Malaya Journal of Matematik, Vol. 8, No. 4, 2097-2102, 2020

https://doi.org/10.26637/MJM0804/0131

On K-eccentric and K-hyper eccentric indices of Benzenoid H_k system

M. Bhanumathi[1], R. Rohini[2] and G. Srividhya[3*]

Abstract

Let G be a connected graph with vertex set $V(G)$ and edge set $E(G)$. Bhanumathi and Easu Julia Rani introduced the first K -Eccentric index $B_1E(G)$ and the second K - Eccentric index $B_2E(G)$ of a graph G as $B_1E(G) = \sum_{ue}\left[e_G(u)+e_{L(G)}(e)\right], B_2E(G)=\sum_{ue}\left[e_G(u)e_{L(G)}(e)\right]$ They also defined the first K -Hyper eccentric index $HB_1E(G)$ and the second K -Hyper eccentric index $HB_2E(G)$ of a graph G as $HB_1E(G)=\sum_{ue}\left[e_G(u)+e_{L(G)}(e)\right]^2, HB_2E(G)=\sum_{ue}\left[e_G(u)e_{L(G)}(e)\right]^2$ where in all the cases ue means that the vertex u and edge e are incident in G and $e_{L(G)}(e)$ is the eccentricity of e in the line graph $L(G)$ of G. They have defined the multiplicative version of these indices also. In this paper, we calculate the first and second K eccentric, the first and second K-hyper eccentric indices and their multiplicative versions of benzenoid H_k system.

Keywords

K-eccentric index, K-hyper eccentric index, Multiplicative K-eccentric index, Multiplicative K-hyper eccentric index, Circo.

[1] *Department of Mathematics, Government Arts College for Women, Sivagangai-630562, Tamil Nadu, India.*
[2] *Department of Mathematics, Government Arts College for Women (Autonomous), Pudukkottai-622001, Tamil Nadu, India.*
[3] *Department of Mathematics, Government Arts College, Tiruchirappalli-620022, Tamil Nadu, India.*
***Corresponding author**: [1]bhanu_ksp@yahoo.com; [2]rohinianbazhagan7@gmail.com; [3] vkm292011@hotmail.com
Article History: Received **19** September **2020**; Accepted **19** November **2020**

Contents

1. Introduction

A topological index is a real number associated with chemical constitution. It correlates the chemical structure with various physical and chemical properties and biological activity.

All graphs in this paper are simple, finite and undirected. A graph G is a finite nonempty set $V(G)$ together with a prescribed set $E(G)$ of unordered pair of distinct elements of V. The cardinality of $V(G)$ and $E(G)$ are represented by $|V(G)|$ and $|E(G)|$, respectively. Let, $d_G(v)$ be the degree of a vertex v of G and $N_G(v)$ be the neighborhood of a vertex v of G. The distance between the vertices u and v of a connected graph G is represented by $d_G(u,v)$. It is defined as the number of edges in a shortest path connects the vertices u and v. The eccentricity e $_G(v)$ of a vertex v in G is the largest distance between v and any other vertices u of G.

To take an account on contributions of pairs of incident elements, Kulli [5] introduced the first and second K Banhatti indices. In [4], Bhanumathi and Easu Julia Rani introduced the first K -Eccentric index $B_1E(G)$ and the second K - Eccentric index $B_2E(G)$ of a graph G as

$$B_1E(G)=\sum_{ue}\left[e_G(u)+e_{L(G)}(e)\right], B_2E(G)=\sum_{ue}\left[e_G(u)e_{L(G)}(e)\right]$$

and also defined the first K-Hyper eccentric index $HB_1E(G)$ and the second K-Hyper eccentric index $HB_2E(G)$ of a graph G as $HB_1E(G)=\sum_{ue}\left[e_G(u)+e_{L(G)}(e)\right]^2$, $HB_2E(G)=\sum_{ue}\left[e_G(u)e_{L(G)}(e)\right]^2$ where in all the cases ue means that the vertex u and edge e are incident in G and $e_{L(G)}(e)$ is the eccentricity of e in the line graph $L(G)$ of G [4].

