INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR
DISCIPLINE OF MATHEMATICS

MA 633: THEORY OF PARTITIONS
Course Plan Autumn 2021

Instructor: ATUL DIXIT

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Office: Academic Block 5, Room 340

PRE-REQUISITES

Undergraduate Real Analysis and undergraduate Complex Analysis; knowledge of Elementary Number Theory would be helpful.

COURSE CONTENTS

- **Fundamental theorems in q-series and theta functions:** q-binomial theorem, Jacobi triple product identity, Euler's pentagonal number theorem, Ramanujan's ${}_1\psi_1$ summation formula, quintuple product identity and its special cases.
- **Applications of the elementary series-product identities to partitions:** Combinatorial techniques in partition theory – through generating functions, and through bijective proofs, Gaussian polynomials and their properties.
- **Congruences for $p(n)$ and the associated partition statistics:** Congruences for the partition function $p(n)$ modulo 5, 7, and 11, ranks, cranks – their properties and their generalizations.
- **Restricted partition functions:** Connections with q-series, modular forms and mock modular forms.
- **Rogers-Ramanujan identities:** Analytic and combinatorial versions, applications in various areas.
- **The Hardy-Ramanujan-Rademacher formula for $p(n)$:** Proof and applications.
- **Miscellaneous topics in partitions:** Macmahon's partition analysis, plane partitions, recent advances in partition theory.

Note: Selection of topics from the above will be done at the discretion of the instructor.

BOOKS

I will use my own notes during the lectures. In addition to that, the following books will be used as texts/references.

Texts/References

1. Bruce C. Berndt, *Number Theory in the Spirit of Ramanujan*, American Mathematical Society, Providence, RI, 2006.

2. George E. Andrews, *The Theory of Partitions*, Addison-Wesley Pub. Co., NY, 300 pp. (1976), reissued by Cambridge University Press, New York, 1998.

LECTURES AND TUTORIALS

Lectures: Tuesday, Thursday and Friday: 5:05 pm - 6 pm.

Tutorial: Wednesday 5:05 pm - 6 pm

Office hours: To be decided

LINKS FOR LECTURES AND TUTORIALS:

`https://iitgn-ac-in.zoom.us/j/92515234053`

POLICY FOR EVALUATION

5 Quizzes: 6% each (Surprise quizzes may be given)
Mid-semester exam: 30%
End semester exam: 40%

GRADING RUBRIC

Relative grading policy will be followed.