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**FIRST SEMESTER 2020-2021**

# Course Handout Part II

Date: 17-08-2020

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : CS F222

## Course Title : Discrete Structures for Computer Science

## Instructor-in-Charge : Manjanna B

## Instructors : Mrityunjay Singh, Ramaswamy Venkatakrishna, Rajita B S A S, S Vishwanath Reddy

**Scope and Objective of the Course:** This course aims to provide the mathematical foundations for many computer science courses including data structures, algorithms, databases theory, automata theory, formal languages, compiler theory, computer security, and operating systems. This course can develop mathematical maturity to understand and create mathematical arguments. The course encompasses topics like methods of proof (induction, contradiction, proof by cases etc), set theory, functions, relations, partially ordered sets, lattices, graph theory, basic number theory and its application to cryptography, algebraic structures & coding theory.

The objectives of the course are to:

* Equip students with mathematical foundations to study computer science subjects
* Understand different methodologies to prove or disprove a given proposition
* Understand mathematical structures and solve practical problems using these structures
* Understand advanced counting techniques

**Textbooks:**

**T1. Kenneth H. Rosen:** Discrete Mathematics and its applications, 8th edition, Tata McGrawHill Education Private Limited.

**Reference books**

**R1. Eric Lehman, F Thomson Leighton, Albert R Meyer,** Mathematics for Computer Science, 2018

**R2. Martin Aigner, Gunter M. Ziegler,** Proofs from THE BOOK

**R3.** [**Ronald Graham**](https://en.wikipedia.org/wiki/Ronald_Graham)**,**[**Donald Knuth**](https://en.wikipedia.org/wiki/Donald_Knuth)**, and**[**Oren Patashnik**](https://en.wikipedia.org/wiki/Oren_Patashnik), Concrete Mathematics: A Foundation for Computer Science

**R4. Lovasz et al**. Discrete Mathematics, Elementary and Beyond

**R5. Mott, Kandel, Baker,** Discrete Mathematics for Computer Scientists and Mathematicians

**R6. Douglas West:** Introduction to Graph Theory, PHI, 2nd edition, 2011

**R7. Miklos Bona:** A Walk Through Combinatorics, World Scientific, 3rd edition

**R8. David Burton:** Elementary Number Theory, TMH, 7th edition

**R9. Tremblay and Manohar**, Discrete Mathematical Structures with Applications to Computer Science, Tata Mc-Graw-Hill Edition 1997.

**R10. C. L. Liu**, Elements of Discrete Mathematics, Second Edition.

**Course Plan:**

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| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1 | To introduce the course | Introduction to Discrete Structures and its applications to Computer Science, Course overview | Class Notes |
| 2 | To understand different methodologies to prove or disprove a given proposition | Methods of Proof – Week and Strong Induction, Proof by Contradiction, Proof by cases etc.  Circular Reasoning, Disproving a proposition | T1 – Ch.1 & Ch.5 |
| 3 – 4 | To learn sets, functions and their equivalent representations | Set Theory, Function, Introduction to Godel’s Incompleteness Theorem and Russel’s Paradox | T1 – Ch.2 & Class Notes |
| 5 – 7 | To learn relations, partial ordered sets and lattice theory with applications to computer science | Relations, Partially Ordered Sets, Equivalence Relation, Lattice Theory | T1 Ch.9 |
| 8 – 12 | To understand fundamentals concepts in graph theory | Graph Theory - Basic concepts, Isomorphism, Subgraphs, Special Graphs, Planar Graphs, Multi Graphs, Eulerian & Hamiltonian cycles/paths, Graph Coloring | T1 – Ch.10,R6 |
| 13 – 17 | To understand fundamental concepts of trees, spanning trees and algorithms to generate Minimum Spanning Trees | Trees, Spanning Trees, Minimum Spanning Trees | T1 – Ch.11,R6 |
| 18 – 22 | To understand techniques of counting | Combinatorics – Simple & Generalized Pigeonhole Principle, Inclusion-Exclusion etc. | T1 – Ch.6 |
| 23 – 27 | To understand recurrence and recurrence relations and how to solve them | Recurrence, Recurrence Relation and Generating functions, Discrete Geometry | T1 – Ch.5 & Ch.8, R2 |
| 28 – 32 | To learn basic number theory concepts required for cryptography | Basics in Number Theory – Primes, Factorization, GCD, Residues and application to cryptography | T1- Ch. 4 |
| 33 – 40 | To learn Groups, Rings, Fields and Coding Theory | Algebraic Structures – Monoids, Groups, Rings and Coding Theory | R9- Ch. 3-4  R10 -Ch.11-12 |

**Evaluation Scheme:**

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| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |

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| **Test-1** | **30 mins** | **15%** | September 10 –September 20  (during scheduled class Hour) | **Open Book** |
| **Test-2** | **30 mins** | **15%** | October 9-October 20(during scheduled class hour) | **Open Book** |
| **Test-3** | **30 mins** | **15%** | November 10-November 20 during scheduled class hour) | **Open Book** |
| **Assignments(2)** | **Take Home** | **20%** | To be announced | **Open Book** |
| **Comprehensive Examination** | **120 mins** | **35%** | As announced in the Timetable | **Open Book** |

**Chamber Consultation Hour:** Saturday 12-1 PM (meet.google.com/bwv-nnjw-jdy)

**Notices:** All notices about the course will be put on CMS.

**Make-up Policy:** Make-up will be granted only to genuine cases with prior permission only.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**

**Manjanna B**