Table 1

Edge set	No. of edges $e = uv$	Eccentricity of end vertices $(e(u), e(v))$	Eccentricity of e in $L(G)e_{L(G)}(e)$
E_1	6	$(2k+1, 2k+1)$	$2k+1$
E_2	6	$(2k+1, 2k+2)$	$2k+1$
E_3	12	$(2k+2, 2k+3)$	$2k+2$
E_4	6	$(2k+3, 2k+3)$	$2k+3$
E_5	12	$(2k+3, 2k+4)$	$2k+3$
E_6	24	$(2k+4, 2k+5)$	$2k+4$
E_7	6	$(2k+5, 2k+5)$	$2k+5$
E_8	18	$(2k+5, 2k+6)$	$2k+5$
E_9	36	$(2k+6, 2k+7)$	$2k+6$
$\vdots$	$\vdots$	$\vdots$	$\vdots$
$E_{3(k-2)-2}$	6	$(2k+2(k-2)-1, 2k+2(k-2)-1)$	$2k+2(k-2)-1$
$E_{3(k-2)-1}$	$6(k-2)$	$(2k+2(k-2)-1, 2k+2(k-2))$	$2k+2(k-2)-1$
$E_{3(k-2)}$	$12(k-2)$	$(2k+2(k-2), 2k+2(k-1)-1)$	$2k+2(k-2)$
$E_{3(k-1)-2}$	6	$(2k+2(k-1)-1, 2k+2(k-1)-1)$	$2k+2(k-1)-1$
$E_{3(k-1)-1}$	$6(k-1)$	$(2k+2(k-1)-1, 2k+2(k-1))$	$2k+2(k-1)-1$
$E_{3(k-1)}$	$12(k-1)$	$(2k+2(k-1), 2k+2(k-1)+1)$	$2k+2(k-1)$
$E_{3(k-1)+1}$	6	$(2k+2(k-1)+1, 2k+2(k-1)+1)$	$2k+2(k-1)+1$

2. First and second K-Eccentric indices, First and Second K-Hyper Eccentric indices of Benzenoid H_k system:

The circumcoronene homologous series of benzenoid also belongs to the family of molecular graphs that has several copy of benzene C_6 on its circumference. The terms of this series are represented as, H_1-benzene, H_2-coronene, H_3-circumcoronene and H_4 circumcircumcoronene etc. A benzeniod system is a connected geometric figure. It is obtained by arranging congruent regular hexagons in a plane. Consequently two hexagons are either disjoint or have a common edge.

Let G be a graph with vertex set $V(G)$ and edge set $E(G)$. The eccentricities of $u, v \in V(G)$ are denoted by $e(u), e(v)$ respectively and for $e = uv \in E(G)$, denote the eccentricities of the end vertices of the edge e by $(e(u), e(v))$.

Let V be the vertex set of H_k and E be the edge set in H_k, then $|V| = 6k^2$ and $|E| = 9k^2 - 3k$ for the structure of H_k. First, we shall determine the number of edges $e = uv$ with the eccentricity of the end vertices $e(u), e(v)$ and eccentricity of the edge e in $L(G)$. We give these values in the following Table 1.

Theorem 2.1. *For any positive integer number k, let H_k be the general form of circumcoronene series of benzenoid system, then*

$$(i)\quad B_1E(H_k) = 6\sum_{i=1}^{k}[8k+4(2i-1)] + 6\sum_{i=1}^{k-1}[8k+4(2i-1) +1] + 12\sum_{i=1}^{k-1} i[8k+4(2i)+1]$$

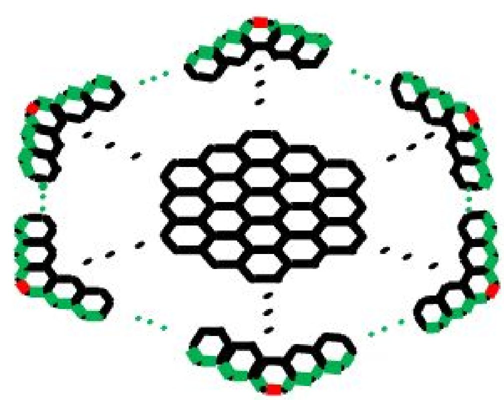

Figure 1. The Circumcoronene homologous Series of Benzenoid $H_k (k \geq 1)$ with edges

