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# SP Mean E-Cordial Labeling

[1]M. Aishwarya, [2*]V. Maheswari and [3]V. Balaji

[1]Research Scholar, Department of Mathematics, Vels Institute of Science Technology and Advanced Studies, Chennai, Tamil Nadu, India.
Email: aishwaryamuthazhagu@gmail.com

[2,*]Research Supervisor, Professor, Department of Mathematics, Vels Institute of Science Technology and Advanced Studies, Chennai, Tamil Nadu, India.
Corresponding author: maheswari.sbs@vistas.ac.in

[3]Associate Professor, Department of Mathematics, Sacred Heart College, Tirupattur, Tamil Nadu, India.

Email: pulibala70@gmail.com

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**Abstract:**
Assigning an integer to a vertices or edges is called a vertex or edge labeling respectively. Suppose $G$ is a simple graph. Consider the function $f$ for the edge set $f: R \rightarrow \{0, 1\}$. For each vertex $t \in T$, define $f(t)=\sum f(ut) \setminus ut \in R(G)$ *(mod2)*. The function $f$ is known as an E-cordial labeling (E-CL) of $G$ if $|r_f(0) - r_f(1)| \leq 1$, and $|t_f(0) - t_f(1)| \leq 1$ where $r_f(0)$, $r_f(1)$and $t_f(0)$, $t_f(1)$ are the number of edges and vertices labeled with 0 and labeled by 1 respectively. A graph that admits E-CL is said to be E-cordial graphs (E-CG). Based on the above definition we propose a novel labeling known as SP Mean E-cordial labeling (E-CL). In this paper, we study SP Mean E-CL of several families of graphs such as complete bipartite graphs, complete graphs, wheels, etc.

**Keywords**: Mean E-cordial labeling, Wheel, Complete graphs

## 1. Introduction

In this research, a graph is defined as a simple graph G. For graph theory definition and results we refer to F. Harary [1,2]. Rosa [3] introduce a new idea called labeling the graph. Assigning an integer to a vertices or edges is called a vertex or edge labeling respectively. Several labeling introduced by various authors [4,5,6,7,8,9]. Here we discuss with edge labeling.

If a mapping $f: R(G) \rightarrow \{0,1,2 \dots \dots, q\}$ exists, a graph G is said to have elegant edges such that the induced mapping $f^*: T(G) \rightarrow \{0, 1, 2, \dots \dots, p-1\}$ given by $f(u) \leq \sum f(ut) mod|t|, ut \in R(G)$. [10,11,12,13,14,15,16]. The label of vertex $v$ under $f$ is said to be f(v). A mapping $f: T(G) \rightarrow \{0, 1\}$ is known as binary vertex labeling of G.

Cordial labeling is the binary vertex labeling of a graph G if $\left|r_f(0) - r_f(1)\right| \leq 1$ and $\left|t_f(0) - t_f(1)\right| \leq 1$. A graph satisfies cordial labeling is defined as cordial graph, where $r_f(0)$, $r_f(1)$ and $t_f(0)$, $t_f(1)$are the number of edges and vertices labeled by 0 and 1 respectively. The cordial labeling introduced in 1987 by Cahit [17].

## 2. SP Mean E-Cordial Labeling

**Definition 2.1** Let $G$ be a simple graph. Let $f$ be a function $f{:}R \rightarrow \{1,2\}$ and an induced function $f^*: T \rightarrow \{0,1\}$. We associate two integers. $S = \sum f(ut) \setminus ut \in R(G)$ and $P = \prod f(ut)$. For each

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vertex $u$ assign the label $\left\lfloor\frac{S+P}{2}\right\rfloor$ (mod 2), then $f$ is defined as SP mean E-cordial labeling if $|r_f(1) - r_f(2)| \leq 1$ and $|t_f(0) - t_f(1)| \leq 1$ where $t_f(0)$ and $t_f(1)$ is the number of vertices labeled with 0 and labeled by 1 and $r_f(1)$ and $r_f(2)$ is the number of edges labeled with 1 and labeled by 2 respectively. A graph which admits SP mean E-CL is known as SP Mean E-CG (Figure 1).

