



Krishnaswami Alladi
304 Little Hall
(352) 294-2290
email: alladik@ufl.edu

M and W 7th period (1:55 – 2:45 pm) in LIT 304 and by appointment.

The theory of partitions and q-hypergeometric series

The theory of partitions was founded by Euler. Although partitions are combinatorial objects, Euler used formal power series to establish his identities. These series considered by Euler are special cases of q-hypergeometric series, whose systematic study was taken up much later. In the latter part of the 19th century, Sylvester and his school, extended many results of Euler by purely combinatorial methods. Then in the early part of the 20th century, the Indian mathematical genius Srinivasa Ramanujan, with his magic touch, gloriously transformed the subject. He discovered spectacular results involving continued fractions, hypergeometric series, theta functions, partition congruences, and modular forms that revealed surprising connections between apparently disparate fields. Today the theory of partitions and q-hypergeometric series (q-series for short) is at the cross-roads of number theory, combinatorics, analysis, and the theory of modular forms. We shall begin with the foundations laid by Euler, and then establish several combinatorial results of the Sylvester school. Then we will take up a discussion of q-series before delving into the fascinating realm of Ramanujan. We shall study recent partition results and conclude the course with the remarkable Hardy-Ramanujan asymptotic series for the partition function by using the circle method, a powerful analytic technique that they initiated.

The course will be self contained and should appeal to any graduate student or advanced undergraduate.

I shall use my own notes, and give a number of references for additional reading.

Grades will be based on homework that will be assigned periodically.

The plan is for [Professor Garvan](#) to offer MAS 7216 in Spring 2019, in which he will discuss the approach via modular forms, and conduct a study of mock theta functions as well.

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