$$(ii)\quad B_2E(H_k) = 6\sum_{i=1}^{k}\left[(2(2k+2i-1))^2\right] + 6\sum_{i=1}^{k-1} i\left[(2k+2i-1)^2 + (2k+2i)(2k+2i-1)\right] + 12\sum_{i=1}^{k-1} i\left[(2k+2i)^2 + (2k+2i)(2k+2i-1)\right]$$

$$(iii)\quad HB_1E(H_k) = 6\sum_{i=1}^{k}\left[(2(2k+2i-1))^2 + (2(2k+2i-1))^2\right] + 6\sum_{i=1}^{k-1} i\left[(2(2k+2i-1))^2 + ((2k+2i)+(2k+2i-1))^2\right] + 12\sum_{i=1}^{k-1} i\left[(2(2k+2i))^2 + ((2k+2i+1)+(2k+2i))^2\right]$$

$$(iv)\quad HB_2E\,(H_k)=6\sum_{i=1}^{k}\left[\left((2k+2i-1)^2\right)^2+\left((2k+2i-1)^2\right)^2\right]$$
$$+6\sum_{i=1}^{k-1}i\left[\left((2k+2i-1)^2\right)^2+((2k+2i)(2k+2i-1))^2\right]$$
$$+12\sum_{i=1}^{k-1}i\left[\left((2k+2i)^2\right)^2+((2k+2i+1)(2k+2i))^2\right]$$

Proof. Consider the General form of H_k-Circumcoronene graph.

$$(i)\quad B_1E\,(H_k)=\sum_{ue}\left[e_{H_k}(u)+e_{L(H_k)}(e)\right]$$
$$=\sum_{e=uv\in E(G)}\left[e_{H_k}(u)+e_{L(H_k)}(e)+e_{H_k}(v)+e_{L(H_k)}(e)\right]$$
$$=\sum_{uv\in E_1(G)}\left[e_G(u)+e_{L(G)}(e)+e_G(v)+e_{L(G)}(e)\right]+\dots$$
$$+\sum_{uv\in E_{3(k-1)+1}(G)}\left[e_G(u)+e_{L(G)}(e)+e_G(v)+e_{L(G)}(e)\right]$$
$$=6\sum_{i=1}^{k}[8k+4(2i-1)]+6\sum_{i=1}^{k-1}[8k+4(2i-1)+1]$$
$$+12\sum_{i=1}^{k-1}i[8k+4(2i)+1]$$

$$(ii)\quad B_2E\,(H_k)=\sum_{ue}\left[e_{H_k}(u)\times e_{L(H_k)}(e)\right]$$
$$=\sum_{uv\in E_1(G)}\left[e_G(u)e_{L(G)}(e)+e_G(v)e_{L(G)}(e)\right]+\dots$$
$$+\sum_{uv\in E_{3(k-1)+1}}\left[e_G(u)e_{L(G)}(e)+e_G(v)e_{L(G)}(e)\right]$$
$$=6\sum_{i=1}^{k}\left[(2(2k+2i-1))^2\right]$$
$$+6\sum_{i=1}^{k-1}i\left[(2k+2i-1)^2+(2k+2i)(2k+2i-1)\right]$$
$$+12\sum_{i=1}^{k-1}i\left[(2k+2i)^2+(2k+2i)(2k+2i-1)\right]$$

$$(iii)\quad HB_1E\,(H_k)=\sum_{ue}\left[e_{H_k}(u)+e_{L(H_k)}(e)\right]^2$$
$$=\sum_{uv\in E_1(G)}\left[\left[e_G(u)+e_{L(G)}(e)\right]^2+\left[e_G(v)+(e)\right]\right]^2+\dots$$
$$+\sum_{uv\in E_{3(k-1)+1}(G)}\left[\left[e_G(u)+e_{L(G)}(e)\right]^2+\left[e_G(v)+e_{L(G)}(e)\right]\right]^2$$
$$=6\sum_{i=1}^{k}\left[\left(2(2k+2i-1)^2\right)+(2(2k+2i-1))^2\right]$$
$$+6\sum_{i=1}^{k-1}i\left[(2(2k+2i-1))^2+((2k+2i)+(2k+2i-1))^2\right]$$
$$+12\sum_{i=1}^{k-1}i\left[(2(2k+2i))^2+((2k+2i+1)+(2k+2i))^2\right]$$