**Example 2.2**

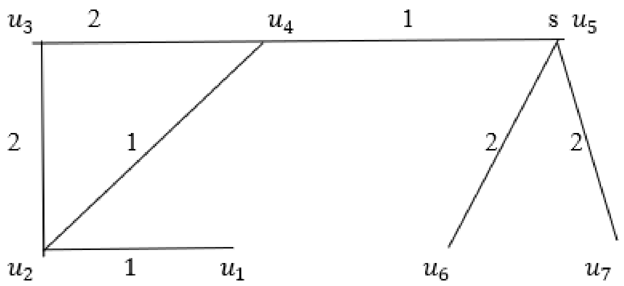


**Figure 1. SP Mean E-CG**

For vertex $u_1$ , then $S = 1$ and $P = 1$ then $f^*(u_1) = 1$

For vertex $u_2$ , then $S = 4$ and $P = 2$ then $f^*(u_2) = 1$

For vertex $u_3$ , then $S = 4$ and $P = 2$ then $f^*(u_3) = 0$

For vertex $u_4$ , then $S = 4$ and $P = 2$ then $f^*(u_4) = 1$

For vertex $u_5$ , then $S = 5$ and $P = 4$ then $f^*(u_5) = 0$

For vertex $u_6$ , then $S = 2$ and $P = 2$ then $f^*(u_6) = 0$

For vertex $u_7$ , then $S = 2$ and $P = 2$ then $f^*(u_7) = 0$

Hence $t_f(0) = 4, t_f(1) = 3$ this implies

$$|t_f(0) - t_f(1)| \leq 1$$

Hence the above graph is a SP Mean E-CG.

**Theorem 2.3** For any Star $(K_{1,n})$ is SP Mean E-cordial graph if $n$ even.

**Proof:** Let $T(K_{1,n}) = \{u, u_i \ / \ i = 1,2, \ldots .n\}$ be the vertices and $R(K_{1,n}) = \{uu_i \ / \ i = 1,2, \ldots .n\}$ be the edges. Then

$|\ T(K_{1,n})| = n + 1$ and $|\ E(K_{1,n})| = n$

Define the function $f: R(G) \to \{1,2\}$ as

$$f(uu_i) = \begin{cases} 2 \ \ if \ \ i \ is \ even \\ 1 \ if \ \ i \ is \ odd \end{cases}$$

Find $S = \sum f(ut) \setminus ut \in E(G)$ and $P = \prod f(ut)$ for each vertex in $T(K_{1,n})$

Define $f^*: T(G) \to \{0,1\}$ defined by $f^*(u) = \left\lfloor\frac{S+P}{2}\right\rfloor$*(mod 2).*

Then for $n \equiv 0(mod\ 4)$

| | $t_f(0)$ | $t_f(1)$ | $r_f(1)$ | $r_f(2)$ |
|---|---|---|---|---|
| $n \equiv 0(mod\ 4)$ | $\frac{n}{2}$ | $\frac{n}{2}+1$ | $\frac{n}{2}$ | $\frac{n}{2}$ |
| $n \equiv 0(mod\ 4)$ | $\frac{n}{2}+1$ | $\frac{n}{2}$ | $\frac{n}{2}$ | $\frac{n}{2}$ |

The above labeling satisfies, $|t_f(0) - t_f(1)| \leq 1$ and $|r_f(1) - r_f(2)| \leq 1$.

The Star graph admits SP Mean E-CL.

Hence star graph is a SP Mean E-CG if *n* is even.

**Theorem 2.4** For any Path graph $P_n$ is SP Mean E-CG if *n* is odd.

**Proof:** Let $T(P_n) = \{u_1, u_2, \dots, u_n\}$ and $R(P_n) = \{u_1u_2, u_2u_3, u_3u_4, \dots, u_{n-1}u_n\}$ be the vertices and edges respectively. Then | T($P_n$)| = $n$ and | R($K_{1,n}$)| = $n - 1$

Define the labeling function $f: R(G) \to \{1,2\}$ as follows

$$f(u_iu_{i+1}) = \begin{cases} 1 \quad if\ 1 \leq\ i \leq \frac{n-1}{2} \\ 2 \quad if\ \ \frac{n-1}{2} \leq i \leq n-1 \end{cases}$$

Find $S = \sum f(ut) \setminus\ ut \in R(G)$ and $P = \prod f(ut)$ for each vertex in $T(K_{1,n})$

Define$f^*: T(G) \to \{0,1\}$ defined by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| $t_f(0)$ | $t_f(1)$ | $r_f(1)$ | $r_f(2)$ |
|---|---|---|---|
| $\frac{n+1}{2}$ | $\frac{n}{2}$ | $\frac{n-1}{2}$ | $\frac{n-1}{2}$ |

The above labeling satisfies, and $|t_f(0) - t_f(1)| \leq 1$ and $|r_f(1) - r_f(2)| \leq 1$.

