Research article Available online www.ijsrr.org ISSN: 2279–0543

International Journal of Scientific Research and Reviews

Weyl Fractional Derivative of Multivariable Polynomials and I- Function

Neelam Pandey[1], Harish Kumar Mishra[*2] and Kshamapati Tripathi[3]

[1]Department of Mathematics, Govt. Model Science College , Rewa (M.P.), India
[2]S.V. M. Science and Technology, Lalganj, Pratapgarh, India
[3]Department of Mathematical Sciences, A.P.S. University,Rewa (M.P.), India
[2]Email: mishraharish9@gmail.com

ABSTRACT

In this research work, we establish a theorem on Weyl fractional derivative of the product of multivariable polynomials and I– function in the literature of special functions. The results are obtain in the compact form containing the multivariable polynomials. Some special cases of our theorem have been discussed.

KEYWORDS- Weyl fractional derivative operator, multivariable polynomials and I-function.

***Corresponding author**

Harish Kumar Mishra

S.V. M. Science and Technology,

Lalganj, Pratapgarh, India

Email: mishraharish9@gmail.com

INTRODUCTION

Recently, for modeling of relevant systems in various fields of sciences and engineering, such as fluid flow, diffusion, relaxation, oscillation, anomalous diffusion, polymer physics, chemical physics, propagation of seismic waves, etc. see, Glöckle and Nonnenmacher[1] , Mainardi[2, 3], Miller and Ross[4], Kilbas et al.[5] and others.

The I-function of the one variable is defined by Saxena[6] and we will represent here in the following manner:

$$\mathrm{I}[z] = \mathrm{I}^{m,n}_{p_i,q_i;r}[z] = \mathrm{I}^{m,n}_{p_i,q_i;r}\left[z\left|\begin{matrix}\ldots,\ldots\\ \ldots,\ldots\end{matrix}\right.\right] = \mathrm{I}^{m,n}_{p_i,q_i;r}\left[z\left|\begin{matrix}(a_j,e_j)_{1,n}; & (a_{ji,}e_{ji})_{n+1,pi}\\ (b_j,f_j)_{1,m}; & (b_{ji,}f_{ji})_{m+1,qi}\end{matrix}\right.\right] \tag{1.1}$$

$$= \frac{1}{2\pi i}\int_L \theta(s)\, z^s ds\,, \tag{1.2}$$

where $i=\sqrt{(-1)}, z(\neq 0)$ is a complex variable and (1.2) $z^s = \exp\left[s\left\{\log|z| + i \arg z\right\}\right]$.In which log |z| represent the natural logarithm of |z| and arg |z| is not necessarily the principle value. An empty product is interpreted as unity. Also,

$$\theta(s) = \frac{\prod_{j=1}^{m}\Gamma(b_j - f_j s)\prod_{j=1}^{n}\Gamma(1-a_j+e_j s)}{\sum_{i=1}^{r}\left[\prod_{j=m+1}^{q_i}\Gamma(1-b_{ji}+f_{ji}s)\prod_{j=n+1}^{p_i}\Gamma(a_{ji}-e_{ji}s)\right]} \tag{1.3}$$

m, n, p_i and $q_i \forall i\in(1,\ldots r)$ are non-negative integers satisfying $0\le n\le p_i$, $0\le m\le q_i;\forall i\in\{1,\ldots,r\}, e_{ji},(j=1,\ldots,p_i;i=1,\ldots r)$ and $f_{ji},(j=1,\ldots,q_i;i=1,\ldots r)$ are assumed to be positive quantities for standardization purpose. Also $a_{ji},(j=1,\ldots,p_i;\ i=1,\ldots r)$ and $b_{ji},(j=1,\ldots,q_i;\ i=1,\ldots,r)$ are complex numbers such that none of the points.

$$S=\{(b_n+v)|\,f_h\}, h=1,\ldots,m; v=0,1,2,\ldots, \tag{1.4}$$

Which are the poles of $\Gamma(b_h - f_h s), h=1,\ldots,m$ and the points

$$S=\{(a_l-n-1)|e_l\} l=1,\ldots,n;\eta=0,1,2,\ldots, \tag{1.5}$$

Which poles are of $\Gamma(1-a_l+e_l s)$ coincide with one another, i.e. with

$$e_l(b_n+v)\neq b_n(a_l-\eta-1), \tag{1.6}$$

for $v, \eta = 0,1,2,\ldots;\ h = 1,\ldots,m; l = 1,\ldots,n$.

