Work Plan and Methodology

We have established a relation between the double Laplace transform and the double Mellin transform. A double Laplace-Mellin transform of the product of \( H \)-functions of one and two variables is then obtained. Application, summation formula and some interesting special cases have also been discussed.

We evaluate an integral involving an exponential function, Sine function, generalized hypergeometric series and \( I \)-function, and have employed it to evaluate a double integral and establish Fourier series for the product of generalized hypergeometric functions. We will also derive a double Fourier exponential series for the \( I \)-function. Our results will be unified in nature and act as a key formula from which we can derive many particular cases.

We derived three compositions of the fractional integral operators associated with a product of \( I \)-function and a general class of polynomials due to Srivastava. The particular cases will obtained to general character and apply for the general composition of the various fractional integration operators associated with special functions of mathematical Physics and Chemistry appeared in various recent publications.

We established one single integral and two multiple integrals involving product of extended Jacobi polynomials, general class of polynomials and \( I \)-function. These integrals are unified in nature and act as a key formula from which we can derive as its particular cases, integrals involving a large number of simpler special functions and polynomials.

We established four interesting theorems exhibiting interconnections between images and originals of related functions in the Laplace transform. We will also derive six corollaries of the theorems. Further, we will obtain some new and general integrals by the application of the theorems. The importance of our findings lies in the fact that they involve the \( I \)-function which are very general in nature and are capable of yielding a large number of simpler and useful integrals merely by specializing the parameters in them. These results may find applications in solving certain problems of applied mathematics.

We established some transformations of double infinite series involving the \( I \)-function. These formulas are then used to obtain double summation formulas for the said function. Our study will be quite general in character and a number of summation formulas can be deduced as particular cases.

There we present an analytic proof of the integrals for astrophysical thermonuclear functions which are derived on the basis of Boltzmann-Gibbs statistical mechanics. Among the four different cases of astrophysical thermonuclear functions, those with a depleted high-energy tail and a cut-off at high energies find a natural interpretation in q-statistics.