$$(iv)\quad HB_2E\,(H_k)=\sum_{ue}\left[e_{H_k}(u)\times e_{L(H_k)}(e)\right]^2$$
$$=\sum_{e=uv\in E_1(G)}\left[\left[e_G(u)\times e_{L(G)}(e)\right]^2+\left[e_G(v)\times e_{L(G)}(e)\right]\right]^2+\dots$$
$$+\sum_{e=uv\in E_{3(k-1)+1}(G)}\left[\left[e_G(u)\times e_{L(G)}(e)\right]^2+\left[e_G(v)\times e_{L(G)}(e)\right]\right]^2$$
$$=6\sum_{i=1}^{k}\left[\left((2k+2i-1)^2\right)^2+\left((2k+2i-1)^2\right)^2\right]$$
$$+6\sum_{i=1}^{k-1}i\left[\left((2k+2i-1)^2\right)^2+((2k+2i)(2k+2i-1))^2\right]$$
$$+12\sum_{i=1}^{k-1}i\left[\left((2k+2i)^2\right)^2+((2k+2i+1)(2k+2i))^2\right]$$

□

For example, let us evaluate the indices for H_4. Consider the H_4-Circumcircumcoronene graph.

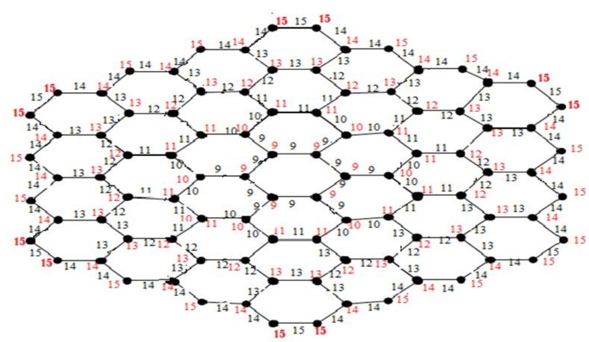

Figure 2

Let V be the vertex set and E be the edge set in H_4 = Circumcircumcoronene, then $|V|=96$ and $|E|=132$. Also, the number of edges with eccentricities of end vertices $e=uv\in E(G)$ and $e\in L(G)$ are given as follows:

Table 2

Edge set	No. of edges	Eccentricity of end vertices $(e(u),e(v))$	Eccentricity of e in $L(G)e_{L(G)}(e)$
E_1	6	(9,9)	9
E_2	6	(9,10)	9
E_3	12	(10,11)	10
E_4	6	(11,11)	11
E_5	12	(11,12)	11
E_6	24	(12,13)	12
E_7	6	(13,13)	13
E_8	18	(13,14)	13
E_9	36	(14,15)	14
E_{10}	6	(15,15)	15

(i) $B_1E(H_4) = \sum_{ue}\left[e_{H_4}(u) + e_{L(H_4)}(e)\right]$

$$= \sum_{uv\in E_1(G)}\left[e_G(u) + e_{L(G)}(e) + e_G(v) + e_{L(G)}(e)\right] + \ldots + \sum_{uv\in E_{10}(G)}\left[e_G(u) + e_{L(G)}(e) + e_G(v) + e_{L(G)}(e)\right]$$

$= 6588$

(ii) $B_2E(H_4) = \sum_{ue}\left[e_{H_4}(u) \times e_{L(H_4)}(e)\right]$

$$= \sum_{e=uv\in E_1(G)}\left[e_G(u)e_{L(G)}(e) + e_G(v)e_{L(G)}(e)\right] + \ldots + \sum_{e=uv\in E_{10}(G)}\left[e_G(u)e_{L(G)}(e) + e_G(v)e_{L(G)}(e)\right]$$