Further, the contour L runs from $-i_\infty$ to $+i_\infty$. Such that the poles of $\Gamma(b_n - s)$, $h = 1,\ldots,m$; lie to the right of L and the poles $\Gamma(1-a_l + e_l s)$, $l = 1,\ldots,n$ lie to the left of L. The integral converges, if $|\arg z| < \frac{1}{2} B\pi, B > 0, A \le 0$, where

$$A = \sum_{j=1}^{p_i} e_{ji} - \sum_{j=1}^{q_i} f_{ji} \text{ and} \tag{1.7}$$

$$B = \sum_{j=1}^{n} e_j - \sum_{j=n+1}^{p_i} e_{ji} + \sum_{j=1}^{m} f_j - \sum_{j=m+1}^{q_i} f_{ji} \text{ , } \forall i \in (1,\ldots,r) \tag{1.8}$$

Let A denote a class of good functions. By good function f, we mean Miller[7] a function which is everywhere differentiable any number of times and if it is all of its derivatives are $0(x^{-\upsilon})$, for all υ as x in increases without limit. We define the Weyl fractional derivatives of a function g(z) as follows:-

Let $g \in A$, then for $q < 0$,

$$_zW_\infty^q g(z) = \frac{(-1)^q}{\Gamma(-q)} \int_z^\infty (u-z)^{-q-1} g(u) du. \tag{1.9}$$

For $q \ge 0$

$$_zW_\infty^q g(z) = \frac{d^n}{dz^n} ({}_zW_\infty^{q-n} g(z)), \tag{1.10}$$

Where n being positive integer, such that $n > q$.

The general class of multivariable polynomials is defined by Srivastava and Garg[8].

$$S_{\mathrm{L}}^{h_1,\ldots,h_r}[x_1,\ldots,x_r] = \sum_{k_1,\ldots,k_r=0}^{h_1k_1+\ldots+h_rk_r \le \mathrm{L}} (-\mathrm{L})_{h_1k_1+\ldots+h_rk_r} A(\mathrm{L}; k_1,\ldots,k_r) \frac{x_1^{k_1}}{k_1!} \cdots \frac{x_r^{k_r}}{k_r!}, \tag{1.11}$$

Where $h_1,\ldots,h_r$ are positive integers and the co-efficient $A(\mathrm{L}; k_1,\ldots,k_r)$, ($\mathrm{L}$; $h_1 \in$ N; i = $1,\ldots,r$) are arbitrary constant, real or complex.

Evidently the case $r = 1$ of the polynomials(1.11).

Would correspond the polynomials given by Srivastava [9].

$$S_{\mathrm{L}}^{h}[x]=\sum_{k=0}^{[L,h]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k}\,x^{k}\,\{\mathrm{L}\in N=(0,1,2,\ldots)\}, \tag{1.12}$$

where h is arbitrary positive integers and the co-efficient $A_{\mathrm{L},k}(\mathrm{L},k\geq 0)$ are arbitrary constant, real or complex.

2. MATHEMATICAL PRE-REQUISITES - To establish the main result, we need the following integral of the H-function by SaigÖ[10].

$$\int_{x}^{\infty}t^{\rho-1}(t-x)^{\sigma-1}\mathrm{I}_{p_i,q_i;r}^{m,n}\left[zt^{\mu}(t-x)^{\upsilon}\left|\begin{matrix}(a_j,e_j)_{1,n};\,(a_{ji},e_{ji})_{n+1,p_i}\\(b_j,f_j)_{1,m};\,(b_{ji},f_{ji})_{m+1,q_i}\end{matrix}\right.\right]dt$$

$$=x^{\rho+\sigma-1}\mathrm{I}_{p_i+2,q_i+1;r}^{m+1,n+1}\left[zx^{\mu+\upsilon}\left|\begin{matrix}(1-\sigma,\upsilon),(a_j,e_j)_{1,n};\,(a_{ji},e_{ji})_{n+1,p_i},(1-\rho,\mu)\\(1-\rho-\sigma,\mu+\upsilon),\,(b_j,f_j)_{1,m};\,(b_{ji},f_{ji})_{m+1,q_i}\end{matrix}\right.\right], \tag{2.1}$$

