DEPARTMENT OF MATHEMATICS

APB GOVENMENT PG COLLEGE AGASTYAMUNI (RUDRAPRAYAG)

RESEARCH PROJECT PROPOSAL

UNDER THE

ASIAN DEVELOPMENT BANK (ADB)

SUBMITTED

TO

PRINCIPAL

(PROF. PUSHPA NEGI)

APB GOVENMENT PG COLLEGE AGASTYAMUNI

RUDRAPRAYAG, UTTARAKHAND-246421

SUBMITTED

BY

DEPARTMENT OF MATHEMATICS

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About the Department: The Department of Mathematics of APB Government PG College Agastaymuni (Rudraprayag) came into existence in 1979 with the commencement of Under-Graduate classes. Post Graduate programs started in 2005. At present, there are 120 seats in B.Sc. (PCM) & 20 seats in M.Sc. programs. The department focuses on Quality-Teaching & Research oriented activities and has three well-qualified and experienced faculties who specialize in different areas of Mathematics: Algebra, Nonlinear Functional Analysis, and Applied Mathematics. Dr. Shiv Prasad is the Head of the Department. The other two faculties are Dr. Sudheer Petwal (Assistant Professor) & Dr. Virendra Prasad (Assistant Professor). Department of Mathematics is post graduation based with intake capacity 120 seats (02 batches) at UG level and 20 seats at PG level. At UG Physics, Chemistry and Mathematics & in PG semester system is running at college level while in graduation Ist semester NEP 20 is running. BSc II year and BSc III year classes are running as er yearly basis. I NEP graduation level one separate paper is designed for practical basis, which required laboratory to provide best knowledge to the students.

Focus of the Department:

1. The Department is focused on effective teaching and quality research.
2. The Department takes pride in producing 15 research publications in journals of international repute indexed in Scopus and Web of Science.
3. The Department is exploring the ways of applying Mathematics in Life Science, Social Science, Earth Science, and so on.

Research Interests:

1. Pure Mathematics (Non-linear Analysis).
2. Computational Mathematics.

Project Proposal for Non linear Analysis:

Background of the Project: The beginning of the fixed-point theory lies in the methodology of progressive estimation used to show the presence of solutions of differential equations originally introduced hundred years ago. However, mathematicians like Luitzen Egbertus Jan Brouwer, Stephan Banach, and Juliusz Schauder made classical fixed-point theory a crucial component of mathematical analysis at the beginning of the 20th century. In 1922, Stephan Banach described the conditions that guarantee the presence and uniqueness of a fixed point. For mappings that satisfy distinct contractive conditions in various settings, various outcomes relating to fixed points, fixed circles, fixed discs, fixed ellipses, and fixed elliptic discs for single-valued and multi-valued mappings have been investigated, and this practice is ongoing. There are several ways that the well-known Banach contraction principle can be used to solve nonlinear equations. However, one drawback is that contraction mapping necessitates continuity of involved mapping throughout the metric space. Since the majority of real-world phenomena are discontinuous, it is

interesting to note that discontinuous mapping is of great interest here. The existence of a unique fixed point for a suitable mapping is analogous to the existence of a solution in a variety of scientific issues, beginning with various mathematical subfields. We can guarantee the existence of a solution to the original problem because fixed-point theorems provide sufficient conditions for the existence of a distinct fixed point for a given function. When mapping under minimally suitable conditions has a distinct fixed point, this is one of the significant outcomes of fixed-point theory. However, there may be instances in which mapping does not have a unique fixed point. Finding the conditions under which mappings have non-unique fixed points and collections of non-unique fixed points including some geometric shapes is essential because non-unique fixed points play a crucial role. In particular, non-unique fixed points of a discontinuous self-mapping play an important role because, if the fixed point is not unique, the set of non-unique fixed points can form a circle, disc, or ellipse, which has a lot of potential for use in many different areas.

In real life, a fixed point indicates a situation where a steady state condition or equilibrium is reached. After locating these fixed points in a system, the stability of each fixed point can be determined. In engineering and sciences, fixed point theorems are applied to find the solutions to integral equations, initial value problems, and operator equations. In economic models, fixed point theorems are useful to the steady state solution of a Markov chain, the steady state of markets under the demand and supply chains, and the strategic planning of games. By converting these problems into a fixed point problem associated with a suitable mapping, such problems are solved with the help of fixed point theorems. Furthermore, we may utilize fixed point techniques to model and solve an initial value problem appearing in Production–Consumption Equilibrium. It is well-known that the consumption and production of material goods are related to each other, and not one or the other exists without the other. Consumption is the method of utilizing goods or services by deriving utility from them and subsequently fulfilling our needs through production which is an action embraced, where raw materials are converted into a finished good with the utilization of components of production such as land, labor, and so on.

Objectives:

This project aims to study unique and non-unique fixed points and their application to solve real-world problems for the benefit of society and academics. The following are some examples of potential topics:

1. Discontinuity, fixed points, and their applications to real-world problems.
2. To introduce the students to computers using some software like: Python, SPSS, Matlab etc.
3. Geometric properties of non-unique fixed points in different spaces, and their applications to neural network.
4. Fixed point theorems for multi-valued mappings, and their applications to real-world problems.
5. Non-unique fixed-point theorems satisfying distinct contractive conditions, and their applications to real-world problems.
6. Fixed point to fixed disc, fixed circle, or elliptic.
7. Application based work with other departments.

Requirements for Computer Laboratory: To provide the best teaching learning skills in mathematics, our highly qualified faculty members are working in the department. To provide valuable knowledge to our students, it is required to upgrade the department by computer lab as per the given details:

Approximate Budget:

S.No.	Item	Quantity	Approximate Price (in rupee)
1	Computer with I7 processor	60	60 x @ 80000 = 4800000.00
2	Computer tables & Chairs	60	60 x @ 5000 = 300000.00
3	Original Softwares : Python / Matlab / Mathematica / SPSS / Latex etc.	1	100000.00
4	Printer	2	02 x @ 25000 = 50000.00
5	Inverter	1	01 x @ 50000 = 50000.00
			Total = 5300000.00

.....End of the Proposal.....

(Prof. Pushpa Negi)

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