Abstract

In this thesis, we study generating functions and related congruences for various types of generalized Frobenius partitions, also referred to as F-partitions. Specifically, we discuss F-partitions with h repetitions, F-partitions with k colors and h repetitions, $(k, a)-$colored F-partitions, and a restricted class of F-partitions enumerated by $a_{k,i}(n)$. We also explore derivation of modular equations from theta function identities that arise in the context of F-partitions. Another contribution of this work is the proof of 2^n-dissection formula for the Euler product $E(q)$, originally conjectured by M.D. Hirschhorn. Using integer matrix exact covering systems and properties of Ramanujan's general theta functions, we derive representations for the generating functions of F-partitions with 4, 5, 7, 8, 11, and 15 repetitions. Some of these representations yield arithmetic properties for the associated F-partition functions. In our work, we obtain two mixed modular equations for the quadruple of degrees 1, 3, 5, and 15 by equating two different representations for the generating function of F-partitions with 5 repetitions. We also derive representations for generating functions for specific instances of F-partitions with k colors and h repetitions thereby obtaining several congruences. Our study further includes generating function expressions and congruence relations for various cases of $(k, a)-$colored F-partition functions resulting in few Ramanujan-type congruences for particular values of k and a. We also derive generating function representations and congruences for few instances for the restricted class of F-partitions enumerated by $a_{k,i}(n)$. Finally, we provide an elementary proof of the conjecture on 2^n- dissection of the Euler product using product identities for Ramanujan's general theta functions.