CS-13104: Foundations of Logical Thoughts (Credits: 4-0-0-4)

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Prerequisite: None

Objective: This course is aimed at Computer Science majors who have never taken any type of mathematical theory courses before, though it is also a useful course for developing general reasoning and problem solving skills. For those that continue studying Computer Science, this course serves as excellent preparation for the required course Discrete Math For Computer Scientists. However, all students taking this course should benefit by improving their reasoning and abstract thinking skills, learning how to construct sound, logical arguments, and by learning to detect flaws in unsound arguments.

Course Description This course offers a presentation of fundamental tools required in advanced computer science. The main topics covered in this subject include propositional and first-order logic, recursion, proofs, other kinds of logic. This forms the basis for the subjects like Automata theory and formal methods.

Course Plan

There will be around total 40 lectures, 4 lectures per week.

Course Outline (to be covered in 40 lectures)

Unit. No.	Topic	Textbook	Number of Lectures
1	**Formal logic:** • Propositional Logic • Relational logic • First order logic, and related issues • Notion of proofs	Rosen (Ch. 1)	8
2	**Basic Structure** • Set Theory • Relations • Linear congruence • Functions and Recursion • Number Theory	Rosen (Ch. 2) Rosen (Ch. 7)	8
3	**Lattice and Boolean Algebra**	Rosen (Ch. 7) Rosen (Ch. 10)	8
4	**Group Theory and related issues** Algebraic System and Group Theory	Rosen (Ch. 11)	6
5	**Finite Fields and related issues**	Rosen (Ch. 11)	6

	• Rings • Integral Domains, Division Rings • Fields		
6	**Generating Functions and related issues** • Recurrence relations and • Generating, Functions	Rosen (Ch. 6)	4

Textbook:

1. Rosen: Discrete Mathematics and Its Applications Seventh Edition 7th Edition by Kenneth Rosen, McGraw Hill. *https://www.amazon.in/Discrete-Mathematics-Applications-KennethRosen/dp/0073383090/ref=sr_1_2?dchild=1&keywords=Discrete+Mathematics+and+Its+Applications+Seventh+Edition&qid=1596876353&s=books&sr=1-2*
   The Indian version of the above book is: *https://www.amazon.in/Discrete-Mathematics-Its-ApplicationsSIE/dp/0070681880/ref=sr_1_1?dchild=1&keywords=Discrete+Mathematics+and+Its+Applications+Seventh+Edition&qid=1596876353&s=books&sr=1-1*
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/

Reference book

1. Manohar: Discrete Mathematical Structure with Application to Computer Science", J.P Trembley, & R. Manohar. *https://www.amazon.in/DISCRETE-MATHEMATICAL-STRUCTURESAPPLICATIONS-COMPUTER/dp/0074631136*
2. Schaum's DM: Lipschutz S. Schaum's Outlines of Theory and Problems of Discrete Mathematics., 2016. *https://www.amazon.in/Schaums-Outline-Discrete-Mathematics-S/dp/0070380457*
3. Schaum's Abstract Algebra: Jaisingh LR, Ayres F. Schaum's Outline of Abstract Algebra. McGraw Hill Professional; 2003 *https://www.amazon.in/Schaums-Outline-Abstract-Algebra-Outlines/dp/0071403272*