CSC 333 - DISCRETE STRUCTURES FOR COMPUTER SCIENCE

CREDIT HOURS: 3
PREREQUISITES: CSC 202; MTH 138 or 140 or 143 or 233
GRADE REMINDER: Must have a grade of C or better in each prerequisite course.

CATALOG DESCRIPTION

Mathematical structures for describing data, algorithms, and computing machines. Theory and application of sets, relations, functions, combinatorics, matrices, graphs, and algebraic structures which are pertinent to computer science.

PURPOSE OF COURSE

To develop logical and mathematical concepts necessary to understand and analyze computational systems. Introduce concepts, techniques, and skills necessary to comprehend the underlying structure of problems encountered in designing and implementing computer systems and software. Provide the foundations for understanding computer science topics that rely upon the comprehension of formal abstract concepts.

EDUCATIONAL OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Use formal notation for prepositional and predicate logic.

2. Construct formal proofs in prepositional and predicate logic and use such proofs to determine the validity of English language arguments.

3. Prove conjectures using the techniques of direct proof, proof by contraposition, proof by contradiction, and proof by induction.

4. Prove the correctness of programs that contain looping constructs.

5. Demonstrate an understanding of recursive definitions and to write recursive definitions for certain sequences and collections of objects.

6. Describe how recursive algorithms execute.

7. Use set notation and set operations to prove/disprove set identities.

8. Use the Principle of Inclusion and Exclusion to find the number of elements in the union of sets.

9. Solve permutation and combination problems for a set of *n* distinct objects.

10. Use relations and functions and apply these concepts to ordering problems.

11. Use graphs, directed graphs, and trees as representation tools in a wide variety of contexts.

COURSE CALENDAR

This course meets for a minimum of 37.5 lecture contact hours during the semester, including the final exam. Students have significant weekly reading assignments. Students are expected to complete weekly homework and/or lab assignments, and 2-3 periodic exams in addition to the final exam. Students are expected to prepare for any class assignments or quizzes over the material covered in class or in the reading material. Successful completion of these activities requires at a minimum six additional hours of outside of classroom work each week.

CONTENT **Hours**

The foundations …..……12
- Propositional Logic
- Predicates
- Rules of Inferences
- Introduction to Proofs

Basic Structures…….7
- Set Theory
- Functions
- Sequences
- Sums
- Matrices

Algorithms…….3
- Introduction to Algorithms
- The Growth of Functions
- Complexity

Induction and Recursion……6
- Mathematical Induction
- Recursive Algorithms
- Program Correctness

Counting……..…5
- Counting Principles
- The Pigeonhole Principle
- Permutations and Combinations

Recurrences……....3
- Applications of Recurrence Relations
- Solving Recurrence Relations

Relations……...…3
- Relations and Their Properties
- Representing Relations

Graphs ……3
- Graphs and Graph Models
- Graph Terminology

Representing Graphs
Introduction to Graph Algorithms

Exams.....3

TOTAL 45

REFERENCES

Aho, A. and Ullman, J., Foundations of Computer Science, C Edition, W.H. Freeman, 1995.

Epp, S., Discrete Mathematics with Applications, Cengage Learning, 2010.

Gersting, J., Mathematical Structures for Computer Science, 7th Ed., W.H. Freeman, 2014.

Grimaldi, R., Discrete and Combinatorial Mathematics, 5th Edition, Addison-Wesley, 2004.

Hein, J.L., Discrete Structures, Logic, and Computability, 3rd. Ed., Jones and Bartlett, 2010.

Rosen, K.H., Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill, 2012.