ABSTRACT

This thesis consists of six chapters and is organized as follows:

Chapter 1

In this chapter, the historical approaches of graph theory have been explained and mentioned some application areas of it. The introduction of Pure Mathematics, DNA and DNA Sequencing, Euler Diagram, Euler graph and VLSI floorplanning has been discussed and the related works on them are also included in this chapter.

Chapter 2

In this chapter, the proof of Goldbach conjecture which states that “Every even number n > 2 can be expressed as a sum of two primes” has been forwarded with the help of consecutive even number finding graph, which gives a new direction of application of graph theory for the proof of long standing Goldbach conjecture. A new algorithm has been developed in section 2.2.8, which gives the adjacency matrix with self loop for constructing the consecutive even number finding graph. Some new definitions are considered and some theorems are established with the help of new definitions in sections 2.2.6, 2.2.9, 2.2.7 and 2.2.10.
Algorithm 2.2.8: Construction of adjacency matrix for Consecutive Even number Finding graph (CENFG)

**INPUT:** Number of prime, N

**OUTPUT:** Find the adjacency matrix with self loop for CENFG

**Definition 2.2.6: Complete Prime Vertex and Even Edge Weighted graph with Self loop:** Let G (V, E) be a Complete Prime Vertex and Even Edge Weighted graph [56]. We now introduce self loops to all vertices of the graph and attached all the consecutive primes to all vertices, where the self loop means addition of same prime for attached weight (Prime) and the edges are represented by the sum of two primes and the graph thus obtained is called Complete Prime Vertex Even Edge Weighted graph with Self loop which is denoted by the graph CPVEEWGS (V, E).

**Definition 2.2.9: Consecutive Even Number Finding Graph:** A prime vertex and even edge weighted graph [56] G (V, E) is called a consecutive even number finding graph if all the edges of the graph gives consecutive even numbers and this graph is denoted as a graph CENFG (V, E) where V is the number of attached vertices and E is the number of edges/even number.

**Theorem 2.2.7:** Consecutive even numbers can be calculated out of all even numbers obtained from the graph G (X, (X^2+X)/2), where X= 5+m*n for m=n=0, 1, 2, 3... up to some certain limit.
Theorem 2.2.10: The graph CENFG (X, P), where X=5 +m*n , m=n=0, 1, 2, 3… and P is the value that can be calculated from the matrix obtained from the algorithm 2.2.8, always gives consecutive even numbers/edges which are the sum of two primes.

Chapter 3

In this chapter, a new algorithm has been developed to find the shortest superstring of a given spectrum having variable or fixed length of fragments. In this algorithm the graph theoretical approach has been used. This algorithm gives all the possible shortest superstrings that may present in a given spectrum of fixed or varying length of fragments. The algorithm Compute_Shortest_Superstring is discussed in 3.2.1 which gives a set of sequences and the overlap value. In section 3.3 the algorithm has been justified with some suitable examples.

Chapter 4

In this chapter, a particular class of Euler graph has been constructed from the Euler diagram having some certain set of properties. The various properties of the corresponding Euler graph, dual graph and intersection graph which are obtained from a particular pattern of Euler Diagram have been discussed. Some theoretical properties of these types of graphs have been proposed in this chapter.
Theorem 4.3.1: The graph $G(4n + 8, 8n + 16)$ for $n \geq 1$ is always three colorable.

Theorem 4.3.2: The dual $H(4n + 10, 8n + 16)$ for $n \geq 1$ of the graph $G(4n + 8, 8n + 16)$ for $n \geq 1$ is not Euler and two colorable.

Theorem 4.3.3: The graph $G(4n + 8, 8n + 16)$ for $n \geq 1$ is always has a 2 factor.

Theorem 4.3.4: The graph $G(4n + 8, 4n + 14)$ for $n \geq 1$ is always two colorable.

Chapter 5

In this chapter, a new representation for a Slicing and Non slicing floorplan having rectangular as well as L-shaped modules have been discussed in 5.2. In this representation the concepts of Polish expression and four new operators have been used to represent the floorplan. An algorithm has been proposed in 5.3.1 to determine the shape and the layout of the modules in the floorplan. This algorithm will give the layout of the modules and corresponding shapes. In section 5.4 two operations have been discussed for any modification of a given floorplan.

5.3.1: An Algorithm of determining the shape and placement of modules for a NGPE

INPUT: $X$ – a NGPE

OUTPUT: $Y$ – floorplan corresponding to the NGPE $X$ with the shape of the modules.
Chapter 6

In this chapter, the conclusion has been included by highlighting the contributions of solving three different problems from three different fields such as Pure Mathematics, VLSI design and Bioinformatics. Some theoretical results of a particular class of Euler graph have also been discussed. Finally, future scope of our research finding has been discussed.