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CUBIC LEVEL ANALOGUE OF RAMANUJAN'S EISENSTEIN SERIES IDENTITIES

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Abstract: Let $Q_n = 1 + 240\sum_{k=1}^{\infty}\frac{k^3q^{nk}}{1-q^{nk}}$. On page 51-53 of his lost notebook, Ramanujan recorded very interesting identities which relates Q_1, Q_5, Q_7 with his theta functions. In this article, we establish analogous identities with respect to Q_1 and Q_3.

Keywords and Phrases: Ramanujan's theta functions, Eisenstein series, P-Q theta function identities.

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1. Introduction

For any complex number a and $q = e^{-\pi\sqrt{n}}$, where n is a positive integer. we define

$$(a;q)_\infty := \prod_{n=0}^{\infty}(1-aq^n).$$

S. Ramanujan defined his theta function $f(a,b)$ by

$$\begin{aligned} f(a,b) &= \sum_{n=-\infty}^{\infty} a^{n(n+1)/2}b^{n(n-1)/2} \\ &= (-a;ab)_\infty(-b;ab)_\infty(ab,ab)_\infty, \quad |ab|<1. \end{aligned}$$