Title of Minor Research Project: **STUDY OF SOME INTEGRAL TRANSFORMS, GENERALISED FUNCTIONS AND BOEHMIANS**

(UGC Reference No. : F. No. 47-1818/11 (WRO) dated **11.01.2012)**

Principal Investigator desire to study the effect of combination of two integral transforms using the theory of distribution and generalized function. Basically those transforms are studied which gives large scope for applied mathematics , optics, engineering mathematics ,wavelet analysis etc.

Report of work performed in First Year:

In the first year, various integral transforms have been studied and related to these transforms reference work and research papers are collected. For this purpose, I visited to different national institutes like IIT Powai Mumbai, Shivaji University, Kolhapur, University of Pune, etc. Different research and reference books have been purchased from the allotted budget. Equipments like Laptop, one printer–scanner machine has been purchased and related material to that are also purchased from suppliers through college from the allotted budget and registered in departmental register. The progress has been according to the plan of work.

As per the plan mentioned during the proposal, the classical transforms like Laplace, Fourier, Double Fourier sine transform, Finite Marchi Fasulo transform are studied. When Finite Marchi Fasulo transform is applied to problems of heat equation ,wave equation some restriction arises for the kernel as well as for the inverse of a function. Hence there is need to extend these transforms to certain class of generalized functions and to boehmians space using the theory of Zemanian. I referred some research papers regarding to this .Also some books like A.H. Zemanian ,R.S.Pathak ,Ahmad Zayed are referred . Mean while, some other methods of extending this transform are also studied .

Report of work performed in Second Year

In the second year, the work was continued for the study that how the classical integral transforms have been extended to a class of generalized functions and boehmians. For this I studied the functional analysis and Hann Banach theorem . The theory of Schwartz's distributions and its applications are well known in the literature .Several generalizations are developed to solve differential equations which do not admit even distributional solutions.The

general concept of Boehmians as an extension of the regular operators ,Schwartz's distributios and other spaces of generalized functions are studied. The notion of δ convergence and Δ convergence are studied. The space of Schwartz distributions can be identified with a proper subspace of Boehmians. Firstly I applied the technique of Zemanian which he applied to classical Laplace transform for extending it to generalized function. I defined the space $£_{+,a}$, $£_{+}(w)$. The set $£_{+,a}$ denotes the space of all Complex valued smooth functions $\boldsymbol{\phi}(z, t)$ that are infinitely differentiable w.r.t. z & t on $I = (0 , \infty)\times(-h , h)$ on which the function λ_{a,k_1,k_2} are defined .Then I defined the space as countable union space. The collection of all continuous linear functionals on $£_{+,a}$ is called as dual of $£_{+,a}$ & is denoted by $£'_{+,a}$ & we denote by $£'_{+}(w)$ the dual of $£_{+}(w)$. A sequence $\{\varphi_p\}_{p=1}^{\infty}$ converges in $£_{+,a}$ to φ if and only if for each pair of nonnegative integers k_1 ,k_2 , $\lambda_{a,k_1,k_2}(\varphi_p - \varphi) \to 0$ as $p\to\infty$ and a sequence $\{\varphi_p\}_{p=1}^{\infty}$ is a cauchy sequence in $£_{+,a}$ if and only if $\lambda_{a,k_1,k_2}(\varphi_p-\varphi_q) \to 0$ $\forall$ $k_1 ,k_2 = 0 , 1 ,2, 3,\ldots$ as $p , q \to \infty$. I proved the space $£_{+,a}$ complete and therefore it is a Frechet space. I proved analyticity theorem i.e. the Generalized Laplace Finite Marchi Fasulo transform is an analytic function of s. Finally I proved the inversion theorem as let $f \in £_{+,a}$ and let F(n ,s) be the distributional Laplace Finite Marchi Fasulo transform of f (z ,t) .For $(n,s) \in D_f$, in the sense of convergence in D' (I) ,

$$f(z,t) = \lim_{r,m\to\infty}\left[\frac{1}{2\pi i}\sum_{n=1}^{m}\frac{2p_n(z)}{\lambda_n}\int_{\sigma-ir}^{\sigma+ir}F(n,s)e^{st}ds\right]$$

Where σ is any fixed number such that $\sigma > \sigma_f$.

In these two years, Principal Investigator of the project visited different institutes like, IIT , Mumbai, TIFR Mumbai ,Shivaji University, Kolhapur , Pune university Pune for the discussion with scientists and professors. The integral transforms are discussed with Prof. M.S. Chaudhary Ex Head Shivaji university Kolhapur and some guidelines are taken from Dr S.S. Sharma Postdoctorate fellow from TIFR Mumbai.. The books which are purchased through

this project are submitted to college library with accession number. Also the equipments (Laptop, printer , Scanner ,harddisc) that has been purchased are also submitted to the college. I attended and presented my research paper in a national conference.

Oral/Paper presentation of Research paper in Conferences, Seminars, Workshops, Symposia during the tenure of project :-

Sr. No	Title Conference / Seminar / Workshops / Symposia	Organized by and Date
1	UGC sponsored 'National Conference on Recent Trends in Mathematics & their application in Computer Science	Rajarshi Shahu Mahavidyalaya, Latur, Maharashtra on 17^{th} -18^{th} January 2014