The Path graph admits SP Mean E-CL.

Hence Path graph is a SP Mean E-CG.

**Theorem 2.5** For any Cycle graph $C_n$ is SP mean E-CG if *n* is odd.

**Proof:** Let $T(C_n) = \{u_1, u_2, \dots, u_n\}$ and $R(C_n) = \{u_1u_2, u_2u_3, u_3u_4, \dots, u_{n-1}u_n, u_nu_{n1}\}$ be the vertices and edges respectively . Then | $T(P_n)$| = $n$ and | $R(K_{1,n})$| = $n - 1$

Define the labeling function $f: R(G) \to \{1,2\}$ as follows

$$f(u_i u_{i+1}) = \begin{cases} 1 & if\ 1 \le i \le \dfrac{n+1}{2} \\ 2 & if\ \dfrac{n+1}{2} \le i \le n-1 \end{cases}$$

Find $S = \sum f(ut) \setminus ut \in R(G)$ and $P = \prod f(ut)$ for each vertex in $T(K_{1,n})$

Define$f^*: T(G) \to \{0,1\}$ defined by$f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| $t_f(0)$ | $t_f(1)$ | $r_f(1)$ | $r_f(2)$ |
|---|---|---|---|
| $\frac{n+1}{2}$ | $\frac{n-1}{2}$ | $\frac{n+1}{2}$ | $\frac{n-1}{2}$ |

The above labeling satisfies,$|t_f(0) - t_f(1)| \le 1$ and $|r_f(1) - r_f(2)| \le 1$.

The Cycle graph admits SP Mean E-CL.

Hence Cycle graph is a SP Mean E-cordial graph.

**Note 2.6** $K_3, K_4$ are the only complete graph in SP Mean E-cordial graph.

**Theorem 2.7** For any Wheel graph $W_n$is a SP Mean E-cordial graph if *n* is even.

**Proof:** Let $T(W_n) = \{u, u_i\ i = 1,2,3 \dots n\}$ and $R(W_n) = \{uu_i, u_1u_2, u_2u_3, u_3u_4, \dots, u_nu_1\}$ be the vertices and edges respectively, *u* is apex vertex and $u_1, u_2, u_3 \dots, u_n$ be the vertices of cycle $C_n$.

Then | T($W_n$)| = $n + 1$ and | R($W_n$)| = $n$

Define the labeling $f: R(G) \to \{1,2\}$ as below

$$f(uu_i) = 2, if\ i\ is\ even$$
$$f(uu_i) = 1, if\ i\ is\ odd$$
$$f(u_iu_{i+1}) = 2, if\ i\ is\ even$$
$$f(u_iu_{i+1}) = 1, if\ i\ is\ odd$$

Find $S = \sum f(ut) \setminus ut \in E(G)$ and $P = \prod f(ut)$ for each vertex in $T(K_{1,n})$

Define $f^*: T(G) \to \{0,1\}$ defined by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| $t_f(0)$ | $t_f(1)$ | $r_f(1)$ | $r_f(2)$ |
|---|---|---|---|
| $\frac{n}{2}$ | $\frac{n}{2}$ | $n$ | $n$ |

The above labeling satisfies $|r_f(1) - r_f(2)| \le 1$ and $|t_f(0) - t_f(1)| \le 1$.

Hence Wheel graph $W_n$ admits SP Mean E-cordial graph labeling.

**Theorem 2.8** For any Bistar $B_{n,n}$ is SP Mean E-CG if $n$ is even.

**Proof:** Let $T(B_{n,n}) = \{u, t, u_1, u_2, u_3 \ldots\ldots u_n, t_1, t_2, t_3 \ldots., t_n\}$ be the vertices and

$R\left(B_{n,n}\right) = \{ut, uu_1, uu_2, uu_3 \ldots\ldots uu_n, tt_1, tt_2, tt_3 \ldots., tt_n\}$ be the edges.