Where

(i) ρ,σ are complex numbers and μ,υ are positive real numbers,

(ii) $|\arg z|<\frac{1}{2}A\pi$, A defined as $A=\sum_{j=1}^{p_i}e_{ji}-\sum_{j=1}^{q_i}f_{ji}$,

(iii) $\min\left[\mathrm{Re}\left(\frac{1-\rho-\sigma}{\mu-\nu}\right),\min 1\leq j\leq m\left[\mathrm{Re}\left(\frac{b_j}{f_j}\right)\right]\right]>\max\left[-\mathrm{Re}\left(\frac{\sigma}{\nu}\right),\max 1\leq j\leq N\left[\mathrm{Re}\left(\frac{a_j-1}{e_j}\right)\right]\right].$

3. WEYL FRACTIONAL DERIVATIVE OF MULTIVARIABLE POLYNOMIALS AND I- FUNCTION-

THEOREM. Let m,n,p_i and q_i be non-negative integers such that $0\leq n\leq p_i, 0\leq m\leq q_i$ and $\sum_{j=1}^{n}e_j-\sum_{j=n+1}^{p_i}e_{ji}+\sum_{j=1}^{m}f_j-\sum_{j=m+1}^{q_i}f_{ji}>0$ together with the set of conditions (i) – (iii) given with equation (2.1). Then, for all value of q,

$${}_{z}W_{\infty}^{q}\left\{x^{\rho-1}(z-x)^{\sigma-1}S_{L}^{h_1,\ldots,h_r}\left[c_1x^{\delta_1},\ldots,c_rx^{\delta_r}\right]\right.$$

$$\times \mathrm{I}_{p_i,q_i;r}^{m,n}\left[yx^{\mu}(x-z)^{\upsilon}\left| \begin{matrix} (a_j,e_j)_{1,n};(a_{ji},e_{ji})_{n+1,p_i} \\ (b_j,f_j)_{1,m};(b_{ji},f_{ji})_{m+1,q_i} \end{matrix} \right. \right]\Bigg\}$$

$$=\frac{(-1)^{q+\sigma-1}}{\Gamma(-q)} z^{\rho+\sigma-q-\sum_{i=1}^{r} k_i\delta_i-2} \sum_{k_1,\ldots,k_r=0}^{h_1k_1+\ldots+h_rk_r\le L} (-L)_{h_1k_1+\ldots+h_rk_r} A(L;k_1,\ldots,k_r)\frac{c_1^{\,k_1}}{k_1!}\cdots\frac{c_r^{\,k_r}}{k_r!}$$

$$\times \mathrm{I}_{p_{i+2},q_{i+1};r}^{m+1,n+1}\left[yz^{\mu+\upsilon}\left| \begin{matrix} (2-\sigma+q,\upsilon),(a_j,e_j)_{1,n};(a_{ji},e_{ji})_{n+1,p_i},(1-\rho-\sum_{i=1}^{r}k_i\delta_i,\mu) \\ (2+q-\rho-\sigma-\sum_{i=1}^{r}k_i\delta_i,\mu+\upsilon),(b_j,f_j)_{1,m};(b_{ji},f_{ji})_{m+1,q_i} \end{matrix} \right. \right]. \qquad (3.1)$$

PROOF - Taking left hand side of equation (3.1) and using equation (1.11), we get

$${}_zW_{\infty}^{q}\Bigg\{ x^{\rho+\sum_{i=1}^{r}k_i\delta_i-1}(z-x)^{\sigma-1} \sum_{k_1,\ldots,k_r=0}^{h_1k_1+\ldots+h_rk_r\le L} (-L)_{h_1k_1+\ldots+h_rk_r} A(L;k_1,\ldots,k_r)\frac{c_1^{\,k_1}}{k_1!}\cdots\frac{c_r^{\,k_r}}{k_r!}$$

$$\times \mathrm{I}_{p_i,q_i;r}^{m,n}\left[yx^{\mu}(x-z)^{\upsilon}\left| \begin{matrix} (a_j,e_j)_{1,n};(a_{ji},e_{ji})_{n+1,p_i} \\ (b_j,f_j)_{1,m};(b_{ji},f_{ji})_{m+1,q_i} \end{matrix} \right. \right]\Bigg\}, \qquad (3.2)$$

Now using equation (1.9) and definition of I– function, easily we can find the proof of equation (3.1).