$= 41868$

(iii) $HB_1E(H_4) = \Sigma_{ue}\left[e_{H_4}(u) + e_{L(H_4)}(e)\right]^2$

$$= \sum_{e=uv\in E_1(G)}\left[\left[e_G(u) + e_{L(G)}(e)\right]^2 + \left[e_G(v) + e_{L(G)}(e)\right]\right]^2 + \ldots + \sum_{e=uv\in E_{10}(G)}\left[\left[e_G(u) + e_{L(G)}(e)\right]^2 + \left[e_G(v) + e_{L(G)}(e)\right]\right]^2$$

$= 167580$

(iv) $HB_2E(H_4) = \sum_{ue}\left[e_{H_4}(u) \times e_{L(H_4)}(e)\right]^2$

$$= \sum_{e=uv\in E_1(G)}\left[\left[e_G(u) \times e_{L(G)}(e)\right]^2 + \left[e_G(v) \times e_{L(G)}(e)\right]\right]^2 + \ldots + \sum_{e=uv\in E_{10}(G)}\left[\left[e_G(u) \times e_{L(G)}(e)\right]^2 + \left[e_G(v) \times e_{L(G)}(e)\right]\right]^2$$

$= 7105236$

Thus we have $B_1E(H_4) = 6588$, $B_2E(H_4) = 41868$, $HB_1E(H_4) = 167580$ and $HB_2E(H_4) = 7105236$.

Corollary 2.2. *H_1 be the first terms of this Circumcoronene series of Benzene H_k. Then*

(i) $B_1E(H_1) = 72$

(ii) $B_2E(H_1) = 108$

(iii) $HB_1E(H_1) = 432$

(iv) $HB_2E(H_1) = 972$.

Corollary 2.3. *H_2 be the second terms of this Circumcoronene series of Benzene H_k. Then*

(i) $B_1E(H_2) = 714$

(ii) $B_2E(H_2) = 2154$

(iii) $HB_1E(H_2) = 8634$

(iv) $HB_2E(H_2) = 82182$

Corollary 2.4. *H_3 be the third terms of this Circumcoronene series of Benzene H_k. Then*

(i) $B_1E(H_3) = 2646$

(ii) $B_2E(H_3) = 12366$

(iii) $HB_1E(H_3) = 49770$

(iv) $HB_2E(H_3) = 1134150$

3. Multiplicative First and Second K-Eccentric indices, Multiplicative First and Second K Hyper Eccentric indices of Benzenoid H_k system:

Theorem 3.1. *For any positive integer number k, let H_k be the general form of circumcoronene series of benzenoid system, then*

(i) $$B\Pi_1E(H_k) = 6\prod_{i=1}^{k}\left[4(2k+2i-1)^2\right] \times 6\prod_{i=1}^{k-1} i[2(2k+2i-1)(4k+4i-1)] \times 12\prod_{i=1}^{k-1} i[2(2k+2i)(4k+4i+1)]$$

(ii) $$B\Pi_2E(H_k) = 6\prod_{i=1}^{k}\left[(2k+2i-1)^4\right] \times 6\prod_{i=1}^{k-1} i\left[(2k+2i-1)^3(2k+2i)\right] \times 12\prod_{i=1}^{k-1} i\left[(2k+2i)^3(2k+2i+1)\right]$$

(iii) $$HB\Pi_1(H_k) = 6\prod_{i=1}^{k}\left[16(2k+2i-1)^4\right] \times 6\prod_{i=1}^{k-1} i\left[(4(2k+2i-1))^2\right] \times \left[((2k+2i)+(2k+2i-1))^2\right] \times 12\prod_{i=1}^{k-1} i\left[4(2k+2i)^2\right] + \left[((2k+2i+1)+(2k+2i))^2\right]$$

(iv) $$HB\Pi_2(H_k) = 6\prod_{i=1}^{k}\left[(2k+2i-1)^8\right] \times 6\prod_{i=1}^{k-1} i\left[(2k+2i-1)^6\right] \times [(2k+2i)] \times 12\prod_{i=1}^{k-1} i\left[(2k+2i)^6\right]\left[(2k+2i+1)\right]$$

