..

Assessment Tool: (For example, what will students demonstrate, represent, or produce to provide evidence of their learning?)

Classroom presentations will be critiqued and homework will be graded.

*(Repeat if needed for additional outcomes 2 and 3)*

**Outcome #2:**

Students will be able to demonstrate problem solving skills using elementary probability concepts of permutations and combinations..

Learning Activity:

After lecture over the topic and example demonstrations, students will demonstrate examples in class and in homework.

Assessment Tool:

Classroom presentations will be critiqued and homework will be graded.

**Outcome #3**:

Students will be able to write proofs for statements using appropriate proof methods (direct, indirect, mathematical induction).

Learning Activity:

After lecture over the topic and example demonstrations, students will demonstrate examples in class and in homework.

Assessment Tool:

Classroom presentations will be critiqued and homework will be graded.

24. Please indicate the extent to which this course addresses university-level student learning outcomes:

* 1. Global Awareness

Minimally  
Indirectly  
Directly

* 1. Thinking Critically

Minimally  
Indirectly  
Directly

* 1. Using Technology

Minimally  
Indirectly  
Directly

**From the most current electronic version of the bulletin, copy all bulletin pages that this proposal affects and paste it to the end of this proposal.**

**To copy from the bulletin:**

1. Minimize this form.
2. Go to <http://registrar.astate.edu/bulletin.htm> and choose either undergraduate or graduate.
3. This will take you to a list of the bulletins by year, please open the most current bulletin.
4. Find the page(s) you wish to copy, click on the “select” button and highlight the pages you want to copy.
5. Right-click on the highlighted area.
6. Click on “copy”.
7. Minimize the bulletin and maximize this page.
8. Right-click immediately below this area and choose “paste”.
9. For additions to the bulletin, please change font color and make the font size larger than the surrounding text. Make it noticeable.
10. For deletions, strike through the text, change the font color, and enlarge the font size. Make it noticeable.

Paste bulletin pages here...