Editorial

I am pleased to introduce the Special Issue of the Mapana Journal of Sciences (MJS) that has come out based on the conference proceedings on "Recent Developments In Pure And Applied Mathematics", on behalf of our editorial team. MJS has been committed to publish innovative and original research and review articles in the field of sciences, and we are proud to continue this in this latest issue, which is dedicated to mathematics.

Over the years, Mapana has congruously been a forum for disseminating creative and novel contributions to the field of science. This issue features nineteen articles from various prominent research areas of mathematics including algebra, topology, differential equations, optimization techniques, and graph theory. Our contributors have provided their sagacious research articles with investigations on these diverse topics, that offer their perspectives and help us advance our interpretations of these complex and ever-developing topics.

The field of graph theory is a rapidly growing research area, where both modeling of real-life situations and the relation between a set of elements are investigated. The developed theory addresses real-life situations and optimal and feasible solutions are obtained based on the theory. The subject offers a wide range of research areas like graph labeling, colouring, domination, extremal graph theory, and so on, and it is overwhelming to see articles from all these aspects in this issue. Firstly, S. Jose study the distance pattern colouring of graphs along with the distance pattern distinguishing colouring, which is two closely related vertex colourings. The work of H. Aiya and Y. S. Valaulikar on the subject of differential equations establishes the existence results for the periodic boundary value problem of first-order delay differential equations using Leray - Schauder alternative and Schauder's fixed point theorem. The lower and upper solutions are defined to establish the existence of solutions between them along with the strict lower and upper solutions for the problem to establish the existence of solutions strictly between the two.

In graph theory, T. Jebaraj and M. A. Kirupa investigated the Double Geodetic Number of Line graphs of different classes of graphs. Following this, the article by P. K. Pillai and S. J. Kumar investigates the sigma chromatic number of certain graphs. The Sigma colouring (σ-colouring) of a graph G with n vertices is an injection from $V(G)$ to $1,2,\dots,n$, such that the colour sums of any two neighbouring vertices are different. The smallest number of colours needed to colour a graph G is called the sigma chromatic number. In this article, the σ-colouring of some special graphs is obtained.

In this issue, two articles explore different graph colourings. Domination in graphs is a widely studied area in graph theory with several definitions of domination existing in literature. The authors G. Rajasekar and G. Rajasekar worked on the Reserved Domination Number of graphs. They obtained the Reserved Domination Number of Line graphs of Several classes of graphs. V. Jyothi and J. S. Kumar have worked on Edge Italian domination of a graph, obtaining values of the domination parameter for several wheel-related graphs.

Three different graph labeling articles are present in the issue, among which Velmurugan and Ramachandran show that arbitrarily the super subdivisions of ladder graph and super subdivisions of ladder graph have an M $modulo$ N graceful Labeling using a C++ program to trace the M modulo N graceful labeling on a given graph. Following this, in the field of algebra, S. Bhatt and H. Chandra have established the structure of the unit group of group algebras for the abelian groups of order 40, over the finite field of odd characteristics p, which has the order p^n.

The Grid Bandwidth Minimization Problem (GBMP) in graph theory is to find an embedding of G into a host graph H such that the bandwidth over all edges is minimized. A. Khandelwal, K. Srivastava, and G. Saran developed a Simulated Annealing (SA) algorithm for GBMP in which an initial solution is generated using two problem-specific construction heuristic using four neighborhood strategies designed to explore the search space. As a known fact, the problem of integer partitioning in number theory is an intriguing area of research. In this field, P. Geetha presents the concepts of sextuple (6 – tuple) complete partitions of integers and has attempted to prove certain results based on the last part of

sextuple complete partitions of integers. Another article on labeling is by G.S. Prijith et al., which deals with the topological cordial labeling of graphs. A graph that admits a topological cordial labeling is called a topological cordial graph and in this article, the topological cordial labeling of some special graphs is discussed.

Optimization problems play an important role in mathematically modeling real-life situations. The authors Tharani and Theeba study the optimization of one such problem, the Deteriorating Inventories during a Sudden Pandemic Situation. They have presented a model of the deteriorating food supply chain with two different dealers during the pandemic situation, where the profit maximization is done through the genetic algorithm and compared with the results of both dealers. In the sequence, A. S. Issacraj and J. P. Joseph investigated the necessary and sufficient condition for the fork-decomposition of the Cartesian product of graphs. S.M. Nair and J.S. Kumar explore the Fibanocci vertex prime labelings of several types of graphs such as Path, Cycle, Wheel, Gear, Helm, Shell, Bistar and Umbrella graphs are FVP graph. This study can be seen as the incorporation of the concepts in number theory into graph theory. The concept of colouring can also be seen as graph labeling with special properties.

In a similar line of work, M. P. Sunil and J. S. Kumar studied the concepts of D-boundary vertex, D-interior vertex, D-null vertex, D-closure of a graph, and D-closed graph, based on the idea of D-distance. They investigated the structural properties of these concepts and determine whether some special classes of graphs are D-closed or not. Subdivision of edges and decomposition of graphs gives rise to several characterizations of graphs. The last article of the issue is a contribution by M. A. Fathima and J. Rani in the area of pure mathematics, as they have presented a detailed study on the properties of $b\mu_{ij}$-open sets in bigeneralized topological space and have obtained certain characterizations.

MJS section Editor of Mathematical Sciences, and the interns for their unwavering support and cooperation. The diverse range of topics covered in this issue highlights the beauty and strength of the subject in modern scientific research, and the journal takes pride in providing a platform to communicate such significant works in the field. The ever-growing knowledge of the subject through path-breaking discoveries increases the interest and significance in publishing the work and gives us immense joy. I conclude my editorial note hoping that Mapana shall benefit its readers by enriching their knowledge and helping the researchers to publish quality work in the vast field of sciences.

Manoj Balachandran

Editor