

Combinatorics - Video course

COURSE OUTLINE

This course covers the topics typically covered in a first level combinatorics course. It introduces the elementary notions in combinatorics and presents the most elementary techniques in combinatorics – pigeon hole principle, inclusion-exclusion principle, recurrence relations and generating functions.

COURSE DETAIL

Module No.	Topics
1.	Pigeon hole Principle
	1. Pigeon hole principle - (Part 1)
	2. Pigeon hole principle - (Part 2)
	3. Pigeon hole principle - (Part 3)
	4. Pigeon hole principle - (Part 4)
2.	Elementary Concepts
	5. Elementary concepts and basic counting principles
	6. Elementary concepts; Binomial theorem; Bijective proofs - Part (1)
	7. Bijective proofs – Part (2)
	8. Bijective proofs - Part (3); Properties of binomial coefficients; Combinatorial identities - Part (1)



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Computer Science and Engineering

Pre-requisites:

Basic familiarity with sets relations, function, partial orders etc. is assumed.

Additional Reading:

The books given under references contain a lot more topics which the student may want to read.

Coordinators:

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	9. Combinatorial identities - Part (2); Permutations of multisets – Part (1)
	10. Permutations of multisets – Part (2)
	11. Multinomial Theorem, Combinations of Multisets – Part (1)
	12. Combinations of Multisets - Part (2)
	13. Combinations of Multisets – Part (3), Bounds for binomial coefficients
	14. Sterling's Formula, Generalization of Binomial coefficients - Part (1)
	15. Generalization of Binomial coefficients - Part (2)
	16. Generalization of Binomial coefficients - Part (3); Double counting - Part (1)
3.	Some Techniques
	17. Double counting - Part (2)
	18. Hall's Theorem for regular bipartite graphs; Inclusion exclusion principle - Part (1)
	19. Inclusion exclusion principle - Part (2)
	20. Inclusion exclusion principle - Part (3)
	21. Inclusion exclusion principle - Part (4)
	22. Inclusion exclusion principle - Part (5)
4.	Recurrence relations and generating functions
	23. Recurrence Relations - Part (1)

	24. Recurrence Relations - Part (2)
	25. Recurrence Relations - Part (3)
	26. Recurrence Relations - Part (4)
	27. Recurrence Relations - Part (5)
	28. Generating functions - Part (1)
	29. Generating functions - Part (2)
	30. Solving recurrence relations using generating functions - Part (1)
	31. Solving recurrence relations using generating functions - Part (2)
	32. Exponential generating functions - Part (1)
	33. Exponential generating functions - Part (2), Partition Number - Part (1)
5.	Special numbers
	34. Partition Number - Part (2)
	35. Partition Number - Part (3)
	36. Partition Number - Part (4); Catalan Numbers - Part (1)
	37. Catalans Numbers - Part (2)
	38. Catalan Numbers - Part (3), Sterling numbers of the 2nd kind
	39. Difference Sequences

References:

- Discrete and Combinatorial mathematics – An applied introduction.
R.P. Grimaldi, B.V. Ramana
Pearson Education (2007)
- Introductory Combinatorics
Richard A Brnaldi
Pearson Education, Inc. (2004)
- Introduction to Enumerative Combinatorics
Miklos Bona
Mc Graw Hill (2007)
- A walk through Combinatorics – An introduction to enumeration and graph theory – Miklos Bona
World Scientific Publishing Co. Pvt. Ltd. (2006)
- A course in Combinatorics
J.H. Vanlint, R.M. Wilson
Cambridge University Press – (1992, 2001)
- External Combinatorics – With applications in computer science
Stasys Jukna
Springer-Verlag (2001)