JOINT INSTITUTE
交大密西根学院

Standard Undergraduate Course Profile

<table>
<tr><td>COURSE NUMBER: Ve203</td><td>COURSE TITLE (EN & CN): Discrete Mathematics</td></tr>
<tr><td>CREDIT: 4</td><td>PREREQUISITES: None</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
Gallier, J., Discrete Mathematics, Springer, New York, 2011, ISBN: 978-1-4419-8047-2

Lovász, L., Pelikán, J., Vesztergombi, K. Discrete Mathematics – Elementary and beyond, Springer, New York, 2003, ISBN: 978-0-387-21777-2

(Both books are available freely from within the SJTU network via SpringerLink.)</td><td>PREPARED BY: Horst Hohberger
DATE OF UC APPROVAL:
LAST UPDATED: July 20th, 2020</td></tr>
<tr><td>CATALOG DESCRIPTION:
Background and Goals
The present course is different from typical math courses in that it does not give an in-depth look at any one topic. Instead, we visit several different mathematical fields that are loosely grouped together under the heading “discrete mathematics”. These fields have in common that they deal with problems related to integers (as opposed to the real numbers fundamental to calculus). Hence, the questions can often be formulated in quite elementary terms. Many of these problems are classical, having been analyzed by natural philosophers and scientists for centuries or (in some cases) millennia.

Content
Topics include basic concepts in logic, basic concepts in set theory, natural numbers and mathematical induction, equivalence relations, integers, rational numbers, functions, sequences, real numbers; divisibility theory of the integers, Diophantine equations, prime numbers and their distribution, the theory of congruences, factorization and verifying primality; algorithms and computational complexity, computer arithmetic, recurrence relations and divide-and-conquer algorithms, combinatorics, applications of probability; graphs, paths and circuits in graphs, planar graphs, trees, applications of graph theory.</td><td>COURSE TOPICS:
1. Basic concepts of logic, proofs, sets and numbers (12 hours at 45 min each)
2. Number theory (10 hours)
3. Algorithms, computer arithmetic, applications of combinatorics and probability to algorithms (18 hours)
4. Graph theory and applications (14 hours)
5. Three exams (6 hours)</td></tr>
<tr><td colspan="2">COURSE STRUCTURE and CONTACT HOUR: Lecture: 30 x 90 minutes. Discussion classes: 4 x 45 minutes. Total: 64 contact hours</td></tr>
<tr><td>COURSE OUTCOMES [Student Outcomes* in brackets]</td><td>After completing Ve203, students should be able to:

1. Perform a proof using structural induction. [1]
2. Solve simple Diophantine equations. [1]
3. Calculate modular exponentials. [1]
4. Analyze the time complexity of simple algorithms. [1]
5. Solve linear recurrence relations. [1].
6. Apply the pigeonhole principle to prove simple statements. [1]
7. Apply the Diffie-Hellman or the RSA algorithm. [1]
8. Analyze basic properties of graphs. [1]</td></tr>
<tr><td>COURSE OBJECTIVES [Course Outcomes in brackets]</td><td>1. To provide an introduction to the various fields of discrete mathematics and their application to algorithms. [1-8]</td></tr>
<tr><td>ASSESSMENT TOOLS [Course Outcomes in brackets]</td><td>1. Examinations [1-8]</td></tr>
</table>

ABET Student Outcomes* —— Applies to Engineering Courses

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3) an ability to communicate effectively with a range of audiences

4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies