UNIVERSITY GRANTS COMMISSION

1. **Title of the Project**: **"STUDY OF SOME INTEGRAL TRANSFORMS, GENERALISED FUNCTIONS AND BOEHMIANS"**
2. **NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR:**
   Shri. A.M.Mahajan, Assist. Professor, Department of Mathematics, Walchand College of Arts & Science, Solapur-413006 (M.H.)
3. **NAME AND ADDRESS OF THE INSTITUTION:** Walchand College of Arts & Science, Ashok Chowk, Walchand-Hirachand Marg, Solapur-413006 (M.H.)
4. **UGC APPROVAL LETTER NO. AND DATE: F. No. 47-1818/11 (WRO)** dated **11.01.2012**
5. **DATE OF IMPLEMENTATION** :- **10.04.2012 .**
6. **TENURE OF THE PROJECT :** Two years (10.04.2012 To 09.04.2014)
7. **TOTAL GRANT ALLOCATED** : 1 50,000/- (One lakh fifty thousand only)
8. **TOTAL GRANT RECEIVED :** 1,15000/- (One lakh fifteen thousand only)
9. **FINAL EXPENDITURE :** 1 , 46765/- (One lakh forty six thousand seven hundred sixty five only)

10. TITLE OF THE PROJECT: "STUDY OF SOME INTEGRAL TRANSFORMS GENERALISED FUNCTIONS AND BOEHMIANS "

11. OBJECTIVES OF THE PROJECT:

The concept of the integral transformation has been originated from the confluence of two mathematical disciplines i.e. ' the theory of integral transformation and 'the theory of generalized functions. The theory of distributions or generalized functions is essentially a new foundation for mathematical analysis. The famous delta function was beginning of the distribution theory. An important achievement of the theory of generalized functions was the extension of some integral transforms to generalised functions . The purpose of this research is to introduce the use of integral transforms in obtaining the solutions of ordinary and partial differential equations

,boundary value problems and integral equations in distributional sense. Many of the problems which cannot be solved with the ordinary differential equation can be solved with integral transforms. Integral transformation are used in pure as well as in applied mathematics. Zemanian has extended the bilateral Laplace transform .But here I want to extend the integral transform whose kernel is product of two integral transforms .For this the domain of the definition is $(-h,h) \times (0,\infty)$.The present work can be devided into two parts .The first part is to extend this transform and the second part is to apply the inverse problem of transient heat conduction in a finite circular cylinder wirh the given temperature distribution on an interior curved surface of the cylinder being a function of both time and position

12. WHETHER OBJECTIVES WERE ACHIEVED: Yes, Please See Enclosure

13. ACHIEVEMENTS FROM THE PROJECT: One research paper based on this project work is communicated

14. SUMMARY OF THE FINDINGS : -

The progress has been according to original plan of work and towards achieving the objectives. There is a wild scope for the extension of various integral transorms to generalized functions and to boehmians spaces. In this project the I have combined two integral transforms namely Laplace transform and Finite Marchi fasulo transform & extended it to a class of generalized function. For this I constructed an integral transform whose kernel is the product of the kernels of Laplace and Finite Marchi Fasulo transform

i.e. $£M\{f(z,t)\} = F(n,s) = \int_{-h}^{h} \int_{-\infty}^{\infty} f(z,t)\, e^{-st} p_n(z)\, dt\, dz$

I extended this transform to a class of generalized functions by using Zemanian technique. For this I defined some spaces namely testing function space ,countable union space ,frechet space, alongwith this I also defined the dual spaces and some properties of testing function space and their duals. After these properties the actual definition of generalized Laplace Finite Marchi Fasulo transform is defined as

$£M\{f(z,t)\} = F(n,s) = \langle f(z,t), e^{-st} p_n(z) \rangle$

I also proved the boundedness property and analyticity theorem For proving the inversion theorem for generalized function I proved four lemmas which are the basics of

the inversion theorem. Lastly I proved the inversion theorem and uniqueness theorem. After that this transform is applied to solve the a problem of solid circular cylinder whose axis is coincident with the z axis. For this I considered the heat conduction problem with symmetry w.r.t.z axis. I considered the temperature u(r,z,t) at any point of the cylinder where t is time is the solution of the following heat conduction equation

$$\frac{\partial^2 u}{\partial r^2} + \frac{1}{r}\frac{\partial u}{\partial r} + \frac{\partial^2 u}{\partial z^2} = \frac{1}{k}\frac{\partial u}{\partial t}$$

$k = \frac{K}{\rho_0}$ where K is conductibility of medium and ρ_0 is calorific capacity which is const.

This problem has a solution with classical sense i.e. we first apply the finite Marchi Fasulo transform to this equation and after that we apply Laplace transform. After applying the generalized integral transform to this problem we get easier solution than earlier. I extended this work for more integral transforms which can be applied to some differential equations.

15. CONTRIBUTION TO THE SOCIETY:- The study of generalized functions is now widely recognized to be of considerable interest and importance ,both to applied mathematician and to a large class of engineers working in the fields of control, communication system electrical network etc. .This integral transform finds wide application in physics , particularly in heat conduction problems. This problem has an application in engineering. Integral transforms find special applicability within other scientific and mathematical disciplines.

16. WHETHER ANY PH.D. ENROLLED/ PRODUCED OUT OF THE PROJECT: No

17. NO. OF PUBLICATIONS OUT OF THE PROJECT: - **One research paper based on this project work is communicated**

Shri. A.M. Mahajan
Principal Investigator

Dr. A. H. Manikshete
Principal