Department and Course Number	**CS 410**	Course Coordinator	Thomas Sudkamp
Course Title	**Theoretical Foundations of Computing**	Total Credits	4

BS CE: Elective; BS CS: Elective;

This document was prepared by: Thomas Sudkamp Date: May 13, 2005

Catalog Description

Turing machines; mu-recursive functions; equivalence of computing paradigms; Church-Turing thesis; undecidability. 4 hours lecture. **Prerequisite**: CS 466.

Text Book

Thomas Sudkamp, *Languages and Machines: An Introduction to the Theory of Computer Science*, 2nd edition, Addison-Wesley, Reading, 1997.

Home Page

http://www.cs.wright.edu/~tsudkamp/courses.htm

Course Objectives

The students should develop an awareness of the capabilities and limitations of algorithmic computation. A student completing this course should have knowledge of

1. Computation via Turing machines
2. The implications of the Church-Turing thesis
3. The undecidability of the halting problem
4. Using problem reduction to establish undecidability
5. The computability of recursive and partial recursive functions

Prerequisites by Topic

1. Naïve set theory
2. Use of grammars for the generation of languages
3. Use of finite state machines for pattern recognition

Course Topics

The topics covered include

1. Countable and uncountable sets, diagonalization. T
2. Turing machines as language acceptors and language enumerators.
3. Deterministic and nondeterministic machines. Multi-track and multi-tape machines.
4. Decision problems.

5. Church-Turing thesis.
6. Undecidability. The halting problem. Problem reduction.
7. The Post correspondence problem. Rice's theorem.
8. Recursive and mu-recursive functions.

Course Contribution to Professional Component

CS 410 contributes 3 hours to criterion 4 (a) College Level Mathematics and 1 hour to Criterion 4(b) Engineering Design.

Course Contribution to Program Educational Objectives

CS 466 contributes to objectives 1 and 2 by providing them with fundamental knowledge of the theoretical background of their discipline.

Course Contribution to Program Outcomes and Assessment

a	b	c	d	e	f	g	h	i	j	k
PX	0	PX	0	P	0	0	0	0	0	0

Estimate CSAB Category Content

	Core	Advanced			Core	Advanced
Data Structures				Concepts of PL		
Algorithms		1.0		Comp Organization + Architecture		
Software Design				Other		3.0

Oral and Written Communications

Other than examinations and participation in class, there are no explicit oral or written requirements.

Social and Ethical Issues

None.

Theoretical Content

The majority of this class is devoted to topics in the theory of computer science. The particular topics are listed above.

Problem Analysis and Solution Design

The students are required to design solutions to decision and pattern recognition problems, both at a high level and using Turing machine. Students must also be able to determine that certain problems have no algorithmic solution.

Outcome Assessment

The students are assessed by a series of tests and/or quizzes administered throughout the quarter. There is also an entrance and exit survey.