Then | $T(B_{n,n})$| = $2n + 2$ and | $R(W_n)$| = $2n + 1$

To define the labeling function $f: R(G) \rightarrow \{1,2\}$ as follows

$$f(ut) = 1$$

$$f(ut_i) = 1$$

$$f(tt_i) = 2$$

Find $S = \sum f(ut) \setminus ut \in R(G)$ and $P = \prod f(ut)$ for each vertex in $T(K_{1,n})$

Define$f^*: T(G) \rightarrow \{0,1\}$ defined by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| $t_f(0)$ | $t_f(1)$ | $r_f(1)$ | $r_f(2)$ |
|---|---|---|---|
| $n+1$ | $n+1$ | $n$ | $n+1$ |

The above labeling satisfies $|t_f(0) - t_f(1)| \leq 1$ and

$|r_f(i) - r_f(j)| \leq 1$.

The Bistar $B_{n,n}$admits SP Mean E-CL.

Therefore, Bistar $B_{n,n}$is a SP Mean E-CG.

**Theorem 2.9** Combo graph $P_n \odot K_2$ is a SP Mean E-CG.

**Proof:** Let $T(P_n \odot K_2) = \{u_i, u_i' 1 \leq i \leq n\}$ be the vertices and

$R(P_n \odot K_2) = \{u_i u_{i+1}, uu_i', 1 \leq i \leq n\}$ be the edges.

Then | $T(P_n \odot K_2)$| = $2n$ and | $R(P_n \odot K_2)$| = $2n - 1$

Define the function $f: R(G) \rightarrow \{1,2\}$ as below

$$f(u_i u_{i+1}) = \begin{cases} 2 & if\ \ i\ is\ even \\ 1 & if\ \ i\ is\ odd \end{cases}$$

$$f(u_i u_i') = \begin{cases} 2 & if\ \ i\ is\ even \\ 1 & if\ \ i\ is\ odd \end{cases}$$

Find $S = \sum f(ut) \setminus ut \in E(G)$ and $P = \prod f(ut)$ for each vertex in $T(K_{1,n})$

Define $f^*: T(G) \rightarrow \{0,1\}$ defined by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| $r_f(1)$ | $r_f(2)$ | $t_f(0)$ | $t_f(1)$ |
|---|---|---|---|
| $n$ | $n-1$ | $n$ | $n$ |

The above labeling satisfies $|r_f(1) - r_f(2)| \leq 1$ and $|t_f(0) - t_f(1)| \leq 1$.

Combo graph $P_n \odot K_2$ admits SP Mean E-cordial labeling.

Hence Combo graph $P_n \odot K_2$is a SP Mean E-cordial graph.

**Theorem 2.10** Crown graph $C_n \odot K_2$ is a SP Mean E-CG.

**Proof:** Let $T(C_n \odot K_2) = \{u_1, u_2, u_3 \dots, u_n, u_1', u_2', u_3' \dots, u_n'\}$ be the vertices and $R(C_n \odot K_2) = \{u_1u_2, u_2u_3, u_3u_4, \dots, u_nu_1, u_1u_1', u_2u_2', u_3u_3' \dots, u_nu_n'\}$ be the edges.

Then | $T(C_n \odot K_2)$| = $2n$ and | $R(C_n \odot K_2)$| = $2n$

Define the labeling function $f: R(G) \to \{1,2\}$ as below

For $1 \leq i \leq n-1$

If $n$ is odd

$$f(u_iu_{i+1}) = \begin{cases} 2 & if\ i\ is\ even \\ 1 & if\ i\ is\ odd \end{cases}$$

$$f(u_iu_i') = \begin{cases} 1 & if\ i\ is\ even \\ 2 & if\ i\ is\ odd \end{cases}$$

If $n$ is even

$$f(u_iu_{i+1}) = \begin{cases} 2 & if\ i\ is\ even \\ 1 & if\ i\ is\ odd \end{cases}$$

$$f(u_iu_i') = \begin{cases} 2 & if\ i\ is\ even \\ 1 & if\ i\ is\ odd \end{cases}$$

Find $P = \prod f(ut)$ and $S = \sum f(ut) \setminus ut \in E(G)$ for each vertex in $T(K_{1,n})$

Define$f^*: T(G) \to \{0,1\}$ by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| | $r_f(1)$ | $r_f(2)$ | $t_f(0)$ | $t_f(1)$ |
|---|---|---|---|---|
| $n$ is even | $n$ | $n$ | $n$ | $n$ |
| $n$ is odd | $n$ | $n-1$ | $n$ | $n$ |

The above labeling satisfies $|r_f(1) - t_f(2)| \leq 1$ and $|t_f(0) - t_f(1)| \leq 1$.