For $q \geq 0$ invoking the definition (1.10) the relation (3.2) further reduces to

$$=\sum_{k_1,\ldots,k_r=0}^{h_1k_1+\ldots+h_rk_r\le L} (-L)_{h_1k_1+\ldots+h_rk_r} A(L;k_1,\ldots,k_r)\frac{c_1^{k_1}}{k_1!}\cdots\frac{c_1^{k_{r1}}}{k_r!}\;\frac{(-1)^{q+r+\sigma-1}}{\Gamma(r-q)}\frac{d^r}{dz^r}\{z^{\rho-\sigma-q+r-\sum_{i=1}^{r}k_i\delta_i-2}.$$

$$\mathrm{I}_{p_{i+2},q_{i+1};r}^{m+1,n+1}\left[yz^{\mu+\upsilon}\left| \begin{matrix} (2-\sigma-r+q,\upsilon),(a_j,e_j)_{1,n};(a_{ji},e_{ji})_{n+1,p_i},(1-\rho-\sum_{i=1}^{r}k_i\delta_i,\mu) \\ (2+q-\rho-\sigma-\sum_{i=1}^{r}k_i\delta_i,\mu+\upsilon),(b_j,f_j)_{1,m};(b_{ji},f_{ji})_{m+1,q_i} \end{matrix} \right. \right]\}$$

In replacing of (q - r) by q, we may obtain again

$$=\frac{(-1)^{q+\sigma-1}}{\Gamma(-q)} z^{\rho+\sigma-q-\sum_{i=1}^{r} k_i\delta_i-2} \sum_{k_1,\ldots,k_r=0}^{h_1k_1+\ldots+h_rk_r\le L} (-L)_{h_1k_1+\ldots+h_rk_r} A(L;k_1,\ldots,k_r)\frac{c_1^{\,k_1}}{k_1!}\cdots\frac{c_r^{\,k_r}}{k_r!}$$

$$\times \mathrm{I}_{p_{i+2},q_{i+1};r}^{m+1,n+1}\left[yz^{\mu+\upsilon}\left| \begin{matrix} (2-\sigma+q,\upsilon),(a_j,e_j)_{1,n};(a_{ji},e_{ji})_{n+1,p_i},(1-\rho-\sum_{i=1}^{r}k_i\delta_i,\mu) \\ (2+q-\rho-\sigma-\sum_{i=1}^{r}k_i\delta_i,\mu+\upsilon),(b_j,f_j)_{1,m};(b_{ji},f_{ji})_{m+1,q_i} \end{matrix} \right. \right] \qquad (3.3)$$

4. SPECIAL CASE - If we put r=1 in the general call of multivariable polynomials given by Srivastava and Garg[8] reduces to the polynomials given by Srivastava(1972) and I- function reduces into Fax's H – function as follows :

$$ {}_zW_\infty^q\left\{ {}_zW_\infty^q\left\{ x^{\rho-1}(z-x)^{\sigma-1}S_{\mathrm{L}}^h\left[x^k\right]\times H_{p,q}^{m,n}\left[yx^\mu(x-z)^\upsilon \middle| \begin{matrix}(a_1,e_1)_{1,p}\\(b_1,f_1)_{1,q}\end{matrix}\right]\right\}\right. $$

$$ =\frac{(-1)^{q+\sigma-1}}{\Gamma(-q)}z^{\rho+\sigma-q-k-2}\sum_{k=0}^{[L,k]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k}\times H_{p+2,.q+1}^{m+1,n+1}\left[yz^{\mu+\upsilon}\middle| \begin{matrix}(2-\sigma+q,\upsilon),(a_j,e_j)_{1,p},(1-\rho-k,\mu)\\(2+q-\rho-\sigma-k,\mu+\upsilon),(b_j,f_j)_{1,q}\end{matrix}\right]. \tag{4.1} $$