Proof. Consider the General form of Hk - Circumcoronene graph, Using Table 1, we obtain the following:

$$(i) \quad B\Pi_1 E\left(H_k\right)=\prod_{ue}\left[e_{H_k}(u)+e_{L(H_k)}(e)\right]$$
$$=\prod_{uv\in E_1 G}\left[\left[e_G(u)+e_{L(G)}(e)\right]\left[e_G(v)+e_{L(G)}(e)\right]\right]\times\ldots$$
$$\times\prod_{uv\in E_{3(k-1)+1}(G)}\left[\left[e_G(u)+e_{L(G)}(e)\right]\left[e_G(v)+e_{L(G)}(e)\right]\right]$$
$$=6\prod_{i=1}^{k}\left[4(2k+2i-1)^2\right]$$
$$\times 6\prod_{i=1}^{k-1} i[2(2k+2i-1)(4k+4i-1)]$$
$$\times 12\prod_{i=1}^{k-1} i[2(2k+2i)(4k+4i+1)]$$

$$(ii) \quad B\prod_2\left(H_k\right)=\prod_{\mathrm{ue}}\left[e_{H_k}(u)\times e_{L(H_k)}(e)\right]$$
$$=\prod_{e=uv\in E_1(G)}\left[\left[e_G(u)\times e_{L(G)}(e)\right]\left[e_G(v)\times e_{L(G)}(e)\right]\right]\times\ldots$$
$$\times\prod_{e=uv\in E_{3(k-1)+1}(G)}\left[\left[e_G(u)+e_{L(G)}(e)\right]\left[e_G(v)+e_{L(G)}(e)\right]\right]$$
$$=6\prod_{i=1}^{k}(2k+2i-1)^4\times 6\prod_{i=1}^{k-1} i\left[(2k+2i-1)^3(2k+2i)\right]$$
$$\times 12\prod_{i=1}^{k-1} i\left[(2k+2i)^3(2k+2i+1)\right]$$

$$(iii) \quad HB\Pi_1\left(H_k\right)=\Pi_{ue}\left[e_{H_k}(u)+e_{L(H_k)}(e)\right]^2$$
$$=\prod_{e=uv\in E_1(G)}\left[\left[e_G(u)+e_{L(G)}(e)\right]^2\left[e_G(v)+e_{L(G)}(e)\right]^2\right]\times\ldots$$
$$\times\prod_{e=uv\in E_{3(k-1)+1}(G)}\left[\left[e_G(u)+e_{L(G)}(e)\right]^2\left[e_G(v)+e_{L(G)}(e)\right]^2\right]$$
$$=6\prod_{i=1}^{k}\left[16(2k+2i-1)^4\right]\times 6\prod_{i=1}^{k-1} i\left[(4(2k+2i-1))^2\right]$$
$$+\left[((2k+2i)+(2k+2i-1))^2\right]\times 12\prod_{i=1}^{k-1} i\left[4(2k+2i)^2\right]$$
$$+\left[((2k+2i+1)+(2k+2i))^2\right]$$

$$(iv) \quad HB\Pi_1\left(H_k\right)=\prod_{ue}\left[e_{H_k}(u)\times e_{L(H_k)}(e)\right]^2$$
$$=\prod_{e=uv\in E_1(G)}\left[\left[e_G(u)\times e_{L(G)}(e)\right]^2\left[e_G(v)x+e_{L(G)}(e)\right]^2\right]\times\ldots$$
$$\times\prod_{e=uv\in E_{3(k-1)+1}(G)}\left[\left[e_G(u)\times e_{L(G)}(e)\right]^2\left[e_G(v)\times e_{L(G)}(e)\right]^2\right]$$
$$=6\prod_{i=1}^{k}\left[(2k+2i-1)^8\right]\times 6\prod_{i=1}^{k-1} i\left[(2k+2i-1)^6\right]$$
$$\times[(2k+2i)]\times 12\prod_{i=1}^{k-1} i\left[(2k+2i)^6\right][((2k+2i+1)]$$

Using MATLAB programme, we have calculated these indices for H_1, H_2 and H_3. Those values are given below corollaries. □

Corollary 3.2. *H_1 be the first terms of this Circumcoronene series of Benzene H_k. Then*