The Crown graph $C_n \odot K_2$admits SP Mean E-CL.

Hence Crown graph $C_n \odot K_2$is a SP Mean E-cordial graph.

**Theorem 2.11** Triangular snake $nC_3$ is a SP Mean E-CG.

**Proof:** Let the path $P_n$ having the edges $r_1, r_2, r_3 \dots \dots .., r_{n-1}$ and vertices $t_1, t_2, t_3, \dots, t_n$.

To construct Triangular snake $nC_3$ from path $P_n$ join $u_i$ and $u_{i+1}$ to a new edge $t_i$ by edges $u_i t_i$ and $u_{i+1} t_i$, for

$i$ = *1,2,3*……., $n-1$

Then | $T(nC_3)$| = $2n-1$ and | $R(nC_3)$| = $3n-3$

Define the labeling function $f: R(G) \rightarrow \{1,2\}$

$$f(u_i u_{i+1}) = \begin{cases} 2 \text{ } if \text{ } i \text{ } is \text{ } even \\ 1 \text{ } if \text{ } i \text{ } is \text{ } odd \end{cases}$$

$$f(u_i u_i') = 1$$

$$f(u_{i+1} u_i') = 2$$

Find $S = \sum f(ut) \setminus ut \in E(G)$ and $P = \prod f(uv)$ for each vertex in $T(K_{1,n})$

Define$f^*: T(G) \rightarrow \{0,1\}$ defined by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| | $t_f(0)$ | $t_f(1)$ | $r_f(1)$ | $r_f(2)$ |
|---|---|---|---|---|
| $n$ is even | $n$ | $n-1$ | $n+1$ | $n+1$ |
| $n$ is odd | $n$ | $n-1$ | $n+1$ | $n+1$ |

The above labeling satisfies $|r_f(1) - r_f(2)| \leq 1$ and $\left|t_f(0) - t_f(1)\right| \leq 1$.

The Triangular snake $nC_3$ admits SP Mean E-cordial labeling

Hence Triangular snake $nC_3$is a SP Mean E-cordial graph.

**Theorem 2.12** Fan graph $F_{1,n}$ is a SP mean E-CG if *n* is odd.

**Proof:** Let $T(F_{1,n}) = \{u, u_1, u_2, u_3 \dots, u_n,\}$ be the vertices and $R(F_{1,n}) = \{u_1u_2, u_2u_3, u_3u_4, \dots, u_{n-1}u_n, uu_1, uu_2uu_3, \dots, uu_n\}$ be the edges. Here *u* is apex vertex and $u_1, u_2, u_3 \dots, u_n$ be the vertices of path. Then| $R(F_{1,n})$| =$2n-1$ and | $T(F_{1,n})$| = $n+1$.

Define the function $f: R(G) \rightarrow \{1,2\}$ as below

$$f(uu_i) = \begin{cases} 2 \quad if \text{ } i \text{ } is \text{ } even \\ 1 \quad if \text{ } i \text{ } is \text{ } odd \end{cases}$$

$$f(u_i u_{i+1}) = \begin{cases} 1 & if\ i\ is\ even \\ 2 & if\ i\ is\ odd \end{cases}$$

Find $P = \prod f(ut)$ and $S = \sum f(ut)\ /ut \in E(G)$ for each vertex in $T(K_{1,n})$

Define$f^*: T(G) \to \{0,1\}$ by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| $t_f(0)$ | $t_f(1)$ | $r_f(1)$ | $r_f(2)$ |
|---|---|---|---|
| $\frac{n+1}{2}$ | $\frac{n+1}{2}$ | $n$ | $n-1$ |

The above labeling satisfies $|t_f(0) - t_f(1)| \leq 1$ and $|r_f(1) - r_f(2)| \leq 1$.

The Fan graph $F_{1,n}$ admits SP Mean E-cordial labeling.

Hence Fan graph $F_{1,n}$ is a SP Mean E-CG.

**Theorem 2.13** Semi point total graph of path $T_2(P_n)$is a SP Mean E-CG.

**Proof:** Let the path $P_n$ having the edges $r_1, r_2, r_3 \dots \dots .., r_{n-1}$ and the vertices $u_1, u_2, u_3, \dots u_n$.

To construct Semi point total graph of path $T_2(P_n)$from path $P_n$ join $u_i$ and $u_{i+1}$ to a new edge $t_i$ by edges $u_i t_i$ and $u_{i+1} t_i$, for *i = 1,2,3… ….,* $n-1$.