Replacing υ by –υ equation (4.1) correspond to the following result according as μ > υ, μ < υ and μ = υ, i.e. for μ > υ

$$ {}_zW_\infty^q\left\{ {}_zW_\infty^q\left\{ x^{\rho-1}(z-x)^{\sigma-1}S_{\mathrm{L}}^h\left[x^k\right]\times H_{p,q}^{m,n}\left[yx^\mu(x-z)^{-\upsilon} \middle| \begin{matrix}(a_1,e_1)_{1,p}\\(b_1,f_1)_{1,q}\end{matrix}\right]\right\}\right. $$

$$ =\frac{(-1)^{q+\sigma-1}}{\Gamma(-q)}z^{\rho+\sigma-q-k-2}\sum_{k=0}^{[L,h]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k}\times H_{p+1,.q+2}^{m+2,n}\left[yz^{\mu-\upsilon}\middle| \begin{matrix}(a_j,e_j)_{1,p},(1-\rho-k,\mu)\\(2+q-\rho-\sigma-k,\mu-\upsilon),(\sigma-q-1,\upsilon),(b_j,f_j)_{1,q}\end{matrix}\right] \tag{4.2} $$

For $\mu<\upsilon$

$$ {}_zW_\infty^q\left\{ {}_zW_\infty^q\left\{ x^{\rho-1}(z-x)^{\sigma-1}S_{\mathrm{L}}^h\left[x^k\right]\times H_{p,q}^{m,n}\left[yx^\mu(x-z)^{-\upsilon} \middle| \begin{matrix}(a_1,e_1)_{1,p}\\(b_1,f_1)_{1,q}\end{matrix}\right]\right\}\right. $$

$$ =\frac{(-1)^{q+\sigma-1}}{\Gamma(-q)}z^{\rho+\sigma-q-k-2}\sum_{k=0}^{[L,h]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k}\times H_{p+2,.q+1}^{m+1,n+1}\left[yz^{\mu-\upsilon}\middle| \begin{matrix}(\rho+\sigma-q+k-1,\upsilon-\mu),(a_j,e_j)_{1,p},(1-\rho-k,\mu)\\(\sigma-q-1,\upsilon),(b_j,f_j)_{1,q}\end{matrix}\right] \tag{4.3} $$

and $\mu=\upsilon$

$$ {}_zW_\infty^q\left\{ {}_zW_\infty^q\left\{ x^{\rho-1}(z-x)^{\sigma-1}S_{\mathrm{L}}^h\left[x^k\right]\times H_{p,q}^{m,n}\left[yx^\mu(x-z)^{-\upsilon} \middle| \begin{matrix}(a_1,e_1)_{1,p}\\(b_1,f_1)_{1,q}\end{matrix}\right]\right\}\right. $$

$$ =\frac{(-1)^{q+\sigma-1}\Gamma(2-q-\rho-k)}{\Gamma(-q)}z^{\rho+\sigma-q-k-2}\sum_{k=0}^{[L,h]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k}\times H_{p+1,.q+1}^{m+1,n}\left[y\middle| \begin{matrix}(a_j,e_j)_{1,p},(1-\rho-k,\mu)\\(\sigma-q-1,\upsilon),(b_j,f_j)_{1,q}\end{matrix}\right] \tag{4.4} $$

Finally writing $-\mu$ instead of μ, equation (4.1) yields the following results according as $\mu>\upsilon$, $\mu<\upsilon$ and $\mu=\upsilon$ respectively.

For $\mu>\upsilon$

$$ {}_zW_\infty^q\left\{x^{\rho-1}(z-x)^{\sigma-1}S_{\mathrm{L}}^h\left[x^k\right] \times H_{p,q}^{m,n}\left[yx^{-\mu}(x-z)^{\upsilon}\left|\begin{matrix}(a_1,e_1)_{1,p}\\(b_1,f_1)_{1,q}\end{matrix}\right.\right]\right\} $$

$$ =\frac{(-1)^{q+\sigma-1}}{\Gamma(-q)}z^{\rho+\sigma-q-k-2}\sum_{k=0}^{[L,h]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k}\times H_{p+2,,q+1}^{m,n+2}\left[yz^{-\mu+\upsilon}\left|\begin{matrix}(q-\rho-\sigma-k+1,\mu-\upsilon),(2+q-\sigma,\upsilon),(a_j,e_j)_{1,p}\\(b_j,f_j)_{1,q},(\rho+k,\mu)\end{matrix}\right.\right] \tag{4.5} $$