(i) $B\Pi_1 E\left(H_1\right)=2176782336$

(ii) $B\Pi_2 E\left(H_1\right)=2.824295365\times 10^{11}$

(iii) $HB\Pi_1 E\left(H_1\right)=4.738381338\times 10^{18}$

(iv) $HB\Pi_2 E\left(H_1\right)=7.976644308\times 10^{22}$

Corollary 3.3. *H_2 be the second terms of this Circumcoronene series of Benzene H_k. Then*

(i) $B\Pi_1 E\left(H_2\right)=2.086352657\times 10^{64}$

(ii) $B\Pi_2 E\left(H_2\right)=2.901497086\times 10^{92}$

(iii) $HB\Pi_1 E\left(H_2\right)=3.1023e+040$

(iv) $HB\Pi_2 E\left(H_2\right)=8.4187e+184$

Corollary 3.4. *H_3 be the third terms of this Circumcoronene series of Benzene $H_{k.}$ Then*

(i) $B\Pi_1 E\left(H_3\right)=1.3789e^{+093}$

(ii) $B\Pi_2 E\left(H_3\right)=7.3558e^{+128}\times 1.0328e^{+234}$

(iii) $HB\Pi_1 E\left(H_3\right)=1.9013e^{+186}$

(iv) $HB\prod_2 E\left(H_3\right)=5.4107e^{+257}\times 5.7517e^{+151}\times 6.7910e^{+251}\times 2.7308e^{+064}$

4. Conclusion

In chemical graph theory a topological index of a molecular graph characterizes its topology. Here, we have computed the first, second K-eccentric indices, K-hyper eccentric indices and multiplicative first, second K-eccentric and K-hyper eccentric indices of benzenoid H_k system.

References

[1] M. Bhanumathi, K. Easu Julia Rani, S. Balachandran, The edge version of inverse sum index of Connected graph, *International Journal of Mathematical Archive,* 7(1)(2016), 8–12.

[2] M. Bhanumathi, K. Easu Julia Rani, On K-eccentric indices and K hyper-eccentric indices of graphs, *Aryabhatta Journal of Mathematics and Informatics,* 9(1)(2017), 509–520.

[3] M. Bhanumathi, K. Easu Julia Rani, On Some Multiplicative Topological Indices, *International Journal on Recent Trends in Life Science and Mathematics,* 4(2017), 09–18.

[4] M. Bhanumathi. K. Easu Julia Rani, Harmonic Eccentric Index of Hexagonal Chain, *International Journal of Elixir Appl. Math. Appl. Math,* 104C(2017), 45871–45880.

[5] V. R. Kulli, On K Banhatti Indices of Graphs, *Journal of Computer and Mathematical Sciences*, 7(4)(2016), 213–218.

[6] V. R. Kulli, Second Multiplicativee K Banhatti Index and Coindex of Graphs, *Journal of Computer and Mathematical Sciences,* 7(5)(2016), 254–258.

[7] V. R. Kulli , Multiplicative K hyper-Banhatti indices and coindices of graphs, *International Journal of Mathematical Archive,* (2016), 1–6.

[8] V. R. Kulli, On K hyper-Banhatti indices and coindices of graphs Research gate, (2016), 1–6.

[9] V. R. Kulli, First Multiplicative K Banhatti Index and Coindex of Graphs, *Annals of Pure and Applied Mathematics,* 11(2)(2016), 79–82

[10] M. Bhanumathi, R. Rohini, G. Srividhya, On K-Eccentric and K-Hyper Eccentric indices of Benzenoid Hk system, *National Conference on Recent Trends in Pure and Applied Mathematics*, Government Arts College for Women, Sivagangai, Tamilnadu on 13th Feb.2019.

[11] V. R. Kulli, Multiplicative hyper-zagreb indices and coindices of graphs: computing these indices of some nanostructures, *International Research Journal of Pure Algebra,* 6(7)(2016), 342–347.

⋆⋆⋆⋆⋆⋆⋆⋆⋆
ISSN(P):2319 − 3786
Malaya Journal of Matematik
ISSN(O):2321 − 5666
⋆⋆⋆⋆⋆⋆⋆⋆⋆