Then | $T(T_2(P_n))$| =$2n-1$ and | $R(T_2(P_n))$| = $3n-3$

Define the labeling function $f: R(G) \to \{1,2\}$

$$f(u_i u_{i+1}) = \begin{cases} 2 & if\ i\ is\ even \\ 1 & if\ i\ is\ odd \end{cases}$$

$$f(u_i u_i') = 1$$

$$f(u_{i+1} u_i') = 2$$

Find $S = \sum f(ut)\ \backslash\ ut \in E(G)$ and $P = \prod f(ut)$ for each vertex in $T(K_{1,n})$

Define $f^*: T(G) \to \{0,1\}$ defined by $f^*(u) = \left\lfloor \frac{S+P}{2} \right\rfloor$ (mod 2).

| | $r_f(1)$ | $r_f(2)$ | $t_f(0)$ | $t_f(1)$ |
|---|---|---|---|---|
| $n$ is even | $n+1$ | $n+1$ | $n$ | $n-1$ |
| $n$ is odd | $n+1$ | $n+1$ | $n$ | $n-1$ |

The above labeling satisfies $|r_f(1) - r_f(2)| \leq 1$ and $\left|t_f(0) - t_f(1)\right| \leq 1$.

The Semi point total graph of path $T_2(P_n)$admits SP Mean E-CL.

Hence Semi point total graph of path $T_2(P_n)$is a SP Mean E-CG.

## 3. Conclusion

In this research, we define a new labeling based on edge is called SP mean E-cordial labeling and SP Mean E-cordial graph. Here is it verified some of the standard graphs like cycle, path, wheel, crown graph, combo graph, Triangular snake graph and Semi point total graph are SP Mean E-cordial graph. In future we extend this work for some more special graphs.

## References

1. Harary, F. (2018). *Graph theory (on demand printing of 02787).* CRC Press.
2. Harary, F. (1972). *Graph theory.* Addison-Wesley Reading Mass.
3. Rosa, A. (1967). On certain valuations of the vertices of a graph. In *Theory of graphs (International Symposium, Rome, July 1966)* (pp. 349-355). Gordon and Breach, N.Y., and Dunod Paris.
4. Gallian, J. A. (2012). Graph labeling. *The Electronic Journal of Combinatorics, DS6-Dec.*
5. Ponraj, R., Sivakumar, M., & Sundaram, M. (2012). Mean cordial labeling of graphs. *Open Journal of Discrete Mathematics, 2*(4), 145.
6. Gayathri, B., & Siva Kumar, C. (2019). Some mean cordial labeling of graphs. *International Journal of Scientific Research and Review, 8*(7), 263-285.
7. Boxwala, S. (n.d.). *Some problems in cordial labeling of graph.* LAP Lambert Academic Publishing.
8. Vaidya, S. K., & Kothari, N. J. (2011). Some new families of line graceful graphs. *International Journal of Mathematics and Scientific Computing, 1*(2), 26-28.
9. William, A., Rajsingh, I., & Roy, S. (2013). Mean cordial labeling of certain graphs. *Journal of Computer & Mathematical Sciences, 4*(4), 274-281.
10. Yilmaz, R., & Cahit, I. (1997). E-Cordial graphs. *Ars Combinatoria, 46*, 251-266.
11. Vaidya, S. K., & Vyas, N. B. (2012). Some results on E-cordial labeling. *International Journal of Mathematics and Scientific Computing, 2*(1), 9-13.
12. Vaidya, S. K. (2011). Some new families of E-cordial graphs.
13. Vaidya, S. K., & Lekha Bijukumar. (2011). Some new results on E-cordial labeling. *International Journal of Information Science and Computer Mathematics, 3*, 21-29.
14. Vaidya, S. K., & Vyas, N. B. (2011). E-cordial labeling of some mirror graphs. *International Journal of Contemporary Advanced Mathematics, 2*(1), 22-27.
15. Vaidya, S. K., & Vyas, N. B. (2011). E-cordial labeling for Cartesian product of some graphs. *Studies in Mathematical Sciences, 2*, 11-15.
16. Wavelet, D. (2010). *A study on E-cordial labeling of graphs* (Ph.D. thesis). Manonmaniam Sundaranar University.
17. Cahit, I. (1987). Cordial graphs—a weaker version of graceful and harmonious graphs. *Ars Combinatoria, 23*, 201-207.