for $\mu<\upsilon$

$$ {}_zW_\infty^q\left\{{}_zW_\infty^q\left\{x^{\rho-1}(z-x)^{\sigma-1}S_{\mathrm{L}}^h\left[x^k\right]\times H_{p,q}^{m,n}\left[yx^{-\mu}(x-z)^{\upsilon}\left|\begin{matrix}(a_1,e_1)_{1,p}\\(b_1,f_1)_{1,q}\end{matrix}\right.\right]\right\}\right. $$

$$ =\frac{(-1)^{q+\sigma-1}}{\Gamma(-q)}z^{\rho+\sigma-q-k-2}\sum_{k=0}^{[L,h]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k}\times H_{p++,.q+1}^{m+1,n+1}\left[yz^{-\mu+\upsilon}\left|\begin{matrix}(2-\sigma+q,\upsilon),(a_j,e_j)_{1,p}\\(2+q-\rho-\sigma-k,\upsilon-\mu),(b_j,f_j)_{1,q},(\rho+k,\mu)\end{matrix}\right.\right] \tag{4.6} $$

and for $\mu=\upsilon$

$$ {}_zW_\infty^q\left\{{}_zW_\infty^q\left\{x^{\rho-1}(z-x)^{\sigma-1}S_{\mathrm{L}}^h\left[x^k\right]\times H_{p,q}^{m,n}\left[yx^{-\mu}(x-z)^{\upsilon}\left|\begin{matrix}(a_1,e_1)_{1,p}\\(b_1,f_1)_{1,q}\end{matrix}\right.\right]\right\}\right. $$

$$ =\frac{\Gamma(2-\rho-k-\sigma+q)\quad(-1)^{q+\sigma-1}}{\Gamma(-q)}z^{\rho+\sigma-q-k-2}\sum_{k=0}^{[L,h]}\frac{(-\mathrm{L})_{hk}}{k!}A_{\mathrm{L},k} $$

$$ \times H_{p+2,.q+1}^{m+1,n+1}\left[yz^{\mu+\upsilon}\left|\begin{matrix}(2-\sigma+q,\upsilon),(a_j,e_j)_{1,p},(1-\rho-k,\mu)\\(2+q-\rho-\sigma-k,\mu+\upsilon),(b_j,f_j)_{1,q}\end{matrix}\right.\right]. \tag{4.7} $$

DISCUSSION

We have obtained the results namely theorem and special cases which satisfied all the conditions mention in the statement.

REFERENCES

1. Glöckle W. R. and Nonnenmacher T. F.(. Fractional integral operators and Fox functions in the theory of viscoelasticity. Macromolecules American Chemical Society 1991; 24: 6426-6434.
2. Mainardi, F., Fractional diffusive wave in viscoelastic solids, In: Wegner JL, Norwood FR(eds) Nonlinear waves in solids ASME, 1995; 93-97.
3. Mainardi, F., The fundamental solution for the diffusion–wave equation. Appl Math Lett 1996; 9(5): 23-28.

4. Miller, K. S. and Ross, B., An introduction to the fractional calculus and fractional differential equations Wiley, New York 1993.
5. Kilbas A. A., Saxena R. K., Saigo, M. and Trujillo, J., Analytical methods of an analysis and differential equations.AMADE2003, Cambridge Scientific, Cambridge 2006; 117-134.
6. Saxena, V.P., Formal solution of certain new pair of Dual integral equations involving H-function. Proc. Nat. Acad. Sci. India 1982; 52: A III: 366-375.
7. Miller, K.S., The Weyl fractional calculus, fractional calculus and its applications. Lecture Notes in Math., 457, springer-Verlag, New York 1975; 80-89.
8. Srivastava, H. M. and Garg, M., Some integrals involving a general class of polynomials and multivariable H-function. Rev Roumaine Phy.1987; 32: 685 – 692.
9. Srivastava, H. M., A contour integral involving Fox's H-function. India J. Math. 1972; 14: 1 – 6.