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FRACTIONAL DIFFERENTIAL EQUATIONS OF HYPERGEOMETRIC FUNCTIONS AND LAGUERRE POLYNOMIAL

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Abstract: The object of this paper is to find a solution to fractional differential equations of hypergeometric function and Laguerre Polynomials by using Caputo derivatives.

Keywords and Phrases: Caputo derivative, Mittag-Leffler function, Hypergeometric Function, Laguerre Polynomial.

2020 Mathematics Subject Classification: 33E12, 35R11, 26A33, 33CXX.

1. Introduction and Definitions

Caputo Derivative.
The fractional derivative [10] of $f(x)$ in the Caputo sense is defined as

$$D^{\alpha}f(x) = I^{m-\alpha}D^{m}f(x)$$

$$= \frac{1}{\Gamma(m-\alpha)}\int_{0}^{x}(x-t)^{m-\alpha-1}f^{(m)}(t)dt. \tag{1.1}$$

for $m-1 < \alpha \leq m, m \in N, x > 0$.
For the Caputo derivative, we have $D^{\alpha}C = 0$, is constant.

$$D^{\alpha}t^{n} = \begin{cases} 0 & n \leq \alpha - 1 \\ \frac{\Gamma(n+1)}{\Gamma(n-\alpha+1)}t^{n-\alpha} & n > \alpha - 1 \end{cases} \tag{1.2}$$